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and Its Practical Applications

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INDEX TO VOLUME LXXVI

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GENERAL INDEX

Entries from the Digest of Current Electrical Literature are indicated by D (Digest)

PAGES BY WEEKS

July	3	1 to	52
July	10	53 to	108
July	17	109 to	156
July	24	157 to	218
July	31	221 to	268
Aug.	7	269 to	316
Aug.	14	317 to	364
Aug.	21	365 to	412
Aug.	28	413 to	460
Sept.	4	461 to	508
Sept.	11	509 to	556
Sept.	18	557 to	604
Sept.	25	605 to	663
Oct.	2	669 to	716
Oct.	9	717 to	764
Oct.	16	765 to	812
Oct.	23	813 to	860
Oct.	30	861 to	908
Nov.	6	909 to	956
Nov.	13	957 to	1004
Nov.	20	1005 to	1052
Nov.	27	1053 to	1100
Dec.	4	1101 to	1148
Dec.	11	1149 to	1196
Dec.	18	1197 to	1244
Dec.	25	1245 to	1292

A

Accident prevention:
——California planning new in its utilization of Safety Orders, 1275.
——Conservation of human lives (comment), 765.
——Danger sign, a universal, *930.
——Defective lighting said to cause annual accident loss of $300,000,000, p. 894.
——Electrical causes, accidents due to, show marked decrease, 983.
——Fire and safety codes, Berresford declares combination impracticable, 700.
——"Foolproof" electrical apparatus (comment), 269.
——"Illumination and Safety" to be discussed at joint meetings, 798.
——Light and safety. By A. B. Oday (D), 344.
——Line construction, safety considerations in, *835.
——Line protective apparatus, high voltage. Bush Electric Co., *47.
——"No accident week," public utilities promote sucessful, 91.
——Testing of small transformers, safety-first. By A. Heckma (D), 391.
Accounting:
——Better methods necessary, 742.
——Classification, gas and electric interests get together on, 91.
——Classifications, agreement reached on standard, 650.
——Construction, applying, *868, comment 958.
——Engineering scrutiny of accounts (comment), 365.
——Utility construction, *574, comment 558.
——Uniform system for utilities, draft approved, 1037.
——Virginia utilities to have uniform system, 1278.
Acheson, Edward Goodrich, *160.
Air cleaning by the Cottrell electrical precipitation processes. By P. E. Landolt and H. M. Pier (D), 295.
Air compressors: machinery blowing outfit, Black & Decker Mfg. Co., 1001.
Alaska, water powers, ask $40,000 to investigate, 92.
Alternating-current circuits and apparatus, the protection of. By E. T. Norris (D), 135.
Alternating-current network protector. By H. C. Stewart (D), *32.
Alternating-current propagation—on the effect of a variation in one of the line constants. By Pomey (D) 1178.
Alternating-current systems, automatic protective devices for. By A. E. McCall (D), 86.
Alternator, 1,750-kva. slow-speed (D), 1126.
Aluminum contacts, resistance and constancy of. By R. Richter (D), 888.
Aluminum, telegraph and telephone plants, use in. By U. Meyer (D), 345.
American Bureau of Welding, proposed reorganization, 895.
American Engineering Standards Committee, new officers, 1230.
American Institute of Electrical Engineers:
——Ampere Centennial, meeting to commemorate, 542.
——Atlanta section, hydro-electric power survey to be made by, 939.
——Celebrates discoveries of Ampere, Arago, Davy and Oersted, 797.
——Chicago meeting, lightning protection to be discussed at, 893.
——Committee appointments by President Berresford, 397.
——Convention, annual, 1920, at White Sulphur Springs, *37, technical sessions, 57; electrical machinery session, 58; excitation systems session, 60; protective devices section, 62; electric welding session 64; power factor session, 65.
——Convention, annual, 1921, West wants, at Salt Lake City, 591; Salt Lake City to be meeting place, 796; Social activities to be emphasized, 1084.
——Edison Medal committee, new, 445.
——Forty degree-fifty degree motor investigation to be sponsored by, 1227.
——Geographic division of, arousing interest, 491.
——Lighting protection discussed by, 1040.
——Pacific Coast convention discusses insulators, 204.
——Pacific, railroad electrification and hogged fuel discussed by 254.
——Technical committee reports, 19.
American Society of Mechanical Engineers:
——Centralized control of power districts discussed by, 1227.
——Coal conservation plans crystallizing, 1182.
——Convention, annual 894, 1182.
——Fortieth anniversary, celebrates, 943.
——Valuation, to discuss, 444.
Ampere, Andre Marie: Centennary *570, *736, comment 559; Crocker-Wheeler Company's celebration 1039, *1183; Electricity, too, has its Columbuses. By W. C. F., 1170.
Antenna. (See Radio)
Appliance market, eastern jobbers discuss conditions in, 702.
Argentina; Buenos Aires, special lighting during national holiday at, despite high fuel cost, *728.
Armature (See Motors and Motor Repairs).
Arnold, Bion Joseph, *864.
Associated Manufacturers of Electrical Supplies:
——Fall meetings announced, 699, schedules, 796.
——Section chairman, elect new, 203.
——Standards, meet to further, 35.
Association of Edison Illuminating Companies, convention Sept. 13-16 at New London, 349.
Association of Edison Illuminating Companies convention, 589.
Association of Iron and Steel Electrical Engineers:
——Convention, plans complete, 492; report, *653.
——Program, adopt tentative, 300.
Audion oscillator. By R. A. Heising (D), 1225.
Austria, water-power development in, 233.
Auto-transformers for motor starting. By V. S. Foster, 977.

B

Babbitts, physical characteristics of, 724.
Baking, core, experience with electric. By Alan D. Dauch, *168, comment 158.
Batteries:
——Clark standard cell, two common failures of the. By E. C. McKelvy and M. P. Shoemaker (D), 985.
——Depolarisant, oxygen from the air as a. By Fery (D), 745.
——Standardization of electrical, 612.
Belgium:
——Electric systems, proposed reorganization, 475.
——Rebuilding France and, electrically. By Oliver Field Allen, *1208, comment, 1197.
Boiler room:
——Ashes, sluicing, shows low cost. By Alex. W. Morgan, *16.
——Boiler units and combustion chambers larger, increase economy, 979.
——Clinker grinders facilitate operation 882.
——CO_2 recorder, dependability of the. By W. Elsworth Lawson, 880.
——Coal and oil fuel costs of, compared by chart. By F. H. Daniels, *739.
Boiler room (Continued):
——Coal ash, test of fusing point of. By Wayne Edwards, 189.
——Coal bunkers, waterproofing overhead. By C. S. Lloyd, 77.
——Coal consumption for different grate spuds. By Fred M. Richards, 22.
——Colloidal fuel, advantage of 930.
——Combustion engineers increase plant economy 20 per cent. By E. H. Tenney, 577.
——Condensers, cleanings, saves one fireman on two 3,000-kw. turbines. By A. L. Platt, 738.
——Economizers save seven per cent of total heat, 690.
——Feed heating for land power station. By K. Baumann (D), 840.
——Fuel-oil installation, a. By H. A. Wilcox (D), 439.
——Furnace conditions, opportunity to improve (comment) 1054.
——Lignite containing 23 per cent moisture develops 275 per cent boiler rating, *479.
——Maintenance and operation, seventeen rules for efficient boiler-plant. By E. H. Tenny, 639.
——Oil atomizer, mechanical efficient at 320 per cent boiler ratings. By Dorrah Corbet, 786.
——Oil-burning furnace, Babcock & Wilcox. By A. G. Pratt, 689.
——Pulverized coal versus stoker firing. By S. N. Clark, 1265.
——Steam-flow calculations, chart facilitates, *76.
——Stoker trouble eliminated by using spring to lift counterbalance. By Kenneth Walz, *785.
——Superheater losses, saving of. By Norman G. Hardy, 385.
Boilers:
——Arches, remodeling ignition. By T. A. Marsh, *823.
——Boiler plants, factors in the design of large. By J. Grady Rollow (D) Part I, 696.
——Mercury, the Emmet (D), 696.
——Ratings, effect of boiler, on furnace maintenance. By Theodore Maynz, *1210, comment, 1246.
——Steam pressures and superheat. By R. M. Osterman, 21.
——Stoker furnace for coal or oil (D), 438.
——Waters for, preparing Pittsburgh district (D), 536.
Bonding in special locations. By G. H. McKelway (D), 584.
Book reviews:
——Armature winding and motor repair. By D. H. Braymer, 889.
——Oscillations and electric waves, electric. By Prof. G. W. Pierce, 87.
——Radio telegraphy and telephony, Robison's manual of. By Capt. S. S. Robison, 87.
——Service at cost plants. By Harlow C. Clark, 87.
——Winning the public. By S. M. Kennedy, 745.
Boston Edison Company reduces rates and increases wages, 36.
Brazil, storage-battery buses used by Brazilian tramways, 624.
Brooklyn Edison officials explain alleged irregularities in coal orders, 747, comment 717, freed from coal-hoarding charge, 987, not guilty of Lever Act violation, 1276.
Brush, Charles Francis, *112.
Brushes:
——Carbon and commutation wear. By R. E. Hellmund (D), 294.
——Carbon, stocks of, in good supply, 101.
——Carbon, testing. By John S. Dean, *369, comment 366.
Buck, Harold Winthrop, *1248.
Bureau of Standards. (See also National Electrical Safety Code.)
——Lead-covered-cable failures, investigating, 142.
——Utility investigation, wants more money for, 1184.
Bushing:
——Transformer. General Electric Co., *408.
——Wire, economy in electric baking of steel, *193.
Business. (See also Trade Conditions.)
——Beware of the pessimist (comment), 1101.
——Cheerfulness as an antidote to depression (comment), 1245.
——Industrial outlook. A. W. Douglas on, 799.
——Moral obliquity in (comment), 957.
——Return to normal the (comment), 221.
——Revival ahead, Dwight P. Robinson sees; 1129.
Byllesby, Henry Marion, *224; says electric light and power outlook is good, 1181.
Byllesby, H. M. & Co.: customer-owners of, properties exceed 24,000, 645.

*Indicates illustrated articles

C

Cables:
——Construction, modern tendencies in (comment), 462.
——High-tension, losses in. By Rennesson (D), 344.
——Lead-covered current-carrying capacity of. By Ralph W. Atkinson (D), 936.
——Lead-covered single-conductor, characteristics of. By Capdeville (D), 984.
——Lead-covered single-phase. By Capdeville (D), 1224.
——Manufacture, recent tendencies in. By H. Savage (D), 583.
——Power, locating faults in. By K. de Koning (D), 295.
——Stresses in high-voltage electric, allowable working. By L. W. Davis and D. M. Simons (D), 248.
——Submarine, is dried out and replaced, *1012.
——Transmission, alternating currents for submarine cable (comment), 814.
——Underground, locating faults on. By W. R. Bullard, *1057, comment 1055.
California:
——Commission links state's prosperity with hydro-electricity, 893.
——Codes, unification of, in, 491.
——Contractors continue "more outlets" campaign, 844.
——Co-operative campaign:
Electrical home campaign, results of, *789.
Electrical homes, continues, 935.
Electrical home idea promotes electric service in, *437, comment, 413.
Emphasizes one thing each month, 1276.
Lighting exhibits, plans, 444.
Ohio, to be tried in, 203.
——Industrial load in, *428, comment 415.
——Power administrator curtails lighting to save power, 489.
——Power for, heavy October snows, assure next year's, 894.
——Power restrictions extended, 747.
——Power shortage now being felt, anticipated, 444.
——Rain comes and restrictions go in, 845.
——Safety codes electrical interests combine to discuss, 795.
——Safety orders, planning new rules in its utilization, 1275.
Canada:
——British Columbia power interests consolidated, 1280.
——Co-operative movement in British Columbia, 491.
——Co-operative plan launched at Vancouver, B. C., 799.
——Co-operative campaigns launched at Winnipeg and Montreal, 843.
——Electrical apparatus, turns out $30,000,000 of, 708.
——Heating, electric, declared impracticable by authority, 927.
——Licenses to export power, Dominion government reduces amount of, 989.
——Niagara power project, design of new (D), 1031.
——Ontario government rejects proposal of Toronto company, 988.
——Ontario Hydro-Electric Commission awards $2,000,000 worth of contracts, 1231.
——Ontario Hydro-Electric Commission favors St. Lawrence plan 895
——Ontario Hydro-Electric Commission seeks to buy MacKenzie interests, 1040.
——Ontario Hydro Commission will not build auxiliary steam plant, 399.
——Ontario hydro-electric world's largest system, purchase of MacKenzie interests makes, *1184.
——Ontario, power situation in, relieved, 1039.
——Power exports prohibited because of situation in Ontario, 893.
——Radio interests, merger of Canadian General Electric and Marconi, 703.
——Toronto Hydro-Electric System increases rates, *485.
——Toronto power situation cleaned up, 1231.
——Water power. By James White, 337.
——Water-power development, *229.
Canal haulage, pioneer electrical. By Thomas Commerford Martin, 977.
Carle Nathaniel Allen, *608.
Carty, John Joseph, *1008.
Central stations. (See also Hydro-electric developments and Transmission systems.)
——Adirondack Power & Light Corporation, 252.
——Cape Cod properties consolidated, 399.
——Census of central stations, 1917, U. S., *476, comment 463.
——Central Maine Power acquires smaller properties, 92.
——Consumers' Power Co. starts record frequency changer, *800.
——Consumers' Power system, final steps being taken in unifying 140-kw., 202.
——Duquesne Light Company's Calfox plant added to Pittsburg power suppiy, 1278.
——Expansion in 1920, 518.
——Idaho Power Company to make extension, 298.
——Kansas City Company to build new substations as measure of economy 255.
——Kerckhoff station, starting of, breaks three-year power famine, 399.
——Milwaukee Electric Railway & Light Company's new plant will relieve power shortage about Dec. 1. p. 800.
——Niagara Falls Power Co., extension to Station No. 3; *561, *678, *779, *825, *875, *961, comments, 767, 815.
Central Stations (Continued):
——Northern Ohio Traction & Light Company may build 120,000-kw. plant to satisfy industrial demand, 1035.
——Northwest system, electrical storm causes great damage to, 206.
——Pacific Power & Light Company's new station, *544.
——Paper manufacturers purchase interest in utility company, 1232.
——Pennsylvania-Ohio Company segregates railway and power property, 1088.
——St. Louis, additional capacity installed at, 301.
——San Joaquin Light & Power Co., additional plant capacity rushed by, 494.
——Southern California Edison Company's forty-million dollar construction plans, 847.
——Southern Power Co., 1252; will build new 60,000-kw. hydro-electric plant, 942.
——Toledo Railways & Light Company, new million dollar power line for, 205.
——Washington Water Power Co. expanding, 1230.
——West Penn Power Co., Springdale plant; first 25,000-kva. unit started, 205; by G. G. Bell, I*625., II*733, comment 605; by George S. Humphrey, I*1114, II*1165, comment 1103.
Central station business and sales management:
——Advertising important to central-station merchandising policies 1124.
——Advertising, making billboard, realistic, *934.
——Appliance campaign, two-month electric, in New York City, *197.
——Appliance tests, portable meter rack for, *133.
——Billing, quarterly, of residential customers proves economical, 246.
——Bills, light, used to advertise civic enterprises, *885.
——Boston company's new business exceeds last year's record, 645.
——Cape Cod, central-station office on tip of, *1079.
——Central-station and oil-engine power, comparative costs of, 483.
——Central station places its credit at disposal of dealers, *29.
——Central-station power, increased use of, by Baltimore industries, *535.
——"Commercializing" a terminal house, *30.
——Competitive supply of electrical energy (comment), 1005.
——Cost per customer served, data on, 247.
——Credit deposits and the rate of interest thereon. By "Kassandra," 533.
——Customer, keeping the, informed, *390.
——Denver company plans another record vacuum-cleaner campaign, 484.
——Denver company sells $40,000 worth of washing machines in thirty days, 581.
——Deposits, refund of customers', 293.
——Earnings, estimating utility, from graphic records, *886.
——Educating consumers to best use of central-station service, 645.
——Electric dollar has increased in value, how the, *533.
——Holyoke municipal plant adds lighting service charge, 39.
——House wiring records, Providence company establishes, 84.
——Income per kilowatt, central station. By "Kassandra," 1176.
——Industrial loads, segregate (comment), 413.
——Inspection department is important factor in good service. By C. B. Merrick, *293.
——Kitchen and laundry, model electric, for demonstrating appliances, *247.
——Lamps, time saved in selling, *695.
——Ledger accounts, advantages of simplifying, 82.
——Lighting equipment, utility maintains customers', 743.
——Lighting, industrial, offers increased revenue for central stations, 343.
——Load factor, high, results from long-hour business, *743.
——Merchandising as a public policy asset, 33.
——Merchandising department profitable, New Orleans company makes 886.
——Merchandising expenses, proper, shown by classification of accounts, 246.
——Merchandising policy should fill load-curve valleys, 1030.
——Merchandising, Wilmington company discontinues, 390.
——Meters, advantages in use of glass-covered, 1125.
——Motor displays, composition platform for, *582.
——Motors, posting current prices of. By H D. Stokes, *29.
——Northwest utility sells $1,000,000 issue locally in eleven days, 838.
——Off-peak business to be most sought for this year, 544
——Oil fields, electric power in the, as a central station load. By W. G. Taylor (D), 792.
——Ovens, electric bake, a desirable central-station load. By George W. Cole, *1078.
——Pacific Gas & Electric's record increase of customers, 1079.
——Power-factor penalty applied to kilowatt-hours consumed, 343.
——Power loads, measured demands of, found most satisfactory, *1176.
——Power "prospect" form saves useless work, *83.
——Ranges, results of twelve months' operation of, 134.
——Ranges, Tacoma City officials refuse to discontinue sale of, 398.
Central Stations (Continued):
——Rate, Providence (R. I.) company increases power, 247.
——Reconnection of service, charges for, 342.
——Refrigeration should be developed, domestic electric. By Vernon Tallman, 1124.
——Reliable service first (comment), 557.
——Residential consumption, growth in four years, *1029.
——Rules, constructive versus defensive use of rules, 790.
——Rural business in Ohio, handling, 29.
——Salaries, increasing salesmen's, reduces cost of new business, 885.
——Sales Managers' Association, growth of, in last ten years, 485.
——Service charge urged in Massachusetts, 349.
——Soliciting expense, central station and contractors' share, 342.
——System troubles, how a Michigan company helps customers to understand, *535.
——Three-phase extension for residential elevator declared burdensome, 582.
——Traction companies as customers (comment), 365.
——Truck, electric, education of user insures success. By Secor Cunningham, Jr. and L. T. Carpenter, *1270.
——Vancouver appliance sales continue at high rate, 694.
Central station management:
——Bulletins, Maine company instructs employees through weekly, 83.
——Cafeteria for company employees, *343.
——Central-station costs and income, *1067, comment 1054.
——Civic advantages of adequate power supply, *935.
——Coal contract should be based on unit of B.t.u., 84.
——Coal cost, ratio of, to total operating expenses, *484.
——Continuity of service is paramount, 1029.
——Costs, graphic illustration of increased operating, *935.
——Customer co-operation reduces peak during power shortage, *1223.
——District office reports, schedule of forwarding dates for, 28.
——Employees, educating, as to company activities (comment), 1197.
——Employees instructed in all operations of company, 839.
——Employees receive medals for heroism, seventeen utility, *1222.
——Employers warned to carry compensation insurance, 582.
——Farmers, managing electric service for. By A. W. Jones, *283.
——Industrial power charts stored compactly, *84.
——Insurance, life and health, for Chicago company employees, 133.
——Intercompany meetings of commercial representatives, 197.
——Inventories, connected load (comment), 813.
——Magazine, Pacific Gas & Electric stockholders to receive company, 742.
——Meter maintenance: Training men for some one else (comment), 909.
——Milwaukee company asks customers to curtail consumption, 789.
——Open-door policy, officers of Baltimore company maintain, 982.
——Operating expenses, investments that will reduce, 644.
——Power factor, low, penalized by increased service charge, 1222.
——Power-factor penalty works in Boston, how, 83.
——Power shortage relieved by isolated plants, 1078.
——Prizes for constructive suggestions, Samuel Insall offers, 983.
——Rate embodying coal and oil clauses, public benefits from, 28.
——Rate theories, new angle from which to look at. By Kassandra, 581.
——Right understanding of commission rulings aids public confidence, 789.
——Rural line construction in Ohio cost of, 838.
——Rural lines, ownership of, 390.
——Rural service, demand for, based on economic reasons, *817, comment 815.
——Rural service needs study (comment), 269.
——Rural service, wrong impression conveyed regarding cost of, 1271, comment 1245.
——Salvaging municipal plants when utility takes over system. By P. D. Kline, 839.
——Securities department, Pacific Power & Light Co. forms, 292.
——Service ideals in danger (comment), 813.
——Service 98.9 per cent perfect, canvass of customers shows company's, 342.
——Starting compensators, central station regulations for use of. By Vernon Tallman, 196.
——Stock, increased freight rate as argument for sale of, *581.
——Stock in exchange for bonds, utility issues, 82.
——Stock to customers and employees only, Providence company offers, 1131.
——Stock, utility's sale of, to customers, encouraging comments on, 197.
——Storeroom stocks, economies in (comments), 222.
——Tabular analysis of central stations for executives convenient, 1030.
——Vacancies, interesting use of "want ads" to fill, 196.
Central station operation. (See also Boiler room: all "Station and Operating Practice" articles are indexed under these headings.)

*Indicates illustrated articles

Central Stations (Continued):
——Auto-transformer for feeding two-phase motor from three-phase line. By E. C. Westcott, *188.
——Auto-transformers, operation of, to avoid trouble. By Robert Treat, 691.
——Auxiliaries, plant efficiency improved by conserving drippings from. By William Reinhardt, 1120.
——Battery discharge on unbalanced load, equalizing. By Eustace C. Soaves, *338.
——Boilers should be tagged when being worked on. By H. Hurth, 242.
——Brushes on interpole generators, shifting, changes voltage. By James Dixon, *243.
——Cable across stream, attractive construction for supporting. By H. S. Knowles, *128.
——Cable, current determined by voltage drop in 1 ft of, *691.
——Cable faults, contract-current rectifier locates. By Walter H. Millan, *1074.
——Cable, underground, handhole assists in pulling. By Henry A. Davis, *1265.
——Choke coils, wire screens on ends of, keep out birds. By P. P. Ashworth, *1120.
——Circuits, branching five 13,200-volt, on three poles, *187.
——Circuits, feeding two, with generators which cannot be paralleled. By W. A. Darter, *77.
——Coal, life of cable for conveying, almost doubled. By F. C. Ralston, 1218.
——Condenser, surface, maintenance where scale forms on tubes. By Edwin B. Ricketts, *638.
——Conduit, knockdown, work in substation construction. By G. C. Hickman and E. R. Stauffacher, *24.
——Conduit records help in making alterations, station. By Alex. Bauhan, 432.
——Cross-arms, treating, with old transformer oil. By L. C. Peterman, 1172.
——Danger sign, a universal, *930.
——Dielectric strength, reduction of, by testing, *432.
——Emergency, serving 6,600-volt load over 66,000-volt line in. By Arthur L. Lofstrand, *637.
——Emergency support for 60,000-volt line, stack of cross-ties as. By P. M. Downing, *76.
——Engine, four-valve, shows economy over turbine, 76.
——Floodlights for buildings and yards of manufacturing plants. By C. D. Gray and E. Hagenlocher, 693.
——Fuel cost in combination coal and oil, determining average, 640.
——Fuel-oil and coal-burning plants, comparison of first cost of. By F. H. Daniels, 338.
——Furnaces, arc-type, from 15 to 20 per cent reactance desirable for. By G. G. Potts, 128.
——Fuses, 45-kw. and 60-kw. outdoor-type expulsion. By Paul P. Ashworth, *386.
——Generator size, relation of lubricating oil used to, *882.
——Generator, unbalanced magnetic effect in, overcome by change of connections. By James Dixon, *1024.
——Generator used to correct power factor after engine breakdown. By W. A. Darter, 530.
——Generators, distribution of heat in windings and core of, *433.
——Generators, gritty brushes cure high mica on engine-type. By James Dixon, 288.
——Generators, operating interpole, in parallel. By James Dixon, *577.
——Gloves, simple equipment for making voltage tests on rubber, 930.
——Gloves, tank for quick and safe tests on rubber gloves, *77.
——Grounding lines before working on them, arrangement for. By P. P. Ashworth, *1171.
——Grounds on distribution circuits, exploring coil outfit locates. By W. C. Heston, *834.
——Grounds on transmission systems, effects of. By Robert Treat, 640.
——High resistance in neutral grounds, special relay permits use of. By A. W. Copley, *834.
——High tension lines, etc., testing, before applying protective grounds, *188.
——Hold-off tag prevents energizing apparatus being adjusted, *979.
——Hydro-plants, operating small, without an attendant. By H. J. Burton, 1075.
——Insulators, egg-shaped, prove serviceable on distribution lines, *577.
——Insulators, megger fork facilitates testing line. By W. R. Battey, *432.
——Insulators, strain, about 2,000 lbs. normal working load for. By L. N. Crichton, 978.
——Lightning arresters pipe frame guards, against trucks, *126.
——Line construction, safety considerations in, *835.
——Line inspectors, systematic, practiced by N. Y. State companies, 126.
——Low wire work, portable ladder platform for, *242.
——Maintaining equipment in 60,000-kva. plant, cost of, 739.
——Maintenance crews, map used to route work of city. By D. W. Roper, *578.
——Megger, proper use of, in drying out transformers and generators, *289.
——Meter block which speeds testing. By D. A. McNulty, *639.
——Metering combined power and lighting loads. By M. F. Smalley, *480.
Central Stations (Continued):
——Meters and motor equipment, rules for installing, 1266.
——Meters, charging 25-cycle, for 60-cycle operation. By P. M. Cordell, 78.
——Meters, pilot lamps denote failure of potential on high-tension meters, *289.
——Meters, spring rack prevents damage to meters in automobile. By T. T. Thomas, *690.
——Oil, moisture tests and evaporation tests on. By C. D. Basler, 288.
——Outdoor night work, portable generator and lamps for. By Fred W. Bagnall, *1217.
——Parallel operation, checking connections for. By James Dixon, *1171.
——Pipe-thawing outfit for coming winter. By H. S. Rush, *480.
——Poles, raising, with insulators attached saves time. By Paul P. Ashworth, *338.
——Pole setting, machine reduces cost of hole digging and, 25 per cent. By P. O. Reyneau, *931.
——Power factor quickly read from table supplied to metermen. By C. C. Moler, 1172.
——Primary line records, system for keeping, up to date. By John H. Mitchell, *1074.
——Production costs of Detroit company at Connors Creek station, *1025.
——Reactor, unbalanced, on three-wire generator causes flicker. By R. H. N. Lockyer, *187.
——Rope, shocks received through defective, 23.
——Run-off has no constant ratio to rainfall, *189.
——Rural transformer installation for $375, company supplies 2.5 kva. By D. O. Vaughn, *882.
——Standby plants, rehabilitating. By J. W. Andree, *22.
——Station records used to improve operation, 785.
——Station trouble, rules to follow during, before consulting dispatches. By H. J. Burton, 1217.
——Street-lighting maintenance cost analyzed, 637.
——Substation, galvanized piping used for buses on outdoor. By Lewis A. McArthur, *385.
——Substation, simplified low-cost, *1121.
——Switch and grounding device, combined outdoor. By P. P. Ashworth, *881.
——Switch changes, dispatcher's board that facilitates. By F. W. Pollock, *690.
——Switch for wattmeter, home-made reversing. By R. H. N. Lockyer, *242.
——Switch, reversing, for meters which has 190 microhms resistance. By E. C. Soares, *23.
——Switches and meters, rules for connecting service, 881.
——Switches mounted on two-circuit steel tower, *978.
——Switch, shunting, permits testing large meter without killing line. By J. S. McCarthy, *243.
——Synchronizing, safe method of. By R. H. N. Lockyer, *978.
——Synchroscope for instruction purposes, easily constructed. By Leslie F. Carter, *529.
——Testing insulators and bus supports. By Allen Ramsey, *1024.
——Thrust-bearing trouble caused by increasing oil pressure, 23.
——Tower, standard, adapted for switch mounting, *1075.
——Trailer reduces central station's hauling expense. By G. Genung, 835.
——Transformer, increasing current of constant-current, in emergency. By Eustace C. Soares, *881.
——Transformer installation that provides clear working space, *1120.
——Transformer insulation and oil, drying, before operating. By James Dixon, 78.
——Transformer, potential, strap iron employed as rigid lead for. By U. R. Bauket, *188.
——Transformers, connecting, across proper phase increases output. By Cornelius G. Weber, *1218.
——Transformers, differentially wound watt-hour meter for testing current. By E. C. Wescott, *433.
——Transformers, instrument, mounting plate saves time in replacing. By Walter H. Millan, 979.
——Transformers made weatherproof, *739.
——Transformers, pole-top hoist saves time in raising. By W. R. Battey, *288.
——Transformers, 28-ton auto-trailer hastens, to stations, *578.
——Transformers, two, used in place of damaged balance coil. By W. D. Hardaway, *1121.
——Transformers, standard accessories that must be furnished with, 479.
——Transmission line, anchoring a, to an old chimney. By L. J. Chase, *738.
——Transmission lines, chart shows tension and sag for, *529.
——Transmission trouble, large birds found to be cause of, 126.
——Turbine room, ventilating system which prevents condensation in. By Sabin Crocker, *339.
——Turbines to use for different loads on plant, chart shows. By S. N. Clark, *127.
——Turbo-generator fire protection, water-spray system for. By F. T. Leilich, *385.
——Wires, copper and aluminum, melting current of, compared, 1265.

Chamber of Commerce declares for the prohibition of utility strikes, 301, comment 269.
Chicago:
——Commonwealth Edison has not asked for higher rates, Insull tells why, 89.
——Commonwealth Edison Co. issuing $5,000,000 of stock at par, 846.
China:
——Electrical development in, 122.
——Exporting electrical goods to China (comment), 909.
Cigar lighter. Duralectric Corporation, 1289.
Cleveland boosts electrical service, 943.
Clock, time. General Electric Co., 360.
Coal:
——Attorney-General's fair coal price expected soon, 348.
——Bituminous, situation, *541.
——Brooklyn Edison officials explain alleged irregularities in coal orders, 747, comment 717.
——Cars, large proportion of assigned, going to utilities, 588.
——Car movement, embargoes asked on cross-town, 348.
——Car order, Interstate Commerce Commission extends open-top-, 397.
——Car order preference expected to be continued, utility, 587.
——Car priority for utilities continued in separate order, 649.
——Car priority order, N. E. L. A. requests continuance of, 347.
——Car priority privilege abused by utilities, says I. C. C., 1035.
——Cars, railroads shall not refuse, to utilities with a surplus, 441.
——Cost of, is 76 per cent of generating expense, 982.
——Cost to affect lighting bills, 894.
——Cutters, economy and safety secured by use of a. c. By Charles B. Officer (D), 646.
——Doherty properties adopt centralized purchasing plan, 252.
——Emergency needs of utilities to be taken care of by special permits, 795.
——Emergency order difficulties met with in applying, 891.
——Exports in June, record, 252.
——Federal control of mining, Senators Calder and Edge threaten, 989.
——Freight rates throw burden on utilities, increased, 396.
——Fuel distribution committee appointed for New York, 845.
——I. C. C. emergency order for utilities vacated, 1129.
——I. C. C. keeps utility emergency order in force, 939.
——I. C. C. right to issue priorities questioned, 490.
——Industries outbid utilities for, 202.
——Interruption of service caused by poor, 588.
——Michigan governor appoints utility men on, committee, 541.
——New England gets priority order, 252.
——New England priority suspended for few days, 489.
——New Jersey utility orders own cars to insure, supply, 587.
——New York commission asks I. C. C. to extend its coal order, 348.
——New York utilities' supply shows slight improvement, 397.
——New York utilities' supply continues to show slight improvement, 441.
——Northwest situation shows signs of improvement, 540.
——Ohio utilities experience better conditions, 588.
——Operators should stock their commodity, says J. W. Lieb, 1182.
——Philadelphia Electric gets priority, 90.
——Price anywhere up to $23 a ton, 203.
——Priorities established for utilities, 139.
——Priority order extended thirty days, 347.
——Priority order means more coal at contract price, 201.
——Priority order of temporary benefit, 140.
——Priority privilege of public utilities threatened, 748.
——Profiteering, attorney-general takes steps to end, 251.
——Profiteering charged by prominent utility man, 543.
——Pulverized (D), 135.
——Railroads refusing coal cars to utilities with a surplus, 348.
——Regulation (comment), 269.
——Regulation of industry recommended, 1230.
——Reserves of electric public utilities, government estimate of, 845.
——Rider applied to domestic rates in New York City, 1129.
——St. Louis to distribute to utilities and others, 298.
——Senate committee investigating situation among utilities, 398.
——Service order No. 21 not meeting utility emergency requirements, 987.
——Shortage and high prices predicted, continued, 588.
——Shortage, guarding against, *494.
——Shortage, many utilities still suffer from, 1083.
——Situation (comment), 221, 461.
——Situation, effect of, on central station in last six years, 772, comment 766.
——Situation has become easier with falling prices, 940.
——Situation looking brighter, 35.
——Soft-, prices steadily declining, asserts Coal Association, 1035.
——Soft-, prices will continue to drop, National Coal Association says, 990.
——Sources of power, and water compared as. By R. S. McBride (D), 584.

*Indicates illustrated articles

Coal (Continued):
——Spot, costing New York utilities an additional $7,000,000 a year, 251.
——Stocks on hand at electric utility plants, 90.
——Storage of, for central stations. B. H. H. Stock, *225, comment 223.
——Super-Power Survey, prices receive attention in, 1083.
——Supply, assigned cars at mines only solution of utility, 141.
——Supply, smaller utilities in worst shape on, 89.
——United Kingdom, conservation in the. By Dugald Clerk (D), 31.
——Utilities with car assignments unable in some instances to get, 347.
——Utility priority order, modification of, being pressed, 699.
——Utility supply lowest ever known, 348.
Code. (See National Electric Code and National Electric Safety Code.)
Code, Electrical Manufacturers' Council confers with A. E. S. committee on dual, 1037.
Coil-end leakage resistance. By L. Dreyful (D), 135.
Coils, self-oscillations and critical frequency in single-layer. By Gothe (D), 1081.
Commutators: Carbon and commutator wear. By R. E. Hellmund (D), 294.
Condenser surface-, maintenance. By R. J. C. Wood, *623, comment 607.
Conductors, electrical discharges from pointed. By John Zeleny (D), 840.
Conductors, locating buried. By Dieckmann (D), 841.
Conduit:
——Destruction of, laid in cinders. By Israel Lovett, 689.
Conference Club:
——Idea, large opportunity seen for, 747.
——To meet at end of month to formulate plans, 540.
Connections, generating stations, relative merits of, employed in high-voltage. By Ernest Pragst (D), 32.
Connector. R. A. Macbeth, 1241.
Connector for large capacity, clip. Mueller Electric Co., *1289.
Construction man, responsibilities of the engineer and (comment), 1053.
Contracts for switches and busbars, design of. By W. Hopp (D), 697.
Control:
——Automatic, of reversing rolling mill equipment. By E. S. Lammers, Jr. (D), 392.
Converting apparatus, sixty-cycle. By J. L. Burnham (D), 31.
Co-operation, commendable (comment), 765.
Co-operation of electrical interests (comment), 557.
Co-operative campaign: (See also California and Canada.)
——Atlanta, idea spreads to, 1131.
——Cleveland electrical promotion campaign ready to go ahead, 1182.
——Co-operation that co-operates (comment), 1149.
——Mountain states, spreads to, 1036.
——Pacific northwest, progress in, 140.
——Vancouver, B. C., launched at, 799.
Copper a delicate material. By N. B. Pilling (D), 392.
Copper needed for dynamo, calculating weight of. By F. Loppé (D), 198.
Cords, a durability standard for flexible, 800.
Core and incremental losses in rotating machinery. By Laurence H. A. Carr (D), 135.
Cores, laminated, reducing temperature of. By T. S. Taylor, *1159, comment 1151.
Cost of materials, present, compared with 1915 prices, 885.
Costs, complete analyses of, (comment), 223.
Cranes, electric lifts and. By F. R. Housden (D), 1225.
Cranes, Ward Leonard control applied to heavy. By H. H. Broughton (D), 937.
Crocker, Francis Bacon, *56.
Current interruptions without arc. By Burstyn (D), *1080.

D

Daylight saving:
——Drawbacks, and its, (comment) 862.
——Eastern zone, for, again being urged, 1181.
Detroit Edison Co.:
——Connors Creek station, production costs of, *1025.
——Consumers' committee allots energy, 252.
——Earnings, high-priced coal affects net, 292.
——Expansion, no further, at current money and material costs, 298.
——Generator relieves power emergency, new 45,000-kva., 989.
——Rates, new, reflected in November statement, 1229.
Developments, electrical, and industrial progress almost synonymous, *182.
Detroit, progress phenomenal (comment), 53.
Direct-current machines:
——Commutation in. By Emil Alm, 198.
——Instability of, two cases of. By J. Kelen (D), 791.
Distribution systems:
——Feeder voltage regulation, calculation of. By W. C. Chappell, *73.
——Industrial distribution flexible, making, *1108, comment 1102.
——Networks, design of distributing. By C. A. Gillin (D), 438.
——Nitrate plant, electrical distribution at. By C. D. Gray and E. Hazenlocher, *113, comment 110.
——Losses and fuel scarcity, distribution, (comment) 557.
——Power Factor correction on. By D. M. Jones (D), *646.
Distribution Systems (Continued):
——Protecting industrial distribution lines. By R. B. Gerhardt, *176, additional note, 383; comment 158.
——Three-phase four-wire system. By O. P. Rey, 478.
——Voltage drops in distribution networks, graphical method for computing. By A. Schwaiger (D), 391.
Doane, Samuel Everett, *816.
Doherty, Henry Latham, *320.
Doherty, H. L. & Co.:
——Predicts cheaper money for utilities, 1132.
Dunn, Gano, *1056.
Dynamos. (See Motors and Generators.)

E

Edison Illuminating Companies, Association of discusses power factor, 1132.
Edison Pioneer elect New Members, 1278.
Edison, Thomas A., get distinguished-service medal, 1035.
Education, engineering:
——Butler, Dr., turns the tables. By Frank W. Chase, 1216.
——California Institute of Technology, curricula of. By Edward C. Barrett, 1170.
——Columbia's six-year course for engineers, 124.
——Co-operation, closer, needed between electrical schools and industry, 95.
——Day & Zimmermann's cadet course, outline of, 133.
——Electrical engineering taught by nation to 571 disabled ex-service men, 703.
——Harvard, five-year business-engineering course at, 94.
——Languages eliminated from engineering school curricula, 833.
——Shortage of instructors. By V. Karapetoff, 737.
——Teachers, qualifications of engineering (comment), 317.
——Technical education (comment), 461.
——Westinghouse summer course, engineering professors taking, *302.
Education, vocational:
——Arkansas utility men co-operate with university in metermen's course, 988.
——Factory educational courses have definite limits (comment), 1053.
——Meter men, University of Illinois conducts short course for meter men, 142.
——Meter maintenance: Training men for some one else (comment), 909.
Eglin, William Charles Lawson, *1152.
Electric Power Club:
——Safety work of (comment), 1101.
——Semi-annual meeting, Hot Springs, Va., Nov. 15-17, p. 1084.
——Universal Markings, to act as sponsor, 1275.
Electric Furnace Association. (See under Furnace, electric.)
Electrical and highway exposition planned for 1925, p. 1279.
Electrical industry:
——Deflation in the (comment), 861.
——Organization of the. By C. H. Wordingham (D), 392.
——Publicity which is detrimental to the (comment), 606.
Electrical pioneers, commemorating the (comment), 1245.
Electrical pioneers, honoring the American. By Thomas Commerford Martin, 1264.
Electrical Supply Jobbers' Association:
——Merchandising, to discuss, at semi-annual meeting, 988.
——Publicity campaign started, 654.
——Pacific coast jobbers discuss their relation to water power, 943.
——Semi-annual convention at Cleveland, 1038, 1086, 1092.
Electrification. (See under Railways.)
Electrification by impact. By Harold F. Richards (D), 1225.
Electrochemical Society, American, spring meeting, special symposium on corrosion for, 1132.
Electrolysis, ways of lessening, being investigated, 351.
Electromagnet:
——External field produced by cylindrical. By Cary T. Hutchinson and Harold Pender (D), *937.
——Momentum. By H. A. Wilson (D), 537.
——One hundredth anniversary, *570, *736, comment 559.
Electron power tubes and some of their applications. By William C. White (D), 536.
Electron tubes, development of. By Marius Latour, I *521, II *870, comment 510.
Electron tubes having tungsten cathodes, fundamental phenomena in, I. By Irving Langmuir (D), I 249, II 537.
Electrostatic generator, the condenser machine, a new. By Wommelsdorf (D), 984.
Elliott Cresson Medal, W. L. R. Emmet awarded, *1131.
Elevator, new devices increase safety of automatic. By C. W. Geiger, 80.
Empire State Gas & Eelectric Association:
——Convention, annual, 798.
——Convention, sixteenth annual, at Utica, Oct. 7-8, p. 702.
——Meeting, analysis of rainfall records emphasized at, *36.
Emf., rule for determining direction of induced. By E. Thovez (D), 487.
Energy, problem of the world's supply of. By Svante August Arrhenius (D), 697.
Engineer:
——Application, progress and the. By John J. Brophy, 384.
——Code of ethics, mechanical engineers propose new, 8.
——Co-ordinating the work of scientist and. By John Mills, 689.
Engineer (Continued):
——Industrial electrical, recognizing the (comment), 1149.
——Police duty, the engineer's (comment), 269.
——Registration for engineers and architects proposed in Ohio, 1280.
——Responsibilities of, and construction man (comment), 1053.
Engineering reticence (comment), 223.
Engineering societies should avoid, pitfalls (comment), 54.
Engineering Societies, Federated American:
——Civil engineers would block (comment), 717.
——Civil engineers take steps to block, 1086.
——Committees, standing, appointed, 1277.
——Council, American Engineering:
First meeting Nov. 18-20, 651, comment, 605.
Hoover elected first president of, *1085.
Stage set for action (comment), 957.
Federal Power Commission, may advise, 489; offer accepted, 588.
——Favorably received, 489.
——Features explained, 204.
——Influence, massing engineering society (comment), 317.
——Interest in, growing, 587.
——Invitations to join federation out, 297.
——Largest engineering body, 443.
——Local societies, going strong with, 539.
——Many societies to take action on federation soon, 845.
——Minnesota planning state federation for, 92.
——Membership, large, charter, 987.
——Membership growing, 795.
Equations, use of bi-symbolic, in electrical engineering. By August Hund (D), 985.
European electrical practice. Schachardt tells of developments in, 797.
Excitation systems, relative merits (comment) 3.
Exciter system, selection and design of, *235.

F

Federal Power Commission. (See also Water power.)
——Accounting system, less than four months in which to establish water-power, 943.
——Accounting system being worked out by, 846.
——Activities, 1088.
——Advanced work may be delayed, 1228.
——Advertised water powers, 1232.
——Application, first water-power, to be completed filed for Deschutes River, 649.
——Applications, waterpower, now in excess of 10,000,000 hp., 1276.
——Appointive powers limited, 201.
——Appropriation, need for larger, 699.
——Appropriation of $482,065 asked by, 1183.
——Eight million hp. involved already in water-power applications, almost, 1129.
——Engineering Council may advise, 489.
——Engineering Council's offer, accepts, 588.
——Executive secretary, duties of, 299.
——Ford water-power application first to be advertised, 587.
——Great Falls development discussed before, 441.
——Hearings, holds special, 442.
——Hydro projects to be advertised prior to completion of applications, 749.
——Merrill appointed executive secretary, *89.
——Northwest men want regional water power office, 539.
——Organization, 251, 299.
——Organization awaits return of Secretary Meredith, 139.
——Parks, propaganda to amend water-power bill so as to protect national, 701.
——Permits and licenses, regulations governing water power, 568.
——Permits, further applications for water power, 490.
——Personnel, bill would authorize employment of, 1278.
——Pit River Company, issue of permits to not inimical to nation's interest, 991.
——Power permits, no, for national parks until Congress has chance to act, 297.
——Preliminary power permits under consideration, *422.
——Projects advertised, additional water-power, 1132.
——Quarters, new, 349.
——Regulations and rules of, *395.
——Regulations governing application for permits completed, 539.
——Regulations now being drafted, all interests to confer on, 297.
——Rulings made by chief counsel of, numerous, 751.
——Secretary of War to be chairman of, 35.
——Water power districts, *299.
——Water-power projects advertised, 990.
——Water-power projects being advertised, additional, 847.
Ferro-magnetism, a tentative mathematical theory of. By Kelen (D), 1032.
Financial:
——Adirondack Power & Light puts new bond issue on market, 298.
——Alabama Power offers $1,000,000 preferred stock locally, 94.
——August financing, longer terms and higher yields in, 491.
——Bonds, public utility (comment), 813.
——Bonds, tax-exempt utility (comment), 317.
——Brooklyn Edison bonds sell on 7¼ per cent basis, 1183.
——Central-station financing. By H. M. Addinsell, 725.
——Commonwealth Edison Co. issuing $5,000,000 of stock at par, 846.

*Indicates illustrated articles

Financial (Continued):
——Consumers' Power Company securities offered to customers, 544.
——Convertible securities favored by investors, 749.
——Credit, Samuel Insull outlines elements of public utility, 649.
——Customer ownership of securities (comment), 1053.
——Customer ownership of securities. By William H. Hodge, 1018, comment, 1007.
——December; week brings 15,250,000 new financing, 1277.
——Default of interest, few electric light and power utilities in, 1129.
——Detroit Edison to issue new stock and $5,500,000 bonds, 1130.
——Doherty Company predicts cheaper money for utilities, 1132.
——Duquesne Light issue of $8,000,000 to finance increased capacity, 205.
——Electrical financing week of October 30, almost $50,000,000 new, 891.
——Electric light and power financing during first half of year, 36.
——Electric public utilities, financing. By Dr. W. F. Gephart, I 471, II 516, comment, 511.
——G. E. Company offers $27,000,000 new stock to supply working capital, 1035.
——Great Western Power Co. issues bonds to complete Caribou plant, 490.
——Hartford company issues $5,000,000 of notes for additions, 494.
——Interest rates for utility securities, prominent utility banker sees lower, 941.
——Investment bankers see brighter outlook for utility investments, 750.
——Invesment bankers urge public to safeguard the commissions, 940.
——Investments, safety of electrical (comment), 221.
——July, financing for, amounts to almost $25,000,000, 298.
——Lower yields on new utility, 843.
——Massachusetts utilities may ask right to issue stock for premiums, 1231.
——Money at 8 per cent (comment), 1.
——Money, cost and competition for (comment), 413.
——Money, dear, ascribed by comptroller of currency to Wall Street manipulation, 847.
——Money, high cost of (comment), 557.
——Niagara Falls Power Co. issues $4,000,000 of thirty-year bonds, 1131.
——Northwestern utility sells $1,000,000 issue locally in eleven days, 838.
——November financing; long-term issues yield as low as six and one-half per cent, 1130.
——October record month in electric light and power financing, 940.
——Pacific Gas & Electric's stock holders live in California, three-fourths of, 94.
——Pacific Power & Light Company, new financing by, 445.
——Plant extensions financed by Ohio consumers, 701.
——Preferred stock, central-station companies are again issuing, 701.
——Protection for public utility investment. By H. C. Hopson, 636.
——Public utility securities to become as stable as municipals, 587.
——Puget Sound company offers second million of securities to customers, 1177.
——Readjustment without panic predicted by Archer W. Douglas, 1087.
——Securities, new, totaling $12,500,000 marketed this week, 202.
——Securities, selling, locally. By William H. Hodge, 1156, comment, 1150.
——September, no very short-term utility financing reported in, 700.
——Short-term notes backed by long-term bonds advised for financing, 844.
——Tax exemption on utility bonds. B. E. Sunny urges, 297.
——Tax-free feature of preferred stock dividends, attention called to, 942.
——Utilities, strengthening the. By Carl D. Jackson, 831, comment, 814.
——Utility chart shows many facts in small space, *839.
——Utility issues, three more, totaling $4,900,000, 252.
——Utility securities show improvement during past week, 702.
——Utility sells common stock above par, 390.
——Westinghouse stockholders authorize increased capitalization, 1088.
Fire from electrical causes. By Israel Lovett, 125.
Fisken, John B., *464.
Flatirons, early electric. By R. P. Ingalls, 576.
Foreign trade: (See also Trade conditions.)
——British electrical labor market, improvement shown in, 996.
——British manufacturers endeavoring to regain world trade, 707.
——Canada turns out $30,000,000 of electrical apparatus, 708.
——Canadian firm will manufacture hydraulic turbines, new, 43.
——China, exporting electrical goods to (comment), 909.
——Cuba, promising market for lighting fixtures in, 1045.
——England, electrical manufacturing industry progressing in, 498.
——Europe's trade more valuable than bonds, 492.
——Export field, new corporation to broaden, 1237.
——Exports, May's electrical, highest for present year, 211.
Foreign Trade (Continued):
——Exports, October electrical, set record for year, 1189.
——Fans, analysis of exports of electric, for year 1919, *355.
——German manufactures showing up in foreign trade, 1236.
——Germany hopes to regain world electrical trade, 549.
——July, electrical exports for, half a million ahead of last year, 659.
——Promising market for electrical devices abroad, 452.
——September electrical exports holding up well 995.
——South African dealers complain of American manufacturers, 596.
——Steel towers, foreign demand good, 147.
——Switches, record export of, in June, 403
——Towers, **strong foreign demand** for transmission, 1139.
——Transformers, analysis of exports for year 1919, *260.
——Transformers and rheostats, record export in August, 900.
——World trade, developing (comment), 365.
France:
——Ambassador to Berlin, the French (comment), 157.
——Electric service in, re-establishing, *68 comment, 54.
——Radio station, powerful, put in service in, 445.
——Rebuilding, and Belgium electrically. By Oliver Field Allen, *1208, comment, 1197.
——Rebuilding the devastated sections in, . By E. J. Mehren, 431.
——Transmission line, 110-volt, from Switzerland to France. By Paul Meyer (D), 249.
Freeman, W. Winans, *416.
Frequency changers:
——Consumers Power Co. starts record, *800.
——Induction type. By Harry S. Smith (D), 583.
Fuel:
——Administrator, immediate appointment of, not likely, 140.
——Alcohol, power. By Eric Sinkinson (D), 840.
——Consumption, Geological Survey's figures on energy production and fuel, 800.
——Conservation which does not save is futile (comment), 1198.
——Economy, better, by utilizing exhaust steam. By Gercke (D), 1033.
——Hogged, used to save coal in Albuquerque, N. M., 544.
——Michigan committee, central stations recognized in the, 444.
——Sawmill refuse, burning. By Darrah Corbet, *183.
——Situation (comment), 1.
——Sludge, washery, burned in pulverized form at Seattle. By Charles H. Bronley (D), 1080.
Fuel oil. (See Oil.)
Furnaces, electric:
——Arc furnace electrodes, automatic control of. By J. A. Seede (D), 439.
——Arc, repelling, Industrial Electric Furnace Co., *809.
——Arcs, some phenomena observed in. By J. Kelleher (D), 937.
——Brass; economies of melting electrically, *1253, comment.
——Brass, highly developed, 286.
——Graves-Etchells installation, improved. By Edward T. Moore (D), 1178.
——Greene Electric Furnace Co., 152.
——Induction. By C. H. Clamer (D), 1225.
——Regulator, combined step and induction, *527.
——Relative thermal economy of, and fuel-fired furnaces. By E. F. Collins (D), *984.
Furnace Association, Electric, refractories to be discussed, 443, discussed, 750.

G

Gasoline cost drives municipalities to control-station service, 300.
General Electric Co.:
——American Telephone & Telegraph and, to exchange wireless patents, 441.
——Business rapidly increasing, 499.
——Employees, more than 1,700 twenty-five-year service, 494.
——Large-turbine orders during past year, 1084.
——Offers $27,000,000 new stock to supply working capital, 1035.
Generating plants:
——Stabilizing large generating systems, *5, comment, 2.
Generators:
——Alternating-current, construction of. By S. L. Henderson (D), 1080.
——Alternating-current, temperatures in large. By W. J. Foster (D), 438.
——Induction, use of. By Zederbohm (D), 1031.
——Internal temperatures of large, investigating, 846.
——Niagara Falls Power Company's, factors determining design of, *779, comment, 767.
——Steam-driven electric, small. Lucy Mfg. Corp., *215.
Germany:
——Electrical industry, standardization in (D), 1031.
——Golpa, electrical equipment of super-power station at. By H. Probst (D), 1081.
Germany (Continued):
——Lamp combination, incandescent. By F. Pinner (D), 537.
——Switchgear for street-lighting control in, electrically operated, 520.
——Telephone from Stockholm to Berlin. By A. Holmgren (D), 249.
——Telephony and telegraphy in, high-frequency multiplex. By K. W. Wagner (D), 985.
Governor adjustment for efficient parallel operation. By F. Oppenheimer, *239.
Great Britain:
——Dalmarnock power station (D), 984.
——Manufacturers endeavoring to regain world trade, 707.
——Wireless, linking up the British empire by, 124.

H

Hair waving machine. Le Bijou Co., 1001.
Harding shows knowledge of utility problems, 92.
Harper, John Lyell, *560.
Harries, George Herbert, *512.
Hawaii. Honolulu more progressive than many cities in the United States. By J. M. Wakeman, 576.
Heating, electric:
——Applications, power shortage holds back development of, 991.
——By de La Brosse (D), 1081.
——Communal system, 1170.
——Elements, material for mending heating. Carricite Co., 1049.
——Foundry core room, electrifying the. By J. L. Jones, *1203.
——Impracticable, declares Canadian authority, 927.
——Industrial heating engineering (comment), 861.
——Industrial heating equipment, mass production desirable in (comment), 1199.
——Surplus power for heating purposes, use of. By H. Theorell (D), 136.
——Units for irons, radiators, etc. Prometheus Electric Heating Co., *952.
Herr, Edwin Musser, *960.
Highways, community has prior rights on (comment), 719.
Holland:
——Electric power in (D), 85.
——Electrification for, national (D), 791.
Hydro-electric development. (See also Central stations and Water Power.)
——Airplane in modern hydro-electric practice. By R. C. Starr (D), 1272.
——Airplane substituted for automobile by western construction engineer, *443, comment, 413.
——Alabama Power to build 100,000 hp. hydro plant, 38.
——Boulder Canyon, plan for large irrigation and power project in, outlined, 542.
——Canadian Niagara power project, design of (D), 1031.
——Eastern Iowa contemplated, in, 543.
——Great Falls development awaits action of Congress, 1232.
——Low-head plant, developing the. By Louis E. Ayres., *1260, comment 1247.
——Mobridge (S. D.) hydro project to be considered next spring, 444.
——Muscle Shoals, work again under way at, *752.
——New York State leads nation in hydro-electric output, 142.
——Niagara Falls, developing, without marring its beauty. By Col. J. G. Warren, *329
——Niagara Falls Power Co., extension to station No. 3, *561, *678, *779, *825, *875, *961, comment, 558.
——Pacific Gas & Electric Co. Pit River development of 385,000-kw. to require $125,000,000, 491.
——Pacific Gas & Electric Co., two 40,000 hp. waterwheels ordered by, 701.
——Potomac River, developing power of the. By John C. Hoyt, *421.
——Rhine, hydro-electric power plants for the, 1134.
——St. Lawrence plan, Ontario Hydro-Electric Commission favors, 895.
——St. Lawrence power development, Harriman favors, 895.
——St. Lawrence River development, possibilities of the proposed, 1113.
——Sierras, high, *513, comment, 511.
——Skagit River project, work may be entirely suspended, 1133.
——Tasmania, hydro-electric power works at the Great Lake (D), 391.

I

Illinois:
——Constitutional Convention rejects utility measures, 200.
——Home-rule candidate for governor wins in Illinois, 941.
Illinois State Electric Association Convention, Chicago, Dec. 9, 942; good value of customer ownership pointed out by M. J. Insull, 1228; service and finance discussed at, 1182.
Illuminating Engineering Society:
——Convention postponed to October 4-7, 252.
——Convention, program of Cleveland, 349.
——Convention; interior lighting, metering and effects on vision discussed, 751.
Indiana Electric Light Association:
——Announces program, 442.
——Convention, sliding scale of bonus and forfeiture advocated at, 592.

Indiana Electric Light Association (Continued).
——Convention report; Association to aid commission in plans for future 652.
Indiana State Association of Electrical Contractor Dealers pledges utilities aid in selling securities, 1133
Inductance:
——Coefficients of electric lines in induction B Capdeville (D) 887.
——Coils design of air-core, of minimum weight for a given weight inductance and resistance. By C O Gibson (D) 647.
Induction and coercive force, variation of residual, with magnetizing force. By R. L. Sanford and W. L. Cheney (D) 199.
Inductive interference:
——Problem of By J A Lighthipe 75.
——To attack problem from new angle 939
Industrial Applications: (See also Motor repairs and Repair methods.)
——Acid proof construction for conduit and lamps. By W. B. Todd *341
——Auto-transformers, simplifying switch connections for. By Victor M. Arana. *387.
——Batteries, pointers on maintenance and use of Edison. By Anderson Pace *641
——Bearing trouble results from uncentered rotor. By W. A. Harris *26
——Belt dressing, graphite in, removes static electricity. By C M Green 244
——Belt drives, removing slack from short, by means of weights *580
——Belts on individual motor drives, tightening short. By Alex. H May. *1267.
——Brushes, cards for recording performance of motor. By W. A. Harris. *245.
——Cable, pulling, without tackle or windlass. By A Pertle *932.
——Changes in factory distribution visualized by cardboard models, proposed. By A. H. May. *1221.
——Circuits, outfit to test for high-resistance. By Eugene Tyler. *245.
——Coal-mine distribution circuits, safe construction for 1123.
——Compensator mounted on strap-iron support. By A. R. McDonald. *531.
——Conductors on steel members, supporting openwork. By C. Walker. *290
——Conductors, running openwork, through concrete beams. By James B. Bond *884
——Crane shutdowns, classified causes of electric, 643.
——Current-transformer connection board. By A. R. McDonald *1027
——Cut-out cabinet with watchman switch adjacent, practical By H S. Knowles *244.
——Direct-current line drop, chart for easy determination of By L J. Voorhees *481.
——Distribution, open and conduit wiring combined for economical factory. By John Schiehser. *191.
——Elevator, stacking, mounted on industrial tractor. By C. W. Geiger. *129.
——Energy consumption in manufacture of ferro alloys, 195.
——Fiber cutting to narrow widths. By H Knowles. *740.
——Furnace, improper electrodes will stick in operating brass. By James S. Brusster. 1123.
——Generator and switchboard arrangement to give 220 volts to 2,300 volts. By A. R McDonald *26.
——Granite quarry, motor load at. By C. R. Broadhead, 787.
——Grid connections, simple, to give wide range of resistance. By Eustace C. Soares. *1173.
——Hysteresis and eddy current losses in iron, separating, *1220.
——Lamp, portable storage battery, for very damp locations. *693.
——Lamps, light and small test By Edward Hatch. *79
——Light in offices effective, 431
——Lighting, cost of good, only 1.41 per cent of labor cost, 388.
——Lighting efficiency decreased 20 per cent by pulleys and columns, *836.
——Lighting fixture, industrial, which may be raised, lowered or detached. *884.
——Lighting fixtures, determining economical interval for cleaning, *1122.
——Lighting fixtures dust on, reduces light 25 per cent, 837.
——Lighting in modern automobile factories. 788.
——Magnetic clutch and button control make toggle presses safe. By J. K. Govan. *981.
——Motor arranged for either 440 volts or 220 volts. By C. A. Johnson. *1269.
——Motor, avoiding unbalanced operation of two-panel By James Dixon 387
——Motor, control and grinder in compact arrangement, *1026.
——Motor distribution and consumption in steel plant requiring 117,852 hp., 130.
——Motor drive takes less power for starting with chain than with belt. By H. E Stafford, *25.
——Motor, squirrel-cage; changing speed without changing horsepower. By A. C. Roe. 1220.
——Motors, emergency operation of induction, at low speed. By C. G. Hadley. 388.
——Motors, 40 cycle, operated on 60 cycles to utilize old equipment. By C. W. Leonard, 741.
Industrial Applications (Continued).
——Motor maintenance and to [illegible] record saves time in By A R M Donald *642
——Motors, maximum speeds for recommended by Electric Power Club 1267
——Motor overload protection effected system of By A R McDonald *388
——Motor record card facilitates ordering spare parts By Frederick Krug *191
——Motor-starting switch, emergency control for *980
——Motor, synchronous, starts primed pump through magnetic clutch *79
——Motor windings protecting against acid fumes. By W B Todd *190
——Motors, inspection system which keeps 1,200 running By H E Wood 884
——Motors, reducing 1,430 hp. in, to 1,250 hp saves $1,000 a year 340
——Motors, steel mill, proper housing and ventilating of. By O. Needham. *1219.
——Motors, synchronous, advantages compared with induction, 579
——Motors, synchronous, advantage of motor-driven exciters for By H L Burns 1173.
——Motors, synchronous, for mill drives said to be impracticable, 245.
——Motors, two, connected in parallel drive same load. By Eustace C. Soares. *641
——Motors two 500 hp a-c divide hoist load equally. By F. C. Stanford. *27.
——Operating indoor transformers partly exposed to weather. By H. S. Knowles *27.
——Outlet boxes setting in reinforced concrete columns. By Nicholas F. Condron. *131
——Photometer tests, blanks for recording. By D. W. Blakeslee. *741.
——Pier illumination requires far more attention to surrounding surfaces, 482
——Poles, crane wires and lamps on same, concrete. By H. S. Knowles. *1174.
——Power factor, static condenser raises industrial from 60 to 90 per cent By E A. Reeser. *195
——Power graphic charts showing cost of electric help plant management By D. W. Blakeslee. *194.
——Pulley sizes, standard, for motors recommended by Power Club 580
——Pumps, poor alignment causes most trouble of centrifugal. By John M. May. 836
——Rheostats connection of for testing By Eustace C. Soares. *579.
——Rivets out electrically in five seconds, three-quarter-inch. By J. A. Osborn. 290.
——Rivets, machine electrically heats, in series. By Alex. Stirling (D). *643.
——Shovel, electric, economical in excavating canal, 932.
——Solenoid, double-acting, which has strong pull. By J. W. Murray. *435.
——Speed, best way to take By D W. Blakeslee, 340.
——Storage-battery maintenance systems for good operation By Anderson Pace 932.
——Substation in narrow space, compact industrial. *341.
——Substation, portable, mounted on sled. By F E Gray *131
——Sweating, keeping electrical machines warm prevents sweating. By O. Needham. 79
——Switch, home-made inclosed reversing, prevents shock. By E. C. Soares. *190.
——Switch, starting, mounted directly on grinder frame, *1173.
——Switch, window bricked in to hold service. By A. Johnson. *291.
——Switchboard arranged for quickly making wide range of tests. By W. H. Farr. *192.
——Synchronous motor, starting a, without starting equipment. By Frederick Krug 482.
——Test clips with insulating handles. By Philip G. Bernholz. *290.
——Tests of lamps and fuses, board for quick By F. Krug. *340.
——Textile motors attached directly to spinning frame cylinders. By L R West *1076.
——Tractor, does heavy hauling on 25 per cent grade. By D. L. Darnell. *81.
——Tractor economies, industrial, 481.
——Tractor, saves 50 per cent at unloading pier. By Frederick B. Fink, 1026.
——Trolley and runway, serviceable. By Walter H. Millan. *1123.
——Voltages, various single-phase, from three-phase generator. By Eustace E. Soares. *532.
——Welding electrode, flat, requires less skill By W. W. Palmer. *883.
——Welding pipe, energy requirements in butt-. By G. T. Jacocks. *1267.
——Welding, short arc is necessary for successful. By C. J. Holslag. *434.
——Welding, speeds attained in electrical hand. *981.
——Welds, simple tests for. By S. W. Miller. 1174.
——Wire, elastic brake for unreeling. By Cornelius G. Weber. *837.
——Yard lamps and transformers carried on same pole. *1077.
Industrial equipment, intelligent salesmen for (comment), 157.
Inspection and maintenance, systematic, *179 comment, 158.
Inspection for power plants, scheduled, *922, comment, 911.
Inspection, insurance companies are placing more emphasis on electrical, 893.
Inspection tests for electrical equipment. By A. S. MacDowell, *633, comment, 607.
Institute of Radio Engineers:
——Germany and Austria, progress in discussed, 492
Insurance, Iowa discussing rural-line liability insurance 989
Instruments:
——Anemometer, the directional hot-wire; its sensitivity and range of application. By J S G Thomas (D) 1179
——For photographical or electrical registration of periodic changes in rotational velocity By Blondel (D) *841
——Phase-sequence indicator portable States Company, *1289.
Reading indicating from a distance By Palm (D) *792
——Scientific, tariff on (comment), 54.
——Testing table, polyphase and instrument By H. P. Sparkes. *380.
——Transformers By R S J Spilsbury (D) 86
Insulating, electric:
——Cable, thickness of, differs widely with different companies, 339.
——Tests, duration of. By R. C. Muir, 186.
——Transmission line, in America. By F Peek, Jr., *1061, *1104, comment 1054, 1102.
Insulators:
——High tension, theory of. By Schwaiger (D), 936.
——High-tension, voltage distribution on. By A. Schwaiger (D), *1272.
——High-voltage, surface creepage and. By T Nishi (D), 1273.
——Higher voltages, for (comment), 269.
——Surface creepage and insulator flash-over (comment), 1199.
——Surface leakage as a factor in design By T. M. Feder (D), 840.
——Suspension, case against Ohio Brass Company dismissed, 990.
——Suspension, characteristics and tests of By P. G. Venturini (D), *536.
——Suspension, electrical characteristics of the By F. W. Peek, Jr., (D), II, 696.
——Suspension, factors controlling design and selection of. By W. D. A. Peaslee (D), *438.
——Suspension unit voltage duties in long By Harris J. Ryan and Henry H. Henline (D), 344.
——Testing, in factory and field. By Leslie N. Crichton (D), 1179.
Interest charges during construction. By Page Golsan, *116, comment, 109.
Intermountain utility commissioners would form association, 1278.
International Bureau of Weights and Measures, functions may be increased, 445.
International Chamber of Commerce:
——Work, preparing for, 301.
International Electrotechnical Commission. By Francis B. Crocker, 337.
Iron:
——Alloys, magnetic properties of (D), 392.
——Losses, high-frequency. By Thomas Spooner (D), 745.
——Standing, for delicate fabrics. Waage Electric Co., 1049.
Isolated plants and central-station costs (comment), 270.
Italy:
——Rome radio station of Italian navy By Cyril F. Elwell (D), 199.

J

Jackson, Dugald, Caleb, *1104.
Janssen medal awarded to Dr. W. W. Coblentz, *1279.
Japan soon to have 160 kw. transmission line, 254.
Jovian Order, future of to be decided at November meeting, 799.
Junkersfeld, Peter, *1200.

K

Kansas Public Utilities Assn., convention: recommended principles for inclusion in Kansas utility act, 1183.
Kansas to hold water-power congress, 1087.
Kennedy, Samuel Macaw, *912.

L

Labor:
——Boston Edison reduces rates and increases wages, 36.
——Chicago electrical men expect wage settlement, 255.
——Democratic platform discusses labor's rights and duties, 93
——Doherty would stimulate production by throwing out trouble makers, 1083.
——Economic forces, not superior to (comment), 1101.
——Education of, a good investment (comment), 221
——Family spirit of employees a valuable asset to an organization, 1195.
——Government electrical workers, basic rates for, 1276.
——Oregon industrial court proposed, 846.
Lamps, electric:
——Arc, enclosed carbon, versus novalux mazda units. By H. E. Butler (D), 294.
——Arc photographic. J. H. Wagenhorst & Co., *342
——Arc, with rotating arc. By Garbarini (D), 85.
——Cadmium—vapor lamp, new. By Frederick Bates (D), 31.

*Indicates illustrated articles

Lamps, gas-filled:
——Mercury vapor, Cooper Hewitt. By L. J. Luttolph (D) 1 936
——Mercury-vapor lamps for alternating current 1065.
Lamps, incandescent:
——Cubop—toned (comment) 1006.
——Double-base, safety features of. By Edwin D Tillson 75
——Machine for winding lamp filaments Charles Eisler, 1049.
——Mazda, changes in Edison Lamp Works of G. E Co., *712
——Miniature, Edison, standard versus special. By L. C. Porter (D) 344.
——Projection for (comment) 159.
——Testing of Government supplies, 877.
——Theory and characteristics of. By Henry Schroeder (D), *583.
——White "Mazda," distinctive features of (D). 1031.
Legal decisions (Court decisions):
——Appellate court must exercise independent judgment in proceedings charging confiscation, 1186.
——Assumption of risk by lineman question for jury 897.
——Barrier between substation bus wires and transformer, electric company not negligent in failing to provide, 945.
——Burden of proof, 594.
——Burglar-alarm company, electric, a public utility, 97.
——Circumstantial evidence of contributory negligence not necessarily conclusive, 304.
——City stopped from denying that rights were conferred on company 594
——City operating electric light plant not a "private corporation," 1136.
——Cities in Florida, power of, 496.
——Commission cannot fix rates in territory exempted from its jurisdiction, 1136.
——Commission law, Missouri, 897.
——Commission orders, conclusiveness of, 546
——Commission, powers of Colorado, 449.
——Commission's illegal action by [illegible]
——Commission's power to change franchise rates not unconstitutional, 1090
——Compensation claimant, cessation of disability of, open to inquiry after final judgment 657
——Confiscation needs convincing proof, 449.
——Contracts and powers of the State, 945.
——Contracts not voided by change in form of city government, 401.
——Contributory negligence despite warning prevents recovery of damages, 145.
——Contributory negligence in Vermont, 1234.
——Contributory negligence not a factor where lineman climbs rotten pole in course of duty, 704.
——Corporations have no liability for injuries incurred while they were in federal control, 208.
——Court order for definite complaint not appealable, 1136.
——Courts will not interfere with corporate management in absence of fraud, 754.
——Cupples Station case, 657
——Customer responsible for existence of "jumper" on his service. By O B Reemelin, 1216.
——Damage case, where facts in, are undisputed, degree of care shown is question of law, 353.
——Damage suit, specific complaint, 1234.
——Damages, recovery of, denied where company's negligence was not proximate cause of injury, 353.
——Dams, safety factor in construction of, 145.
——Dams that do not interfere with navigation are not nuisances per se, 1090.
——Death from 120 volts held not to warrant damages—Negligence must be proximate to be actionable, 594.
——Death from uninsulated wire passing through tree, company liable for, 496.
——Declaration of death of child from uninsulated wires furnishes legal cause of action, 257.
——Defective insulation as a proximate cause of injury, 1042.
——Delegated authority and commission regulation, 1090.
——Demand charge, unusual court action appears to question, 1184.
——Directed verdict where defense charged contributory negligence, 1186.
——Duty of power company to servants of telephone company using same street, 993.
——Electric company responsible for line over which it transmits energy, regardless of ownership 546
——Electrical jurisprudence, a fine point in. By Frank W Chase 689
——Eminent domain and electric utilities, 257.
——Employer held responsible for death supposedly caused by 110 volts 849.
——Erroneous instruction on reasonable case upsets verdict 1186
——Financing by state of line construction, contract for upheld 544.
——Flooding land, damage from, 97.
——Franchise purchasers of [illegible] may discontinue operation 1042
——Franchise rights consent of municipal authorities and right to injunction, 41.
——Fraudulent transfer, 754.
——Highway crossing railroad track electric companies may use 1186
——Joint use of and poles in street as nuisances, 849.
——Jury must be shown in order to bring reversal [illegible] 657
——[illegible] to [illegible] factor, owners not [illegible]

Legal decisions (Continued):
——Jurisdiction of court of equity in case appealed from commission, 208.
——Jurisdiction of court public service commissions law does not oust, 1282.
——Jury entitled to know that witnesses in damage suit represent insurance company, 897.
——Law, fourteen-year-old, becomes confiscatory, 1234
——Missouri commission enjoined from enforcing rate based on original cost, 1036.
——Modification of contract in accordance with approved provisions, Massachusetts department without power to prevent, 145.
——Municipal plants in Arkansas, establishment of, 546.
——Municipalities in Ohio, powers of, 496.
——Negligence and defective insulation, 802.
——Negligence in furnishing safe place to work a question of fact, 208.
——Negligence of electric company must be proximate cause of death to justify verdict for damages, 208.
——Negligence under California workmen's compensation act, 594.
——Negligence, what constitutes, 594.
——Niagara, right to construct tunnel at, sustained, 704.
——Operation at a loss cannot be compelled, when utility abandons property, 1136.
——Overflow, eighteen years' silence does not outlaw suit for damages from, 145.
——Operation may be discontinued where utility can only be run at a loss, 1186.
——Power Co. wins right etc.:
Correction, "Bulk energy supply in competitive territory not allowed," 1184.
——Power to fix charge retained by state, 754.
——Powers of trial judge in jury case involving alleged injury from erection of dam, 353.
——"Proximate cause," definition of, 993.
——Public service commissions and the Fourteenth Ammendment, 257.
——Public Service Commission, functions of, 208.
——Public utility procedure not changed by creation of Kansas court of industrial relations, 449.
——Railroad commission, powers of Michigan, 401.
——Rate base, principles applying to determination of present-day, 1234.
——Rate-fixing powers, commission's—equal protection—franchises not property, 41.
——Rate-fixing powers of commission, emergency, 754.
——Rate fixing, value of franchise in, 1234.
——Rate increases not retroactive, 657.
——Rate procedure in N. Y. State, 1042.
——Rate, schedule, collectible even if commission investigation is proceeding, 657.
——Rates action by commission a prerequisite in raising contract, 41.
——Rates, legislative power of municipality to fix utility, cannot be abridged, 657.
——Rates, moral debt by company where excessive, have been paid, 594.
——Rates, power of utility to increase, without sanction of commission, 97.
——Rates prescribed by ordinance unreasonable, burden on utility to show, 657.
——Rates, unjust, cannot be approved by commission, 594.
——Rates, utility cannot increase franchise, without action by commission, 945.
——Rehearing from commission need not be asked before court action, 594.
——Responsibility for damages caused by fire set by employees, 304.
——Seattle's new plant, judge refuses to hinder, 304.
——Scope of review of facts, 802.
——Service, public utilities may be forced by mandamus to continue, 1282.
——State and municipal function, 704.
——Station commission, powers of, to modify city franchise, 255.
——Streets, privilege of using, 496.
——Transformers, no obligation on company to guard, 1234.
——Tree-trimming rights, 208.
——Water, manner of flowing, over another's land cannot be materially changed without consent, 657.
——Water rights at Dolgeville, N. Y., title to, 97.
——Wire, broken or fallen charged, in street presumptive evidence of negligence, 993
——Wire over unopened highway, liability for injury from 208
——Wire strung through tree, company liable for injury to child from, 208.
Lighting, electric (See also Lighting, industrial and Lighting, street.)
——Alternating current. By V G Goodwin (D), *198.
——Brightness and allied considerations (comment), 1103.
——Calculation of illumination, graphical. By K S Weaver *880.
——Christmas tree lamp, Westinghouse Lamp Co., 1001.
——Christmas-tree outfit. General Electric Co., *215.
——Coefficients of utilization. By Ward Harrison and Earl A Anderson (D) 135
——Color of walls and ceilings effect of, on resultant illumination By A L Powell (D) 135
——Daylight artificial for merchandising and industry By G H Stuckney (D) 248
——Data file, 143.

Lighting, electric (Continued):
——Defective lighting said to cause annual accident loss of $300,000,000, 894.
——Direct and indirect illumination, designing. By M. M. Samuels and C. O. von Danenberg, *721, comment, 718.
——Dyes, machine to test permanence of. Atlas Electric Devices Co., 1001.
——Feeders, relation of, to watts per square foot. By Victor Tousley, 686.
——Glare, cut, and save energy (comment). 413
——Illumination and safety to be discussed at joint meeting, 798.
——Illumination, monograph on. By George A. Hoadley (D), 1224.
——Indirect, equipment, maintenance of. By J L. Stair (D), 646.
——Intensity of illumination on functions of importance to the working eye. By C. E. Ferree and Gertrude Rand (D). 936, comment, 910.
——Motor-car headlights and rear lights in relation to traffic requirements. By J. W. T. Walsh (D). 438.
——N. E. L. A. to conduct lighting demonstrations through new department, 543.
——Railroad signals, of. By L. C. Porter and F. S. Stallknecht (D), 439.
——Reflection factors, measurement of diffuse, and a new reflectometer. By A. H. Taylor (D), 984.
——Ryan, W. D'A., talks on achievments in. 1036.
——Office buildings and drafting rooms, lighting of. By A. L. Powell (D), 391.
——One hundred and ten volts versus 220-volt circuits from the standpoint of lighting service. By F. J. Gray and E. B. Fox (D), 438.
——School, should give 6 to 12 ft. candles, 18.
——Schools, lighting of. By A. L. Powell (D) 438.
——Shadow shield. Western Electric Co., 47.
——Show windows and show cases, lighting. By A. L. Powell (D), 536.
——Sign lighting, development of electric. By E. A. Mills (D). 744.
——Spotlight. Chicago Cinema Equipment Co., 857.
——Theater aisles, light for. Chicago Electric Light Co., 857.
——Theater, lighting the world's largest, *776. comment, 766.
——Traveling lights for display on Christmas trees. Edward A. Dieterich, *664.
——Walls and floors—their effects on lighting. By Van Rensselaer Lansingh (D), 85.
——Window, color screen for. National X-Ray Reflector Co., 503.
Lighting, industrial:
——Accidents and. By J. M. Woltz, 1216.
——Demonstrating effective, *865, comment. 862.
——Exhibit to open in San Francisco, 895.
——Holder, flexible light. Sterling Co., 1001.
——Lamp hanger, incandescent. Thompson Electric Co., 857.
——Machine tools, illumination for. By G. Wagschal, *925.
——Maintenance of lighting system. By A. L. Powell (D), 294.
——Mass production, as an element in. By Leon Gaster (D), 31
——Oregon, modern, for. By F. H. Murphy. *820, comment, 815.
——Output, necessity for standards in the relation between illumination and. By Ward Harrison (D), 646.
——Piers and warehouses, lighting. By A. L. Powell and R. E. Harrington (D). 344.
——Practical demonstration for jobbers at Nela Park, 654.
——Printing-plant, effective. By A. D. Bell *1153, comment, 1151.
——Production and illumination. By R. E. Harington (D), 1224.
——Productive illumination intensities, the real meaning of. By Davis H. Tuck, *684. comment, 670.
——Reflector for, R. L. M. standard. By Ward Harrison (D), 744.
——Textile mills, lighting of. By A. L. Powell (D), 391.
——Wisconsin lighting code now in effect for old installations, 91.
Lighting, street:
——"Electrical World" tables for 1920, issued, 1231.
——Ornamental, tendencies in. By L. A. S Wood, *324.
——Park system, maintenance of equipment on Lincoln. By C. H. Shepherd (D), 583
——St. Louis, cost nearly doubled, 644.
——St. Louis, electric lighting replaces gasoline park lamps in, 444.
——Units, developments in. By A. D. Cameron and C. A. B. Halvorson (D), 135.
Lightning:
——Arrester, self-contained low voltage. Westinghouse Electric & Mfg. Co., *664
——Arresters. By C E. Bennett (D), 1225.
——Arresters, oxide-film, life and permanence tests of. By N. A. Lougee (D), 1272.
——Protection discussed by A. I. E. E 1040
——Protection of 4,000-volt lines, *973, comment, 959.
——Protection, theory and practice. By F. A. Brackett (D), 1127.
Line construction, closer supervision of (comment), 1005.
Lubricating oils and greases, writing specifications for. By A. A. Potter and A. J. Mack, 281.

*Indicates illustrated articles

M

McGraw James H., *4.
Machinery, electrical
——Direct current design of commutating poles in. By Oelschlater (D), 646.
——Direct current, periodic self excitation in. By Leyerer (D), 744.
——Grounding of and installations. By J Dannen (D), 85.
——Predetermination of the general dimensions of. By H de Pistove (D), 85.
Magnet:
——Control, hold-down, for vertical plate shears, *1071.
——Permanent in theory and practice. By S Evershed (D), 345.
——Steels method of testing. By F. R Hou den (D), 887.
——Windings, concentrated versus distributed (comment), 1006.
Magnetic:
——Circuit of a magneto, energy in the. By N. W. McLachlan (D), 584.
——Compasses, testing of. By R. L. Sanford (D), 487.
——Effect, a new galvano. By La Rosa and Sellerio (D), 537.
——Field close to an iron surface. By Lehrs (D), 1273.
——Forces in disconnecting switches, *1263.
——Properties of inhomogeneous material. By Gumlich (D), *1179.
——Properties of iron alloys (D), 537 (D) 697.
——Separator, Butte Electric & Mfg. Co., 952.
Maintenance problems and solutions. By E. A. Quinn and R. C. Denny, *1211, comment, 1199.
Maintenance; service work for 1919 below prewar cost. By D. W. Roper, *273, comment 274.
Manufacture of apparatus, American (comment) 109.
Manufacturers, opportunity for electrical (comment), 862.
Measurements:
——Alternating-current, bridge methods for. By D. I. Cone (D), 392.
——Casting temperatures in the brass foundry measurement of. By John Arnott (D), 937.
——Commercial electric, accuracy of. By H. B. Brooks (D), 199.
——Dielectric losses in high-tension apparatus, measuring. By A S mon (D), 647.
——Diffuse reflection factor, of, and a new reflectometer. By A. H. Taylor (D), 984.
——Direct currents, measuring large, at a distance. By H Ring (D), 86.
——Dynamometrical comparator. By Edy Velander (D), 295.
——High-tension currents, wave form of intermittent and pulsating (D), 1225.
——Hysteresis values, of, from high magnetizing forces. By W. L. Cheney (D), 199, (D), 439.
——Magnetic flux distribution, direct recording method of measuring. By F. S. Dellenbaugh, Jr (D), 295.
——Maximum demand, of, and determination of load factor. By Perry A. Borden (D), 985.
——Radio frequency note on. By Carl England (D), 584.
——Radio transmission, of the electromagnetic field of waves received during transoceanic. By Giancarlo Vallauri (D), 584.
——Rates, establishing simple basis for. By Ray H. Wolford, *382, comment, 415.
——Reflection factors, actual measurment of (comment), 863.
——Reflection factors, measurement of. By C. H. Sharp and W. F. Little (D), 936.
——Reflectometer, new portable. By A. H. Taylor, *467, comment, 463.
——Spectropyrheliometer, new, and measurements of the component radiations from the sun and from a quartz mercury-vapor lamp. By W. W. Coblentz and H. Kahler (D), 33.
——Thermocouples of iron and nickel alloys, use at high temperatures. By Hoffmann and Schultze (D), 841.
——Water, photographing stream lines in flowing. By Camichel (D), 1225.
Mechanical Engineers, American Society of. (See American Society of Mechanical Engineers.)
Meetings in September, electrical, 442.
Meltzer, Dr. S. J., of electric-shock-resuscitation fame, died November 7, p. 991.
Merchandise, new outlet for electrical, through chain stores, 395.
Merchandising electrical goods properly, a complete plan for, *534.
Metals, greatly increased use of electricity in production of various (D), 841.
Meters:
——Automobile test set. F B Electric & Mfg. Co., 1289.
——Light, new form of portable. By Davis Tuck (D), 984.
——Reading device. Economy Appliance Co., *1289.
——Records can be simplified. By Edward Howell and Charles L. Rose, *1256, comment 1246.
——Reflectometer a new, and measurement of diffuse reflection factors. By A. H. Taylor (D), 984.
——Steam-plant metering practice. By Robert E. Dillon, *630, comment, 718.
Meters (Continued):
——Steam plant, selection of. By J. W. Andree, *1014, comment, 1005.
——Voltmeter, direct-reading. By Abraham E. Bloch and L. Bloch (D), 249.
——Volt reader for testing batteries. Service Stations Supply Co., *712, correction, 1001.
——Wattless energy metering of. By R Kopp (D), 1127.
——Watt meter, thermal storage demand. By Paul M. Lincoln (D), 86.
Mexico:
——Federal ownership program causes surprise, 703.
——Sonora River, plans for 100,000-hp. plant on, 1232.
Middle west section, power service for a. By Capt. Lyle A. Whitsit, *969, comment, 958.
Mill, largest rolling, in world (D), 439.
Mines and mining
——Bureau of Mines may study physiological effect of electricity, 800.
——Coal, power requirements for. By Robert Anthony, *14, comment, 3.
——Electric power for mining. By F. S. Viele (D), 438.
——Locomotive headlight with spring-suspended case. Westinghouse Electric & Mfg. Co., *601.
——Locomotives, methods that will make electrical parts run efficiently (D), 439.
——Signal systems, designing. By R. H. Bacon, *372, comment, 367.
Missouri River Electrical Distributors' convention, 847.
Mixer aerating, for kitchen use. Air O Mix Corp., 1000.
Montana's first electrical show, *1088.
Motor cars, lighting and starting of, by electricity (D), 792.
Motor repairs:
——A C machines inserting magnetic slot bridges to improve operation of. By James Dixon, 579.
——Armature bands, calculating stresses in. By H. E. Weightman, 192.
——Armature repairs in large steel mill, contest which reduced. By D. W. Blakeslee, 531.
——Brush holder, oil on causes commutation trouble. By C. A. Johnson, *692.
——Coils, insulating ends of, with cambric, saves time. By C. A. Johnson, *80.
——Coils machine for winding armature. By L. E. Wood, *387.
——Coils, stand for holding reel while winding. By L E Wood, *291.
——Commutator, turning a, in place. By James Dixon, *129.
——Commutators on new machines, care and operation of. By James Dixon, 1268.
——Commutators, smoothing, by sanding and stoning. By Donald S. Merton, 1221.
——Cost records of motor repair shop used to classify expenses. By J B Tufts, *1175.
——Crossing of wires in armature coils, eliminating troublesome. By C. A. Johnson, *482.
——Data sheet for armature windings and repair information, *787.
——Induction motors, connecting three-phase. By A. C. Roe, *171, (with supplement)
——Interpole machines, careful adjustment advisable with. By James Dixon, 980.
——Interpole motor, wrong brush position changes speed of. By James Dixon, *692.
——Interpole winding, removal of shunt from, improved operation. By James Dixon, 883.
——Maintenance costs per motor average 50 cents a month. By H. L. Burns, 1077.
——Oil rings, beveling of, prevents sluggish action. By Philip G. Bernholz, *1027.
——Phase rotation, rewound motor for testing. By A. C. Roe, 740.
——Rack for small wire reels which maintains proper tension. By A. C. Roe, *933.
——Reconnecting 220-volt compound motor for 110 volts. By C. A. Johnson, 643.
——Record keeping, subdivision of motor maintenance items assist. By J. B. Tufts, 291.
——Rewinding motor with odd coil groupings. By C. A. Johnson, *25.
——Rewinding two-phase motor for three-phase operation. By A. C. Roe, 883.
——Rewinding 220-volt induction motor for 550 volts. By C. A. Johnson, 341.
——Rotor, test for defective squirrel-cage. By Philip C. Bernholz, 788.
——Short circuits in armature coils, device to detect. By A. Munoz, 1027.
——Slip rings to shaft, expanding sleeve method of fastening, *80.
——Slotting tool with interchangeable tool-steel blades. By W. A. Harris, *1122.
——Switchboard for testing motors, convenient home-made. By M. Haman, *1076.
——Synchronous motor, changing a generator to a. By R. H. N. Lockyer, *980.
——Synchronous motor troubles, how to remedy some. By James Dixon, 81.
——Two-phase motor, reconnecting a, for three-phase operation. By C. A. Johnson, 532.
——Voltage, halving motor, by adding commutator bar. By C. A. Johnson, *244.
——Wagon, motor-repair trouble, *435.
——Wedges, device holds motor, while driving them into place. By C A Johnson *740.
Motor repairs (Continued):
——Windings, cost of [illegible] motor. By J. A. Knutsen, 164.
——Work-order records for motor repair shop. By J. B. Tufts, *1026.
Motors:
——Alternating-current, small, American Radio & Research Corp., *952.
——Ball-bearing type, Cleveland Electric Motor Co., *152.
——Direct-current, for crane and hoist work. By F. L. Moon (D), 1224.
——Direct-current, variable speed, shunt-wound (D), 744.
——Forty degree-fifty degree investigation to be sponsored by A. I. E. E., 1227.
——Forty-degree vs. fifty-degree motors for steel mill uses and practices discussed, 1227.
——Forty-[illegible] advantages of. By L. B Gaffenhouse, 125.
——Fractional horsepower
A-C Electrical Mfg. Co., 1001.
H-G Mfg. Co., *1097.
——Induction.
Core losses. By P. L. Alger and R Ekserdjian (D), 936.
Improving power factor conditions with. By R. G Warner and A E. Knowlton, *1021, comment, 1006.
Two phase, reconnecting. By A C Roe, *683, comment 670 (with supplementary chart).
——Industry, application of power to modern, *165, comment, 158.
——Inspection and maintenance, systematic, *179, comment, 158.
——Loading of electric, continuous, occasional and intermittent. By Blanc (D), 1080.
——Portable power stand. Delco Light Co., 553.
——Rating of, for intermittent work. By Adler and Schiebler (D), 583.
——Standardization, features requiring. By C. W. Starker, *919.
——Starters.
Induction-motor starting switch, Union Electric Mfg. Co., 104.
Time-limit automatic, Cutler-Hammer Mfg. Co., *761.
——Steel-mill, keeping, in service. By O. Needham, *237, comment, 222.
——Three-phase, graphical method for analyzing the performance of cascade-connected. By J. Kozisek (D), 646.
——Traction dimensions of single phase. By F. Unger (D), 31.
——Utility, on tripod base, Westinghouse Electric & Mfg. Co., *1144.
Municipal ownership:
——Costly experience resulting from political interference, *376.
——Fiasco of government and (comment), 1101.
——Manufacturers urge city to replace municipal with purchased energy, 351.
——Municipal point of view, a queer (comment), 413.
——National Association of Railway and Utility Commissioners criticize public ownership and operation, 1028.

N

National Association of Electrical Contractors and Dealers:
——Convention, business and pleasure to blend at, 295.
——Convention, industrial business and merchandising to be discussed, 655.
——Convention; merchandising electrical appliances has attention, 752.
——Convention (comment), 765.
——Labor committee, vote to continue, 796.
National Association of Electrical Inspectors:
——Discuss grounding of secondaries, 846.
——Experts to address, 350.
——Underwriters will talk to, 748.
National Association of Manufacturers, political program (comment), 53.
National Association of Railway and Utility Commissioners:
——Oppose government ownership, favor higher rates, 1039.
——To discuss public relations, 844.
National Electrical Code: comment—Unnecessary tax on industry, 861.
National Electrical Credit Association, annual convention; discuss cost-accounting system, 95.
National Electric Light Association:
——Accounting course, reduces price of advanced, 302.
——Coal car priority order, requests continuance of, 347.
——Comments, 1.
——Executive committee meeting manufacturers attend, for first time, 489.
——Executive committee meeting Sept. 1, 350.
——Geographic divisional committee meetings, itinerant (comment), 1149.
——Good-will advertising, approval given to direct, 1277.
——Good-will advertising program developing rapidly, 892.
——Good-will appeal to holders of electric light and power securities *943.
——Good-will campaign (comment), 669.
——Great Lakes section organized, 490.
——Hydraulic power committe formally organized, 702.
——Iowa section, annual convention, *38.
——Iowa section, committee of, urges increased electric rates, 940.
——"Kilo Watt" publicity going strong, 650.

*Indicates illustrated articles

National Electric Light Association (Continued):
——Lamp-voltage standardization, backing, 1279.
——Lighting demonstrations through new department to conduct, 543.
——Manufacturers' co-operative good will advertising plans shaping up, 989.
——Michigan section arranges diversified convention program, 255.
——Michigan section discusses utility problems and rural service, 442.
——Michigan section, convention, 493.
——Nebraska section prepares comprehensive program, 398; convention, *591.
——New England geographic division convention, 652.
——New England section
Convention, 589.
Good-fellowship dinner notable success, 1277.
Prizes to award, 1133.
Program completes, 350.
——Northwest division indorses co-operative plan, 539.
——Public policy committee, S. Z. Mitchell to head, 201.
——Public relations section postpones organization, 139.
——Public relations section, to organize, 350.
——Publicity, to educate public through, 542.
——Rocky Mountain division completes organization, 650.
——Rocky Mountain section to meet with Colorado Association, 398.
——Safety Code rules to which exception is taken by, 446.
——Southeastern section:
Convention, annual, 845, 1037.
Officers for, new, 1088.
Presidents, incoming and retiring, *1134.
——Standards, non-recognition of, results in confusion. By L. C. Peterman, 929.
——Technical section meetings, 253.
National Electrical Safety Code:
——Comment—Unnecessary tax on industry, 861.
——Joint-pole use versus overbuilding or conflicts, 347.
——Revised edition expected late in summer, 94.
——Revision of Bureau of Standards safety code (comment), 366.
——Rules to which exception is taken by N. E. L. A., 446.
National Research Council takes up insulation problem, 942.
National Safety Council, many public utility hazards to be considered by, 592.
Networks, graphical determination of voltage distribution in. By Thomalen (D), 984.
New England electrical interests propose 25 per cent growth in 1921, 1295.
New England power situation, survey of. By Major Carroll H. Shaw, 525, comment, 510, correction, 737.
New York Electrical Show:
——Industrial uses to be emphasized at, 655.
——Largest ever held there, 749.
Niagara Falls Power Co., extension to station No. 3, *561, *678, *779, *825, *875, *961.
Nickel-iron alloys, some physical properties of. By L. R. Ingrsoll (D), 745.
Northwest Electric Light & Power Association, Convention, Spokane, 398, 590.
Northwest Electric Service League indorsed, 989; begins activities, 1131; launching, 1183; proposed policy of, 1223.

O

Oersted centenary, the. By Godfrey A. P. V. Baumgarten, 287.
Ohio Electric Light Association:
——Convention program, 93.
——Ohio and affiliation (comment), 157.
——Public co-operation and need of fair taxation discussed by, 139.
Oil:
——Burning as an industrial proposition. By F. Schoumanne (D), 135.
Fuel as central station. A much mooted question (comment), 462.
——Fuel, considerations in the burning of, *326, comment, 318.
Fuel oil pumps, operation of. By C. H. Delany, 21.
——Fuel, unusual efficiencies with. By Joseph Pope and Frank G. Philo, *730, comment, 719.
Replacing by coal on Pacific Coast, consider, 300.
Oil circuit-breakers:
Capacities, determining. By C. J. Hoe, *67, comment, 55.
Rated at 1,000,000 kva., 702.
Selection of. By W. A. Coates, D, 301, 537.
Oscillograph, portable. By J. W. Legg (D), 744.
Oscillograph, improved, for athoderay. By Rogowski (D), *885.

P

Pacific Gas & Electric Co.
New power plant of, 399.
Rate case, 350.
Pacific Light & Power Corporation, rate case of, national, 13.
Pacific Gas & Electric Co. settles rate case, 39.
Pacific Light & Power Association, Convention, Los Angeles, 193, 590.
Panama Canal, E. B. S. commerce, 103.
Panama Canal, 1,000 miles by way of, 647.
Panama Canal, U. W. Y. & ... 1200.
Plow, new electric. By Delamarre (D), 1273.
Plowing, electric. By Guideney (D), 295.
Poles:
——Joint construction, considerations in (comment), 2.
——Steel, design. By Fener (D), 936.
——Wooden transmission-line, computing the dimensions of. By P. Neumann (D), 840.
Power:
——Development in the Southern States. By Capt. George K. Miltenberg, Capt. Lyle A. Whitsit, and Capt. Robert W. Lamar, *769, comment, 767.
——Development of the future (comment), 1246.
——Electric energy has best of steam power, 246.
——Interchange of industrial and central station energy. By Cornelius G. Weber, *173, comment, 159.
——New England situation, survey of. By Mayor Carroll H. Shaw, 525, comment, 510.
——Restrictions in southern California to be removed, 202.
——Situation on the Pacific-Coast (comment), 910.
——Supply, co-operation in (comment), 55.
Power factor:
——Cost of low (comment), 605.
——Measurement of, for rate purposes (comment), 111.
Power plants: (See also Central stations and Hydro-electric development.)
——Design (D), 840.
——Developments in, and generating stations. By Alfred Still (D), 696.
——Maintenance, centralizing. By W. C. L. Eglin and F. C. Ralston, *609, comment, 671.
——Maintenance costs, analyzing, *613, comment 607, correction, 670.
——Plant efficiency rewards hard work (comment), 909.
——Seattle's Cedar Falls power house, plans ready for city of, 543.
——Steam high economy in small. By E. H. Tenney, *616, comment, 606.
——Transportable. New York Engineering Co., *952.
Power service for a middle west section. By Capt. Lyle A. Whitsit, *969, comment, 958.
Power transmission and industrial congestion (comment), 110.
Precipitation treater, new electrical. By Motoji Shibusawa and Yasuziro Niwa (D), 887.
Prices, determining cost (comment), 222.
Prime movers, regulating hydro-electric. By C. F. Mosher, 280, comment, 271.
Proceedings, publication of verbatim, wasteful. By H. S. Cooper, 75.
Production, preaching the gospel of (comment), 367.
Public relations:
——Acts that hurt utilities are of greater danger to public, says Insull, 939.
——Baltimore company's service department aids, 132.
——Civic enterprises, light belts used to advertise, *885.
——Confidence of public necessary to utilities says Insull, 141.
——Costs, increased operating, affect both newspaper and utility, 82.
——Customer ownership of securities (comment), 1053.
——Customer ownership of securities. By William H. Hodge, 1018, comment, 1007.
——Education and square dealing emphasized (comment), 3.
——Electrical industry, for better, in the, *389, comment, 365.
——Extent of territory served, showing the public, *582.
——Good-will advertising, more than $200,000 already placed for co-operative, 1227.
——Greensboro, N. C., stands by its local electric company, 255.
——Indiana, effort in, to secure passage of resolutions favorable to utilities, 939.
——Indianapolis utility steps out of its field to serve public, 1271.
——Investor, relation of, to public utility good will, 982, comment, 957.
——"I thank you." By S. M. Kennedy, *123, comment 159.
——Louisville public to hear about essentials of light and power business, 799.
Manufacturers' co-operative good will advertising plans shaping up, 989.
——Manufacturers should build "customer-partnership" with utilities, 443.
——Manufacturers to create public good will for utilities, 653.
Merchandising as a public policy asset, 133.
Need for better, seen by New York utility men, 798.
N. E. L. A. good-will advertising program developing rapidly, 892.
——N. E. L. A. good-will campaign (comment), 669.
——Niagara power development, historical address of, *645.
——Ohio, Oklahoma and Missouri now have utility information bureaus, 892.
——Partnership, taking the public into (comment), 109.
Plant closed without warning because of high cost of coal, 654, comment 605.
Public ownership emphasized, undiplomatic (comment), 765.
Publicity with reference to objective, *1177.
Public Relations (Continued):
——Rate adjustments automatic, help (comment), 1149.
——Rate increases, public policy in (comment), 1197.
——Right understanding of commission rulings aids public confidence, 789.
——Sincere but misguided (comment), 223.
——Texas utility conducts successful publicity campaign, *134.
——Utilities must engage in a good-will campaign, why. By George F. Oxley, *694.
Public service corporations:
——A business where honesty prevails. By Frank W. Chase, 1264.
——Brighter outlook for public utilities, says National City Company, 90.
——Executives, future public utility (comment), 717.
——Industrial support for central stations. By John Milton McMillin, 677, comment, 669.
——Insull sees better times ahead for, 795.
——North Jersey Power Company, formation postponed, 143.
——Public ownership and operation criticized by commissioners, 1028.
——Small utility, the (comment), 813.
——Springfield, Ill., renews negotiations to purchase utility properties, 94.
——Utility, strengthening the. By Carl D. Jackson, 831, comment 814.
Pumps and pumping:
——City pumping plant, data on electrically-driven, 1222.
——Oil wells, drilling, pumping and pulling of, done very economically with electricity, *172.
——Water pumping plants found satisfactory, electric, 790.
——Water system, Thompson Mfg. Co., 1241.
Purification of air, electric. By D'Arsonval, Bordas and Touplain (D), 136.

R

Radiation, quantum emission phenomena in. By David L. Webster (D), 584.
Radio:
——Airplane antenna, energy measurements in the radiation field of. By Balders and Hase (D), 888.
——Alexanderson continuous-wave system (D), 439.
——Alexanderson system. By Elmer E. Bucher (D), 1225.
——Alternators, radio-frequency. By Marius Latour (D), 33.
——American R. & T. and General Electric to exchange wireless patents, 441.
——Antenna, method for measuring the reserved current in a. By H. de Bellescize (D), 136.
——Antenna radiation. By A. Press (D), 1273.
——Antenna, wave-length relation for a generalized Bessel's. By A. Press (D), 1081.
——Beat reception, on. By Meissner and Scheiffler (D), 1081.
——British empire, linking up the, by wireless, 124.
——Canadian General Electric and Marconi interests, merger of, 703.
——Central station for radio power supply, *1036.
——Compass, the, and the guiding cable. By S. Kruse, 1170.
——Direction changes and variations of audibility. By Carl Kinsley and Albert Sobey (D), 487.
——Distance of 7,500 miles covered by 80-kw. stations (D), 199.
——Duplex, between the United States and Germany (D), 199.
——Electrostatically coupled circuits. By Louis Cohen (D), 1032.
——France, powerful station put in service in, 445.
——Frequency measurments. By Carl Englund (D), 585.
——Ground wires, use of, at remote control stations. By A. Hoyt Taylor (D), 199.
——Harmonics in machine transmitters, use of electric filters for elimination of. By K. W. Wagner (D), 487.
——Inductance coils, radio-frequency. By M. K. Zinn (D), 33.
——International communication, re-establishing comment), 863.
——Interrupter for spark coils, reversing. By Falkenthal (D), *33.
——Italian navy, Rome radio station. By Cyril F. Elwell (D), 199.
——Largest station will operate five units simultaneously, 143.
Radio-telegraphy multiplex. By F. M. Ryan, J. R. Tolmie and R. O. Bach (D), 1273.
——Radio-telegraphy, Poulsen system of. By C. F. Elwell (D), 345.
——Radio-telephony:
Concerts. By Lee de Forest, 576.
Conductor-directed. By Count Arco (D), 1127.
Duplex. By P. P. Eckersley (D), 647.
Farm living conditions, wireless telephone to improve, 300.
Multiplex. By F. M. Ryan, J. R. Tolmie and R. O. Bach (D), 1273.
Progress (D), 199.
Transmission and reception, simultaneous. By Nobuso Marumo (D), 86.
Transmitter for seaplanes (D), 537.
Transoceanic, another step toward, 951.
Transoceanic (comment), 318.
——Service opened between New York, Cleveland, Detroit and Chicago, 1280.

*Indicates illustrated articles

Radio-telegraphy, multiplex (Continued):
——Ships successfully guided into harbor by radio detectors, 493.
——Spark transmitters, overstresses due to resonance phenomena in high tension direct-current machines for. By K. W. Wagner (D), 647.
——Static elimination by directional reception. By Greenleaf W. Pickard (D), 888.
——Transmission, efficiency of aerials and power required for long distance. By G. W. O. Howe (D), 887.
——Transoceanic transmission, measurements of the electro-magnetic field of waves received during. By Giancarlo Vallauri (D), 584.
——Triode oscillator with intermediate circuit, theory of the. By Kurt Heegner (D), 937.
——Vacua, production and measurement of high. By Saul Dushman, (D), I 295.
——Vacuum-tube amplifiers. By Marius Latour, 241.
——Vacuum tubes at radio frequency, input impedance of. By Julius Weinberger (D), 841.
——Vacuum tubes, some notes on. By John H. Morecroft (D), 33.
Railways:
——Alternating-current track circuiting. By L. H. Peters (D), 1127.
——Braking of direct current vehicles, electric. By W. M. Hutchison (D), 1081.
——Car, the safety. By W. D. Bearce (D), 486.
——Chicago, Milwaukee & St. Paul, electric power consumption on electrified divisions. By Reimer Beeuwkes (D), 1126.
——Circuits, regulation and inductive effects in single-phase. By A. W. Copley (D), 438.
——Cleveland Interurban Railway Co., Multiple-unit control for the. By H. R. Meyer (D), 1178.
——Current collectors, 3,000-volt. By W. Schaake (D), 249.
——Electrification:
Belgium, economical aspects of, in. By Carlier (D), 31.
Cuba, of the Central Limones. By O. Wortman (D), 1127.
Direct or alternating current for. By Seefehlner (D), 936.
Illinois Central terminal, commission appointed for, 1228.
Italy, in (D), 1178.
Question of whether it will pay, now merely a, 891.
Electrification. Steinmetz advocates, 892.
Stockholm-Gothenburg Railroad to be electrified, 1134.
Swiss railroad, near, 351.
——Italian state railway electrification system. By A. Barbagelata (D), 438.
——Locomotives:
Auxiliary and lighting control equipment of the C., M. & St. P. By John A. Clarke Jr. (D), 86.
Braking, regenerative, with single-phase. By M. Schenkel (D), 791.
Coupling between motor axis and drive wheels on, mechanical. By Sheefehlner (D), 791.
Freight, for the St. Gotthard Railroad (D), 294.
Gathering, new type of. By John Liston (D), 86.
New electric (D), 696.
Performance, data on electric, *878, comment 862.
Powerful three-phase (D), 647.
Steam and electric, to discuss relative advantages of, 798.
Swiss electrification, for. By Schraeder (D), 1224.
——Motor buses or trackless trolleys. By H. L. Andrews (D), 32.
——Multiple-unit train operation. By S. B. Scheneck (D), 1031.
——Overhead construction for electric railroads. By Reishaus (D), 584.
——Power, should be placed on competitive basis, 695.
——Protecting electrical equipments. By Lynn G. Riley (D), 1031.
——Signals, electric lighting of railroad. By L. C. Porter and F. S. Stallknecht (D), 439.
——Single phase in thirteen years' successful operation on the Erie. By F. W. Hershey (D), 1080.
——Spokane's traction problems being solved (D), 1272.
——Substations, modern devices and control for automatic. By Cassius M. Davis (D), 85.
Rainfall records, value of. By Byron E. White, 337.
Rates. (See also Regulation of public utilities.)
——Appraisals, actual cost versus reproduction cost in public utility. By Harold Almert, 1118.
——Basis for, Ballard advocates new, 748.
——Basis for, establishing simple. By Ray H. Wolford, *382, comment 415.
——Boston Edison reduces, and increases wages, 36.
——California Commission will not base, on present-day costs, 1083.
——California court annuls order on mumeipality to file, 540.
——Coal cost to affect lighting bills, 894.
——Fixing, arithmetic and rate (comment), 559.
——Flat, are desirable? (comment), 1053.
——Fuel clauses definite, important (comment), 958.
——Higher, imperative (comment), 669.
Rates (Continued):
——Higher, necessary (comment), 317.
——Idaho Power Company gets increase in Oregon, 41.
——Increased, wait on improved service, 1276.
——Increased, will renew confidence in utility securities, 540.
——Indianapolis electric companies increased rates granted, 142.
——Iowa, uniform method of procedure on, advocated, 891.
——Iowa section, N. E. L. A. urges increased electric, committee of, 941.
——Manufacturers ask increased rate for public utilities, 92.
——Metering, secondary, nullifies 10 per cent rate increase, 1279.
——Missouri commission advances rate base from 7 to 7½ per cent, 1230.
——Nebraska electric utility, may be regulated by commission, 588.
——Oil costs, sliding scale of rates asked on basis of, 351.
——Pacific Gas & Electric gets 15 per cent increase, 92.
——Poor service means end of higher, 1228.
——Public policy in rate increases (comment), 1197.
——Puget Sound Company gets increased, 205.
——Railroad rate decision has important bearing on utility changes, 297.
——Readjustment is essential, declares president of Southeastern N. E. L. A., 1037.
——Should central-station rates be materially increased and at once? By Kassandra, 934.
——Straight rate better than combination, in opinion of Michigan company, 703.
——Texas company to raise power, to protect lighting customers, 654.
——Toronto Hydro-Electric System increases rates, *485.
——Utility, and the bonus system (comment), 719.
——Valuation at present-day figures, danger in (comment), 366.
——Valuation, the justice of current cost. By Philip Barton Warren, 1249, comment 1247.
——Valuation on present-day costs, Omaha mayor advocates, 542.
——Variable, objections to, 39.
——Washington commission orders power company to reduce, 39.
——West Virginia Company would equalize, by zoning, 1131.
——West Virginia electric companies get increase in rates, 254.
Reactors for electric furnace circuits. By Harry A. Winne (D), *391.
Rectifiers:
——Mechanical. By A. Soulier (D), *248.
——Mercury-arc, self-exciting (D), 840.
——Thermionic valve, some applications of. By R. L. Smith-Rose (D), 487.
Rectifying galena contacts, artificial sensibility of. By Florisson (D), 840.
Reflecting power of monel metal, stellite and zinc. By W. W. Coblentz (D), 392.
Refractories, Ohio operating men see need for investigation of, 844.
Refrigeration, electric. By C. J. Carlsen (D), 1224.
Regulation of public utilities (Commission rulings):
——Abandonment of service forbidden, 304.
——Abolishing utility commissions (comment), 669.
——Accounts intelligible, insisted on, 754.
——Agricultural service, 496.
——Alabama commission now possesses jurisdiction over all contracts, 894.
——Allocating property of electric light and water company, 401.
——Allocating property of joint gas and electric company, 145.
——Allowances for past services, 496.
——Arkansas commission, fight over abolition expected, 1277.
——Arkansas commission, powers of, 1282.
——Arkansas Corporation Commission approves return of 7.4 per cent, 704.
——Assessing cost of synchronous motor-generator set, 754.
——Bills, fixing amount of minimum, 1090.
——California Commission will not base rates on present-day costs, 1083.
——California Railroad Commission, Commissioner Edgerton defends, 1087.
——Capital, need for adequate working, 1090.
——Cash deposits negotiable uniform, 41.
——Changing from direct- to alternating-current, 754.
——Character of service inefficiency, 897.
——City tax on utility revenues, inequity of, 41.
——Coal clause in Indiana, 897.
——Coal clause objected to as offering no incentive to buy advantageously, 541.
——Coal clause, proper apportionment of, 892.
——Combination contract not affected by change in rates for one of the commodities furnished, 1136.
——Commission, powers of Indiana, 257.
——Commission refuses to question books kept in accordance with its rules, 97.
——Commission will not revoke order restoring old rates because certain tariffs are missing, 446.
——Commission would make "contracting with oneself" legal offence, 1182.
——Commissions duty to see that utilities prosper, 494.
——Competitive company entrance of, into territory held to avail, 1042.
——Competition, Maryland commission will protect utilities against undue, 145.
——Competition, protection from, 257.
——Confiscatory rates, what constitutes, 1090.
Regulation of Public Utilities (Continued):
——Contract approved subject to subsequent valuation, 145.
——Contract limitation of service to installations of 75 kw. unconstitutional, 257.
——Contracts must not be varied without authority from commission, 145.
——Contracts, power and the small consumer (comment), 909.
——Co-operation on part of customers of small utility commended, 754.
——Cost, elements of, 353.
——Cost of money and comparison of return, 1234.
——Courts must decide if contract is violated by shutdown, 546.
——Court receivership does not abrogate commission control, 1090.
——Customer's rights superior to company's, 1090.
——Deferred maintenance in small plants effect of, on rates, 208.
——Delinquent customers right to discontinue service to, 993.
——Demand and "hours' use" factors, 449.
——"Demand charges," definition of, 594.
——Depreciation, 5 per cent for; 6 3 per cent for interest, 304.
——Depreciation funds, company forbidden to borrow from, for indefinite period, 849.
——Development of utilities depends on commissions, 742.
——Disconnection charge authorized, 257.
——Discontinuance of service, temporary, may be authorized, 1136.
——Duty of utility to city served, 449.
——Election favoring acquisition of plant by municipality not voided by technicalities, 353.
——Electric utility, what constitutes an, 257.
——Electricity must not be cut off where bill is disputed, 1186.
——Energy charge favored when shortage of power exists, 401.
——Expense, apportionment of indirect, 945.
——Expense of outside management disallowed, 401.
——Extension of service in rural communities, 208.
——Extension of service lines beyond corporate limits, 449.
——Extensions, abnormal conditions in relation to, 704.
——Extensions to municipal plants in New Jersey, 704.
——Extensions, use of depreciation fund for, forbidden, 657.
——Faith in regulation justified (comment), 317.
——Franchise, surrendering, in return for indeterminate permit, 1234.
——Free or reduced rate service to employees strongly condemned, 353.
——Free service and revenues, 657.
——Free service condemned, 496.
——Frequency rate in New Hampshire, standard, 41.
——"Going concern" value, Pennsylvania commission on, 496.
——"Going value," 496.
——Going value and cost of obtaining business, 1042.
——Going value and other factors entering valuation proceedings, 1136.
——Heating, air and water, discouraged, 945.
——Heating plants of electric utilities, 594.
——Helping the utilities commission to expedite its work, 535.
——Home rule in Denver (comment), 365.
——Hoover says utility regulation is an engineer's problem, 1227.
——Idaho Power Company gets increase in Oregon, 41.
——Illinois commission, first move to abolish, made two days after election, 989.
——Illinois utilities will become a political football? (comment), 957.
——Income of 11.4 per cent for return and depreciation approved, 1042.
——Increase allowed bringing rates up to those charged in surrounding territory by large companies, 546.
——Interruptions to service, responsibility of electric company for, 97.
——Irrigation customers new and old, 449.
——Irrigation service as byproduct of general electric service, 353.
——Just returns where several municipalities are served, means of arriving at, 897.
——Kansas: Governor Allen advocates separate utility commission, 1275.
——Kansas Industrial Court assumes jurisdiction of wage dispute between electric company and its employees, 945.
——Kansas Industrial Court on its relation to capital and labor, 993.
——Keokuk energy consumption limited, 1186.
——Limited-hour service for small utility, advisability of, 41.
——Line extensions, duty to serve in relation to, 657.
——Line loss heavy, as affecting rates for small company, 304.
——Long hours' use, 849.
——Losses in one department [illegible] be recouped from another, 993.
——Maintenance reduction [illegible] 145.
——Margin between revenue and outgo, preserving proper, 41.
——Meters, accuracy of, [illegible]
——Michigan, in (comment), 461.
——Missouri commission enjoined from enforcing rate based on original cost, 1036.
——Municipal consumers duty to pay, 1042.
——Municipal franchises and commission jurisdiction in Virginia, 496.

*Indicates illustrated articles

Regulation of Public Utilities (Continued):
——Municipal plant must sell for cash ribels within corporate limits first, 1282.
——Municipal plant, rules governing service by, 1090.
——Municipal plants not to make a profit declares Maine commission, 301.
——Municipal power, sale of, to a public utility, 802.
——Nebraska commission powers of, illegality of utility strikes, 1234.
——Nebraska may have complete utility regulation, 847.
——Nebraska public utility rates may be regulated by commission, 588.
——New Jersey governor having trouble in ousting utilities commission, 844.
——Non-continuous service regulation of, 754.
——North Dakota commission adopts overhead-line rules, 701.
——Operation, efficient, 1090.
——Payments to municipality in lieu of franchise tax, 208.
——Penalty in lieu of discount, 449.
——Pennsylvania commissioner declares 7 per cent utility return not enough, 302.
——Power-factor clause approved, 453.
——Power sales in Washington state, 145.
——Powers of New York commission over street-lighting contract, 849.
——Private contracts disapproved, 849.
——Recouping street-railway losses from electric department earnings, 401.
——Rate base, fixing the, 449.
——Rate base, item representing no tangible property disallowed as part of, 304.
——Rate fixing, property not used or useful in particular service not considered in, 1136.
——Rate increase, company's judgment on effect of, carries assumption of correctness, 945.
——Rate increase granted, Pacific Power & Light, 897.
——Rate increases, California, 849.
——Rate making, abnormal transformer losses as a factor in, 97.
——Rate making, theory of, subject to varying conditions, 849.
——Rate, twenty-cent, disapproved, 849.
——Rate of return and amount of sales, 657.
——Rates based on costs of coal and labor, Missouri Commission grants variable, 257.
——Rates classification of service in reference to, 993.
——Rates, cost of service in relation to, 1042.
——Rates, elements involved in fixing, 449.
——Rates, excessive and reasonable, 754.
——Rates, flat, to agricultural consumers unfair, 145.
——Rates for electricity, principles governing Massachusetts Department in fixing, 97.
——Rates for purchased energy should rise with cost of that energy, 496.
——Rates for same character of service, business and domestic customers must pay the same, 802.
——Rates for street lighting, reasonable, 704.
——Rates, increase in, must be earned, 704.
——Rates in relation to new capital requirements, 993.
——Rates, intercompany, 496.
——Rates, undesirability of different, for competing companies in same territory, 97.
——Rates, lower, for combined service discriminatory, 849.
——Rates, purchased energy in relation to, 993.
——Rates, objections to variable, 39.
——Rates of diking districts must be affected by ability of consumer to pay, 1282.
——Rates of utility operating several departments, considerations affecting, 353.
——Rates, reparation for, alleged to have been excessive, 704.
——Rates refusal to permit, to vary with cost, 701.
——Rates to meet increased costs, 546.
——Rates to schools discriminatory, special, 41.
——Rates which commission charge cannot affect other rates, 1136.
——Rates, special, given to city by franchise invalid, 897.
——Rates, special, large consumers with several plants, 754.
——Rates, special power in Utah held to be discriminatory, 843.
——Rates of consumers to population proper, 401.
——Reparation for charges under superseded tariff, 546.
——Revenue, additional, to which utility is entitled dependent on several factors, 945.
——Revenue and prohibition, 1042.
——Right to supply bulk energy in competitive territory, power company wins, 1087.
——Rural extension and rate of return, 401.
——Rural line construction in Wisconsin, specifications for, 144.
——Rural service extensions, apportioning cost of, 1136.
——Service at cost, commissioners skeptical about, 1078.
——Service, distinction between night and continuous, 704.
——Service, extension of, 1282.
——Service extensions, Indiana law on, 93.
——Service extensions, paying for, 802.
——Service, suspension versus abandonment of, 945.
——Short-term service, 496.
——Sinking fund establishing depreciation reserve by means of, 304.
——Status of the commission, 843.
Regulation of Public Utilities (Continued):
——Solvency of company no reason for operation at loss, 993.
——Special service, other consumers should not be burdened with cost of, 546.
——Stand-by charge in reclamation service in California, 546.
——Stand-by plant, abandoned property as, 1042.
——Street lamps, valuation of, 945.
——Street lighting, adequate, a public necessity, 1234.
——Street lighting services, restricted, at former rates approved, 449.
——Summer service as viewed by California commission, 1282.
——Surcharge, neglect to add, does not prevent collection later, 257.
——Surcharge, permitted, not applicable to minimum rate, 449.
——Taxes, apportionment of, of utility operating two departments, 257.
——Utah Commission's ruling on special contracts, 1090.
——Utility cannot operate at a loss, 496.
——Utility commissions should recognize efficiency, says O. D. Young, 589.
——Valuation, basis of, on war values denied, 594.
——Valuation is unnecessary, where, 401.
——Violation of commission's order by town officials, 754.
——Valuation of seldom-used standby plants objected to, 304.
——Valuation, Vermont commission on principles of, 897.
——Value not determined by character of service, 401.
——Vermont valuation based on ten-year average price, 39.
——Virginia commission, state-wide policy of, 802.
——Wires, crossing a railroad with high-tension, 304.
——Wisconsin Rule "of going-concern value, 802.
Relays:
——Current-balance relay protection. By E. R. Stauffacher, *465, comment 462.
——Maximum-current, on the necessary sluggishness of. By W. Höpp (D), 647.
——Taking full advantage of (comment), 55.
Repair methods (for motors see motor repairs):
——Ball bearings, fitting, to a sleeve-bearing machine. By Gustave J. Soares, *130.
——Chart tells where troublemen are, *788.
——Tests, floor map near board helps to replace blown. By W. A. Harris, *532.
——Welding, high speeds obtained in routine work by automatic. By H. L. Unland, *836.
Research, scientific and industrial (see National Research Council):
——Department conducted by Prof. Vladimir Karapetoff.
Investigations in progress or completed, 137, 392, 585, 793, 1033.
Suggestions for research, 137, 392, 585, 793, 1033.
——Information bureau established, research, 1134.
——Nela Research Laboratories, reorganization of, 351.
——Science, research in pure. (Comment), 109.
Resuscitation through pain inflicted by a blow. By W. P. Strickland, 929.
Rheostat, potentiometer control. By J. Damien (D), 584.
Rice, Edwin Wilbur, Jr., *672.
Roentgen rays; Coolidge X-ray tube, evolution of (D), 536.
Rural electricity supply, development of (D), 1126.
Rural extension, factors governing. By G. C Neff, *1205, comment, 1198.
Rural lines, strength must not be sacrificed in (comment), 1149.
Rural service controversies unnecessary (comment), 557.
Rural service will help solve national problems (comment), 1053.
Russia, electric power production in Soviet, 1133.
Rust, anti-, compound. Convention products Corp., 264

S

Sales Managers' Association sees desire on part of customers to help the utility, 206.
Scientist, co-ordinating the work of, and engineer. By John Mills, 689.
Searchlight:
——Arcs, color and special composition of certain high-intensity. By I. G. Priest, W. J. Meggers, K. S. Gibson, E. P. T. Tyndall and H. J. McNicholas (D), 1032.
——Control of, distance (D), 887.
——Spectral transmission of the atmosphere, relative. By Enoch Kamer and E. P. Tyndall (D), 887.
Seattle:
——Municipal plant to install stokers to guard against fuel shortage, 1232.
——Sectionalizing devices automatic. By P. Charpentier (D), 344.
Self-interest:
——Financing utilities in (comment) 461.
——Spreading the, idea (comment) 53.
Sheldon, Dr. Samuel, memorial exercises for the late, 988, 1037.
Ships:
——Battle cruisers, power of new, comparable to largest central station, 1072.
——Cargo, electric versus diesel-engine drive for, 1141.
Ships (Continued):
——Electrical installation for, design of. By C. H. Wordingham (D), 744, 887.
——Ocean freighter, first electrically propelled, has trial trip, *847.
——Propulsion of, electric. By Eskil Berg (D), 136.
——Propulsion of, electric. By Charles Rettie (D), 792, 1031.
——Welded ship Fullagar, electrically (D), 439.
Signal Corps asks Congress for $10,697,000, p. 1232.
Society for Electrical Development:
——Bi-monthly meeting, first, 206.
——Christmas campaign, electrical, 591, 797, *895, 1040, 1184.
——Local organizations, may form, 988.
——Weekly conferences, holds, *703.
South, proposed power district in the. By L. A. Whitsit, *1009, comment 1007.
South America:
——Electrical possibilties in. By Verne Leroy Havens, 729.
——Operating conditions. By Victor M. Arana, 384, *1073.
Southern California Edison Company advocates an "equalizing service," 991.
Spain, electrical goods in, 1225.
Spain, electricity in. By Blumenthal (D), 744.
Static frequency doubles, characteristics of. By T. Minohara, (D), 33.
Statistics:
——California, industrial board in, *428, comment 415.
——Central-station capacity increasing fast, *332.
——Central station customers' growth, *161, comment 157.
——Central-station energy output and revenue, April, *17; May, *285; June, *469; July, *687; August, *926; September, *1112.
——Central-station expansion in 1920, 518.
——Central stations, 1917. U. S. census of, *476, comment 463.
——Electrical industries growing, *1214.
——U. S. Geological Survey figures on energy production and fuel consumption, 654, 800, 1040.
Steel Mill:
——Application of power in, *673, comment 671.
——Drive, electric, equaling steam on tonnage basis, *653.
——Drive, rolling-mill. By L. Pothera (D), 1272.
——Installation, six hundred engineers inspect 50,000 hp., 35.
——Motors, 40-deg. vs. 50-deg., users and producers discuss, 1229.
——Repair shop practice, electrical. By R. J. standing (D), 86.
Sterilization of milk, electrical (D), 391.
Stone & Webster, commercial agents, convene, 751.
Stoves, electric:
——Early. By R. P. Ingalls, 576.
——Range lower initial cost of building, electric. By L. P. Perry, *790.
——Ranges, market in United States for 75,000 electric, *483.
——Twenty years in service. By W. J. Boggs, 528.
Steam-flow records, centralized, would be helpful. By Byron E. White, 1073.
Substations:
——Automatic, discussed at Providence, 799.
——Automatic industrial, first. By S. G. Leonard, *417, comment 414.
——Industries, for supplying large. By R. H. Tillman, *231, comment 222.
Super-power zone:
——Advisory board meets for first time, 699.
——British government scheme and national fuel economy. By David Brownlee (D), 646.
——Coal prices receive attention, 1083.
——Engineering staff almost completed, 253.
——Engineering staff of, wide publicity advocated by, 445.
——Engineering staff investigation, W. S. Murray heads super-power zone, *91.
——Engineering staff, organization of, *447.
——South, proposed power distribution in the. By L. A. Whitsit, *1009, comment, 1007.
——Stations, mines versus tidewater as locations for, 1207.
Supplements:
——Motors, connecting three-phase induction. By A. C. Roe. With July 24 issue.
Sweden:
——Hydro-electric energies, utilizing, in *1167, comment 1151.
——Railroad system, electrification of (D), 135.
——Telephone from Stockholm to Berlin. By A. Holmgren (D), 249.
——Transmission line at 220,000 volts planned for, 1087.
——Water power legislation, new. By R Gardning (D), 487.
Switches:
——Air-break, improvements needed in high-voltage. By Frank Howard, 286.
——Contactor fits fuse clips, mercury. Absolute Con-Tac-Tor Co., *1289.
——Disconnecting, magnetic forces in *1263.
——Disconnecting, when wrong, was left open (comment), 766.
——Interruption of alternating current without arcing. By W. Höpp (D), 1178.
——Oil, for large electrical supply systems (D), *1127.
——Switchboard, steel versus marble. By R. H. N. Lockyer, 384.
——Switchgear, continental. By W. A. Coates (D), 1127.
Switzerland:
——Gösgen, water power plant at (D), 246.

*Indicates illustrated articles

Switzerland (Continued):
——Heating, future of electric By M. Hottinger (D), 295.
——Loan of $25,000,000 for railroad electrification, 93.
——Railroad electrification near, 351.
——Transmission line, 110,000-volt, from Switzerland to France. By Paul Meyer (D), 249.
Symbols for electrical machinery and apparatus. By A. Hayet (D), *345.
——Standardizing electrical (comment), 959.
Synchronous machines, field leakage in By Theodore Schon (D), 887.

T

Tackle, new electric (D), *1031
Tacoma, local dealers charge city of, with unfair practices, 941.
Tacoma's condemnation right opposed on account of large power sales, 1182.
Tax, excess profits, discriminatory. By Jerome Remtz, 1119.
Telegraphy:
——Carrier-wave, and telephony. By Fassbender and Habann (D), 86.
——International communication, re-establishing (comment), 863.
——Multiplex telephony and, over open-circuit bare wires laid in the earth or sea. By Maj.-Gen. George O. Squier (D), 392.
——Page-printing telegraph receiver, system Morkum (D), 841.
——Printing telegraph for press service, to use, 494.
——Submarine cable transmission, use of alternating currents for. By Frederick E. Perrot (D), 792.
Telephony:
——Cable, new German submarine (D), 1273.
——Carrier-wave telegraphy and. By Fassbender and Habann (D), 86.
——Cross-talk on long telephone lines. By L. Lichtenstein (D), 295.
——High-tension line, receiving telephone message over, *351.
——International communication, re-establishing (comment) 863.
——Interplant telephone communication established over high tension wires, 141.
——Multiplex, adaptability of aerial and cabled telephone lines for carrier wave. By Fassbender and Habann (D), 537.
——Multiplex, and telegraphy over open-circuit bare wires laid in the earth or sea. By Maj.-Gen. George O. Squier (D), 392.
——Overloads on telephone conductors due to rain and rime. By F. Poppé (D), 31.
——Receivers, energetics of telephone. By Heiichi Nukiyama (D), 888.
——Secret. By Poirson (D), 937.
——Secret common-battery intercommunication telephone system (D), 99.
——Stockholm to Berlin, telephone from. By A. Holmgren (D), 249.
——Switches, theoretical principles of traffic capacity of automatic. By G. F. O'dell (D), 1225.
——Transmitter, the carbon. By H. J. Gregory (D), 392.
Tenney, Charles H. and Co. Convention at Boston notable success, 95.
Tennessee Association of Electrical Contractors meet, 443, pledge support to utilities in fight for relief, 655.
Tesla, Nikola, *272.
Testing automatic apparatus for intermittent. By G. W. Vinal and L. M. Ritchie (D), 487.
Thalophide, spectro-photo-electric sensitivity of, By W. W. Coblentz (D), 439.
Thermal conductivity during fusion of metals, variation of. By Seibel Konno (D), 1273.
Thermocouples, electrically deposited (D), 584.
Thermo-galvanic effect, the Benedicks. By Gonineau (D), *697.
Tonawanda (N. Y.) accident, authoritative report on. By John L. Harper, 1023, comment 1005.
Traction. (See Railways.)
Trade conditions (see also Foreign Trade and business).
——Appliances, output of motor-driven, in 1920 estimated at 2,000,000 units, 708.
——Arc lamps again showing good demand, 356.
——Armored-conductor market expected to continue strong, 100.
——Asbestos wire, active demand for, 548
——Automobile slump (comment), 813.
——Automobile slump reflected in electrical output, 805
——Boxing and crating, practical instructions in, 1237.
——Brass, low prices should offer favorable market, 1189
——Bureau of Foreign and Domestic Commerce sends funds to carry on improvements, 1045.
——Cable, power companies ordering, well, 149.
——Cancellations of orders menace trade, 659
——Cancellation of orders slows down factory output, 891.
——Car shortage curtailing industrial production, 211.
——Chain blocks, good demand for motor-driven, 43.
——Christmas-tree lighting outfits, market undersupplied, 900.
——Collections, credit men optimistic in face of lengthening, 901.
——Collections in Northwest long, 996.
——Collections, relation of stock-moving methods (D), 804.
——Collections slower, trade optimistic although, 355.
Trade conditions (Continued):
——Collections somewhat harder; jobbers in general finding, 210.
——Collections, use of trade acceptances improving, 659.
——Commutator segments, normal buying of, 356
——Conduit production of, still six to seven months behind orders, 996.
——Conduit supply of rigid, offers no immediate relief, 404.
——Contracts manufacturer banks recognition of integrity of, 1138.
——Coolidge lamp patent suit, United States district court upholds, 99.
——Copper goes below pre-war level in October *947.
——Cotton belt, favorable outlook seen in, 1236.
——Cotton, low, has not affected prices of electrical goods, 451.
——Conduit situation, Northwest, slightly tighter, 1188.
——Deflation in the electrical industries (comment), 861.
——Discounts, larger, may reward modern selling methods, 1138.
——Election and the political outlook (comment), 957.
——Electric sheet prices easier for 1921 shipment, 1139.
——"Electrical World" trade service increased, 542.
——Fan manufacturers optimistic over prospects for 1921, 756.
——Fan stocks, hot weather would leave short, 147.
——Farm-light producer builds up plant sales, 1092
——Farm-lighting plant sales better, prospect for, 804.
——Fiber-conduit production booked well into fall months, 355.
——Flexible-armored conductor market is weak, 1093.
——Freight movement, manufacturers assist yardmen in, 100.
——Furnace, non-ferrous electric, orders holding well, 210.
——Glassware packing charges, how should, be handled?, 1188.
——Graphic-recording meter market growing fast, 260.
——Heater, beam type, suits, Majestic patents upheld in, 211.
——Heater suit, Simplex and Westinghouse companies win, 851.
——Heaters, heavy buying of, in winter just passed, 99.
——Heaters, heavy production for 1920 season, 1044.
——Heating appliances, increasingly popular, 147.
——Heating appliances, prospects of shortage in, 597.
——Household appliance manufacturers aim to develop new devices, 403.
——Insulating paper scarce, but outlook hopeful, 451.
——Insulation, lower cotton reflected in prices of, 851.
——Insulation, weak market for, 1237.
——Insulators, high-tension production, long deliveries of, 1188.
——Insulators, high-tension, strong market ruling for, 259.
——Jobbers' costs of handling twelve principal lines, 1092.
——Jobbers doing $50,000,000 business annually, electrical, 805.
——Jobbers find household deliveries becoming less profitable, 804.
——Jobbers, need of co-operation among, 708.
——Jobbers' stock turnover, increasing, by manufacturers' co-operation, 851.
——Jobbers' volume of business 60 per cent above that of last year, 702.
——Labor, reduced, helping to lower factory costs, 1188.
——Labor situation, decided improvement seen in, 596.
——Lamp business, miniature, big future seen in, 804.
——Lamp buying, fall, under way with good local stocks, 757.
——Lamps, Coolidge, patent case, appeal filed in, 147.
——Lamp sales expected to reach 230,000,000 this year, 1044.
——Lamp sales of 1920 expected to surpass 1919 from 25 to 30 per cent, 707.
——Lamp turnover policy to hold in 1921, present, 1284.
——Lamp voltages, standard, to reduce list of stock items, 1092.
——Lighting glassware raw materials show little shortage, 451.
——Line-material stocks low, poor shipments keep, 210.
——Loom prices firm despite falling cotton market, 548.
——Manufacturers, opportunity for electrical (comment), 862.
——Middle west, apparatus held in, for rising market, 1045.
——Montana, brighter prospects for electrical market in, 805.
——Motor market, tendencies of, point to higher cost, 211.
——Motors, easier conditions seen in supply of, 660.
——Motors, integral horsepower, demand easier, 261.
——Motors, need of standards in fractional horsepower, 148.
——New York jobbers interchange surplus stocks, 1138.
——New York jobbers see bright side to present trade conditions, 1093.
Trade conditions (Continued):
——Northwest appliance sales below 1919 holiday volume, 1284.
——Outlet box and cover mat[illegible] universal key simplifies, *306.
——Plugs and receptacles, standardization of, 498.
——Porcelain shortage slightly relieved, 1044.
——Price guarantee question to be threshed out, 707.
——Price problem an embarrassing one to electrical trade, 900.
——Prices, falling, relation of raw materials, labor and overhead to, 948.
——Prices, trend of, held dependent upon raw material, 756.
——Profits, present-day (comment), 717.
——Ranges, electric, demand exceeding production, 499.
——Readjustment without panic predicted by Archer W. Douglas, 1087.
——Reflector market, uneven conditions in industrial, 403.
——San Francisco, heating appliance and range situation in, 995.
——Schedule material lists, producers divided on raising, 43.
——Schedule material manufacturers busy, 995
——Shipments no geographical discrimination in, 356.
——Steel price cuts by independents, further 1237.
——Steel price not expected to help stabilization, 1138.
——Steel price, raw-pipe quotations only, to remain up, 1284.
——Steel products affected by labor and traffic, supply of, 43.
——Steel towers, foreign demand for, good, 147
——Tape, friction, increasing supply of, 548
——Tape, friction, producers see no big price drop before January, 948.
——Tape producers look for good year ahead, 1284.
——Tape, winding, slightly lower in price, 901
——Tools, linemen's, becoming available, 1093
——Trade acceptance, greater use strongly urged, 259.
——Trade acceptances, pamphlets on for distribution, 1236.
——Trade practices on Pacific Coast, Department of Justice investigating, 940.
——Transformer market continues active, 259.
——Transformers, almost no recession in demand for, 947.
——Transformers in good demand, 1236.
——Truck industry, electric, rapidly growing, 1285.
——Warning to association, decision in lumber case sounds, 100.
——Washing machine costs advance in three years, 1285.
——Washing machine motors, progress in standardizing, 948.
——Washing machine manufacturers, uniform guarantee adopted by, 756.
——Washing machine prices still advance, 660.
——Washing machines enter strong buyers' market, 852
——Wire, bare copper, deliveries impeded by fuel and car shortage, 498.
——Wire, guy, again becoming available, 757.
——Wire market, conditions uneven in bare copper, 44.
——Wire prices show downward trend, 852.
——Wire, standard-steel, market steady under short supply, 100.
——Wiring materials prices, no immediate drop in, seen, 947.
——Wiring, new conduit bodies expected to simplify exposed, *307.
Transformers:
——Auto-, for motor starting. By Theodore Schon, *473.
——Current, for 10,000 to 40,000 amp. By Keinajah (D), 1032.
——Current, ratio and phase angle, errors due to remanent magnetism. By Engelhart (D), 985.
——Phasing auto-, for power-factor measurements. States Co., *264.
——Polarity and phase rotation and voltage diagrams of. By A. Boyajian (D), 294.
——Testing of small, safety first. By A. Heckman (D), 391.
——Valve, automatic safety, for oil-filled. Pittsburgh Transformer Co., *1000.
——Vault ventilation, calculating transformer. By W. W. Parker, *334, comment 319.
Transmission systems:
——Aluminum conductors for transmission lines, use of (D), 791.
——Arcing grounds on high-tension lines. By W. D. A. Peaslee, *424, comment 414.
——Calculation, modern methods for transmission line. By Blondel (D), 1126.
——Circuits, electrical characteristics of transmission. By William Nesbit (D), 32, 536, 1178
——Circuits, switching and protection of transmission. By S. Q. Hayes (D), 31.
——Constants, three-phase transmission line, as referred to the frequency of the third harmonic. By Swyngedauw (D), 198
——Corona voltages for actual lines, determining. By T. W. Peek, Jr., *1258.
——Interconnection:
Public aspects of (comment), 1245.
——Distance control in three-phase systems. By Roth (D), 1126.
——Half-wave transmission lines. By Brylinski (D), 31.

*Indicates illustrated articles

Transmission Systems (Continued)
——Interconnection:
Industrial plants, with By T. H. Arnold, 833.
Opportunity for, another. By Ross B. Mateer, *1162; comment 1150
Output of plant, more than triple, 253.
Popularizing (comment), 461.
Power systems of By Harold W Smith (D), 1178.
Small cities, interconnecting, *321, comment 318.
Southern, of 900 miles, closing of 52-mile gap to give, 93
To buy or not to buy (comment), 669.
Vermont, in South, *9.
Vermont, in Southern II, *70.
——Interruptions, reducing, transmission line By F. I. Bowler, *913, comment, 911.
——Knoxville Power Co 150,000-volt transmission line of the By Theodore Varney, D *294
——Networks losses in electric By R Caparo (D), 486.
——New England, longest and highest span in, 95.
——Non-uniformn lines, electric transmissio along. By Ravüt (D), 345.
——Planning, designing and erecting transmission lines By Alfred Still (D), 1080
——Power transmission equipment. By William Crooks (D), 840.
——Protection of transmission systems. By Prof. Emil Alm, I, *277, II, 377; comment 271.
——Quarter-wave transmission lines. By Bunet (D), 198.
——"Sonic" power. By Daval (D), 1127.
——Suspension lines, application of mild and alloy steels to high-tension. By Z. R. O'Neill (D), 646
——Switzerland to France, 110,000-volt transmission line from. By Paul Meyer (D), 249.
——Turbine, steam, General Electric Company's large orders during past year, 1084.
——Wire, determining size of, and the length of span. By D. F. Parrott, *928.
Turbines, water:
——Impulse, utilize wide range of head and flow (D), 791.
——New design. By Reindl (D), 344.
——Repair and inspection of. By L. W. Wyss, 1064; comment 1055.
——Wheels, high-speed, for low head plants By A. Streiff, *121, comment 111.
Turbo-alternators:
——Design, present tendencies in. By J. Shepherd (D), 294.
——Flux distribution in case of By Carl J Fechheimer (D), *486
Turbo-generators:
——Compound, many companies ordering large, 701.
——Locomotive headlights for Westinghouse Electric & Mfg. Co., *601.
——Oil temperatures of medium-sized electrical device for checking the By George J. Deukett (D), 391.
——Unit type geared turbine and generator Steam motors to, 856.
——Ventilation and temperature problems in large. By B. D. Lamme (D), 294.

U

United States Geological Survey figures on energy production and fuel consumption 654, 800, 1040
United States Chamber of Commerce to hold street-railway referendum, 1087.

V

Vacuum tube amplifiers By Marius Latour, 241.
Vehicles, electric.
——City service, in (comment), 414
——Progress, recent. By F Ayton (D), 295
——Tractors, time labor and congestion being saved in many fields by using, *1066.
——Trucks:
Foundry use, for, Elwell-Parker Electric Co., *1241
New England business growing, 132.
Self-loading industrial. Industrial Truck Co., Div of Cowan Truck Co., *1143.
Tiering, industrial. Automatic Transportation Co., *215.
Tier-lifting, with 96-in. lift. Lockwood Engineering Co., *1144.
Voltage rating, rational practice in. By F. D Newbury and R. W E Moore, *916, comment 911.

W

Watchman's clock system. E. Howard Clock Co., 1289.
Water power (see also Federal Power Commission and Hydro-electric development):
Water-level indicator. D. W. Proebstel, *1193.
Water power:
——Act, another national park amendment introduced, 1229.
——Act, ask amendment of, to attract capital, 395.
——Act, other amendments to, thought desirable, 1228.
——Act, senate amendment favorably reported, 1275.
——Act, Senator Walsh of Montana and the. By John J. Harris, *186
——Act starts many activities in northwest, 201.
——Alaskan, development urged to release paper-pulp supply, 655.
——Alaska's, ask $40,000 to investigate, 92.
——Austria, development in, 233.
——Beauty of use, the, *1201, comment, 1197.
——Bill, national park amendments to, introduced in Congress, 1181.
——Bill, propaganda to amend, so as to protect national parks, 701.
——Boston societies hold joint meeting on 1230.
——California commission links state's prosperity with hydro-electricity, 893.
——Canada, development in, *229.
——Canadian. By James White, 337.
——Comments, 1.
——Developments, elements of sound power (comment), 559
——Development will save a billion dollars a year, estimates that, 688.
——Forestallers and. By Frank W. Chase, 431.
——Gösgen, Switzerland, plant at (D), 248.
——Grants for speculation, Coolidge comes out against, 253.
——Kansas looks toward development under states' auspices 1279.
——Kansas to hold, congress, 1087.
——League to hold convention, 541.
——Los Angeles wants to develop 139,800 additional water horsepower, 93.
——Maine governor-elect favors private development, *1039.
——New York, fight on state or private control of water powers in, 843
——New York Republicans oppose state development of, 302.
——North America, of (map), *13.
——North Carolina, conservation urged for, 775.
——Pacific Coast, power needs on the By L H Fowler 873.
——Permit, form of, discussed, 347
——Run-off, calculating, with no rainfall records. By E. J. Crawford, *1111, comment, 1102.
——Sources of power, coal and water compared as. By R S McBride (D) 584
——Swedish legislation, new. By R Garding (D), 487.
——Texas project, deferred, now to be carried out, 206.
Water power (Continued):
——Tidal, stations. By G. Mangin (D), 486.
——Tidewater motions electric power from. By Admiral Amet (D), 1272.
——Water-flow characteristics of rivers. By Contagne (D), 1179.
——Water flow in rivers, predictions of. By Axel Wallen (D), 33.
Water wheels (see also Turbines, water):
——High-speed wheels for low head plants. By A. Streiff, *121, comment 111.
——Niagara Falls Power Co.; two, for generators of different make. By Lewis F. Moody, *681.
——Niagara Falls Power Co.; waterwheel and generator considered as homogeneous unit. By W. M White, *679.
——Pacific Gas & Electric, two 40,000-hp. waterwheels ordered by, 701.
——Pelton wheel construction. By Percy Pitman (D), 391.
Welding, electric:
——Alternating-current welder. Electric Welding Machine Co., 1144.
——American Bureau of, reorganized, 1280.
——Arc:
Automatic welder. General Electric Co., 104.
Building construction (D), 86.
By L. Miller (D), 1031.
Generator, new type. By S. R. Bergman (D), 32.
Hundred-pound machine. Electric Arc Cutting & Welding Co., *1143.
Machines, characteristics of. By A. M Candy, 784.
Machines, characteristics of. By C. J Holslag, 784.
Metal deposition in, II. By D. H. Eschholz, *118.
Overhead. By O. H. Eschholz, *966. comment, 958.
Structural steel work. By D. C. Alexander, Jr., 125.
——Machinery. By J. F. Lincoln, 241.
——Resistance unit for, General Electric Co., *1193.
——Ship Fullagar, electrically welded (D), 439.
——Steel specials, welded, as a substitute for castings (D), 249.
West, the vision of the (comment), 319.
West Virginia Public Utility Association again operative, 847.
Western Society of Engineers for retention of Illinois commission, 539.
Westinghouse Electric & Mfg. Co.:
——Business rapidly increasing, 499.
——Capital to increase, 650.
——Capitalization, stockholders authorize increased, 1088.
——Mail-order house, will not establish. By W. H. Easton, 431.
——Radio field, enters, 749.
Wheeler, Schuyler Skaats, *768.
White, James Gilbert, *720.
Window cleaner, electrical. Hartford Electrical Appliance Co., 1241.
Wireless. (See Radio.)
Wires and wiring:
——Boxes, loom and armored cable. Clemence Brothers, 1097.
——Bushings, rigid conduit. Walker Brothers & Haviland, *104.
——Clamp, adjustable ground. Gillette-Vibber Co., 856.
——Conduit bodies expected to simplify exposed wiring, *307.
——Connector. R. A. Macbeth, 1241.
——Fixture stem, insulated. Electrical Dealers' Supply House, 1144.
——Wire, reduction in the temperature of, when covered with insulation. By A. B Eason (D), 647.
——Wiring, interior, for farm buildings (comment), 1055.
Wishon A G., *368.

X

X-Rays (see Roentgen Rays).

AUTHOR INDEX

ADDINSELL, H. M. Central-station financing, 705; comment 717
Alexander, D. C., Jr. Welding structural steel work, 125.
Allen, Oliver Field. Rebuilding France and Belgium electrically, *1208; comment 1197.
Almert, Harold. Actual cost versus reproduction cost in public utility appraisals 1118
Alm, Prof. Emil. Protection of transmission systems. I, *277, II, *377; comment 271
Archer, J. W. Refurbishing standby plants *202
——Selection of steam plant meters *1014; comment 1005
Anthony, Robert. Power requirements for coal mines, *14; comment 3
Arms, Victor M. Switching and connections for data transformers, *387.
——South American electrical conditions, 384; *1073.
——T. H. Interconnection with steel mill plants, 833
——P. P. Arrangement for [illegible] before [illegible] them, *111
——[illegible] switch and [illegible] *881
——[illegible] outdoor type [illegible] *881
——[illegible] in [illegible] attached [illegible]
——[illegible]
BACON, R. H. Designing mine signal systems, *372; comment 367
Bagnall, Fred W. Portable generator and lamps for outdoor night work *1217
Barrett, Edward C. Curricula of California Institute of Technology, 1170.
Basler, C. D. Moisture tests and evaporation tests on oil, 288.
Batten, W. R. A megger fork that facilitates testing line insulators, *432.
——Pole-top hoist saves time in raising transformers, *288.
Bauhan, Alex. Station conduit records help in making alterations 432
Baker, V. R. Strap iron employed as rigid lead for potential transformer, *188.
Baumgarten, Godfrey A. P. V., The Oersted Centenary, 287.
Bell, A. D. Effective printing-plant illumination, *1153, comment 1151.
Bell, G. G. Generating plant at the mouth of mine, I, *635, II, 733; comment 605
Bernholz, Philip G. Beveling of oil rings prevents sluggish action *1077
Test clip with insulating handles *290
Test for defective squirrel-cage rotor, 788
Bigelow, D. W. Best way to take speed," 340
——Wire screens on ends of choke coils keep out birds, *1120.
Ayres, Louis E. Developing the low-head plant, *1260, comment 1247.
——Blanks for recording photometer tests *741.
——Contest which reduced armature repairs in large steel mill, 531.
——Graphic charts showing cost of electric power help plant management, *194.
Boggs, W. F. Electric stove in service twenty years, 528.
Bond, James B. Running open-work conductors through concrete beams, *884.
Bowler, F. I. Reducing transmission-line interruptions, *913, comment 911.
Broadhead, C. R. Motor load at granite quarry, 787.
Brophy, John J. Progress and the application engineer, 384.
Brusster, James S. Improper electrodes will stick in operating brass furnace, 1123.
Bullard, W. R. Locating faults on underground cables, *1057, comment 1055.
Burns, H. L. Advantage of motor-driven exciters for synchronous motors, 1173.
Maintenance costs per motor average 50 cents a month, 1077.
Burton, H. J. Operating small hydro plants without an attendant, 1075.
——Rules to follow during station trouble before consulting dispatcher, 1217.
CANDY, A. M. Characteristics of arc welding machines, 784
Carpenter, L. T. (See Secor Cunningham, Jr.)

*Denotes illustrated articles

Chappell, W. C. Calculation of feeder voltage regulation. *73
Chase, Frank W. A business where honesty prevails 1264
——A fine point in electrical jurisprudence 689
——Dr. Butler turns the tables 1246
——Forestallers and water power 131
Chase, L. J. Anchoring a transmission line to an old chimney. *738.
Clark, S. N. Chart shows turbines to use for different loads on plant. *127
——Pulverized coal versus stoker firings 1265
Cole, George W. Electric bake ovens a desirable central station load. *1078
Condron, Nicholas F. Setting outlet boxes in reinforced concrete columns. *131
Cooper, H. S. Publication of verbatim proceedings wasteful 75
Copley, A. W. Special rotary permits use of high resistance to neutral grounds. *834
Corbet, Darrah. Burning sawmill refuse. *183
——Mechanical oil atomizer efficient at 320 per cent boiler rating. 586
Cordell, P. M. Changing 25-cycle meters for 60-cycle operation. 78
Crawford, E. J. Calculating run-off with no rainfall records. *1111, comment 1102.
Crichton, L. N. About 2,000 lb. is normal working load for strain insulators 978.
Crocker, Francis B. The International Electrotechnical Commission 337
Crocker, Sabin. Ventilating system which prevents condensation in turbine room. *339
Cunningham, Secor, Jr., and L. T. Carpenter. Education of user insures electric truck success. *1270
Curtis, Leslie F. Easily constructed synchroscope for instruction purposes. *529.

DANIELS, F. H. Comparison of first cost of fuel oil and coal-burning plants 338.
——Costs of coal and fuel oil compared by chart. *739.
Darnell, D. L. Electric tractor does heavy hauling on 25 per cent grade. *81.
Darter, W. A. Feeding two circuits with generators which cannot be paralleled. *77.
——Generator used to correct power factor after engine breakdown 530
Dauch, Alan D. Experience with electric core baking. *168, comment 158.
Davis, Henry A. Handhole assists in pulling underground cable. *1265.
Dean, John S. Carbon brush testing. *369, comment 366.
de Forest, Lee. Radio-telephone concerts, 576.
Delany, C. H. Operation of fuel oil pumps, 21.
Denny, R. C. (See E. A. Quinn.)
Dillon, Robert E. Steam plant metering practice. *630, comment 718
Dixon, James—Avoiding unbalanced operation of two-phase motor, 387.
——Care and operation of commutators on new machines, 1268.
——Careful adjustment advisable with interpole machines 980
——Checking connections for parallel operation *1171.
——Drying transformer insulation and oil before operating, 78.
——Gritty brushes cure high mica on engine-type generators 788
——How to remedy some synchronous motor troubles 81
——Operating interpole generators in parallel. *577.
——Removal of shunt from interpole winding improved operation, 883.
——Shifting brushes on interpole generators changes voltage. *243
——Turning a commutator in place. *129.
——Unbalanced magnetic effect overcome by change of connections. *1024.
——Wrong brush position changes speed of interpole motor. *692
Downing, P. M. Stack of cross-ties as emergency support for 60,000-volt line. *76.

EASTON, W. H. Westinghouse will not establish mail-order house 431
Edwards, Wayne. Test of fusing point of coal ash 189
Eglin, W. C. L., and F. C. Ralston. Centralizing power plant maintenance. *609, comment 671.
Eschholz, O. H. Metal deposition in arc welding. H. *118
——Overhead arc welding. *966, comment, 958.

FARR, W. H. Switchboard arranged for quickly making wide range of tests. *192.
Fink, Frederick B. Electric tractor saves 50 per cent at unloading pier. 1026
Foster, V. S. Auto-transformers for motor starting, 977.
Foster, W. J. Design of 32,500-kva. generator for Niagara Falls Power Company is conservative, *783, comment 767.
Fowler, F. H. Power needs on the Pacific coast 873.
Frankenfield, Budd. After eighteen years, 478.

GATES, S. J. Interchange of electrical energy between central stations and industrial power plants. 528.
Geiger, C. W. New devices increase safety of automatic elevator. 80
——Stacking elevator mounted on industrial tractor. *129
Genung, G. Trailer reduces central stations' hauling expense. 835
Gephart, Dr. W. F. Financing electric public utilities. I, 471. II, 516, comment, 511.
Gerhardt, R. B. Protecting industrial distribution lines. *176, and comment 483, comment 129
Golsan, Page. Interest charges during construction, *116, comment 109.
Govan, J. K. Magnetic clutch and button control make boiler pressure [illegible] *981
Gray, C. D. and E. Hagenlocher. Electrical distribution at intake point. *113, comment 110.
——Floodlights for buildings and yards of manufacturing plants 693
Gray, F. E. Portable substations mounted on sled. *31
Green, C. M. Graphite in lead screens removes static electricity. 744
Greenhut, A. (See I. Schiener.)
Guthorn, S. L. Hold-down magnet control for vertical plate shears. *1074

HADLEY, C. G. Emergency operation of induction motors at low speed. 388
Hagenlocher, E. (See C. D. Gray.)
Haman, M. Convenient home made switchboard for testing motors. *1076.
Hardaway, W. D. Two transformers used in place of damaged balance coil. *1121.
Hardy, Norman G. Saving of superheater losses 380
Harper, John L. Authoritative report on Tonawanda (N. Y.) accident 1023, comment 1005.
——Niagara Falls 100,000 hp. development *561, comment 558.
Harris, John J. Senator Walsh of Montana and the water-power act, 186.
Harris, W. A. Bearing trouble results from uncentered rotor. *26
——Cards for recording performance of motor brushes. *245.
——Floor map near board helps to replace blown fuses. *532
——Slotting tool with interchangeable tool-steel blades. *1122.
Hatch, Edward. Light and small test lamps. *79.
Havens, Verne Leroy. Electrical possibilities in South America. *729.
Heckman, G. C. and E. R. Stauffacher. Knock down conduit work in substation construction. *24.
Hejda, C. J. Increasing oil-circuit breaker capacities *67, comment 55
Henton, S. C. Pilot lamps denote failure of potential on high-tension meters. *289.
Heston, W. C. Exploring coil outfit locates grounds on distribution circuits. *834
Hodge, William H. Customer ownership of securities 1018, comment 1007.
——Selling securities locally 1156, comment 1150
Holslag, C. J. Short arc is necessary for successful welding. *434
Hopson, H. C. Protection for public utility investment, 636.
Howard, Frank. Improvements needed in high voltage air-break switches, 286.
Howell, Edward, and Charles L. Rose. Meter records can be simplified. *1256, comment 1246
Hoyt, John C. Developing power of the Potomac River. *421.
Humphreys, George S. Electrical features of Springdale plant. *1114, *1165, comment 1103.
Hurth, H. Boilers should be tagged when being worked on, 242.

INGALLS, R. P. Early electric stoves and irons, 576

JACKSON, CARL D. Strengthening the utilities, 831, comment 814
Jacocks, G. T. Energy requirements in butt-welding pipe. *1267.
Johnson, J. Allen. Clearing house for fire stations (Niagara Falls Power Co.). *961.
——Six hundred thousand hp. line delivers Niagara power. *875.
——Unit idea in 100,000-hp. electrical layout *825, comment 815.
Johnson, C. A. Eliminating troublesome crossing of wires in armature coils. *482.
——Device which holds motor wedges while driving them into place. *740.
——Halving motor voltage by adding commutator bar. *744
——Insulating ends of motor coils with cambric saves time. *80
——Motor arranged for either 440 volts or 220 volts. *1269.
——Oil on brush holder causes commutation trouble. *692.
——Reconnecting two-phase motor for three-phase operation 532.
——Reconnecting 220-volt compound motor for 110 volts, 643.
——Rewinding motor with odd coil groupings. *25.
——Rewinding 220-volt induction motor for 550 volts, 341.
Johnson, R. Window bricked in to hold service switch. *291
Jones, A. W. Managing electric service for farmers. *283.
Jones, J. L. Electrifying the foundry core room. *1203.

KARAPETOFF, V. Shortage of instructors. 737.
Kassandra. Central-station income per kilowatt, 1176.
——Credit deposits and the rate of interest thereon, 533.
——New basis from which to look at rate theories 581.
——Should central-station rates be materially increased and at once. 934
Kennedy, S. M. [illegible] *133, comment 159
Kline, P. D. Salvaging [illegible] coils when utility [illegible] *829
Knowles, H. S. Attractive construction for supporting cable [illegible] *1[illegible]
——Crane wires and cable on sand-concrete poles. *1174.
——Cutting fiber to narrow widths. *740.
——Protecting indoor [illegible] apparatus exposed to weather. *[illegible]
——Protecting cut-out cleaner with [illegible] switch adjacent. *244.
Knowlton, A. E. (See R. G. Warren.)
Knutsen, J. A. Cost of remsulating induction motor windings 164
Krug, F. Board for quick tests of [illegible] Lines. *340
——Motor record card facilitates ordering spare parts. *191
——Starting a synchronous motor without starting equipment. 482.
Kruse, S. The radio compass and the guiding cable 1170

LAMAR, CAPT. ROBERT W. (See Capt. George K. Miltenberg.)
Latour, Marius. Development of electron tubes. I. *521, II. *870, comment 510
——Vacuum-tube amplifiers 241.
Lawson, W. Elsworth. Dependability of the CO_2 recorder. 880
Leitch, F. T. Water-spray system for turbo-generator fire protection. *385.
Leonard, C. W. Forty-cycle motors operated on 60 cycles to utilize old equipment, 741.
Leonard, S. G. First automatic industrial substation. *417, comment 414
Lighthipe, J. A. The problem of inductive interference, 75.
Lincoln, J. F. Electric welding machinery, 241
Lloyd, C. S. Waterproofing overhead coal bunkers. *77
Lockyer, R. H. N. Changing a generator to a synchronous motor. *980.
——Home-made reversing switch for wattmeter. *242
——Safe method of synchronizing. *978.
——Steel versus marble switchboards. 384.
——Unbalanced reactor on three-wire generator causes flicker. *187
Lofstrand, Arthur L. Serving 6,600-volt load over 66,000-volt line in emergency. *637.
Lovett, Israel. Destruction of conduit laid in cinders, 689.
——Fire from electrical causes, 125.

McARTHUR, LEWIS A. Galvanized piping used for buses on outdoor substation. *385.
McCarthy, J. S. Shunting switch permits testing large meter without killing line. *243.
McDonald, A. R. Card record saves time in motor maintenance and installation. *642
——Compensator mounted on strap-iron support. *531.
——Current transformer connection board. *1027.
——Efficient system of motor overload protection. *388
——Generator and switchboard arrangement to give 220 volts to 2,300 volts. *26
McMillin, John Milton. Industrial support for central stations, 677, comment 669.
McNulty, D. A. Meter block which speeds testing. *639
MacDowell, A. S. Inspection tests for electrical equipment, *633, comment 607.
Mack, A. J. (See A. A. Potter.)
Marsh, T. A. Remodeling ignition arches. *823.
Martin, Thomas Commerford. Honoring the American electrical pioneers 1264.
——Pioneer electrical canal haulage, 977.
Mateer, Ross B. Another opportunity for interconnection, *1162, comment 1150.
May, A. H. Proposed changes in factory distribution visualized by cardboard models. *1221.
——Tightening short belt on individual drives. *1267
May, John M. Poor alignment causes most troubles of centrifugal pumps 836.
Maynz, Theodore. Effect of boiler ratings on furnace maintenance. *1240
Mehren, E. J. Rebuilding [illegible] devastated sections in France 131
Merrick, C. B. Inspection department is important factor in good service. *292
Merton, Dorge S. Smoothing of commutators by sanding and stoning, 1221
Millan, Walter H. Constant-current rectifier locates cable faults. *1074
——Mounting plane save time in replacing instrument transformers. 979.
——Serviceable trolley and runway. *1123.
Miller, S. W. Simple tests for welds, 1174.
Mills, John. Co-ordinating the work of scientist and engineer 689
Miltenberg, Capt. George K., Capt. Lyle A. Whilst and Capt. Robert W. [illegible] Power development [illegible] states. *769, comment 767
Mitchell, John H. System for keeping primary line records up to date. *1074.
Moler, C. C. Power factor [illegible] from table supplied to meterman. 1172.
Moody, Lewis F. Two [illegible] for [illegible] graphs of [illegible] (See Niagara Falls Power Co.)
Moore, R. W. F. (See E. C. Newbraugh.)
Morgan, Alex W. Handling lignite coal to prevent [illegible] combustion. *74.
——Steam [illegible] saves coal. *146
Moses, C. A. Regulating hydro-electric prime movers, 280, comment 271.

*Indicates illustrated articles

Muir, R. C. Duration of insulation tests, 186.
Munoz, A. Device to detect short circuits in armature coils, 1027.
Murphy, F. H. Modern industrial lighting for Oregon, *820, comment, 815.
Murray, J. W. Double acting solenoid which has strong pull, *435.

NEEDHAM, O. Keeping electrical machines warm prevents sweating, 79.
——Keeping steel mill motors in service, *237, comment 222.
——Proper housing and ventilating of steel-mill motors, *1219.
Neff, G. C. Factors governing rural extensions, *1205.
Newbury, F. D. Reliability is keynote of generator for Niagara Falls Power Co., *779, comment 767.
——And R. W. E. Moore. Rational practice in voltage rating, *916, comment 911.

OPPENHEIMER, F. Governor adjustment for efficient parallel operation, *239.
Osborn, J. A. Three-quarter-inch rivets cut electrically in five seconds, 290.
Ostermann, R. M. Boiler steam pressures and superheat, 21.
Oxley, George F. Why utilities must engage in a good will campaign, *695.

PACE, ANDERSON. Pointers on maintenance and use of Edison batteries, *641.
——Storage battery maintenance systems for good operation, 932.
Palmer, N. W. Flat welding electrode requires less skill, *883.
Parker, W. W. Calculating transformer vault ventilation, *334, comment 319.
Parrott, D. F. Determining size of wire and the length of span, *928.
Peaslee, W. D. A. Arcing grounds on high-tension lines, *424, comment 414.
Peek, F. W., Jr. Determining corona voltages for central lines, *1258.
——Transmission line insulation in America, *1061, *1104, comments 1054, 1102.
Pertle, A. Pulling cable without tackle or windlass, *932.
Peterman, L. C. Non-recognition of N. E. L. A. standards results in confusion, 929.
——Treating crossarms with old transformer oil, 1172.
Philo, Frank G. (See Joseph Pope.)
Platt, A. L. Cleaning condensers save one fireman on two 3,000-kw. turbines, 738.
Pollock, F. W. Dispatcher's board that facilitates switch changes, *690.
Pope, Joseph and Frank G. Philo. Unusual efficiencies with oil fuel, *730, comment 719.
Potts, G. G. From 15 to 20 per cent reactance desirable for arc-type furnaces, 128.
Potter, A. A. and A. J. Mack. Writing specifications for lubricating oils and greases, 281.
Pratt, A. G. Babcock & Wilcox oil-burning furnace, 689.
Quinn, E. A. and R. C. Denny. Maintenance problems and solutions, *1211, comment, 1199.

RALSTON, F. C. (See W. C. L. Eglin.)
——Life of cable for conveying coal almost doubled, 1218.
Ramsey, Allen. Machine for testing insulators and bus supports, *1024.
Reemelin, O. B. Court finds customer responsible for existence of "jumper" on his service, 1216.
Reinhardt, William. Plant efficiency improved by conserving drippings from auxiliaries, 1120.
Remtz, Jerome. Excess profits tax discriminatory, 1119.
Rey, O. P. The three-phase four-wire system, 478.
Reyneau, P. O. Machine reduces cost of hole digging and pole setting 25 per cent, *951.
Richards, Fred M. Table shows coal consumption for different grate speeds, 22.
Ricketts, Edwin B. Surface condenser maintenance where scale forms on tubes, *638.
Rittenhouse, L. H. Advantages of 50-deg. and 40-deg. motors, 125.
Roe, A. C. Changing speed of squirrel-cage motor without changing horsepower, 1220.
Roe, A. C. (Continued):
——Connecting three-phase induction motors, *171 (with supplement).
——Rack for small wire reels which maintains proper tension, *933.
——Reconnecting two-phase induction motors, *683, comment 670 (with supplementary chart).
——Rewinding a two-phase motor for three-phase operation, 883.
——Rewound motor for testing phase rotation, 740.
Roeser, E. A. Static condenser raises industrial power factor 60 to 90 per cent, *195.
Roper, D. W. Map used to route work of city maintenance crews, *578.
——Service work for 1919 below pre-war cost, *273, comment 271.
Rose, Charles L. (See Edward Howell.)
Rush, H. S. Pipe-thawing outfit for coming winter, *480.

SAMUELS, M. M. and C. O. von Danerberg. Designing direct and indirect illumination, *721, comment 718.
Schiehser, John. Open and conduit wiring combined for economical factory distribution, *191.
Schou, Theo. Auto-transformers for motor starting, *473.
Smalley, M. F. Metering combined power and lighting loads, *480.
Seidener, I., and A. Gruenhut. Status of Austrian electrical industry, 1069.
Shaw, Mayor Carroll H. Survey of New England power situation, 525, comment 510, correction 737.
Soares, E. C. Connection of rheostats for testing, *579.
——Equalizing battery discharge on unbalanced load, *338.
——Fitting ball bearings to a sleeve-bearing machine, *130.
——Home-made inclosed reversing switch prevents shock, *190.
——Increasing current of constant-current transformer in emergency, *881.
——Reversing switch for meters which has 190 microhms resistance, *23.
——Simple grid connections to give wide range of resistance, *1173.
——Two motors connected in parallel drive same load, *641.
——Various single-phase voltages from three-phase generator, *532.
Sparkes, H. P. Adapting signal indicators to power plant use, *1251.
——Polyphase experimental and instrument-testing table, *380.
Stauffacher, E. R. Current-balance relay protection, *465, comment 462.
——(See G. C. Heckman.)
Stafford, H. E. Motor drive takes less power for starting with chain than with belt, *25.
Stanford, F. C. Two 500-hp. alternating-current motors divide hoist load equally, *27.
Starker, C. W. Motor features requiring standardization, *919.
Streiff, A. High-speed wheels for low-head plants, *121, comment 111.
Strickland, W. P. Resuscitation through pain inflicted by a blow, 929.
Stirling, Alex. Machine electrically heats rivets in series, *643.
Stoek, H. H. Storage of coal for central stations, *225, comment 223.
Stokes, H. D. Posting current prices of motors, *29.
Stone, Frank M. Four-valve engine shows economy over turbine, 76.

TALLMAN, VERNON. Central station regulations for use of starting compensators, 196.
——Domestic electric refrigeration should be developed, 1124.
Taylor, A. H. New portable reflectometer, *467, comment 463.
Taylor, T. S. Reducing temperature of laminated cores, *1159, comment 1151.
Tenney, E. H. Combustion engineers increase plant economy 20 per cent, 577.
——High economy in small steam plants, *616, comment 606.
——Seventeen rules for efficient boiler-plant maintenance and operation, 639.
Thomas, T. T. Spring rack prevents damage to meters in automobile, *690.
Tillman, R. H. Substations for supplying large industries, *231, comment 222.
Tillson, Edwin D. Safety features of the double-base lamp, 75.
Todd, W. B. Acid-proof construction for conduit and lamps, *341.
——Method of protecting motor windings against acid fumes, *190.
Tousley, Victor. Relation of lighting feeders to watts per square foot, 686.
Treat, Robert. Effects of multiple grounds on transmission systems, 640.
——Operation of auto-transformers to avoid trouble, 691.
Tuck, Davis H. The real meaning of productive illumination intensities, *684, comment 670.
Tufts, J. B. Cost records of motor repair shop used to classify expenses, *1175.
——Subdivision of motor maintenance items assist record keeping, 291.
——Work-order records for motor repair shop, *1026.
Tyler, Eugene. Outfit to test for open high-resistance circuits, *245.

UNLAND, H. L. High speeds obtained in routine work by automatic welding, *836.

VAUGHN, D. O. Company supplies 2.5-kva. rural transformer installation for $375, *882.
von Danenberg, C. O. (See M. M. Samuels.)
Voorhees, L. J. Chart for easy determination of direct-current line drop, *481.

WAGSCHAL, G. Illumination of machine tools, *925.
Wakeman, J. M. Honolulu more progressive than many cities in the United S... 576.
Walford, Ray H. Establishing simple basis for rates, *382, comment 415.
Walker, C. Supporting openwork conductors on steel members, *290.
Walz, Kenneth. Stoker trouble eliminated by using springs to lift counterbalance, *785.
Warner, R. G., and A. E. Knowlton. Improving power factor conditions with induction motors, *1021, comment 1006.
Warren, Col. J. G. Developing Niagara Falls without marring its beauty, *329.
Warren, Philip Barton. The justice of current-cost valuations, 1249, comment 1247.
Weaver, K. S. Graphical calculation of illumination, *880.
Weber, Cornelius G. Connecting transformers across proper phase increases output, *1218.
——Elastic brake for unreeling wire, *837.
——Interchange of industrial and central station energy, *173, comment 159.
Weightman, H. E. Calculating stresses in armature bands, 192.
West, L. R. Textile motors attached directly to spinning-frame cylinders, *1076.
Westcott, E. C. Auto-transformer for feeding two-phase motor from three-phase line, *188.
——Differentially wound watt-hour meter for testing current transformers, *433.
White, Byron E. Centralized stream-flow records would be helpful, 1073.
——Value of rainfall records, 337.
White, James. Canadian water power, 37.
White, W. M. Waterwheel and generator considered as homogeneous unit (Niagara Falls Power Co.), *679.
Whitsit, Capt. Lyle A. Power service for a middle west section, *969, comment 958.
——Proposed power district in the South, *1009, comment 1007.
——(See Capt. George K. Miltenberg.)
Williamson, R. B. Operating experience proves correctness of design of 32,500-kva. generator for Niagara Falls Power Co., *782, comment 767.
Woltz, J. M. Lighting and industrial accidents, 1216.
Wood, H. E. Inspection system which keeps 1,200 motors running, 884.
Wood, L. A. S. Tendencies in ornamental street lighting, *324.
Wood, L. E. Machine for winding armature coils, *387.
——Stand for holding reel while winding coils, *291.
Wood, R. J. C. Surface-condenser maintenance, *623, comment 607.
Wyss, L. W. Repair and inspection of hydraulic turbines, 1064, comment, 1055.

*Indicates illustrated articles

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A More Powerful N. E. L. A.

THE reorganization of the National Electric Light Association begun under the able leadership of President Ballard is going on apace. Geographic divisions have been established throughout the country, and the staff at headquarters is organized for prompt and intensive service. It was early realized that if the enlarged work of this important association was to be done effectively, ample funds must be available, and steps to that end were taken at the recent convention at Pasadena. The greatest step forward, however, aside from the provision for geographic divisions, was the formation of the Public Relations Section; the work of which should fill a long-felt want in focusing the attention of executives on the major questions of finance, regulation, management and public relations. Too long has the association neglected these vital topics. Fortunately, the chairmanship of the section has been intrusted to J. E. Davidson of Omaha, who not only possesses abundant energy and enthusiasm but is also well versed and experienced in the management of properties both small and great in many sections of the country. Under his guidance this section should give a good account of itself. The record also of President Ballard is being maintained by President-elect Martin J. Insull, and already there is a fast growing recognition of the prowess of the reinvigorated N. E. L. A. Although active work under the revised constitution and by-laws has only begun, the results so far amply justify the prediction that the National Electric Light Association will be more than ever the dominating organization of the industry.

Water-Power Development

ANNOUNCEMENT had hardly been made that the President had signed the water-power bill before applications began to be filed for licenses aggregating more than 500,000 hp., notwithstanding that the Federal Power Commission is not yet organized. This indicates how vital the interest is in water-power development. The country is in need of all this power, and by the provisions of the act the licensee must commence construction on the project within two years of the date of his license. An outlay of more than $200,000,000 will be necessary before the power is available, and it is futile to deny that such a large sum of money will not be readily forthcoming at reasonably low rates at this time. Such being the case, electrical energy from these sources will not be cheap as we have been wont to measure cheapness. The days for cheap power have gone. If located favorably, these water-power developments should find a ready market for all the energy, and certainly the ever-increasing cost of fuel and labor will render them more and more valuable as time goes on. This consideration as well as the provision of the act for maintaining the integrity of the investment should make water-power securities more attractive than they might otherwise be. Being optimists, we naturally look to see millions of water horsepower developed within the next few years. Production of electricity in the United States has for a long time been too near the peak, and the output has been too meager for the manifold new uses asking to be served. Nothing short of a tremendous increase in the output from sources other than coal-driven stations will avail much.

Prosperity Must Be Mutual

POWER is the lifeblood of industry. Without it factories must close their doors, middlemen sit idly in their offices, and all the complicated machinery of modern business come to a halt. It is therefore not strange to find more than sixteen thousand business men of Illinois represented in an appeal to the Public Utilities Commission of that state to give immediate relief to its utilities in the shape of higher rates. Just as business men are willing to pay higher transportation rates rather than have the arteries of commerce cease to function, so they are willing to pay more for power rather than have its supply restricted because it no longer pays for its generation. It is not a special tenderness for the electrical utilities that prompts them, but self-interest and a recognition of facts.

Money at 8 per Cent

EIGHT per cent, long the real rate of interest borne by many public securities issued at a nominally lower price, has at last received frank recognition in the money market through the issue at that rate of $2,000,000 ten-year gold bonds by the Idaho Power Company. It is obvious that a utility paying 8 per cent and selling its bonds at par pays no more than one paying 6 or 7 per cent and able to sell securities only at a discount equivalent to the difference between the lower and the higher rate. Under the new method a clearer object lesson is given to the public and the commissions, and should the example be widely followed, the effect in obtaining essential rate increases should not be small.

The Fuel Situation

OLD KING COAL is once more playing his unapplauded part on the nation's industrial stage. The threatened shortage is no bogie, but a very real peril. If shutdowns of utilities and factories, with great public inconvenience, widespread suffering and heavy financial losses, are not to ensue, every effort must be made to speed up production and transportation. First and foremost the utilities must be relieved from the peril of hand-to-mouth—perhaps we should rather say car-to-furnace—supply and enabled to accumulate

adequate storage reserves. The Interstate Commerce Commission will surely see the wisdom of granting to them the priority that, on the northern Atlantic seaboard at least, has become a public necessity.

The Stabilizing Effect of Reactors

TWO highly important papers were read at the A. I. E. E. convention this week dealing with the problem of assuring stable operation of high power generating systems in case of short circuit. The papers were presented by R. F. Schuchardt and by Dr. C. P. Steinmetz and are based on the investigation of a startling example of instability which occurred last September on the system of the Commonwealth Edison Company. It is needless here to go into the detail of the series of accidents which conspired to the general result, which was the dropping of substantially the whole 25-cycle load of 200,000 kw. followed by violent hunting of the units for almost a quarter of an hour before synchronous operation was fully restored. In the stations concerned the generators are, with a single exception, provided with reactors of moderate capacity in the phase leads, and part but not all of the tie lines and bus sections are also provided with reactors. The feeders, however, were not so provided, and the result of this omission proved serious.

In brief, there were two extremely violent short circuits, both from cable failures very close to the busbars, with the result of dropping the voltage far below the point where the synchronous load could stay in phase. The lost load caused the generators to speed up, and as the governor control was resumed the various units, reacting at different rates, were left hunting for synchronism until by clearing tie lines and treating the situation in detail order was gradually restored and the machines steadied down to pulling together. Our readers will find the exact report of the sequence of affairs extremely instructive as showing what may happen even in an exceedingly well-designed and remarkably well-operated generating system like that involved.

Dr. Steinmetz worked out some numerical examples showing the exact effect of short circuit under accurately defined conditions corresponding in general with the problem as presented in Chicago. Without feeder reactors the voltage, beaten down by short circuit, rises slowly, and it is pretty certain that all the synchronous apparatus will go out. Some delay will then ensue in getting it back into service. The strain, too, upon the circuit breakers is terrific. A feeder reactance of quite practicable value would greatly reduce the short circuit to be handled by the breakers, would hold the terminal voltage to at least half its normal value and probably save most of the synchronous operations. Dr. Steinmetz shows that even in the fraction of a second before the circuit breaker can possibly operate machines of different types drift apart by greater speed difference than allows their being pulled back into synchronism, and even with indentical machines variation in governing may produce the same effect.

In general terms, if sufficient reactance is available to limit the voltage drop on the generators to 50 per cent or less, these will probably remain in synchronism even through the period of governing, and if reactors are installed in the feeders sufficient to prevent such an initial drop of voltage, the chances are that all the synchronous apparatus will stay at work and come through the period of recovery to normal voltage without serious hunting. Incidentally Dr. Steinmetz has suggested that a strategic change of connections as between the various stations involved may produce a good effect by lessening the danger of a short circuit heavy enough seriously to cripple a large part of the generating capacity.

The whole subject is an exceedingly practical one, and the thanks of the profession are due to Mr. Schuchardt and Dr. Steinmetz for so full a discussion of a singularly instructive, if also destructive, example.

Considerations in Joint Pole Construction

CONSTRUCTION specifications and operating and legal agreements for joint pole construction have for a long time been a source of discussion and often unending controversy between telephone, telegraph, street-railway and central-station companies and other agencies using such devices. In many instances the disagreements have been so great that each company has decided to set independent poles for its own lines. In other instances state or municipal authorities, influenced by the seeming impossibility of an agreement being reached between disputing companies, have enacted laws preventing or limiting joint pole construction. In other places the practice of using joint poles has been considered dangerous to the public and has been forbidden on that account. We find throughout the country a multitude of practices, most of which are not the result of unprejudiced and sound thinking, but simply the fortuitous product of haphazard methods.

Those concerned in pole-line construction should realize that this state of affairs cannot last much longer. The public is fast getting to the point where it will demand still more careful scrutiny of the methods of operation of those companies that serve it. Public sentiment is being directed rapidly toward enforcing conservation, and there is no practice more obviously to be questioned from that standpoint than the practice of erecting several pole lines along the same route. Public authorities, commissions and other regulating bodies will soon be required to formulate more adequate regulations for joint pole construction and the companies interested must be prepared to present adequate suggestions. It would be unfortunate indeed if misdirected action were to delay the adoption of the desired standard practice.

To solve the problem adequately action from the national engineering societies and full co-operation from operating companies are needed. All the good that has been incorporated in existing agreements must be preserved, the public safety must be safeguarded, and all waste and unnecessary cost that the public in the end must pay must be eliminated. General principles that can be applied in the great majority of cases must be set down, and these must be in such form that most companies cannot fail to subscribe to them. Operating companies must realize that action to prevent pole wastage will be forced upon them in the near future by public sentiment. Their own welfare and the public welfare will be safeguarded only by immediate, unprejudiced and serious consideration of this important problem.

Education and Square Dealing Emphasized

PUBLIC utility operators are awake to the necessity of meeting the public they serve on a basis that will leave no room for suspicion or misunderstanding. Too long has the industry suffered from a policy of concealment when no concealment was necessary. Trite as this may seem, M. H. Aylesworth, executive manager of the National Electric Light Association, had occasion to dwell on it in his outline, made before the North Central Electric Association, of the work of the National Electric Light Association and its relation to the geographic section work. That men concerned in actual operating work and in the direction of association work should display the enthusiasm evidenced at Minneapolis means much for the future of the industry in that section and much for the future work of the N. E. L. A. because of its indication that the men who must speak for the industry are thoroughly alive to the trend of development in their field.

Relative Merits of Excitation Systems

THE exciter equipment of central stations has gone through many phases as the art has developed. In the beginning a directly belted or, later, directly connected exciter for each generator was a common device. As stations have grown in output and auxiliaries have multiplied, as in steam-driven plants, the tendency toward a separately driven excitation system has increased, the same units being used to supply excitation and auxiliaries.

The merits and demerits of the four systems—the central separately driven exciter, the direct-driven exciter applied to the general system, and the directly connected and separately driven exciters applied to individual units—were presented before the convention of the American Institute of Electrical Engineers by J. T. Barron and A. E. Bauhan this week.

In efficiency and facile operation the independent exciting plant has obvious advantages. It is, however, subject to some inconvenience, like any other general scheme, when used for purposes aside from pure excitation. In principle a separately driven exciter for each unit gives the greatest degree of reliability. Its cost is greater than that of the other systems and its efficiency in units of moderate size is less; but it possesses a high degree of independence. In case this plan is used it can be associated with other individual exciters for the power supply of auxiliaries. Its disadvantages diminish with the size of the unit and in case of very large turbo-generators are minimized. As regards general reliability, the authors of the paper referred to rate it high despite its additional cost and the requirement of extra space. Closely following it and sometimes more desirable is the independently driven general excitation plant composed of a sufficient number of units to secure continuity of service. Preferably such a system is driven by independent prime movers, although sometimes motor-driven units by the main busbars may be well employed at the cost of certain rather remote possibilities of serious trouble.

Both systems are distinctly better in general performance than those depending on exciters the operation of which is tied up with that of some or all the main generators, convenient as these have sometimes proved to be. The fundamental thing in an exciting system is that it shall deliver to its generator or generators the required amount of exciting current adjusted so far as is necessary by automatic regulators. If the same source of current is used for other purposes, the steadiness of its functioning is more or less impaired according to the precautions that are taken. On the whole, the more independent the exciting system of the performance of the individual main generators, or of all of them, the more likelihood there is of attaining uniform and effective service.

The objection to an independent exciting plant with its own prime movers, aside from installation expense—for such a purpose a secondary consideration—is the chance of failure applying to any generating system whatever. If provision is made for a motor-driven exciter reserve or for driving the exciters either by motor or prime mover, as might be easy in case of hydro-electric plants, the chance for failure of the exciting circuit is correspondingly reduced. In a big and important generating station the excitation on which continuity of service depends must be absolutely reliable so far as care can make it so. This condition seems to be best met by independently driven units made as nearly trouble-proof as is humanly possible.

Electric Power in Coal Mining

FEW persons realize to what extent electric power is now used in coal-mining operations. It has found its way to this task so gradually and with so little of sensational development that its present importance seems devoid of spectacular interest. Robert Anthony in a brief paper this week discusses the actual power requirements of coal mines as found by a long experience over a considerable range of mines. Taking a broad view of the matter, electric power is used for three distinct purposes in the coal industry. The mine must be ventilated and drained, which implies a steady load so long as the mine is in operation. The coal must be cut, hauled and, in shaft mines, hoisted, which constitutes the group of mining uses proper. Finally, a considerable amount of miscellaneous power is required for the upper works of the mine in getting the material ready for shipment. The distribution of the total power under these three heads varies widely from place to place according to the individual requirements of the mine and in particular depends on whether it is a drift or a shaft mine, hoisting being an important factor in the latter case.

Mr. Anthony's diagrams show very plainly the varying situations found in practice. Cutting the coal is a relatively small item, haulage a much more considerable one. Records from some two hundred drift mines in the Pennsylvania and West Virginia fields show total energy consumption averaging less than 2.5 kw.-hr. per ton. Evidently power in such cases is not a serious factor in the cost of the coal. In shaft mines the hoisting and the pumping and ventilation items are increased so that the totals may easily run to double the output in the average drift mine. In any case the power costs decrease as the output increases by reason of the constant items in the total load. The half output requirements of a mine may well be 50 per cent over the full output requirement reckoned in kilowatt-hours per ton of coal produced.



James H. McGraw

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Stabilizing Large Generating Systems

The Value of Feeder Reactance in Keeping Alternators in Synchronism Is Urged by Dr. C. P. Steinmetz, Following Analysis of Serious Breakdowns in a Large Generating System—Typical Examples Are Worked Out in Support of His Thesis

VITALLY related to the trend toward large interconnected systems and super-power stations is the problem of stable operation of alternators within a single station or several stations in parallel. Recent experiences in the Commonwealth Edison system showed that in case of short circuit near one of the generating stations the voltage fell to such a low value that the alternators connected to the bus in trouble fell out of synchronism and drifted helplessly for a quarter of an hour or so before the machines could be brought to synchronous speed and the load restored to normal. An investigation of this experience by the engineers of the company, assisted by Dr. C. P. Steinmetz, indicated that there were not sufficient protective reactances in use. The operating conditions which prevailed in the system at the time of the disturbances were reported by R. F. Schuchardt in a paper on "The Use of Reactors in Large Central-Station System," presented at the annual convention of the American Institute of Electrical Engineers on Thursday, and Dr. Steinmetz's analysis of the problem was presented under the title "Stability of High-Power Generating Stations." These two papers are here outlined at considerable length on account of the importance of the problem of stable operation.

The principal supply of the Commonwealth Edison Company is obtained from three large power houses, Fisk Street, Quarry Street and Northwest, as outlined by Mr. Schuchardt. In each of these there are both 25-cycle and 60-cycle turbo-generator units, but the experience here described refers only to the 25-cycle system.

At Fisk Street there are twelve 25-cycle units, rated at 180,000 kw., which are divided into two sections. Quarry Street, with 56,000 kw. in four units, is operated as one section, as is also Northwest station, with three 25-cycle units aggregating 85,000 kw. The generator and the busbar voltage is 9,000 kw. and all of the units are star-wound. Each unit has an oil switch in the neutral, and this switch is closed on one of the operating units in each section, the neutral bus being connected to earth through a 2.5-ohm non-inductive iron-grid resistance. The generators, which range from 12,000 kw. to 35,000 kw. in capacity, are provided for reactors in the phase leads with one exception. The total reactance of the various units, including the external coils, is from 11 to 14 per cent, the higher figure applying to the larger units.

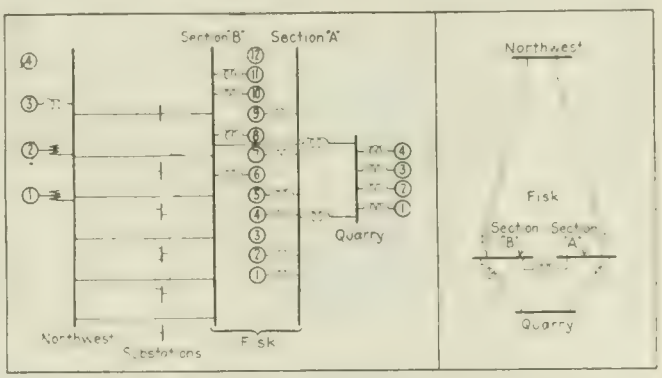
Quarry Street is connected to each of the Fisk Street sections through a short tie line of 750,000 circ.mil, each tie line having a reactor of 1.75 ohms reactance. There was no reactor between the sections of the Fisk Street station. The Northwest station also has a number of transmission lines which connect to one bus section at Fisk Street, but no reactors have been installed in these circuits, this having been postponed until the ultimate capacity at Northwest station had been more nearly fixed.

After generator and bus sectionalizing reactors had been installed it was hoped that the very heavy expenditures necessary for coils and housing for the 150-odd lines in the existing stations could be avoided, but plans for a new station included provision for such feeder reactors.

Cable Failures Make Trouble in the Station

Previous to last year, cable failures were generally at some distance from the station, and the relays promptly disconnected lines when such failures occurred. The disturbance on the system was thus very slight. During the past year, however, there were several failures very close to the busbars, and these had a fairly widespread effect.

On May 19, 1919, at 7:25 a.m., a burn-out occurred in a 12,000-kw. generator on Section A at Fisk Street. The connections are shown in a simplified diagram in Fig. 1. This unit was very promptly cleared by the operator at the switchboard, but immediately an unstable condition resulted and lasted for eighteen minutes. The voltage chart (Fig. 3) showed a constant



FIGS. 1 AND 2—PRESENT CONNECTION SCHEME AND ULTIMATE REACTANCE LAYOUT FOR COMMONWEALTH EDISON PLANTS

swinging of the pressure during this time, the maximum being about 9,100 volts and the minimum, except for the initial drop, about 7,000 volts. The wattmeters and ammeters on the tie lines A and B between Fisk and Quarry and on the lines from Fisk to Northwest swung continuously from one extreme to the other. The frequency varied from 24½ cycles to 26½ cycles. Units No. 2 and No. 7 at Fisk Street tripped their throttles from overspeed. A number of converters in the various substations tripped out. At 7:43 a.m. the disturbance suddenly ceased and the system pressure rose to about 9,400 volts, but was immediately brought to normal.

The experience pointed to the need of more reactance in the tie connections between Fisk and Northwest stations and also to the desirability of installing the Section A-B tie reactors, which had been purchased some time previously but the actual installation of which had been postponed. Arrangements were started to install the A-B coils and, pending the determination of the size of coils for the Fisk-Northwest tie lines, operating instructions were issued to open these lines promptly in the event of trouble producing a condition of instability.

On Sept. 18, 1919, at 3:47 p.m., when the 25-cycle system load was approximately 200,000 kw., a transmission line fed from Section B at Fisk Street broke down within 200 ft. (69 m.) of the station busbars. Because of the closeness to the busbars of this cable failure the voltage dropped to so low a point that all synchronous substation apparatus on Section B and on the Northwest station dropped off and also some of the substation units on the Quarry Street section and on Section A of Fisk Street, owing largely to communication through the direct-current connections. These latter units, however, were quickly restored to service. The load thus being lost on Section B and on Northwest, all of the generating units involved speeded up and the emergency steam valve was tripped. Owing to an incidental happening, the 25,000-kw. unit No. 11, operating on Section B, was disconnected, leaving four of the 12,000-kw. vertical units on the B bus. These units as well as the two which had been in operation at Northwest station were then out of synchronism with the units on those sections remaining normal; that is, Quarry Street and Section A of Fisk Street. Governor control was soon restored on these units, but the out-of-synchronism condition continued for approximately thirteen minutes. After the first seven minutes had elapsed, the reactors on tie line B at Fisk Street showed evidence of excessive current flowing and the tie line meters swung from one end of the scale to the other in irregular beats. Thereupon tie line B switch was opened. Northwest Station and Section B at Fisk Street still remained out of synchronism, however, and the pressure of Section B and Northwest buses remained near zero during the entire thirteen minutes. Fig. 4 shows the pressure charts for the period covering this and the succeeding disturbance.

While the restoration of service following the disturbance just described was in progress and getting on fairly well, another line broke down very close to the busbars. This line had carried an unusually heavy load throughout the day and on excessive load during the period following the first disturbance. The line in question was fed from Section A at Fisk Street, and as the tie line B to Quarry Street, which had been previously opened as above noted, had not yet been closed, the disturbance was not communicated to Section B or the Northwest station lines. There was also no resulting out-of-synchronism condition of any of the Quarry Street or Section A Fisk Street units. It was evident from these disturbances that the installation of feeder reactors in the old stations should not be longer delayed, and it has been decided to use a 0.5-ohm coil for all 9,000-volt, 25-cycle lines. The Section A-B coil at Fisk has been in service for some months and arrangements are being made to provide coils in the tie lines between Fisk and Northwest stations. A suggestion made by Dr. Steinmetz to divide these tie lines into two groups, one group connecting with Section A and the other with Section B at Fisk, has been adopted, so that the bus connections of the three stations will be a figure eight, that is, a double loop, as shown in Fig. 2.

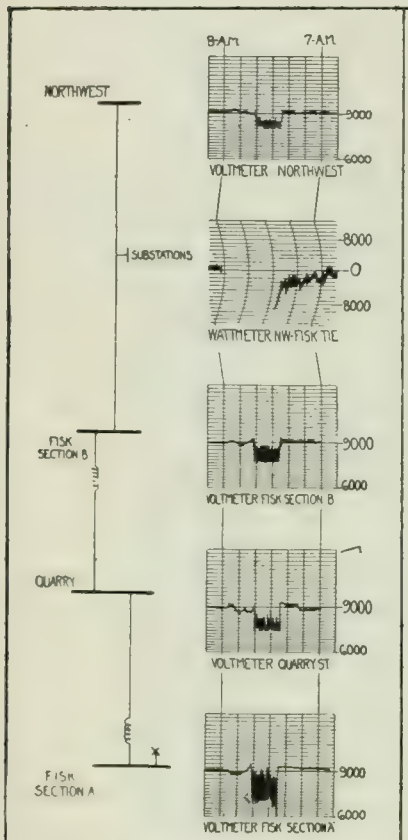


FIG. 3

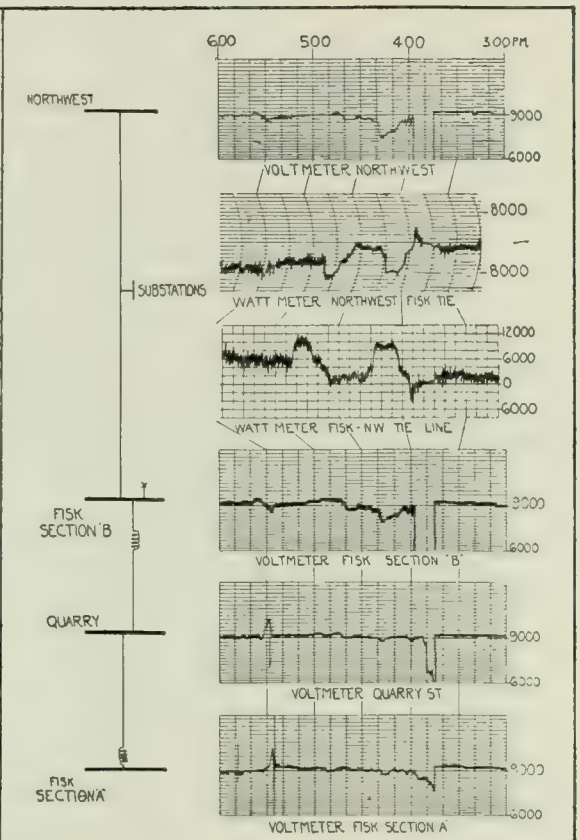


FIG. 4

FIGS. 3 AND 4—CHARTS SHOWING DISTURBANCES OCCURRING IN MAY AND SEPTEMBER

DR. STEINMETZ RECOMMENDS FEEDER REACTORS

In stating his conclusion regarding the use of power-limiting reactors and locating them in the system to the best advantage, Dr. Steinmetz points out the great usefulness of feeder reactors. Even with generator power-limiting reactors and busbar dividing reactors, the effect of a short circuit at or near a busbar section is very severe and probably shuts down this section. As troubles in feeder cables are very much more frequent than at the busbars, the installation of feeder reactors greatly reduces the frequency of serious troubles. While a feeder reactor may be a relatively small percentage, referred to the feeder capacity, it is large relative to the station capacity. It therefore greatly reduces the shock of a short circuit on the system, maintains some voltage on the busbars, and thus, if properly chosen, protects against the dropping out of synchronous apparatus. Also, by permitting a more rapid opening of the circuit breakers, it reduces the duration of the trouble.

A question arises as to what effect this necessary sectionalizing of the system by reactors has on the synchronizing power of the system, and thus on the stability of operation, the more so as in case of trouble a

local and temporary drop of voltage may still further lower the synchronizing power.

Dr. Steinmetz then proposes a specific problem to show that feeder reactors are necessary for the stable operation of alternators within the stations. Considering the effect of a feeder short circuit close to the busbars on a 25-cycle, 9,000-volt generating station of 60,000 kw. steam-turbine-alternator capacity, without and with feeder reactors; assuming that the short circuit is opened after one second; assuming as fair average an equivalent effective reactance of armature reaction of 85 per cent, a true self-inductive internal reactance of the alternators of 6.8 per cent and an external reactance as power-limiting generator reactor of 6 per cent, let the duration of the field transient (full-load conditions be $t_{oo} = 4.51$ seconds and the field attenuation constant $a_o = 0.222$. The transient then is given

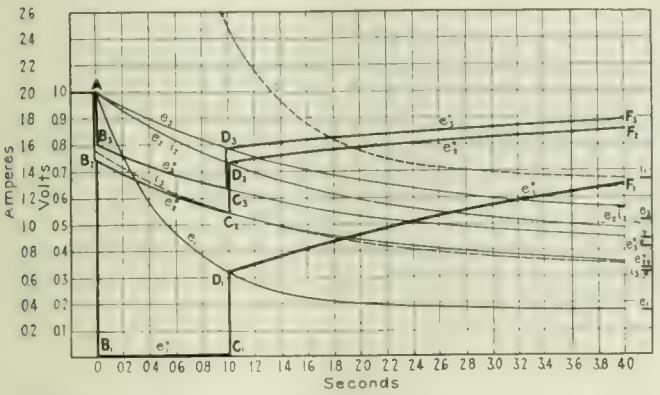


FIG. 5—STEINMETZ CURVES SHOW HOW FEEDER REACTANCE STABILIZES OPERATION OF GENERATING PLANTS

by $e = e_1' + (e_o - e_1)\,\varepsilon^{-a_o t}$, where e_o = voltage of the machine at the moment $t = 0$; for instance, initial voltage in the moment when a short-circuit has been opened. e_1 = machine voltage corresponding to the exciter voltage impressed upon the machine, that is, final voltage of the machine. Three cases are considered:

1. No feeder reactor, thus dead short-circuit on the busbars.

2. A feeder reactor of 0.5 ohm per phase, or 2.9 times the true reactance of the generating station, or 37 per cent.

3. A feeder reactor of 0.7 ohm per phase, or 4.05 times the true reactance of the generating station, or 52 per cent.

1. With 12.8 per cent self-inductive reactance, the momentary or initial short-circuit current, as a fraction of the rated current of the station, is given by $i_o = 7.8$, the final short-circuit current is $i_1 = 1.34$, and the duration of the short-circuit transient is $t_o = 0.582$ second. This gives an attenuation constant $a = 1.72$, and the equation of the short-circuit current transient is $i = 1.34 + 6.46\,\varepsilon^{-1.72t}$. This current is plotted in Fig. 5, marked i_1.

The induced generator voltage, which is given as a fraction of the induced voltage immediately before the short circuit by the transient, is $e = 0.172 + 0.828\,\varepsilon^{-1.72t}$ (plotted as curve e in Fig. 5). The terminal voltage is zero during the short circuit at one second. With the opening of the short circuit the terminal voltage jumps back to the same fraction of the terminal voltage before the short circuit to which the induced voltage has dropped, that is, to the point of curve e_1, 32.2 per cent of the previous terminal voltage. From this point at one second the voltage now gradually recovers on the field transient equation $e' = 1 - 0.678\,\varepsilon^{-0.222t}$. During the short circuit the terminal voltage thus traverses the values of A, B_1, C_1, D_1, F_1, in Fig. 5. As seen, the voltage recovery is very slow, and it is not probable that any synchronous apparatus will remain in step. The short-circuit current after one second in which the circuit breaker has to open is two and one-half times the rated current, or 150,000 kva.

2. With 12.8 per cent self-inductive generator reactance and 37 per cent feeder reactance, the total reactance is 49 per cent, and the cycles of terminal voltage and short-circuit current are again calculated as above and are shown in Fig. 5 by curves i_2, e_2 and e_2'. At the moment of short circuit the terminal voltage makes a sudden drop to curve e_2' to 0.744 of the previous value, then follows the curve e_2' for one second, then on opening the short circuit suddenly jumps from 0.543 on e_2' curve to 0.732 on e_2, and then gradually recovers on the field transient given by the equation $e_o = 1 - 0.268\,\varepsilon^{-0.222t}$. The terminal voltage thus traverses the broken curve $AB_2C_2D_2F_2$.

While the voltage recovery after the short circuit is slow, the terminal voltage even during the short circuit remains above half value. The current after one second when opening the short circuit is only 1.46 times full-load current.

3. In the same manner the curves are calculated for 52 per cent feeder reactance and the values as shown in Fig. 5 are i_3, e_3, e_3', giving for the terminal voltage the curve $AB_3C_3D_3F_3$. The short-circuit current, when the circuit breaker opens after one second, is only 9 per cent above full-load current.

How Synchronism May Be Lost

The question then arises of the bearing of these voltage curves on synchronous operation. During the period of dead short circuit or zero terminal voltage, B_1C_1, there is no synchronizing power. There is no load on the generators beyond the i^2r, and the load losses, which are moderate even at this initial high momentary short-circuit current, rapidly decrease with the decreasing short-circuit current. Thus the alternators speed up until the governor shuts off steam or the emergency governor trips. The former necessarily must take an appreciable time to avoid trouble from steam governor hunting. Usually, the speeding up will occur until the emergency trips and cuts off steam about 10 per cent above normal speed. Then slowing down occurs until the machines are again put on their governors. The speeding up, however, occurs at different rates, owing to the differences in the momentum of different machines; the speed of tripping cannot be exactly the same, as absolute reliability rather than exactness of speed is the main requirement of the emergency cut-off, and, furthermore, some speeding up will continue after the closing of the governor, owing to the steam contained between the cut-off and the turbine, and in the turbine.

Thus, if during this period the machines do not have sufficient power to keep each other rigidly in step, at the time when the short-circuit current is cleared and the voltage returns, the machines probably have drifted so far apart that they cannot pull each other into step again, but continue slipping out of synchronism, short-circuiting each other and keeping zero terminal voltage

indefinitely. An equation which gives the limits of synchronizing power—that is, the maximum speed difference from which the machines can pull each other into step promptly—is then derived by Dr. Steinmetz. It is shown that even in the fraction of a second—that is, in a time much shorter than the circuit breaker can open a short circuit—machines of different types have drifted apart by greater speed differences than those at which the machines can pull each other into step again at their reduced synchronizing power.

However, even with identical machines, especially if the speeding continues to the tripping of the emergency steam valve, inevitable inequalities in the tripping speed and in the time of restoring the machines on steam governor control probably cause greater speed differences than is permissible by the synchronizing power. Furthermore, even if the short circuit is opened in a second or less, the induced voltage has dropped so considerably—e_1 in Fig. 5—and the recovery curve—e_1^0 in Fig. 5—is so slow, that the machines cannot immediately take load, and speeding up continues for some time.

Thus it may be expected that with a dead short circuit at or near the busbars of a high-power steam-turbine station, the generators drop out of synchronism and are not able to pull back promptly, but begin to drift indefinitely, slipping past each other at zero voltage.

For a machine to remain in synchronism with other machines, with full-load steam supply and the load thrown off by a short circuit, etc., the machine must be able to transfer full load to other machines, within its limits of synchronizing power, that is, with a phase displacement not exceeding 90 deg.

Dr. Steinmetz showed that the voltage limit of synchronizing power in most large machines is a little below half voltage, and the conclusion follows that:

As long as the machines do not drop below half voltage, no danger exists of the machines breaking out of synchronism by the sudden loss of load under short circuit or other accidents, and,

If a feeder reactor limits the voltage drop of the station, due to a feeder short circuit, to 50 per cent or less, the machines in the station remain in synchronism, even when speeding up due to the release of load, when tripping their emergency steam cut-offs, etc., and the voltage thus recovers immediately on the opening of the short circuit.

As seen from Fig. 5, this is the case even with the smaller feeder reactor, and under the given conditions, the smaller feeder reactor thus should offer complete protection against loss of synchronism of the station as result of a feeder short circuit.

Similar relations then exist between generating station and synchronous machine loads, such as converters and synchronous motors.

The synchronous converter probably represents by far the most frequent synchronous machine load. Its internal characteristics are somewhat similar to those of the steam-turbine alternator—that is, high effective reactance of armature reaction and low true self-inductive reactance—and it therefore is probable that about the same numerical relations pertain.

Such values of feeder reactors, which are sufficient to guard the generating stations against loss of synchronism by maintaining the station under feeder short circuits, above the voltage limit of synchronizing power, may in general be expected also to guard the synchronous converters in the substations against being thrown out of step—that is, shut down by the shock on the system due to feeder short circuit.

Mechanical Engineers Propose New Code of Ethics

A NEW code of ethics, which may serve as a basis for a code of principles for all engineers, has been proposed by the American Society of Mechanical Engineers and presented before its recent semi-annual meeting and also before the Federation of American Engineering Societies.

The essential feature of the code is its brevity. It contains but fourteen short paragraphs and is intended to be a brief positive statement of the professional relations of engineers to the public, to their clients or employers and to one another. Action will probably be taken on its adoption in December.

The proposed code is as follows:

1. The mechanical engineer should be guided in all his relations by the highest principles of honor, of fidelity to his client and of loyalty to his country.
2. His first duty is to serve the public with his specialized skill. In promoting the welfare of society as a whole he advances his own best interests as well as those of the whole engineering profession.
3. He should consider the protection of his client's or employer's interests in professional matters his essential obligation, provided these interests do not conflict with the public welfare.
4. He shall refrain from associating himself or continuing to be associated with any enterprise of questionable or illegitimate character.
5. He can honorably accept compensation, financial or otherwise, from only one interested party unless all parties have agreed to his recompense from other interested parties.
6. He must inform his clients of any business connections, interests or circumstances such as might influence his judgment or the quality of his services to his clients.
7. He must not receive, directly or indirectly, any royalty, gratuity or commission on any patented article or process used in the work upon which he is retained without the consent of his clients or employers.
8. He should satisfy himself before taking over the work of another consulting engineer that good and sufficient reasons exist for making the change.
9. He must base all reports and expert testimony on facts or upon theories founded only on sound engineering principles and experience.
10. He must not regard as his own any information which is not common knowledge or public property, but which he obtained confidentially from a client or while engaged as an employee. He is, however, justified in using such data or information in his own private practice as forming part of his professional experience.
11. He should do everything in his power to prevent sensational, exaggerated or unwarranted statements about engineering work being made through the public press. First descriptions of new inventions, processes, etc., for publication should be furnished only to the engineering societies or to the technical press.
12. He should not advertise in an undignified, sensational or misleading manner, or offer commissions for professional work, or otherwise improperly solicit it.
13. He should not compete knowingly with a fellow-engineer for employment on the basis of professional charges or attempt to supplant a fellow-engineer after definite steps have been taken toward the other's employment.
14. He should assist all his fellow-engineers by exchange of general information and valuable experience or by instruction through the engineering societies, the schools of applied science and the technical press.

Interconnection in Southern Vermont

Tying Hydro-Electric Properties Together for Co-operative Service Saves Fuel and Water—Centralization of Dispatching Functions Helpful—Graphic Analyses of Intercompany Operations



CHITTENDEN RESERVOIR, WHICH IS MAINSTAY OF VERMONT HYDRO-ELECTRIC CORPORATION

THE progressive interconnection of hydro-electric systems in southern Vermont is establishing a new era in central-station operations in a section of New England hitherto handicapped by isolated utility administration. Taken with the consolidation of various properties in the Rutland district into a single administrative system, the interchange of energy now attained between both industrial and public utility plants is making it possible to handle rapidly increasing loads more effectively, conserve water, avoid the importation of coal or oil on any appreciable scale, utilize labor to better advantage and, last but not least, to keep down the investment burden necessary to supply service in the southern Green Mountain area. The Green Mountain range traverses the state from north to south and affords an abundant supply of water for power, agricultural and other purposes. For many years hydro-electric energy has been utilized extensively throughout the state, but it is only of late that the advantages of interconnection and plant co-ordination have been realized and a comprehensive development exploited.

Southern Vermont Interconnection Comprises Five Systems

Five important systems of hydro-electric supply are now interconnected in the Rutland district, the Vermont Hydro-Electric Corporation, the Hortonia Power Company, the Vermont Marble Company, the Rutland Railway, Light & Power Company and the Fall Mountain Electric Company (supplied from the Vernon station of the New England Power Company interests. These interconnections are still in process with a larger plane of usefulness in sight when new plant developments are completed, but much has already been accomplished, as this study of the Rutland system indicates.

The total generating capacity available for southern Vermont through the interconnection of about a score of plants on these systems is about 27,500 kw. in present installed units, including 3,500 kw. available from the Fall Mountain tie line north of Bellows Falls. The co-operation of these various plants is advantageously shown in the accompanying diagram of energy outputs through October, 1919, and in the diagram of energy interchanges for the calendar year 1918. Conservation of water is perhaps the most striking result indicated, and this has been effected through load dispatching of a very high order of excellence.

In considering the operating co-ordination accomplished on these systems a brief survey of their extent is desirable, with a short account of the improvements recently effected and in progress through consolidation and upbuilding. The operating headquarters of the Vermont Hydro-Electric Corporation and the Hortonia Power Company are both in Rutland, which may fairly be regarded as the load center of the interconnected systems. To the north, northwest and northeast are the generating plants and transmission lines of the Hortonia company. Along a general north and south line running to the west of Rutland is the system of the Vermont Marble Company, with headquarters at Proctor. Northeast of Rutland and extending to the southeast are the lines and plants affiliated with the Vermont corporation, extending into Claremont, N. H., and thence down the Connecticut Valley by tie line to Bellows Falls and the Vernon station, the last being the largest hydro-electric plant on the Chase-Harriman system (New England Power Company group).

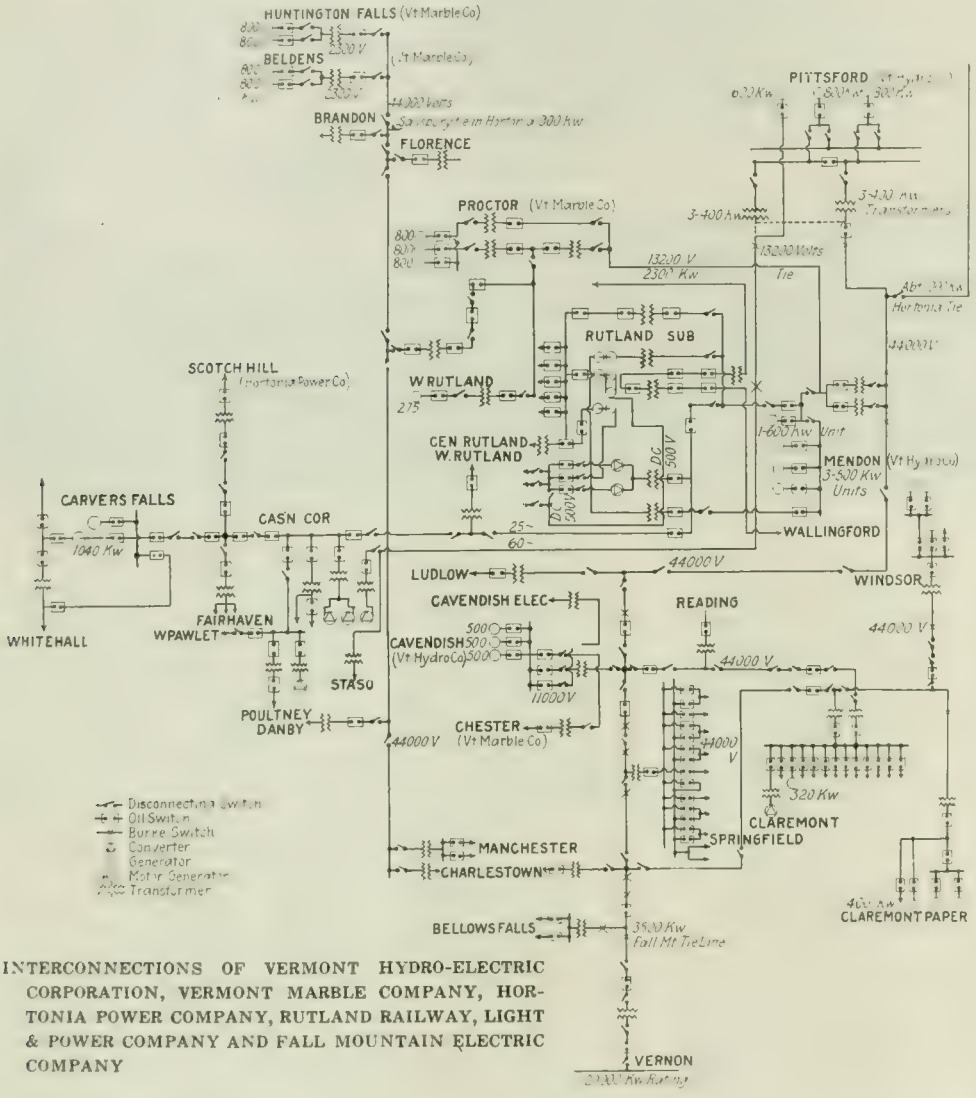
The Vermont Hydro-Electric Corporation acquired in 1919 the plants and lines of the Colonial Power & Light Company, Western Vermont Power & Light Company, Claremont Power Company (of New Hampshire), water

rights of the Clarendon Power Company (of Vermont), the Mendon generating station of the Rutland Railway, Light & Power Company, and the control of the hydro-electric production of the Pittsford Power Company, in order to correlate the plants, obtain larger amounts of energy, sell greater quantities of electricity in southern Vermont and effect economies in management, and further, to raise more readily capital for the development of additional generating facilities.

The Hortonia Power Company, organized in 1915, includes the following consolidated properties in its own system: Neshobe Electric Company, Lake Dunmore Power & Traction Company, Gaysville Electric Light & Power Company and White River Electric Company. This system is being co-ordinated into an operating organization with centralized direction, but at this writing additional transmission-line construction remains to be completed in order that the plant groups may be interconnected between the Bethel and Wells River districts. The major service of the system is furnished in west-central Vermont, and the company's lines extend across the southern end of Lake Champlain into New York State.

The Vermont Marble Company's system is built upon the industrial development of the marble region west and north of Rutland, with a group of hydro-electric stations interconnected with the Vermont Hydro-Electric and Hortonia systems for advantageous use of water and interchange of energy. The Rutland Railway, Light & Power Company handles the central-station and electric railway service of the immediate Rutland district and is operated by the Vermont Hydro-Electric Corporation management. The Fall Mountain system includes no active generating plants, but is a distributer of the New England Power Company organization.

The engineering characteristics of the plants on the foregoing systems are extremely varied. The installations now in service include low, medium and high-head developments, with and without substantial storage facilities. Plant capacities are moderate for the most part, and both 25-cycle and 60-cycle loads are being handled. The most important interconnections are by 44,000-volt, 60-cycle, three-phase transmission. The eighteen principal hydro-electric plants operated on these systems illustrate a range in heads of from 16 ft. to 675 ft. (5.9 m. to 206 m.), with a range in available capacity of from 250 kw. to 3,500 kw. These systems represent a gradual development of local resources and extension of operations to include adjacent markets and interstation co-operation. Some of the plants represent obsolete designs; others afford examples of modern engineering and operating co-ordination. Certain tendencies toward standardization can be seen in plants developed by a single interest and under centralized engineering supervision, but in many respects the properties involved in southern Vermont interconnection are of such a heterogeneous character that it is difficult to trace any general problem solution in the evolution of the plants themselves. At the same time, some engineering and operating details suggest the line of advance being followed in the better utilization of the hydro-electric resources of the particular territory served.

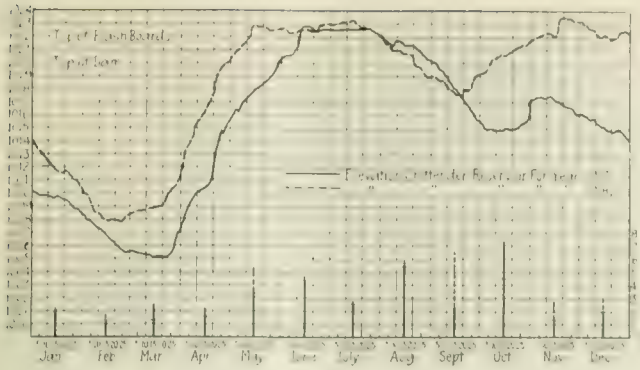


INTERCONNECTIONS OF VERMONT HYDRO-ELECTRIC CORPORATION, VERMONT MARBLE COMPANY, HORTONIA POWER COMPANY, RUTLAND RAILWAY, LIGHT & POWER COMPANY AND FALL MOUNTAIN ELECTRIC COMPANY

Engineering Methods Involved in Territorial Hydro-Electric Development

Some of the more important engineering methods concerned in the development and co-ordination of plants in this district are as follows:

1. Selection of direct-connected units and discard of belt-connected installations in new work.
2. Use of more efficient waterwheels.
3. Use of similar plant designs under favorable conditions.
4. Development of plants to reutilize water on given watershed.



VARIATIONS IN ELEVATION OF CHITTENDEN RESERVOIR WITH CORRESPONDING PRECIPITATION FOR 1917 AND 1918

5. Increasing capacity of exciting plants.
6. Concentration of 25-cycle load for localized supply.
7. Development of plants in gorge sites.
8. Use of frequency changers to increase flexibility of operation.
9. Extension of transmission lines.
10. Diversion of existing streams to increase water supply.

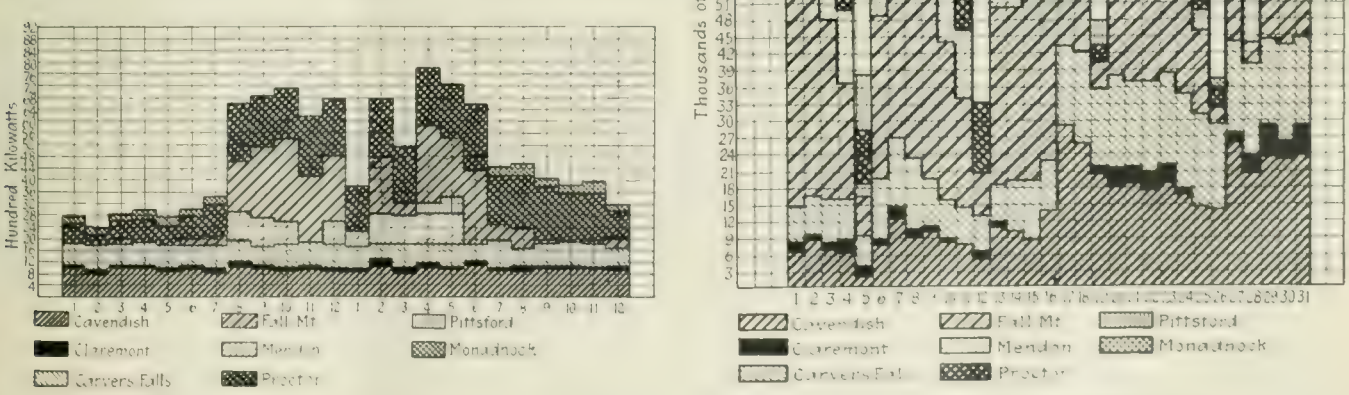
In general, the tendency is to do away with belted generating units in these plants except where the installations are relatively old and of small capacity. In some cases a combination unit consisting of 25-cycle and 60-cycle generators belted or direct-connected to a single waterwheel is utilized. None of the modern stations, of course, uses other than direct-connected equipment, but the necessity for supplying railway rotary converters at 25 cycles as well as 60-cycle loads has required the employment of double-frequency outfits in some installations. The replacement of old wheels by more efficient designs is also being gradually accomplished.

Rehabilitation of Carvers Falls to Increase Output 8,500,000 Kw.-Hr.

Elimination of belt driving, the substitution of more efficient wheels and increase of capacity by raising the head from 120 ft. to 185 ft. (36.5 m. to 56.3 m.) illustrate a program of betterment planned for early accomplishment at the Carvers Falls station of the Hydro-Electric Corporation. This plant is situated on the Poultney River, and the present installation consists of two 500-kva., 25-cycle generators direct-connected to waterwheels and a 300-kva., 60-cycle generator belted to one of the 500-kva. generators. The head will be raised by building a new dam 1,200 ft. (365 m.) above the present dam. Water will be taken to the plant through a wood-stave pipe line 78 in. (200 cm.) in diameter and terminating after a run of 2,000 ft. (610 m.) in steel penstocks about 400 ft. (120 m.) long. In the present station building will be housed two 1,250-kva. generators direct-connected to two waterwheels, with space for a future third unit. This redevelopment will increase the output of this station by about 5,900,000 kw.-hr. primary energy and 2,650,000 kw.-hr. secondary energy per year, making the total output 13,200,000 kw.-hr. at Carvers Falls. The estimated cost of the redevelopment is $200 per kilowatt, or $400,000 total. When redeveloped, the output will be 7,900,000 kw.-hr. primary and 5,300,000 kw.-hr. secondary. The 1918 output of this plant was 2,000,000 kw.-hr. primary and 2,650,000 kw.-hr. secondary energy.

The storage in this watershed, which covers about 186 sq. miles (475 sq.km.), can be materially increased by the utilization of several small lakes and ponds. The present available storage consists of 574,600,000 cu.ft. (16,250,000 cu.m.) in Lake Bomoseen and Glen Lake, and the additional storage under consideration above brings the total possible storage to 749,100,000 cu.ft. (21,210,000 cu.m.), or 4,000,000 cu.ft. per square mile (290,000 cu.m. per sq.km.). In the remodeled plant the efficiencies of the waterwheels and turbines are computed at 73 per cent and 91.4 per cent respectively.

The increased use of water upon an existing watershed is also being provided for at the so-called No. 3 development of the Vermont Hydro-Electric Corporation, about 2 miles (3 km.) north of Rutland. At this point, on East Creek, there is now under construction a 2,000-kw. (initial capacity) station of two units to operate under a head of 175 ft. (53.4 m.). The estimated cost of this installation is about $400,000. This new station will utilize the water which has passed through the Pittsford and Mendon stations, and will also take water from the south branch of East Creek,



TYPICAL LOAD VARIATIONS AND CORRESPONDING OUTPUT OF VERMONT HYDRO-ELECTRIC CORPORATION FOR OCTOBER, 1919

which does not serve the two upper stations. The dam site for this development is about 2,000 ft. (610 m.) below the Mendon station, and water will be taken to the new station by a 78-in. (200-cm.) wood-stave pipe line about 8,000 ft. (2,440 m.) long. The output of No. 3 station will be about 5,000,000 kw.-hr. annually, with two units in service. This station will have the great advantage of the stream regulation furnished by the Chittenden and Pittsford reservoirs. The capacity of the former is about 1,000,000,000 cu.ft. (28,400,000



CLARENDON GORGE, WHICH WILL IMPOUND 50,000,000 CU.FT.

cu. m.) and of the latter 150,000,000 cu.ft. (4,250,000 cu. m.). From the Chittenden Reservoir to No. 3 station the river falls about 900 ft. (275 m.). With proper handling it is expected that No. 3 station can be operated at 2,000 kw. output ten hours a day and 300 days per year. The Pittsford plant produces about 5,000,000 kw.-hr. and the Mendon station 4,000,000 kw.-hr. annually. The load-dispatching headquarters of the Vermont Hydro-Electric Corporation will be at No. 3 station upon its completion, the present headquarters being at the Cavendish station. The No. 3 station will supply additional energy greatly desired in the southern Vermont and western New Hampshire territory, and a third unit will probably be added before the year ends.

The location of generating plants in or near gorges where the hydraulic conditions are unusually favorable to development is illustrated in the Cavendish station of the Vermont Hydro-Electric Corporation. This plant is a 1,500-kw. installation operating under a head of 120 ft. (35.6 m.), and utilizing the waters of the Black River by means of a dam about 1,000 ft. (305 m.) upstream. In common with several other of the company's plants, this installation is provided with a surge tank in the penstock line from the dam. Comparatively little storage is available at present at Cavendish. The company now owns water rights on the Mill River, southwest of Rutland, which include a gorge permitting a development of nearly the entire watershed of the Mill River.

The total watershed above the proposed dam covers about 66 square miles (170 sq.km.). It is planned to build a dam about 70 ft. (21 m.) high in the Clarendon Gorge, which is over 100 ft. (30 m.) deep and 130 ft. (40 m.) wide, impounding about 50,000,000 cu.ft. (1,420,000 cu.m.) of water. The water will be conveyed to the generating station by a 78-in. (200-cm.) wood-stave pipe 9,500 ft. (2,900 m.) long, with a final steel penstock section 1,700 ft. (519 m.) long. The available static head will be 305 ft. (93 m.). A 2,000-kw. generating station is contemplated, and the estimated cost of the development is $450,000.

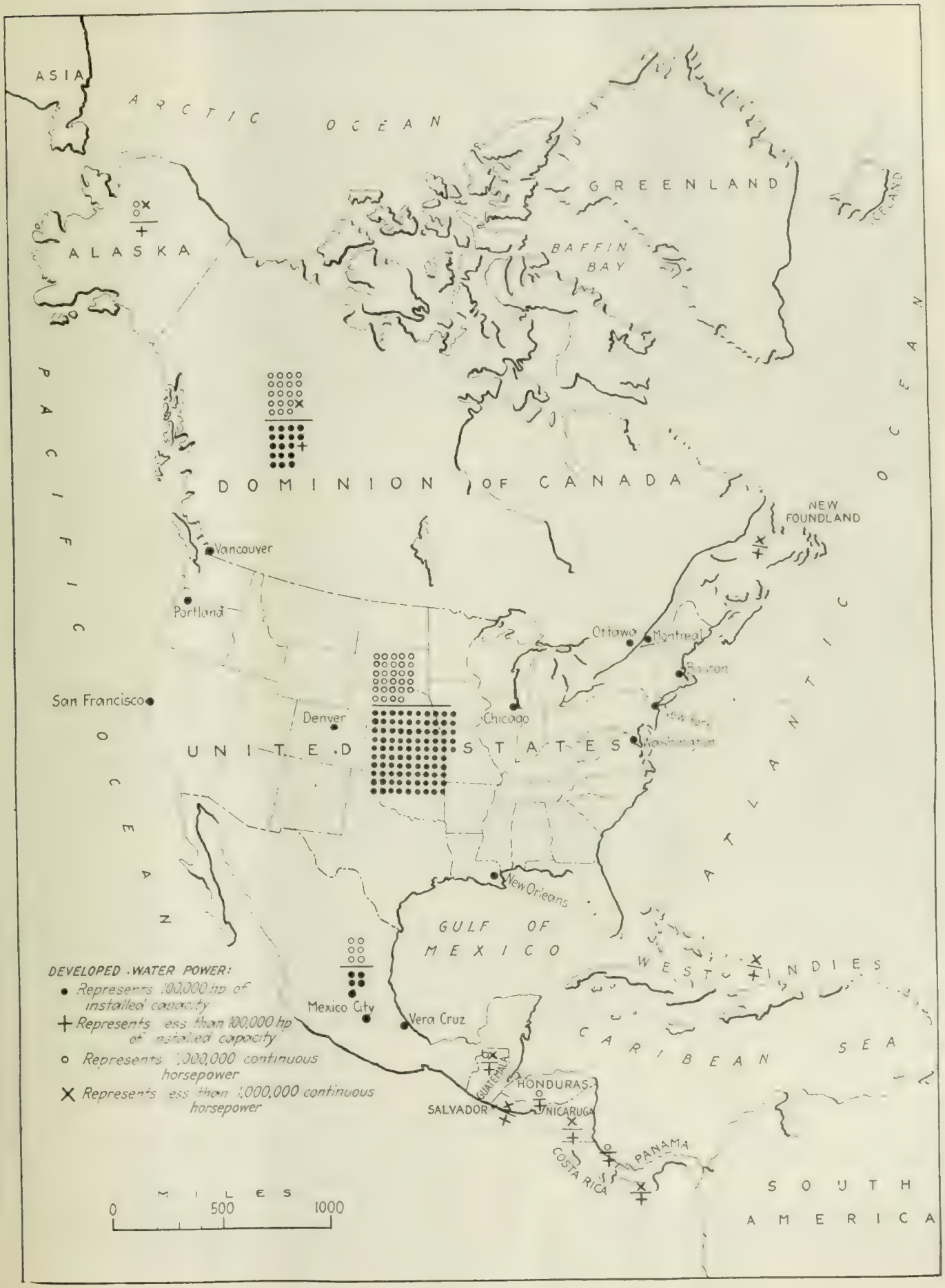
When the No. 3 station, Carvers Falls redevelopment, and the new plant on Mill River are completed, the estimated annual output of the hydro-electric stations of the Vermont corporation's immediately controlled system will be about 41,000,000 kw.-hr., about two-thirds of which will be primary power. The Cavendish station produces about 5,000,000 kw.-hr. a year, and the Clarendon station will deliver about 8,000,000 kw.-hr. The amount of steam power interconnected with this system in small mill or public utility plants is so small as to be practically negligible, although it is of some slight operating advantage.

Eight Stations to Use Water in Succession Using Same Storage

The hydro-electric plants of the Vermont Marble Company are located on Otter Creek, which receives water from East Creek and Mill River, as well as from smaller tributaries. These stations, four in number, and the Mendon and Pittsford stations are established in " hydraulic series," together with the Middlebury station of the Hortonia Power Company, so that when the Vermont Hydro-Electric Corporation's No. 3 station is completed there will be eight plants using water in succession in the Otter Creek valley, co-ordinated into close operating relationship and benefiting more or less from the storage and regulation afforded by the Chittenden and Pittsford reservoirs. The Huntington Falls and Beldens stations of the Vermont Marble Company are in this group and are of similar design. Each operates under a 40-ft. (12.2 m.) head and contains two 750-kw. units directly driven by waterwheels. Three 750-kw. units comprise the generating equipment of the marble company's Proctor station, which is the operating center of this important industrial hydro-electric transmission system.

In a later issue of the Electrical World further details of this New England development, including the 675 ft. (206 m.) plant of the Hortonia Power Company will be given.

Water Powers of North America



Power Requirements for Coal Mining

Energy Consumption and Minimum Demand of Bituminous Coal Mines Shown Under Different Mining Conditions and with Varying Output of Coal — Suggestions Made for Successfully Changing Over Old Mines

By ROBERT ANTHONY

ANALYSIS shows that power is used for three general purposes in the operation of a coal mine: First, it is required to ventilate and drain the mine properly in order to make it a safe place in which to work. This requires a practically constant load which does not vary with the output and depends upon the gas and water conditions.

Then comes the hoisting, hauling and mining of the coal, all of which fall under the second general purpose for which power is used. The power required for this group of operations increases and decreases with the output of the mine and in about the same ratio.

The third classification includes power for the top work, comprising tipples, screens, washers, machine repair shops, etc. Power for this work increases and decreases with the output of the mine, but not in the same proportion.

These general classifications can be applied to both drift and shaft mines, but the interrelation is not the same in these two types of mines, as will be seen by referring to the curves in Figs. 1, 2 and 3. There are some energy-consumption figures, however, which apply for both drift and shaft mines. For instance, the average energy consumption for undercutting coal and moving the cutter is about 85 watt-hours per square foot (8 watt-hours per sq. m.). In some mines only 75 watt-hours is consumed per square foot (7 watt-hours per sq.m.), though in extreme cases and where the coal is very hard 125 watt-hours may be required. If the coal-cutting machine is kept in one place, the undercutting alone requires from 55 watt-hours to 85 watt-hours per square foot (5 watt-hours to 8 watt-hours per sq.m.). None of these figures includes losses in any converting or transforming equipment. Eighty-five watt-hours per square foot (8 watt-hours per sq.m.) is equivalent to about 0.5 kw.-hr. per ton for cutting and moving in a seam 4.5 ft. to 5 ft. (1.35 m. to 1.5 m.) thick. The haulage of coal consumes about 1.2 kw.-hr. per ton, and the haulage of men and materials about one-quarter of that amount on the average when

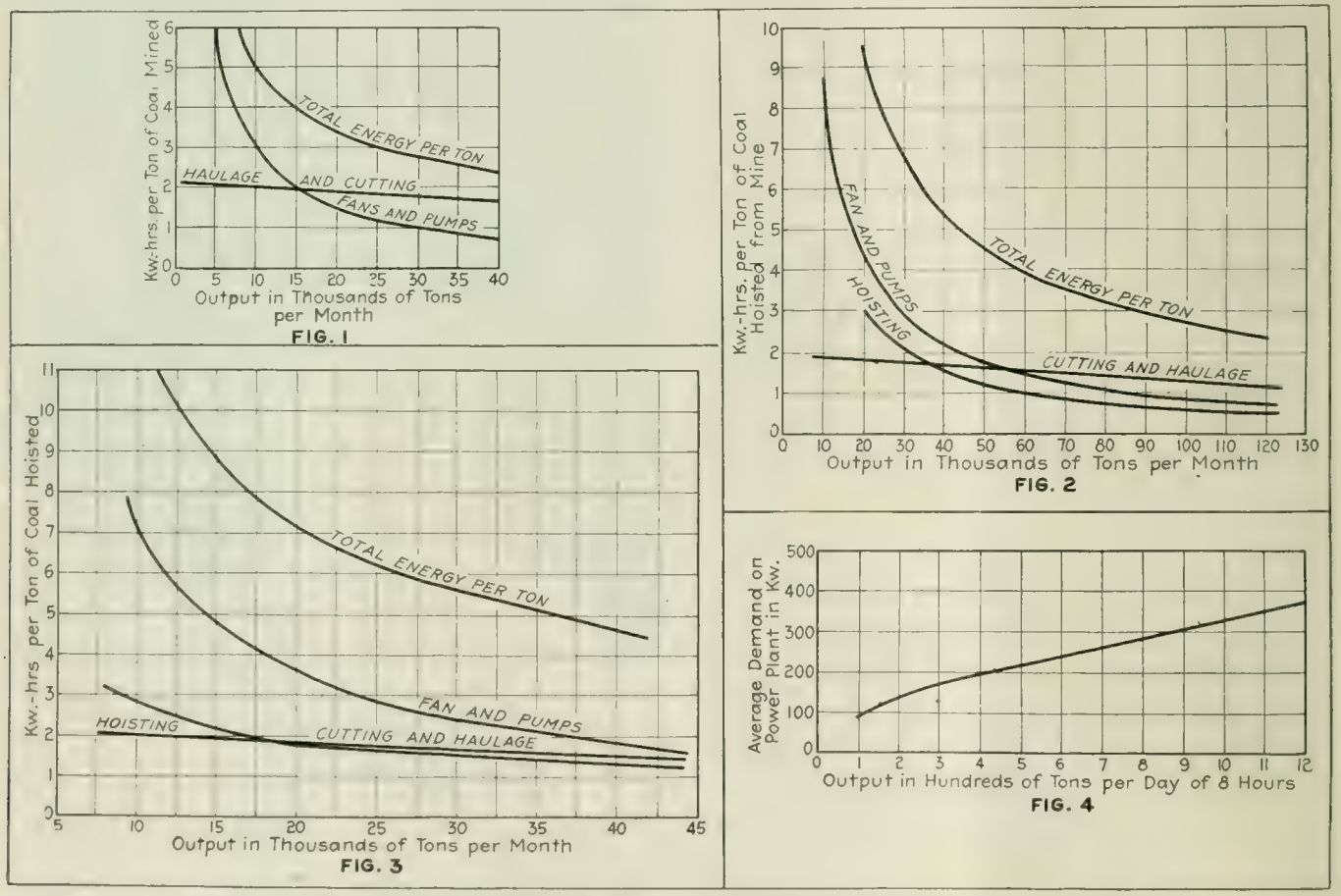


FIG. 1

FIG. 2

FIG. 3

FIG. 4

FIGS. 1, 2, 3, 4 — POWER REQUIREMENTS SHOWN GRAPHICALLY FOR SHAFT AND DRIFT MINES

Fig. 1—*Energy Requirements of a Typical Drift Mine.* These are curves of a three-drift mine in a 5-ft. seam. The average monthly output is 25,000 tons and the maximum is about 35,000 tons.

Fig. 2—*Tests of Energy Consumed in a Shaft Mine.* The shaft is 240 ft. deep and the mine is rated at 1,000 tons of coal per hour. The electrical equipment consisted of the following: One 800-hp. direct-current coal hoist operated from a 500-kw. flywheel motor-generator set, one 250-hp. alternating-current men and material hoist, three 200-kw. motor-generator sets for underground haulage, thirty 50-hp., three-phase coal-cutting machines, one 250-hp., three-phase, two-speed ventilating motor, 150 hp. in three-phase motors for the tipple and shops and 50 hp. in three-phase motors on pumps.

Fig. 3—*Energy Requirements of a Typical Shaft Mine.* These are curves of a shaft mine 450 ft. deep and with a capacity of 2,000 tons of coal in a day of eight hours. The hoist is driven by a 450-hp. induction motor; three 150-kw. motor-generator sets operate the mine haulage system; the fan is driven by a 100-hp., three-phase motor, and other alternating-current motors aggregating 200 hp. to drive pumps are used.

Fig. 4—*Average Demand for a Single-Drift Mine.*

measured on the alternating-current side of the motor-generator set. These energy consumptions total about 2 kw.-hr. per ton for cutting and hauling based on an average haul of $\frac{7}{8}$ mile (1.4 km.) against a grade not exceeding one-half of 1 per cent.

Cutting and hauling constitute the principal power requirements of drift mines. The records from some 200 drift mines in Pennsylvania and West Virginia show an energy consumption ranging from 1.5 kw.-hr. per ton under the most favorable conditions to about 7 kw.-hr. per ton in extremely gaseous and wet mines. Under average conditions the entire energy consumption was 2.35 kw.-hr. per ton and the average output of drift mines approximated 400 tons per drift per day.



GEARED ALTERNATING-CURRENT HOIST

The motor on the hoist is 400-hp., 2,200-volt, three-phase, 60-cycle. The WR^2 of the hoist drums and gears is 450,000. The hoisting weights are: Coal, 5,000 lb.; cage, 11,500 lb.; car, 3,500 lb. The maximum rope speed is 1,830 ft. per minute and the diameter of the rope is 1.375 in.

The energy consumption of shaft mines is generally greater than that of drift mines by an amount which depends largely upon the depth of the mine, the amount of water which has to be pumped out, and ventilation requirements. Fig. 3 is a typical curve of the energy requirements of a shaft mine with a capacity of 2,000 tons per day of eight hours, while Fig. 2 gives the test results from a mine having a capacity of 1,000 tons per hour.

Old shaft mines are usually the more difficult type to change over to electric service on account of the trouble and expense of changing over the hoisting equipment. It has been found preferable to install a new hoist designed especially for motor drive when possible, but a great deal of money can often be saved by gearing a motor to the old steam equipment. When this is done it must be remembered that the electric motor will not speed up as the old engine would under pressure, and a motor should therefore be selected on a working margin of not less than 25 per cent. The electric hoist has proved superior to the steam hoist from operating and economical standpoints, but some operating men do not admit this because they have not had the proper size and type of electrical equipment.

From an installation viewpoint the induction motor is a cheap motor to place on a hoist, and in sizes up to about 400 hp. it is usually more economical in operating cost per ton of coal hoisted from mines. These induction motors are geared to the hoist in nearly every instance, and a typical load curve of a mine so equipped is given in Fig. 5. When larger motors than 400 hp. are required the tendency is to use a direct-current motor either geared or coupled, and supplied with energy from a motor-generator set. The peak load with a synchronous motor-generator set will be approximately the same as with an induction-motor hoist, but the synchronous motor can keep up the power factor. A flywheel type of an induction-motor-generator set is best for very large direct-current hoists to minimize peaks.

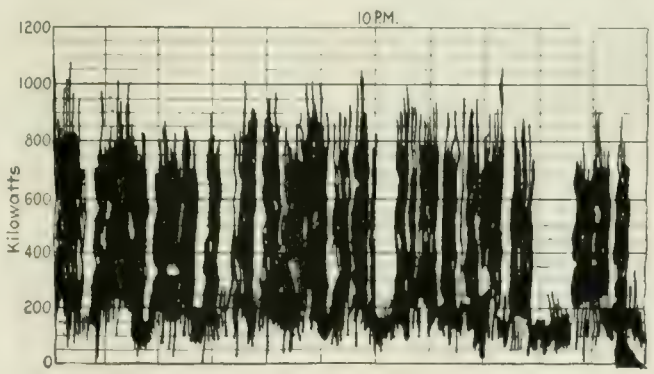


FIG. 5—TYPICAL SECTION OF A LOAD CURVE FROM A SHAFT MINE

This curve was taken during the war, when the mine was operating twenty-four hours per day. The shaft is 300 ft. deep and the rated output is 2,500 tons in eight hours. It will be noted that the haulage, pumping, ventilation, etc., require up to about 300 kw. The peaks above this point are caused by a 300-hp. induction motor driving the hoist.

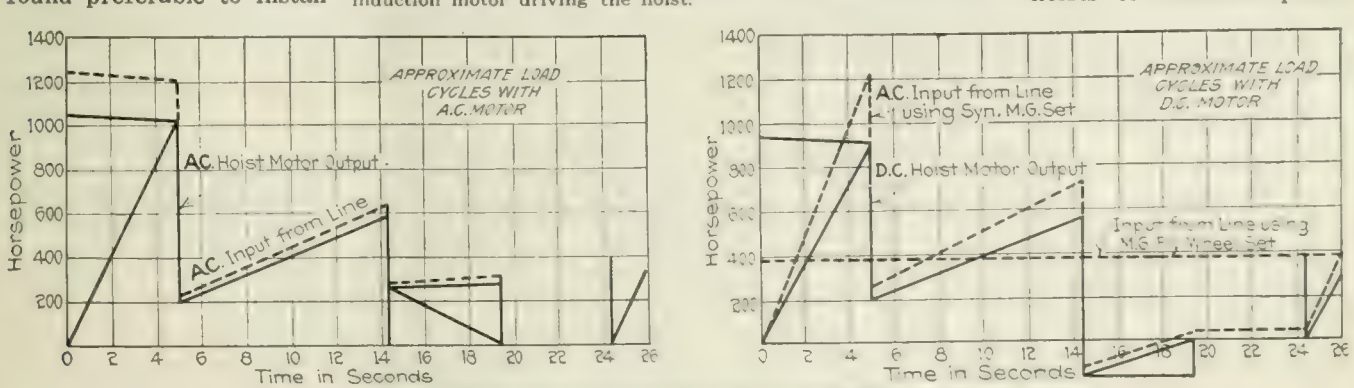


FIG. 6—EFFECT OF DIFFERENT TYPES OF HOIST EQUIPMENT ON THE LOAD CURVE

Sluicing Ashes Shows Low Cost

Method Used in New Denver Station Shows Handling Cost of 16.4 Cents Per Ton of Ashes, or About 2 Cents Per Ton of Coal Fired

BY ALEX W. MORGAN
Denver Gas & Electric Company

ASHES are being transferred from under boilers to a storage pit by means of a sluiceway in the new Lacombe station of the Denver (Col.) Gas & Electric Light Company. The boiler and stoker equipment consists of four 750-hp., class D Connelly boilers equipped with Westinghouse nine-retort stokers and Westinghouse power dumps. The accompanying cross-sectional sketch of the boiler shows the arrangement of the sluice with respect to the ash dumps.

When ashes are dumped they drop directly upon "grizzlies" which will pass pieces of clinker up to 5 in. (12 cm.) in the smallest dimension. All that will pass through the grizzlies is immediately picked up by the water and carried out to the ash sump. The clinkers which do not pass through are first cooled with water sprays and then broken up into pieces that will pass through the grizzlies. The water sprays, consisting of two 2-in. (5-cm.) pipes, run the full length of each side of the ash hoppers. These pipes are drilled with ¼-in. (6-mm.) holes spaced on 3-in. (8-cm.) centers and so placed that a spray of water is directed across the hopper every 1½ in. (4 cm.).

Five 18-in. x 23-in. (45-cm. x 58-cm.) cast-iron side-hung doors are placed in the sides of the ash hopper just above the elevation of the grizzlies. One door is placed on either end and three doors are equally spaced along the front or ash aisle. These doors give sufficient working space to break up the largest clinker.

The sluiceway is 18 in. (45 cm.) wide at the top, 18 in. (45 cm.) deep with a semi-circular bottom and is built of concrete on a 2 per cent grade under all four boilers. Beyond the boilers the water enters sewer tile, 18 in. (45 cm.) in diameter, laid on the horizontal, and discharges into the ash sump. No abrasion of the concrete has been noticed as yet.

The pumping equipment consists of a 5-in. x 6-in. (14-cm. x 17-cm.) American open-runner centrifugal pump, driven through a flexible coupling by a 20-hp., 660-r.p.m., three-phase 220-volt General Electric motor. This pump delivers about 1,100 gal. per minute (4,163 l. per second) against a 25-ft. (8-m.) head and will wash out clinkers weighing up to 15 lb. (6 kg.). The pump has an open runner and the water is recirculated.

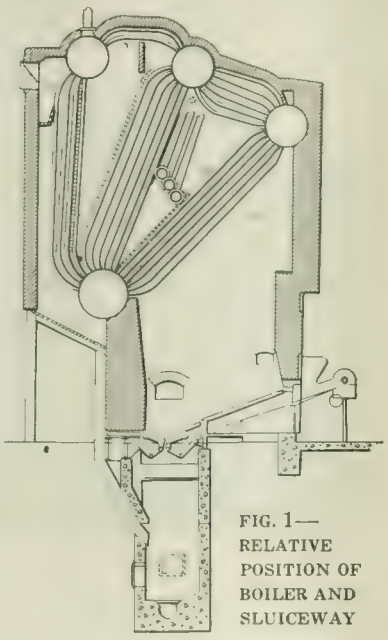


FIG. 1—RELATIVE POSITION OF BOILER AND SLUICEWAY

The sluiceway discharges the ashes into a large hopper 19½ ft. (6 m.) wide by 26 ft. (8 m.) long by 13 ft. (4 m.) deep, from which they are taken by the grab bucket of the coal crane and loaded into railway cars.

This method of handling ashes is the best and most economical with which the writer has come in contact. At the present time the plant is burning 250 tons of coal per day and produces about 33 tons of ashes in twenty-four hours. Three combination men are required, one on each shift, to handle the ashes and look after the feed pumps. About one-third of each man's time is required to handle the ashes. The crane crew consists of two men on two shifts, and each shift spends about one hour removing ashes from the ash sump and loading them on the cars. The cost of handling ashes with this equipment is given in the table.

COST OF HANDLING ASHES IN SLUICEWAY

One ash man, eight hours, at $115 per month	$3.50
Crane crew, two hours at $195 per month	.81
One 20-hp. motor, eight hours at $0.01 per kw.-hr.	1.20
One 60-hp. motor, 2 hours at $0.01 per kw.-hr.	.90
Total cost per day	$6.41
Cost per ton of ashes removed	$0 164
Cost per ton of coal fired	.02

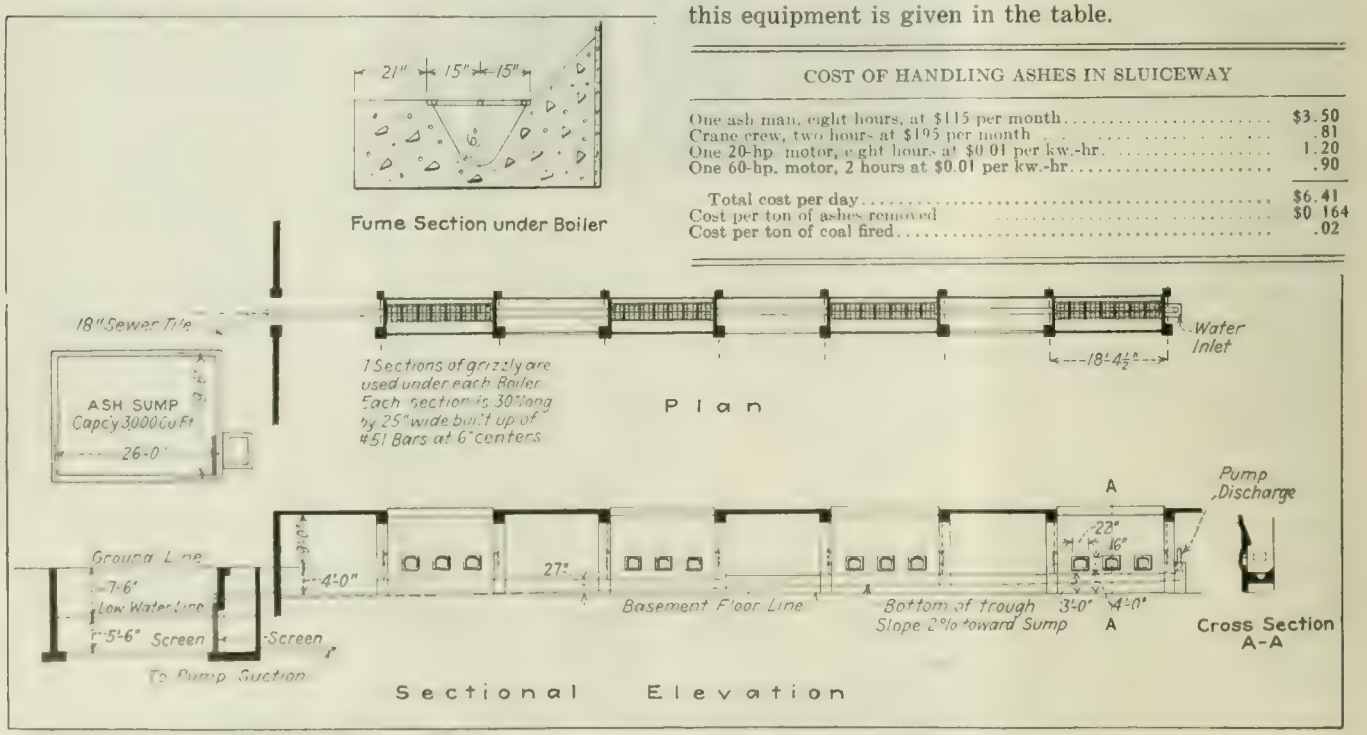
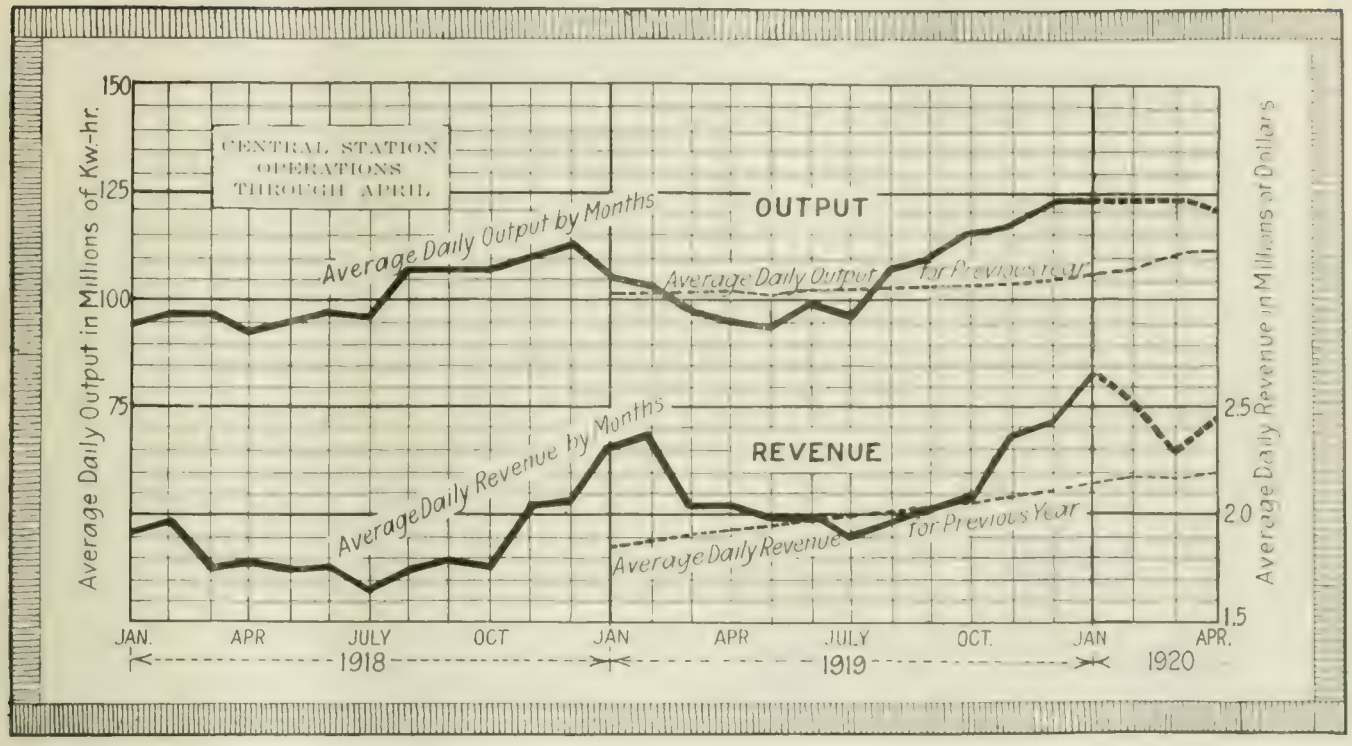


FIG. 2—SLUICEWAY UNDER BOILERS FOR DISPOSING OF ASHES

Outlaw Strike Curtails Power Requirements



THAT central-station operations in April were materially reduced throughout the country as a direct result of the railroad switchmen's strike is indicated in the returns received by the ELECTRICAL WORLD. The reduction in output was also increased by reason of the daylight-saving laws which were put into effect during April in many industrial centers. Despite an average daily decrease of 2,700,000 kw.-hr. under March, the total output for April was 24 per cent larger than that recorded in April, 1919.

Industrial operations in the New England States were seriously handicapped during April by transportation difficulties and local labor disputes. The railroad strike, with its resulting embargoes on freight, affected not only the income of raw materials and the shipment of finished products but also the coal supply. Most centers report that every industry of any importance was well supplied with orders and could have been operated at top speed if raw materials, a requisite amount of help and improved shipping facilities could have been obtained. These insufficiencies, however, taken in conjunction with daylight saving resulted in a drop of 14,400,000 kw.-hr. in comparison with March, as against a drop of only 4,600,000 kw.-hr. during the same period last year.

Delays in delivery of material and fuel caused considerable restriction of industry in the Atlantic section, especially in the northern part, but few plants, if any, were entirely closed as a direct result of the railroad strike. The curtailment in iron and steel production due to the strike was about 17 per cent as compared with the March rate. Several of the large generating companies reported their fuel supply to be near exhaustion, and when the situation eased plans were under consideration for the allotment of power to the more essential industries and for the operation of municipal works and public utilities. The reductions in activities in this section are reflected in central-station operations by a daily average drop of 1,150,000 kw.-hr. in April as compared with March.

In order that the central-station operations in the North Central industrial states and those in the South Central agricultural states may be more clearly defined, the ELECTRICAL WORLD has made a recompilation of the Central States operations and presents two sections for the month of April. These two subdivisions will be continued in subsequent tabulations. The states included in the North Central section are Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota and Wisconsin. The states included in the South Central section are Alabama, Arkansas, Kentucky, Louisiana, Mississippi, Oklahoma, Tennessee and Texas.

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE MONTHS

	Revenue from the Sale of Energy				Kw.-Hr. Output			
	Percentage of Installed Capacities Represented	1919 Thousands	1918 Thousands	Per Cent Increase	Percentage of Installed Capacities Represented	1919 Thousands	1918 Thousands	Per Cent Increase
May	45	$27,795	$24,291	15.5	45	1,306,622	1,314,206	[illegible]
June	47	28,175	24,701	14.1	47	1,399,951	1,367,908	2.3
July	44	25,794	22,568	14.1	44	1,309,301	1,281,874	2.0
Aug.	54	32,756	29,006	13.0	54	1,801,836	1,793,706	0.5
Sept.	53	32,344	28,336	14.0	53	1,761,582	1,695,862	4.3
Oct.	55	35,492	30,077	18.0	60	2,175,636	1,987,004	9.0
Nov.	53	37,439	31,327	17.2	58	2,055,428	1,895,693	8.2
Dec.	59	44,125	37,978	16.0	65	2,509,571	2,270,833	10.0
		1920	1919			1920	1919	
Jan.	57	46,614	39,002	19.8	67	2,581,096	2,186,732	18.0
Feb.*	63	45,881	37,502	22.1	69	2,494,764	1,985,493	25.3
Mar.†	65	46,005	36,860	24.2	70	2,694,556	2,089,443	28.9
Apr.‡	65	45,060	36,214	24.1	70	2,554,377	2,060,640	24.0

* Includes estimates for four companies, representing 1.1 per cent of the total installed capacity of all central stations.

† Includes estimates for twenty-five companies, representing 8.2 per cent of the total installed capacity of all central stations.

‡ Includes estimates for fifty-six companies, representing 11.9 per cent of the total installed capacity of all central stations.

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

	Month	New England States			Atlantic States			North Central States			South Central States			Pacific and Mountain States		
		Percentage of Installed Capacities Represented	1919 Thousands	1918 Thousands	Per Cent Increase	Percentage of Installed Capacities Represented	1919 Thousands	1918 Thousands	Per Cent Increase	Percentage of Installed Capacities Represented	1919 Thousands	1918 Thousands	Per Cent Increase	Percentage of Installed Capacities Represented	1919 Thousands	1918 Thousands	Per Cent Increase
REVENUE	May	70	$3,190	$2,781	14.9	43	$10,817	$9,826	10.1	36	$6,995	$5,826	19.8	35	$1,325	$1,084	22 0	56	$5,468	$4,764	14.2
	June	71	3,317	2,904	14 1	43	10,605	9,537	12.0	39	7,158	6,166	16 0	40	1,599	1,338	19.5	63	5,496	4,767	15.2
	July	70	3,406	2,995	13.7	40	9,320	8,375	12.0	39	7,240	6,121	18.1	38	1,614	1,321	21 9	49	4,214	3,756	12.1
	Aug	74	4,225	3,693	14.4	57	12,174	10,995	11.1	47	9,295	7,924	15.8	39	1,647	1,385	18.4	61	5,415	5,009	8.5
	Sept.	73	4,019	3,536	13 6	53	11,429	10,069	13.5	46	9,671	8,278	16.6	38	1,724	1,488	16.0	63	5,501	4,965	10.9
	Oct	72	4,127	3,453	19.1	53	12,684	10,822	16 9	52	11,401	9,484	20 2	38	1,840	1,519	21.1	62	5,440	4,799	13.9
	Nov	71	4,432	3,800	16 2	56	14,738	12,761	15.7	44	10,541	8,689	21.2	39	2,063	1,694	21.8	63	5,665	4,983	13.9
	Dec	73	4,908	4,254	15.1	57	15,926	13,806	15.8	49	11,660	9,833	18.3	44	2,496	2,070	20.0	77	9,135	8,015	14.2
			1920	1919			1920	1919			1920	1919			1920	1919			1920	1919	
	Jan	78	5,635	4,718	19 8	59	17,659	14,625	20 9	51	12,885	10,799	19.6	53	3,047	2,538	19.9	75	7,388	6,322	16.1
	Feb	82	5,354	4,368	22 1	61	17,245	14,343	20 4	55	13,191	10,403	26 0	53	2,949	2,360	24.7	79	7,142	6,028	18.3
	Mar	82	5,136	4,044	27 0	63	17,703	14,326	23 9	57	13,113	10,462	25.4	54	2,910	2,287	27.2	79	7,143	5,741	24.2
	April	82	5,097	3,957	28.1	63	17,212	13,945	23.5	57	12,643	10,123	26 0	54	2,952	2,181	35.2	79	7,156	6,008	19.1
KW.-HR. OUTPUT			1919	1918			1919	1918			1919	1918			1919	1918			1919	1918	
	May	70	120,856	120,908	−0 1	43	413,043	430,729	−3.9	36	349,890	338,648	3.2	35	40,777	38,877	5.0	56	382,056	385,054	−0.9
	June	71	127,260	119,217	6 7	43	408,335	419,060	−2.5	39	364,552	336,902	8.0	40	53,990	49,520	8.1	63	445,814	443,209	0.5
	July	70	141,551	130,393	8 2	40	373,105	378,053	−1.5	39	371,425	355,664	4.5	38	56,945	52,501	8.1	49	366,275	365,263	0.1
	Aug	74	161,431	153,266	5 1	57	640,616	662,120	−3 2	47	496,745	460,360	8.0	39	58,991	53,231	10.2	61	444,026	464,729	−4.2
	Sept	73	153,837	146,209	4 5	53	610,254	610,179	0.1	46	515,519	463,929	11 5	38	58,316	54,838	6.3	63	423,656	420,707	0.5
	Oct	72	162,859	142,326	14 4	53	694,584	659,859	5.3	67	815,284	709,665	15.3	38	67,155	56,742	18.5	62	435,754	418,412	4.1
	Nov	71	153,171	140,240	9.2	56	724,667	707,347	2.4	60	686,486	597,855	14.9	39	68,352	59,507	14.7	63	422,812	390,744	8.2
	Dec	73	180,493	152,304	18 0	58	803,165	733,222	8.9	67	825,313	713,959	15.8	44	88,658	73,728	20.1	77	611,942	597,620	2.5
			1920	1919			1920	1919			1920	1919			1920	1919			1920	1919	
	Jan	78	207,158	159,773	29.8	60	853,057	717,303	19.2	69	841,841	731,758	15.2	56	140,736	117,677	19.9	75	538,304	460,221	16.2
	Feb	82	187,264	148,103	26.2	62	809,865	672,836	20 1	73	858,939	663,523	29 4	56	130,473	98,098	33.0	79	508,223	403,933	26.1
	Mar	82	198,603	148,512	33 5	64	900,615	712,895	26.1	74	905,829	696,324	30 0	56	137,514	102,771	34 1	79	551,995	428,941	28.6
	April	82	186,842	144,744	29.2	64	848,266	673,094	26.0	74	849,521	685,399	24.0	56	135,140	99,877	35.2	79	534,608	457,526	16.9

The effects of the railroad strike were probably most severely felt in the manufacturing centers of the North Central States. In the Detroit district the coal supply was so short that central-station power to factories was very greatly curtailed. It was more than a week before it was possible to accumulate sufficient coal to give more than a minimum supply of energy. At the end of April plants in this locality were operating at only about 40 per cent capacity for want of sufficient power. Other sections of the North Central States report large curtailments in production and consequent less demand for power. Average daily power demands for this section were 1,250,000 kw.-hr. less than in March.

Labor troubles did not affect industrial activities in the South Central States beyond the placing of embargoes by local railroads while the strike was on. The central-station operations in the section for April show a small increase over those of March.

Strikes of large extent in the mining districts of Montana, Utah and Nevada curtailed power requirements by the mining industry of the Mountain States. The railroad strike was also severely felt by all lines of industry in the Mountain and Pacific States, but despite these adverse industrial conditions and a decreased demand for energy for illumination purposes, the average daily central-station output in this section was 19,000 kw.-hr. more than during March.

FORTUNATELY *for the nation, success dies hard. The great business combinations have not yet been destroyed. If the government policy regarding them had been as completely successful as in the case of the railroads, our ability to meet the emergency produced by the war would have been so much reduced that the assistance we could have rendered the Allies would have been negligible.*—PHILIP CABOT.

School Lighting Should Give 6 to 12 Ft.-Candles

TO INSURE ample light for the student with defective eyesight, and with the hope of increasing the speed of the school work generally, as has been done in industrial work, lighting intensities at least as high as the maximum given in the code should be used. It is doubtful whether the intensities hitherto recommended for school lighting are high enough to reduce eye strain to a minimum. These intensities have corresponded with the lower values of the Illuminating Engineering Society code, which are as a minimum for "ordinary practice" from 2 to 6 ft.-candles (21.5 to 64.5 lumens per sq.m.) for various rooms, and have a range of maximum values from 4 ft.-candles to 12 ft.-candles (43 to 129 lumens per sq.m.).

An attractive installation is desirable. The choice usually lies, therefore, between semi-indirect or indirect fixtures and high-suspended direct lighting with some form of glass reflector. With direct units the difficulty of eliminating glare increases as the required intensity of illumination increases, but they have the advantage of giving about twice as much light for the same expenditure of energy as can be obtained from either indirect or semi-indirect units.

Glare due to the reflection of bright light sources from blackboards, polished table tops and glazed paper should be carefully avoided. The lower part of the walls as high as the top of the blackboard should be finished in a medium tint restful to the eyes. This is especially important in classrooms to avoid contrast with blackboards. A good system of lighting blackboards is by concealed lamps in a hood along the top of the board. These suggestions were given in an address before the Chicago Section of the Illuminating Engineering Society by Prof. F. C. Caldwell, chairman education committee.

A. I. E. E. Technical Committee Reports

Transmission at 220 Kv. Continues to Hold Chief Interest—Extensive Use of Electricity in Heat Treating and New Luminous-Arc Lamps Considered—Developments of Code for Ship Installations

FOLLOWING a plan developed at the 1919 A. I. E. E. convention, Wilfred Sykes, chairman of the board's committee on technical activities, suggested to the various 1920 technical committees that their reports "should cover notable installations or developments during the year. Several of the committees (notably those on transmission, meters and iron and steel) have made a good start to accomplish this purpose, but in other cases the lack of time or a belief that the old plan was more desirable has prevented the general adoption of the new plan.

Thirteen committees out of sixteen reported—electrical machinery, electrochemistry and electrometallurgy, electrophysics, industrial and domestic power, instruments and measurements, iron and steel, lighting and illumination, mines, power stations, protective devices, telegraphy and telephony, traction and transportation, and transmission and distribution. The gist of their reports follows. No reports were submitted by the committees on economics of electric service, education or mines.

Live Problems in Transmission and Distribution

The committee on transmission and distribution has devoted the major portion of its report to the subject of extra high voltage for possible interconnection and super-power plant development and to improvements and tendencies in underground cables and construction, as outlined by its chairman, E. B. Meyer.

Developments of trunk transmission at such a voltage as 220 kv. would involve new problems arising from the high voltage, the large amount of power involved and the high service standards which the importance of the transmission would demand. However, it was said that these problems differ in degree but not in character from those which have satisfactorily been handled in present practice. Regarding transformers in large units for 220 kv., it was stated that no radical departures are involved in either design or construction, and for oil circuit breakers it was said that satisfactory designs have already been worked out. For such high-voltage installations the policy should tend to extreme simplicity of layout and stanchness of equipment. One feature of such policy would probably be the omission of arresters or similar protective equipment. It appears that these would be neither needed nor effective at this high voltage.

There appears to be some doubt, however, as to whether present practice in line insulators can be extended without considerable modification to 220 kv. over the string, and whether suitably shaped electrostatic shields can be used at the ends of the strings. It was said that the mechanical problem is the serious one when it comes to supporting, with adequate margins of safety, the extreme loads which would be called for by 220-kv. service, due to the large size of conductor, the long spans, etc. In view of these limitations of the present type of high-voltage insulator the need for an improved or radically different design for high voltages has been strongly emphasized. Some of the insulator manufacturers appear to be making extensive investigations and experiments in this field.

It was said that there have been marked improvements in the manufacture of underground cables so that the carrying capacity of the cables manufactured today is materially greater than that of cables manufactured a few years ago. The principal improvement is the reduction of dielectric loss at relatively high temperature. This has been accomplished principally as the result of a thorough study of the properties of impregnating compounds.

It has been the aim of the iron and steel industry committee, as reported by W. F. James, chairman, to report as a foundation the present status of electrical application to the iron and steel industry, upon which subsequent committees might base annual reports showing recent progress. Regarding the status of iron ore smelting in electric furnaces, it is said that pig iron of high grade can be made in the electric furnace and is made in considerable quantities, but only at localities that combine the conditions of having ore and charcoal accessible to dependable low-cost electrical energy, not exceeding $12 to $15 per horsepower per year.

The Cottrell system of electrical precipitation has been applied in two instances to the cleaning of blast-furnace gas. The advantages are such that this equipment is likely to become common among the blast furnaces. A typical installation put into service during 1919 takes three-phase, 60-cycle, 220-volt energy from the system, two 25-kv. transformers in open delta being ample for the entire power requirement.

Carbon-resistor type furnaces have been successfully developed for steel treating. Advantage is invariably taken of the possibility of making these furnaces automatic, both as regards the cycle of temperature treatment and the charging and discharging.

Some New Instruments Have Appeared

S. G. Rhodes, chairman of the committee on instruments and measurements, reports a few new developments in measuring devices, some standardization and adaptation to commercial use of the designs dictated by the war. There has been some difficulty in the production of standard and accepted lines of apparatus on account of labor troubles and the lack of materials.

It was said that practically all the companies manufacturing watt-hour meters and demand devices reported the completion of experimental models, finished designs or actual production of devices for measuring kilovolt-ampere-hours and demand devices for measuring the demands of kva., kw. and power factor. These various devices may make the measurements separately or simultaneously on a single record.

One company reported the development of an automatic potentiometer and automatic Wheatstone bridge, both used for recording or controlling processes, or a combination of the two. These automatic equipments are supplied for the control of chemical and electrochemical processes, and some installations of them are in actual use. For chemical and electrochemical work the automatic Wheatstone bridge can be operated on a commercial 60-cycle alternating-current circuit, and a special alternating-current galvanometer has been especially designed for this equipment.

The recording or indicating potentiometer when used in connection with thermocouples produces a satisfactory and accurate record of temperature, it was said. The measure of temperature is, of course, directly related to design and operating requirements of electrical apparatus, and these devices serve to analyze the daily or weekly cycles of thermal performance of cables, transformers, turbine-generators, or in fact any of the various commonly used types of apparatus in generating and distribution systems.

Protection for Potential Transformers

Reporting for the protective devices committee, D. W. Roper, chairman, said that an unusually large percentage of the larger operating companies have experienced severe system disturbances, and in some cases the behavior of the protective devices was an important factor in the disturbances.

It was said that in the last few years there has been a marked improvement in the design of reactors such as methods of winding to reduce eddy currents and improvement in structure to increase the insulation strength and to work the copper to the best advantage.

The committee reported that one of the larger companies in New York had made elaborate and complete short-circuit tests on potential transformer fuses installed with and without protective resistors in series. Following these tests a number of companies have adopted the standard practice of installing protective resistors in series with the potential transformer fuses which are connected to their high-tension buses. Other companies, it is said, are using a different type of fuse which has given excellent results in service and does not require the use of a protective resistor in series.

Progress in Lighting and Illumination

Summarizing the report of the lighting and illumination committee, under the chairmanship of C. E. Clewell, important developments during the last year were stated as follows: (1) A widespread recognition of good lighting as an important aid to manufacturing. (2) The increasing use of the foot-candle meter as a means of checking illumination intensity in various parts of a lighted room. (3) Progress of industrial lighting codes. (4) Progress in automobile lighting regulations in several states. (5) Development of the bowl-enameled gas-filled lamp to give better diffusion. The latest lamps of this type have a feathered edge of the enameling to prevent a sharp "cut-off" line. (6) The proposal of a plug outlet for permitting the convenient change of ceiling and wall fixtures. (7) The increasing tendency on the part of fixture manufacturers to make ready-to-hang types of fixtures. These fixtures are principally for commercial and industrial lighting, but there is also some tendency to invade the residence lighting field. (8) Progress in the enforcement of the industrial and automobile headlight codes. (9) An important development in street lighting of a unit which contains two lamps (in one type, one 1,000-cp. and one 250-cp.). By means of a relay located in the casing of the fixture the 1,000-cp. lamp will be extinguished at midnight and the 250-cp. lamp lighted.

Luminous arc-lamp efficiencies have been increased by the compounding under high pressure of the ingredients of the electrodes. It is reported that by this means 30 to 40 per cent more light is produced than with the previous standard electrodes, with at least equal life. For the same light as formerly increased life of the electrodes is expected.

The compilation of a set of rules for electrical installations on shipboard was started last year and was carried to completion by the marine committee, of which Arthur Parker is chairman this year. These rules will be published in pamphlet form. It was said that the rules were most complete, covering practically every phase of the electrical field as applied to ship work. Much of the credit for this work was due to the ship installation committee, under G. A. Pierce.

One of the ideas brought forth during the year was the consideration of terminal facilities at marine piers. This is more or less a new activity, as very little has been done thus far to facilitate the handling of cargoes at these terminals. The field is large and therefore worthy of a considerable amount of thought.

Telephone and Telegraph

Most important progress has been made by the committee on telegraphy and telephony during the past year in the standardization of telegraph and telephone practice of the railroads of this country and Canada, according to Donald McNichol, chairman.

The activities in both the power and the communication fields since the war have demanded renewed close attention to the study of inductive interference. The growing use of arc furnaces, which usually produce great distortion of wave form, has given rise to serious problems in noise interference prevention. The methods of overcoming interference with communication circuits from normal conditions on adjacent power circuits have not been so well developed as the methods of overcoming disturbances from the normal operation of power circuits.

The progress in radio communication in the past year has been more in the nature of a consolidation of the scientific advances of the war time than in the nature of an entry into new fields of radio signaling.

The industrial and domestic power committee, under the chairmanship of A. G. Pierce, has continued its earlier plan of work without change or modification. Eleven sub-committees are analyzing electrical power applications in eleven different branches of industrial activity. Some of their reports will be available shortly.

In presenting his report, B. A. Behrend, chairman of the committee on electrical machinery, pointed out that the progress of the art in electrical machinery was best traced through the papers which had been solicited. He therefore thought it unnecessary to deal again with subject matter comprehensively presented in the papers. The activities of the committee were in great part directed toward the general subject of super-power stations for the Eastern coast states.

It was thought that the best activity of the committee on electrochemistry and electrometallurgy would be to foster joint meetings with the American Electrochemical Society such as that held in Boston in April, 1920, said F. A. J. Fitzgerald, chairman.

After reviewing the papers which had been brought out by the committee on power stations, Philip Torchio, chairman, recommended the following subjects for consideration during the coming year: (1) Safe maximum limit of operating capacity for each section of bus; (2) reactive component dispatching; (3) auxiliaries in steam and hydro-electric plants; (4) fighting generator fires; (5) trend of modern power station design.

Readers' Views and Comments

Boiler Steam Pressures and Superheat

To the Editor of the ELECTRICAL WORLD:

SIR: The subject of high steam pressure and moderate superheat as against moderate pressure and high superheat has been discussed to considerable extent in the last few years, and it is one that is of great importance. The prime movers committee of the National Electric Light Association has been inviting a discussion of the subject, and the writer was greatly interested in the statements made by W. F. Durand and C. H. Delany, whose article on "Steam-Electric Generation in the Far West" was printed in the May 15 issue of the ELECTRICAL WORLD.

I beg particularly to refer to the table of comparative figures on page 1127, which purports to prove the superiority of the high-pressure and moderate-superheat combination. The authors derive the energy available for both combinations from adiabatic expansion within the steam conditions given by initial pressure and superheat on the one side and condenser pressure on the other, and very correctly prove that the available energy of adiabatic expansion within those limits is greater for the high-pressure combination by 3.83 per cent; but in making the next step and calculating the work in B.t.u.'s abstracted from the steam by the turbine, they assume the same efficiency of 75 per cent for both the moderate and high-pressure combination, an assumption which would seem to be unjustified in view of the fact that the bucket friction and windage losses of a steam turbine increase with the density of the steam. In fact, it seems to the writer that with the assumption of equal turbine efficiency in both cases the authors of the article have entirely disregarded the most important influence of steam superheating upon turbine operation.

At least one of the big steam-turbine builders guarantees decreases of water rate through superheating of about 1 per cent for about every 11 deg. of superheat, which means that such a turbine, operating with 200 lb. pressure and 200 deg. superheat, must use about 18 per cent less steam than a turbine operating at that pressure with saturated steam. A comparison of the available energy of adiabatic expansion between 200-lb. pressure saturated steam or 200-lb. pressure, 200 deg. superheat on the one side and 1-in. absolute on the other results, however, only in a difference of 11.45 per cent, so that it is clear that a comparison on the basis of the energies available from adiabatic expansion alone does not solve the problem. In fact, all of the steam-turbine builders have for years been aware of the fact that the density of the fluid in which buckets and disks revolve has a very considerable bearing upon the turbine efficiency, and the writer believes that when tests are available they will show the conclusions of Messrs. Durand and Delany to be reversed.

At least. it is likely that the turbine efficiencies will be unfavorably affected by the higher mean steam densities which will be encountered within the turbines at the higher pressures. The problem is a rather complicated one, inasmuch as we cannot actually obtain adiabatic expansion in steam turbines, and because the friction and windage losses themselves affect the process of expansion, the heat of friction being absorbed by the steam itself. Nothing short of actual tests will throw sufficient light on the subject, but a great many facts which we now have about the performance of steam turbines seem clearly to favor the high superheat combination.

Another problem the solution of which bears upon this same question, and one about which very little has been said, relates to the efficient production of the high superheat. It is most important that superheaters be so constructed and combined with boilers that the desired amount of high superheat shall be obtained with a minimum of fuel consumption, or with as high a combined efficiency of boiler and superheater as possible.

R. M. OSTERMANN,
Chicago, Ill. Locomotive Superheater Company.

Operation of Fuel-Oil Pumps

To the Editor of the ELECTRICAL WORLD:

SIR: In the article on "Steam-Electric Generation in the Far West," which appeared in the ELECTRICAL WORLD for May 15, 1920, the authors, W. F. Durand and C. H. Delany, touched only slightly upon the oil pump and how it functions in the standard steam power-plant installation where oil is used as fuel. Since an inquiry on this point has come to the attention of the writer, the following information will be of considerable interest as an addition to the original article.

Fuel oil, as a rule, is taken from the supply tank, leading to the burners, by the oil pump. The type of pump ordinarily used for this purpose is the usual duplex steam-driven reciprocating pump. The pump must have brass valves and metallic or other packing that will not be affected by the oil. The pump should be provided with a large air chamber to prevent pulsation of oil pressure due to the strokes of the pump. It is customary to install the pumps in duplicate so that one may be kept shut down at all times ready to go into service immediately if the other has to be shut down for repairs. The pumps should be of sufficient size to deliver the maximum quantity of oil required when operating at comparatively slow speed—not more than fifteen to twenty strokes a minute. The pump must not be set too high above the oil tank, for oil cannot be raised by suction as high as water. The maximum suction lift permissible is approximately 16 ft.

The oil pumps should be provided with a pump governor for the purpose of maintaining a steady oil pressure. One well-known type of pump governor consists of a double-ported throttle valve placed on the steam line supplying the pump. The valve stem is attached to a spring-loaded piston which is actuated by the oil pressure. If the oil pressure increases, the valve partially closes, thus slowing down the pump. If the oil pressure drops, the valve opens wider and the pump is speeded up. Any predetermined pressure may thus be maintained by adjusting the spring.

C. H. DELANY,
Steam-Power-Plant Specialist.
Pacific Gas & Electric Company,
San Francisco, Cal.

Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Table Shows Coal Consumption for Different Grate Speeds

TO OBTAIN hourly readings of coal consumed, the travel of the chain-grate stokers is used in conjunction with the accompanying table by a Missouri power company. There are two sizes of stokers installed, those with grates 9.5 ft. (2.9 m.) wide, feeding 500-hp. Connelly boilers, and class "O" Stirling boilers

COAL CONSUMED PER 10 INCHES OF TRAVEL (LINK) OF CHAIN GRATES.

Gate Opening, in Inches	Pounds with Grate 9 ft. 6 in. Wide	Pounds with Grate 12 ft. Wide
4	132	...
4.5	148	180
5	164	206
5.5	181	227
6	197	248
6.5	214	268
7	230	289
7 5	246	309

of the same rating, and others 11.5 ft. (3.5 m.) wide, feeding 500-hp. class "S" Stirling boilers. For each of these widths the table gives the coal consumption for different grate openings from 4 in. to 7.5 in. (10 cm. to 19 cm.). The amount of coal is given for a travel of the grates equal to one chain link of 10 in. (25.4 cm.). Knowing this coal consumption, it is easy to compute the pounds per kilowatt-hour from the watt-hour-meter readings and to calculate evaporation per pound of coal from the readings of a Cochran V-notch water meter.

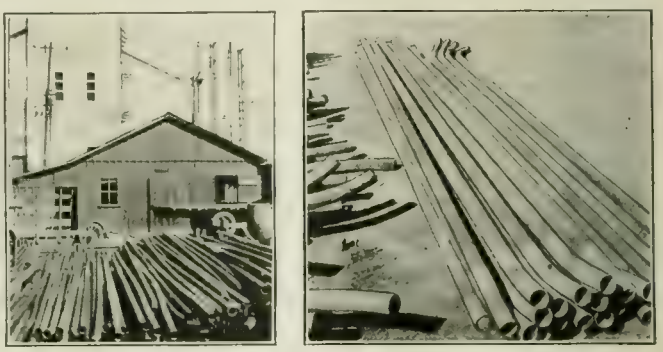
Empire District Electric Co. FRED M. RICHARDS,
Joplin, Mo. Chief Engineer of Power Plants.

Rehabilitating Standby Plants

TO MAINTAIN its output in the face of the water shortage in the mountain streams and the prospects of a season of light precipitation, the Southern California Edison Company has put back into operation a number of small steam plants which had been abandoned on account of their high operating cost. On plants of this character little or no money is spent for upkeep, but corrosion and deterioration go on just as if the plant were in operation, and consequently when such plants are put into operation many unforeseen difficulties are encountered. Leaks caused by the corrosion of boiler, superheater and condenser tubes was one of the most general troubles which had to be remedied in these California plants. Other important work was overhauling turbine valves and drying out electrical equipment.

The largest and most interesting of these rehabilitated plants is the 10,000-kw. Los Angeles No. 3 station, which has not been in continuous operation for about six years. The equipment of this plant consists of two 2,000-kw. Curtis vertical turbines and one 6,000-kw. Westinghouse Parsons turbine, eight 500-hp. Stirling boilers equipped with Niclausse superheaters, and seven 700-hp. Stirling boilers equipped with B. & W. superheaters which have one 24-in. (61-cm.) drum and one 36-in. (19-cm.) drum, with double tube-sheets and six rows of forty-six tubes, each about 12 ft. (4 m.) long and 2 in. (5 cm.) in diameter, extending between the drums.

The tubes in these boilers were badly corroded from the inside, and to put them in reliable operating condition it was necessary to renew the front eight rows of



CORRODED ENDS OF OLD BOILER TUBES (LEFT) CUT OFF AND TUBES REBENT (RIGHT) FOR SHORTER BOILER

tubes in the 500-hp. boilers and the front seven rows in the 700-hp. boilers. The cost of new tubes would be excessive for a standby plant to be operated only a short time. However, it happens that during the past six months this company has been making similar renewals of tubes in its boilers at the Redondo plant. The tubes used at the Redondo plant have the same diameter as those at the Los Angeles No. 3 station but are two feet longer. Since the faults in the tubes removed from the Redondo station are principally due to outside corrosion near the end of the tube where it enters the mud drum, the best of these tubes are selected, the faulty ends are cut off and the tubes are rebent to fit the boilers at the Los Angeles plant. The cost of cutting and rebending these tubes is about $1 each, and the junk value of the tubes is about the same; hence a tube practically as good as new is obtained at an expenditure of approximately $2. About 3,000 of these tubes are being reclaimed.

The Niclausse superheaters in the 500-hp. boilers had deteriorated beyond repair, hence the entire superheaters have been cut out of service. On account of difficulty in removing the superheaters from the boiler settings, the drums have been left in place, but the tubes have been cut off with an oxyacetylene torch in order to facilitate the work of renewing the boiler tubes. Much difficulty is encountered in keeping the tubes tight in the superheaters of the 700-hp. boilers on account of the double tube-sheet. This sheet reinforcing, which is on the inside of the superheater drum, is made of ¼-in. (63-mm.) metal and extends over one-quarter of the circumference of the drum. There is a space of 1½ in. (3.8 cm.) between the two sheets and the tubes

are expanded into both sheets. The tubes corrode badly between the two sheets, and owing to the difficulty of expanding the tubes into the main sheet, it is almost impossible to prevent leakage of steam at this joint. To eliminate this trouble the inside sheet and the ends of tubes protruding through the main sheet have been cut off with an oxyacetylene torch, and the tubes are expanded into the main sheet only.

The turbine valves and condensers were thoroughly overhauled before being placed in operation and a large number of condenser tubes were renewed. The blading of the 2,000-kw. turbines was inspected and found to be practically in as good condition as when new. This is very remarkable when it is considered that these turbines are fifteen or sixteen years old, have never been rebladed and have had hard service. A life of four or five years for blading of modern turbines is considered long. The generators of these units were dried out and put into service, carrying full load without giving the slightest trouble.

The galvanized-iron distributing troughs on the cooling tower were also very badly corroded. Repairs were made by reinforcing corroded portions of the iron troughs with wooden troughs. By this procedure the cost of repairs was kept down to about one-tenth the cost of replacing the troughs as originally built, and they are almost as effective as new troughs.

By means of these and other economical methods of repair this plant has been placed in good condition at a very reasonable figure. It will be operated until more modern steam units are installed and until additional hydroelectric plants now under construction will be completed.

J. W. ANDREE,
Dept. of Generation. Assistant Superintendent.

Shocks Received Through Defective Rope

INVESTIGATION of a coil of rope through which workmen of the Dayton (Ohio) Power & Light Company had received shocks while holding it over a live line disclosed that a small steel wire was made up with the strands of the rope. This coil of rope was purchased from the usual supply house and was thought to be the same rope as had been used for some time. However, as the groundman of a line crew took hold of the rope hanging from a 6,600-volt line he was severely shocked and slightly burned. In another case a 6,600-volt line was short-circuited by throwing the rope over the line, and in a third case when a street-light patrolman attempted to lower a street lamp his hand line, dragging over a railway feeder, severely shocked him. After the occurrence of these accidents samples of all ropes in supply and in use by the line crews were called in and received a high-tension test. All of the ropes from one particular coil broke down at from 500 volts to 7,000 volts per foot, while other samples withstood 36,000 volts per foot. This coil was immediately taken out of service and upon investigation was found to contain a small steel wire, about 0.007 in. (0.175 mm.) in diameter. This wire was difficult to find, but by unraveling several inches of the rope and burning it off it was easily seen. The rope contained the usual marker, but by mistake the strand containing the steel wire which is used for another style of rope had also been included in the coil.

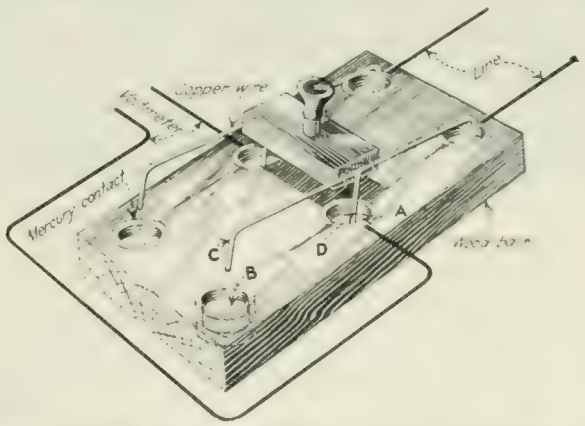
To prevent a recurrence of this trouble, the company has issued orders that all rope purchased be subjected to a high-potential test before being placed in stock.

Thrust-Bearing Trouble Cured by Increasing Oil Pressure

CONSIDERABLE trouble with the thrust bearing on a 7,500-kw. horizontal turbine at the Flint (Mich.) plant of the Consumers' Power Company was overcome by changing the bearing so that the oil supply was received from the hydraulic governor pump instead of the main bearing-supply line. This trouble was at first attributed to the oil holes in the bearing having been made too small, and they were then made larger. As this did not correct the trouble, the style of the bearing was changed without improving conditions. After a more careful study it was found that the trouble was due to dirty steam, which loaded the buckets with mud. Although this mud was periodically removed from the buckets, the bearing trouble continued. Therefore it was recommended that a higher oil tension be put upon the thrust bearing. Accordingly the piping was changed so that the supply of oil was taken from the hydraulic gear instead of the line serving the rest of the bearings. With this connection the oil pressure at the bearings was more than doubled. Since the change the bearing has given no trouble, and apparently the difficulty has been overcome.

Reversing Switch for Meters Which Has 190 Microhms Resistance

AS AN ordinary reversing switch used in the potential circuit of a test table for calibrating instruments was found to give unsatisfactory results, owing to poor contact at the hinged part of the blade, a switch with mercury contacts was employed to prevent the trouble. To hold the mercury, six small cups were made by drilling out solid ¾-in. (2-cm.) brass rod. These cups were set into a wooden base as shown, and the connections were made on the back of the base. Lengths of No. 8 bare copper wire were bent as shown to form the "blades" of the switch. The inside of the small



BLADES OF REVERSING SWITCH DIP INTO CUPS OF MERCURY, GIVING LOW CONTACT RESISTANCE

brass cups was amalgamated by placing a solution of mercurous nitrate in the cups and passing an electric current through it. In a similar manner the contacts on the copper wire were amalgamated. This prevents the mercury globules from adhering to the contacts when the circuit is opened and permits of better contact in the case of the brass cups. A few drops of oil placed on top of the mercury in each cup prevents rapid oxidation of the mercury.

The center posts rest on the bottom of the center cups, the switch being rocked on these points. With this method of supporting the blades the circuit is always closed on one side or the other. It was not necessary in this instance to hold the circuit open, but if it were necessary, the blades could easily be supported on small pedestals cut out of strip brass or copper.

The resistance between the points *A* and *B* on the edges of the cups, including the contact resistance of the points *C* and *D*, was measured and found to be 190 microhms. This resistance is so low that it will not affect the reading of meters.

E. C. Soares,
Ampere, N. J. Electrical Engineer.

Knockdown Conduit Work in Substation Construction

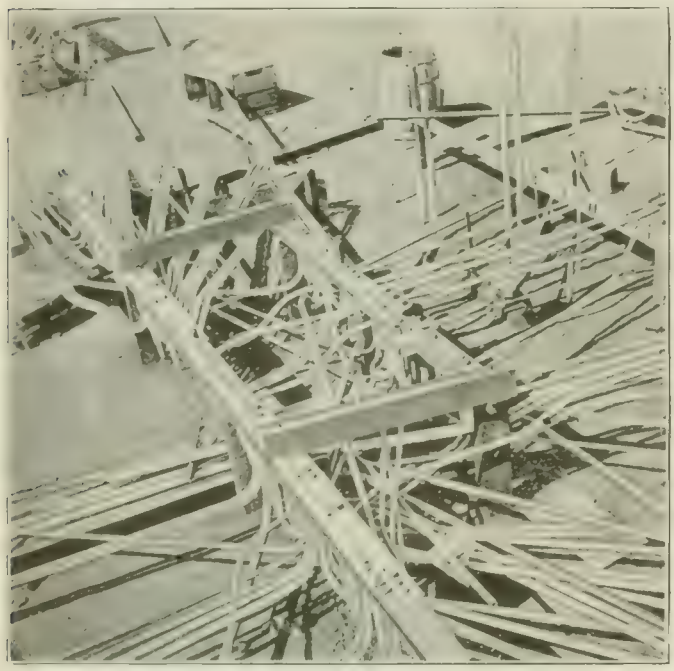
IN THE construction of the new Torrance substation of the Southern California Edison Company a method of installing conduit was developed and worked out which will no doubt have a marked effect in reducing the cost of building the many new stations which the Southern California Company must install during the next few years. Usually in installations of this kind the conduit is worked up piece by piece, each piece being fitted carefully in its proper place in the building as the work progresses. This method makes construction of the building proper very slow as the conduit reaches into all parts of the structure and the concrete, or other building material, can only be placed as the conduit runs are laid out and installed.

At a short distance from the actual substation site an outline of the substation foundation was made and the location of the switchboards, the switches, the metering transformers and all the other electrical equipment was indicated. These were taken from the plans of the station and placed in position to exact scale. This marks the first similarity to a manufactured product—the assembly of parts built to scale. Templates for the switchboards and control circuits were then built and placed in their proper relative positions in the dummy building.

These required careful spacing and alignment and also exact leveling so that the finished product would fit exactly. The conduit was then carefully bent and fitted to the templates in the dummy structure, after which each part was numbered to correspond to its position in the template between which it ran.

All the above work was done in advance of the starting of work on the building proper in order that there might be no delay after the latter began. The foundations of the station were then poured. As this work proceeded the templates retaining the prepared conduit were torn apart and the pieces removed and placed in their location in the substation, as indicated by their markings.

One of the remarkable features of this installation is the fact that more than 370 separate pieces of conduit were bent and placed in position in the templates with the use of almost no threaded bends and elbows. This method has two great advantages—first, wire can be pulled through longer runs without pullboxes, and, second, there remain fewer joints into which moisture can leak.



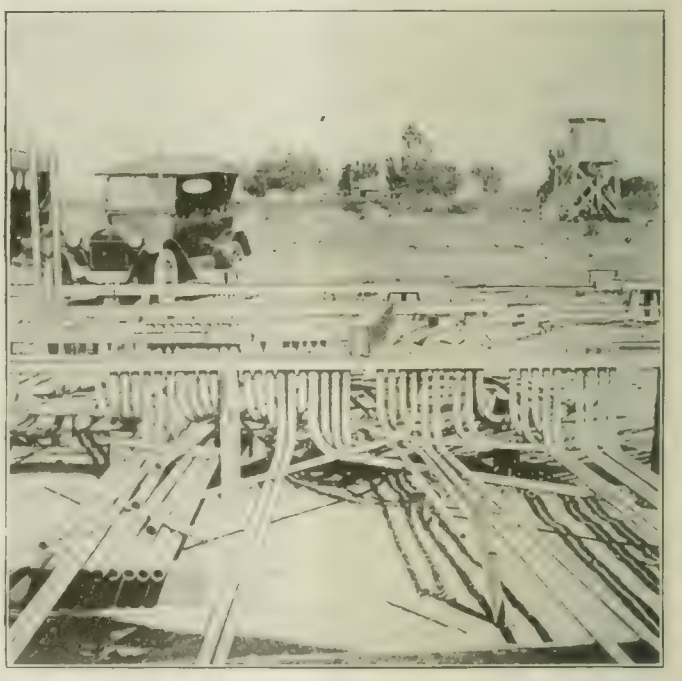


FIG. 1—CONDUIT FITTED TO TEMPLATES. FIG. 2—REASSEMBLED CONDUIT READY FOR POURING

Before construction work began on the substation the conduit was fitted by means of templates laid out from the plans. Each piece was numbered and reassembled as the building proceeded.

The installation at Torrance station included more than 14,000 ft. (4,200 m.) of conduit. Of this quantity only about 2,000 ft. (600 m.) was used for power circuits. All the remainder—nearly 2½ miles (4 km.)—was necessary for the control circuits.

A part of the substation after the conduit was reassembled is shown in Fig. 2. In the right center of the illustration is the switchboard location with the maze of conduit radiating to the feeder switches and other locations. Concrete was poured immediately after the photograph was taken.

Southern California Edison Company, Los Angeles, Cal.

G. C. Heckman,
Electrical Construction Foreman.

E. R. Stauffacher,
Protection Engineer.

Industrial Applications

The Economical Utilization of Electrical Energy
in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

Rewinding a Motor with Odd Coil Groupings

ODD grouping of coils added a difficulty to rewinding a 15-hp. induction motor recently sent to a New York shop. As the motor had seventy-two slots and was to be wound with ten poles this unequal grouping of coils was necessary. The original winding was for 440 volts, three-phase, 720 r.p.m., ten poles, 60 cycles, and the change was to 220 volts, two-phase, 720 r.p.m., ten poles, 60 cycles. The three-phase winding was connected series-star with seventy-two coils of seven turns of two No. 13 double-cotton-covered wires in parallel, wound in two layers with a coil pitch of 1 and 6. The odd grouping of this winding, shown at *A*, is perfectly balanced.

In calculating the two-phase winding it was first estimated that with the original three-phase, 440-volt winding, connected series-star, the voltage on each phase is 440/1.73, or 254.3 volts. The total winding, therefore, was good for $3 \times 254.3 = 763$ volts. In a two-phase winding this winding would develop 381.5 volts, but as 220 volts was required, rewinding was necessary. If the number of turns were reduced to give 220 volts, the copper cross-section would be enlarged and a stiff coil difficult to handle would result. Therefore, it was decided to use a two-parallel connection, increasing the number of turns per slot and using a smaller wire. The turns per coil for this winding were found to be $7 \times [(220 \times 2) \div 381.5]$, or eight turns. The size of wire was seven-eighth times the area of two No. 13 wires, or $\frac{7}{8} \times 5{,}178 \times 2 = 8{,}803$ circ.mils. To make a flexible coil two No. 14 wires with a cross-section of 8,212 circ.mils for both were used; therefore, seventy-two coils were wound of eight turns of two No. 14 double-cotton-covered wires in parallel.

Since there were ten poles and seventy-two slots, an odd grouping was necessary. The number of coils per phase was $72 \div 2$, or 36, and as there were ten poles, there were $36 \div 10$, or 3.6 coils per phase per pole. This means there are some three-coil groups and some four-coil groups. Dividing 36 by 10 gives as a result 3 and a remainder of 6. Then for each phase there are six groups which have four coils and the rest of the groups (10 — 6, or four groups) have three coils. The sum $(6 \times 4) + (4 \times 3)$ equals 36.

In order to place the groups symmetrically, for each six four-coil groups there are four three-coil groups, or three four-coil for two three-coil. Therefore, with five groups, a symmetrical arrangement is 4–3–4–3–4. This forms one-fourth of the total winding. By repeating this sequence as in *B* the whole winding is made symmetrical for a two-phase machine.

In checking a winding containing odd coil groupings diammetrical phase groups should contain the same number of coils and diametrical polar groups should contain the same number of coils. Referring to *B*, the figures in the small circles indicate the number of coils in series in each group. The groups are also numbered from 1 to 20. When it is said that diametrical groups must be equal it is meant that group 1 and group 11, for instance, must have the same number of coils, which in this case is three. Other diametrical groups are 2 and 12, 6 and 16.



CONNECTIONS FOR ODD COIL GROUPINGS ON INDUCTION MOTOR

At left, 440-volt, three-phase motor had seventy-two coils and slots, thirty groups, six groups of two coils and four groups of three coils in series per phase. At right, connected for 220 volts, two-phase, has twenty groups, six groups of four coils and four groups of three coils in series per phase.

Regarding the other condition, polar groups are any two adjacent groups for a two-pole machine, as 2 and 3, forming group *b*. The diametrical pole *g* is exactly opposite, or ten groups away, and the sum of coils in *b* $(4 + 3)$, must equal the sum of coils in *g*, $(4 + 3)$. At the next instant the pole has shifted from *b* to *s*, which must be checked against *y*. With a three-phase machine the pole would slip even one more group.

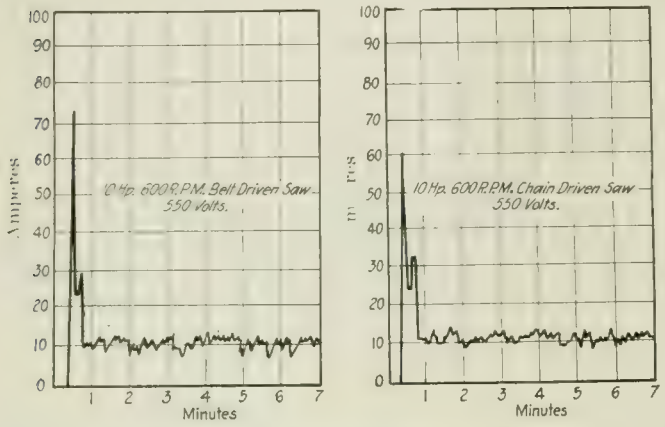
C. A. JOHNSON.

Bronx, N. Y.

Motor Drive Takes Less Power for Starting with Chain than with Belt

FROM recent tests in a Canadian shop it was found that starting a 10-hp. motor driving a saw by a chain takes only 84 per cent of the power required for a belt drive. About 74 amp. was required, as will be seen from the accompanying chart, to start the motor with the belt drive—whereas starting with the chain

drive required only about 62 amp. The reason for this is that the belt must be made tight in order to perform its function, while the chain can be run loose. This tight belt causes friction on the bearings and makes starting difficult. With the chain drive, on the other hand, there is a certain amount of slack which allows the motor to start immediately when power is thrown on it, even before the saw starts. With this initial start



COMPARISON OF POWER REQUIRED BY BELT AND CHAIN DRIVES

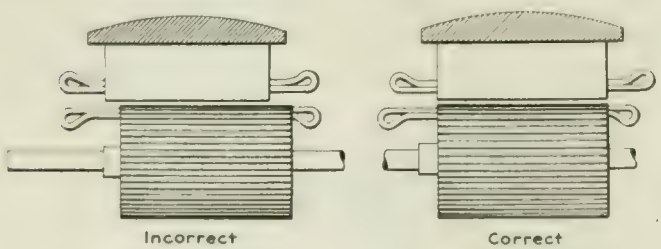
the motor can overcome the inertia of the saw with less consumption of power than if the saw was started exactly with the motor as in the case of the belt drive.

Another case which came to the writer's attention was that of a 15-hp. motor driving a planer. Formerly with a belt drive the motor had to be started by pulling on the belt, but since chain drive has been installed the motor starts the planer without help. Another advantage of chain drive over belt drive is that a chain is not continually running off the pulley as a belt may do unless guides are arranged to keep it in place. The first cost of chain drive is greater than belt drive, either rubber or leather, but the cost of renewals is less on the chain drive and the life is five times that of a belt.

Port Arthur Pulp & Paper Co. H. E. STAFFORD,
Port Arthur, Ont. Electrical Engineer.

Bearing Trouble Results from Uncentered Rotor

OVERHEATING of one bearing of a motor in an Eastern industrial plant was found after some investigation to be caused by an incorrect position of the rotor on the shaft. When this motor operated it was found that one of the bearings became too hot for safety after a few minutes of running. As the motor



UNCENTERED POSITION OF ROTOR CAUSED BEARING TO HEAT

had recently been fitted with a new shaft, it was thought that the rotor had not been centered properly with regard to the stator. The first investigation was made by comparing the relative position of the ends of the stator and rotor coils on each side of the motor. These coils appeared to be in the same relative position on both sides, but a more careful investigation revealed the fact that the coils extended further from the rotor laminations on one end of the motor than they did on the other end. Therefore the motor was investigated to see if the laminations of the rotor were centered with regard to the laminations of the stator. It was found that the rotor had been placed on the shaft a little out of the center with regard to the stator laminations. This was responsible for the pulling of the motor toward one of the bearings and the consequent abnormal friction on the thrust collar which caused the overheating.

When the rotor was shifted so that the laminations checked with those of the stator, the motor operated perfectly and no more bearing trouble was experienced.

New York, N. Y. W. A. HARRIS.

Generator and Switchboard Arrangement to Give 220 Volts to 2,300 Volts

TO OBTAIN any voltage from 220 volts to 2,300 volts for testing motors, etc., in the shop of McCleary, Wallin & Crouse, Amsterdam, N. Y., the leads from pole groups of a 2,300-volt generator have been brought out and connected to the switchboard shown in the accompanying illustration. This twelve-

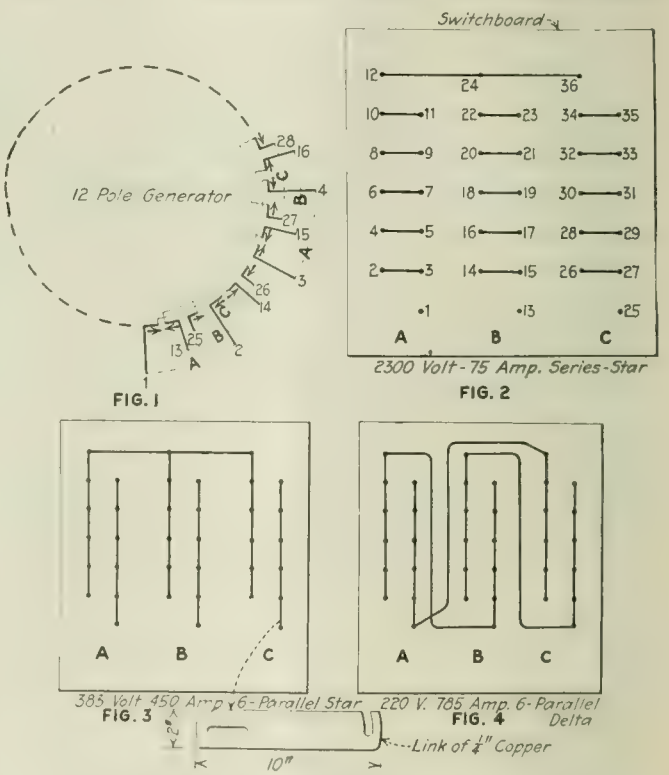


FIG. 1 FIG. 2 FIG. 3 FIG. 4

BY CHANGING LINKS ON BOARD FROM 220 VOLTS TO 2,300 VOLTS IS OBTAINABLE

pole, three-phase generator is installed about 6 ft. (1.8 m.) from the switchboard, and No. 2 flexible leads are brought out as shown in the diagram and connected to $\frac{7}{8}$-in. (2.2-cm.) round brass studs in the board. About $\frac{3}{4}$ in. (2 cm.) of stud protruding from the front side of the board is threaded to take a wing nut with a $1\frac{1}{2}$-in. (4-cm.) face. The connecting links are made of $\frac{1}{4}$-in. x 2-in. x 10-in. (6-mm. x 5-cm. x 25-cm.) strips of copper, slotted in each end as shown. Copper washers are used for separating the links. The board is made of 2-in. (5-cm.) marble, 3 ft. (1 m.) wide and

VOLTAGES AND CURRENTS OBTAINED FROM TEST SWITCHBOARD

Volts	Amp	Connection
2,300	75	Star
1,917	75	Star
1,533	75	Star
1,328	130	Delta
1,150	150	Star
1,107	130	Delta
885	130	Delta
767	225	Star
664	260	Delta
442	390	Delta
383	450	Star
221	780	Delta

3½ ft. (1.2 m.) high, and is mounted on 1¼-in. (3-cm.) iron pipes. By changing the links on the board any voltage from 220 to 2,300, three-phase or single-phase, may be obtained with the corresponding currents shown in the accompanying table. It will be noted that for some values of voltage the full rated power of the generator cannot be obtained. By varying the speed of the prime mover this generator may also be used for 40 cycles and 25 cycles with corresponding change in voltages. A. R. McDONALD.

Amsterdam, N. Y.

Two 500-Hp. Alternating-Current Motors Divide Hoist Load Equally

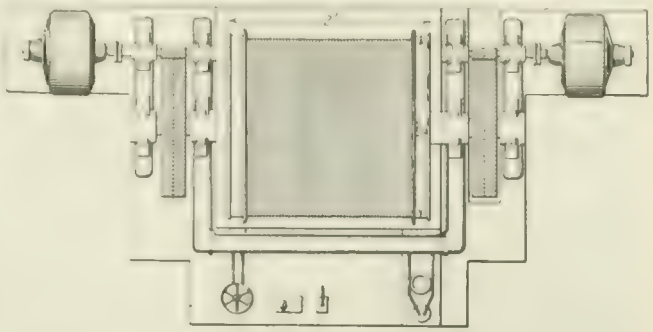
TWO 500-hp. slip-ring-type motors operated by a special controller drive a 1,000-hp. mine hoist with a rope speed of 1,450 ft. per minute (7.4 m. per second) in the plant of the Cleveland Cliffs Iron Company, Ishpeming, Mich. The motors are 2,200-volt, three-phase, 60-cycle, 450-r.p.m. (synchronous) General Electric slip-ring type with a full-load temperature rise of 40 deg. C.

The control was of special construction, as it was necessary to insure an even division of the load between the two motors. The primary windings of the two motors are connected in parallel to six-pole, reversing, air-break, solenoid-operated contactors. The secondary winding of each motor is connected to individual six-point, three-phase, solenoid-operated contactors with separate resistors for each motor. With this arrangement the motors can be made to divide the load to any desired proportion by properly adjusting the secondary resistances.

The control circuit is 440 volts alternating current and is carried through a standard ten-point reversing drum controller, with the control wiring of the secondary contactors connected in multiple. The control apparatus is equipped with the usual current-limiting relays, low-voltage contactors, emergency switches and an extra interrupting contactor to insure absolute electrical interlock and to prevent short circuit.

The hoist drum is 12 ft. in diameter by 12 ft. face (3.6 m. x 3.6 m.), and the installation of two motors instead of one gave a well-balanced mechanical condition, as may be seen in the illustration. The hoist is designed to operate from a maximum depth of 3,000 ft. (915 m.) with a rope speed of 1,450 ft. per minute (7.4 m. per second). Balanced skips are employed, each of which weighs 10,000 lb. (4,500 kg.) and will carry 12,000 lb. (5,500 kg.) of ore. Such an installation might be thought to require direct-current equipment, because 400 hp. or 500 hp. is generally considered about the maximum for alternating-current mine hoists. However, direct-current equipment, including the necessary motor generator set, is very expensive, and all objections to the alternating-current equipment were overcome by dividing the load between the two 500 hp. motors geared to the same hoist.

As a preliminary test, after the installation had been completed, the hoist was operated at full speed forward,



BALANCED MECHANICAL CONDITIONS SECURED BY USE OF TWO MOTORS TO DRIVE HOIST

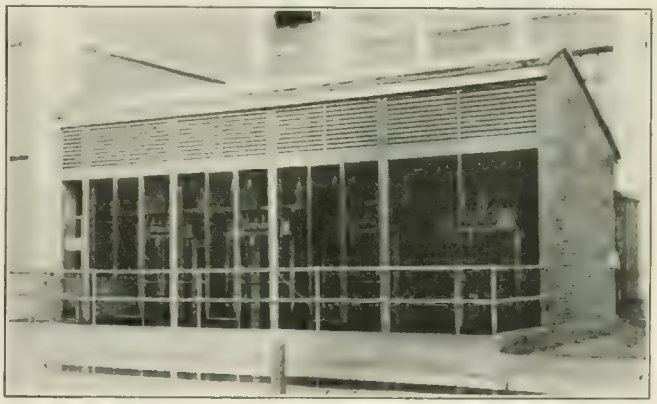
and then the controller was quickly thrown to full speed reverse. The apparatus functioned perfectly, bringing the motors to full speed reverse without distress. There was also a perfect division of the load between the two motors at all loads and speeds. F. C. STANFORD,

Chief Electrical Engineer.

Cleveland Cliffs Iron Company,
Ishpeming, Mich.

Operating Indoor Transformers Partly Exposed to Weather

SUBSTITUTION of copper straps for the knife-blade switches in the leads was practically the only modification necessary to operate the indoor transformers shown here in the partly open building used as a substation by the Naumkeag Steam Cotton Company, Salem, Mass. It was found that expansion and contraction of the blades and jaws of the knife switches on account of temperature changes loosened the contacts and caused heating. For this reason strap copper securely bolted was substituted for the knife switches. After this change no trouble was encountered from heating. This substation, which is built of two brick walls and a roof, saved the expense of changing over the transformers from the indoor to the outdoor type. Moreover, the free circulation of air around the transformers tends to keep them cool under heavy loads.



INDOOR TRANSFORMERS OPERATED IN PARTLY EXPOSED LOCATION

Boston, Mass. H. S. KNOWLES.

Central Station Service

A Department Devoted to Commercial Policy
and Management Topics, Including Methods of Increasing the Use
of Electric Light, Power and Heat

Schedule of Forwarding Dates for District Office Reports

IN ORDER to have district office monthly reports forwarded promptly, the general office of the Pacific Power & Light Company at Portland, Ore., has adopted the accompanying schedule, which shows the dates on which the April reports were due and the dates the various reports were received from each district office up to May 15.

The blanks indicate that no report was required from

Report Form Number....	1091	1105	19	55	90	C C	94	93	1103	1104	M.L.	1053	1019	1065
Due Date	29	1	2	2	2	3	4	10	10	10	10	12	12	12
District Offices:														
Walla Walla	3	29	1	3	3	0	5	5	30	30	6	4	29	3
Pendleton	1	8	6	3		0	8	8	8	8	0	8	8	8
Lewiston	3	0	3	3			4	4		4	0		4	4
The Dalles	28	5	6	3			4	6	3		12	10	3	10
Yakima	3	0	3	3	3	3	3	10	3	3	4	7	5	5
Pasco	30	10	5	3	3	0	4	10	10		0	10	10	10
Kennewick			4	4	4	0	4	10	10		0	10	10	10
Sunnyside	30	3	3	3	3		5	10	5	.....	7	5	3	7
Astoria	29	0	3	3		0	8	6	6	6	0	6	7	6
Seaside	28	3	29	3			7	10	14		0	30	5	30
White Salmon	28	3	29	3	3		3	5	3		0	30	29	29
Pomeroy	29	5	29	3	4			7	5		12	7	7	5
Prosser	29	7	6	6	6	0	6	7	7		0	10	7	6
Goldendale	29	8	5	3	4		7	7	7		0	7	8	0
Dayton	10	30	1	3	3		5	7	30		5	1	30	8
Waitsburg	29	3	3	3	3		3	8	5		5	5	3	5
Toppenish	30	14	5	6	6		6	13	14		11	0	0	14
Vancouver	28	3	4	30	30		30	30		1	0		30	1
Hood River	29	7	3	3			3	6	6		0	10	14	10
Power Department				3	4	4	6	3			10		6	
Kennewick Stores	1	1		3							0			
Const. Dept.	3						3				11			

the district office, and an "O" indicates that no report had been received in the general office on May 15. District office names are given in the order they are carried in the general office books and have no reference to the standing of the particular offices with respect to forwarding the reports promptly.

This record was published in the Pacific Power & Light Company's *Bulletin* and will be given from month to month as a means of speeding up the district offices.

Public Benefits from Rate Embodying Coal and Oil Clauses

FUEL oil introduced into a part of the boiler plant of the Narragansett Electric Lighting Company, Providence, R. I., is making possible a stabilizing of rates which would be difficult to obtain if coal alone were burned. A new fuel clause has been filed with the Rhode Island commission, and officers of the company state that the practical effect of the clause will be the maintenance of present rates in the face of steadily rising coal costs. Six of the twenty-four boilers now operated by the company are being equipped for oil burning or have been equipped in part.

The new fuel clause as applied to power customers and to lighting customers under the company's schedules D, F, G and C has a rate based on a cost to the company of $8 for a gross ton of coal of 14,500 B.t.u. or an equivalent quantity of fuel oil measured in B.t.u. in the bunkers or oil service tank at the generating station. Such cost of fuel for any month is determined by dividing the total cost of all fuel burned by the number of tons consumed, this cost being obtained as follows:

By taking the weighted average cost per gross ton of all fuel in storage on the first day of the month and all fuel received during the month and multiplying such cost by the number of tons of fuel burned and adding thereto all handling, storage and carrying charges on fuel for the month. Storage and carrying charges on fuel include each month in addition to all other charges such sums as will compensate for any increase or decrease in the thermal value of the coal above or below 14,500 B.t.u. and provide for the amortization of approximately 75 per cent of the cost of all oil-burning, conveying and storage apparatus by July 1, 1922. A gross ton of fuel oil is considered to contain 32,480,000 B.t.u. The cost of fuel for any period longer than one month is taken as the weighted average of the foregoing monthly costs.

The new rate clause provides that for every 10-cent decrease or increase in the cost of fuel as above determined below or above $8 per gross ton there shall be a decrease or increase of 0.1 mill for each kilowatt-hour sold under the rate. Such adjustment is made for periods of three months each, using the cost of fuel as determined in the preceding three months' period for the quarter in question.

Lighting rates under the company's schedules A and B are similarly based, but unless the cost of fuel increases or decreases by $2.50 or more above or below the eight-dollar line no adjustment is to be made. If such a decrease or increase occurs in the cost of fuel, the decrease or increase established becomes 5 mills per kilowatt-hour sold under the rate. The adjustment periods in such case are six months each. Unless protest is made or the commission orders otherwise, the new clauses will go into effect July 1. It is possible that if the use of fuel oil increases largely in the plant, the average cost of fuel will be lowered sufficiently to permit rate reductions later.

One Way to Provide More Freight Cars for the Country



A 40-ton electric crane at Providence, R. I., unloads a car in two hours against two days by old hand-hoist methods.

Central Station Places Its Credit at Disposal of Dealers

AT A TIME when banks and investment companies are raising interest rates and telling electrical contractor-dealers to cut down on their time-payment paper, the Commonwealth Edison Company of Chicago has agreed to discount the time-payment contracts of any electrical contractor-dealer in Chicago at a cost of only 4 per cent for six months and 6 per cent for twelve months. It is just possible that credit may get so tight that the utility may have to withdraw this offer temporarily, but except in such a contingency it is the intention of the company to give the plan an extensive trial. During the summer months the central station is stimulating business by advertising that the people of Chicago can go into any electrical retail store in the city and buy such devices as flatirons, toasters and pot-type percolators and grills for $1 down. The balance is usually divided over a six-month period, but the contractor-dealer gets his money immediately from the Commonwealth Edison Company, which also collects all the deferred payments. During the summer campaign last year the company and 117 dealers sold 10,326 flatirons, 271 toasters and 414 percolators in less than three months. From present indications this year's results will be even more gratifying. Attractive window displays play an important part in the campaign, the Commonwealth Edison Company supplying posters and frames upon which to mount them.



ADVERTISEMENT OF SUMMER SALE

The dealer profits greatly by this co-operative summer campaign, but the central station is also benefited from a public-policy standpoint and by the sale of additional energy. The bookkeeping and collecting expense is very small, as the installments are added to the customers' lighting bills and no trouble whatsoever has been experienced on more than 99 per cent of the accounts handled.

Method of Posting Current Prices of Motors

FOR the convenience of employees, contractors, prospective customers and others, the power sales department of the Worcester (Mass.) Electric Light Company posts current prices of motors with auxiliary equipment on a 30-in. x 43-in. (78-cm. x 110-cm.) blackboard mounted in the department and illustrated herewith. This company has standardized on maximum-rated motors, and the prices in dollars shown in the three columns at the left apply to these motors only. At the right, listed as "specials," are a number of 40-deg. motors which the company had in stock. The prices of motors up to and including 2-hp. include a standard make of starting switch and from 3-hp. to 5-hp. overload protection equipment. With 7.5 hp. motors the company uses overload and undervoltage-release type oil switches,



BLACKBOARD FOR LISTING MOTOR PRICES

and above 7.5-hp. rating the company requires the use of a starting compensator with relays. All this auxiliary apparatus is covered in the prices listed, which show the cost to the customer of the motor equipment delivered on his premises.

Worcester, Mass.

H. D. STOKES,
Power Engineer.

Handling Rural Business in Ohio

FARMERS are demanding service in all directions, and the central stations have not agreed upon any one well-defined plan of handling the business, according to statements made by D. O. Vaughn, manager of the Sidney (Ohio) Electric Company, in the course of an address delivered before the new-business co-operations committee of the Ohio Electric Light Association. A number of methods have been devised for obtaining this business on a profitable basis. The three plans most actively in use were, according to Mr. Vaughn, the following:

First is the wholesale plan, under which farmers organize themselves into some sort of an association, purchase energy from a central station and distribute it themselves. This plan has the advantage that it eliminates any worry on the part of the company and the whole association is listed as one customer. However, the farmers do not always get along well together, and instead of growing stronger these associations generally become a source of argument in the community between those who are connected to the system and those who are not. The company may also have difficulty in making the association understand why the company's wholesale meter reads so many more kilowatts every month than the sum total of all of the consumers' meters. Not realizing that there are losses on the system, an association may set very low minimum charges or none at all. Another disadvantage of this plan is that the association generally neglects its maintenance until the service becomes poor.

The second plan is the group plan, under which the farmers organize a temporary association to finance and build the necessary lines. When completed, the farmers' association contracts with the utility to furnish retail service over these lines and issues a bill of sale to the company for all of the lines for and in consideration of $1. Under this plan the utility furnishes the necessary meters only, which are installed on the consumer's premises. The central station accepts the lines as a gift and then becomes liable for their maintenance and upkeep. Under this group plan the Sidney (Ohio) Electric Company requires that each consumer sign an individual contract for service in addition to the contract made with the association. The principal difficulty in the group plan comes in getting the association properly organized and in getting a workable agreement between the company and all of the farmers in the community after the lines are in operation.

The third plan is to deal with only one or at most a few farmers at a time and to have them sign individual contracts. Each farmer finances the cost of the necessary extension, transformers, etc., by paying this amount as a bonus to the company to get the line built to his premises. The title and ownership of the line and equipment always remains with the company. The farmer pays the regular farm lighting rates for service. The Sidney Electric Company accepts contracts of this nature for periods of not more than ten years. The advantage of this plan is the ease with which the business is obtained directly from each individual farmer. The unavoidable delays and expense which are always attendant upon farmers' organizations of any nature can in this way be avoided. The disadvantage of the individual plan is that only a few customers are added at a time, but this objection is usually more than offset by there being fewer misunderstandings, less argument and a reduction in the amount of time and money expended in acquiring the business.

Cost of giving service to the farmers was interestingly analyzed by Mr. Vaughn as follows:

"Assuming that the company's specifications call for well-constructed lines of 30-ft. Northern cedar poles and not less than No. 6 copper wire, I think it is fair to assume that this line may be said to last for from fifteen to twenty years, although this might vary in different localities, owing to soil conditions, storm center, etc. However, we believe it would not be out of reason to charge 5 per cent of the original cost of the line annually against the cost of giving this service for keeping up the lines. If the company owns the lines, it must also add taxes and insurance against liability, etc., which will be very close to 2 per cent per annum. This will necessitate a 7 per cent fixed charge against the cost of giving this service, or $70 per year per $1,000 worth of line. If the energy is sold to the farmer metered on his premises, there will also be the following service cost to each farmer:

Assuming a 2 kw.-hr. transformer, which has 23 kw.-hr. core loss per month at 3 cents per kilowatt hour delivered	$0.69
Meter reading and billing per customer	0.10
Service to customer, such as driving out and fusing up transformers after a storm, etc., per customer per month	0.50
Total cost per month, not considering the energy used by the farmer	$1.29

"The average farmer is a much better user of appliances than the average consumers in the small town, and from our records, taken over a period of a year, of twenty-five farmers connected, we find that they average about 350 kw.-hr. per year use of energy or 30 kw.-hr. per month, this costing 3 cents per kilowatt-hour or 90 cents. If we have a $1,000 line, one mile long, carrying four farmers, they should then pay for the following total:

Maintenance charges per year	$ 70.00
Service charges per year, $1.29 × 12 = $15.48 × four customers	61.92
Four farmers at 360 kw.-hr. per year equals 1,440 kw.-hr. used, at 3 cents per kilowatt-hour	43.20
Total cost of giving the above service to four farmers	$175.00

"This comes to $43.78 per year, or $3.66 per month, per farmer, which is the actual cost of serving each customer."

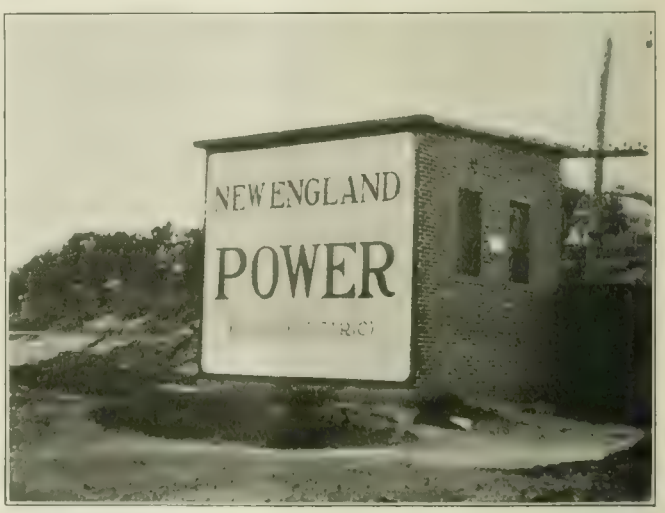
A rate which would protect the company on this basis would be as follows:

A fixed charge of $1 per kilowatt of transformer capacity connected (but not less than $2) plus the regular lighting rates for energy, say, 10 cents per kilowatt-hour. If the above customers have 2-kw. transformers and use 30 metered kw.-hr. apiece, their monthly bills would each contain a fixed charge of $2 plus 30 kw.-hr. at 10 cents, $3, or a total of $5.

This would leave a profit of $1.34 per month, but had each customer used only 10 kw.-hr., there would have been a loss of 66 cents. It therefore behooves the central station either to insist upon at least four customers per mile of line, estimated to cost $1,000, or raise the fixed charge per customer to a point where it will be protected against loss by reason of lack of use of service.

Furthermore, if a profit is to be made from this business, it is very necessary to educate customers to use motors, pumps, heating appliances, ranges and all the large energy consuming devices possible in order to increase the kilowatt-hours used per month by each farmer.

"Commercializing" a Terminal House



FACING a main highway leading into Worcester, Mass., is a terminal house of the New England Power Company used in tying two 13,200-volt feeders run overhead from the Greendale substation to two underground lines feeding the American Steel & Wire Company and interconnected with the Worcester Electric Light Company. The power company has effectively used the terminal house wall to advertise its service, as illustrated.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Motors, Generators and Transformers

Sixty-Cycle Converting Apparatus.—J. L. BURNHAM.—It is said that synchronous converters for voltage of 500 and 600 have been freed from flashing through the use of high-reluctance commutating poles, a special form of brush rigging, screened flash barriers and the high-speed circuit breaker. The author makes a comparison between the synchronous converter and the motor-generator set on the bases of efficiency, reliability, flexibility, costs and floor space. He states that 2½ kw. of synchronous converters are built for every 1 kw. of motor-generator sets.—*General Electric Review*, May, 1920.

Dimensions of Single-Phase Traction Motors.—F. UNGER.—The output of an electric motor may be expressed in terms of the product of armature length, the square of the diameter and the number of revolutions per minute multiplied with a factor of utilization for the material which in correct design tends to a maximum value, depending on the permissible maximum induction and current density. On the basis of a careful study of the conditions affecting the utilization factor the author presents a number of diagrams and tables indicating what magnetic and electric densities should be allowed and what values of the utilization factor should be expected in ordinary cases.—*Elektrotechnische Zeitschrift*, Jan. 1, 1920.

Lamps and Lighting

A New Cadmium-Vapor Lamp.—FREDERICK BATES.—A new method for producing a cadmium vapor arc of great brilliancy has been discovered. It was found that the metal gallium would form an alloy with cadmium. Since gallium has a boiling point about 1,500 deg. C., the vapor pressure relation which exists between cadmium and mercury is reversed when compared with cadmium and gallium. The cadmium therefore acts as the energy carrier when used in combination with gallium in a quartz lamp.—*Scientific Paper No. 371, U. S. Bureau of Standards*, April 10, 1920.

Industrial Lighting as an Element in Mass Production.—LEON GASTER.—The writer discusses the results obtained in America by the use of higher intensity of illumination in industrial plants and points out the needs of British industries with particular regard to health of employees, safety and efficiency.—London *Electrician*, April 30, 1920.

Generation, Transmission and Distribution

Economical Aspects of Electrification in Belgium.—CARLIER.—A detailed comparison is made between the total cost of transporting the necessary coal for industrial purposes from the mines to the various industrial plants and the coal transportation costs if a total electrification were carried out, three steam-driven superpower stations being assumed to deliver all energy needed. The direct saving in coal transportation cost is estimated at 6,600,000 francs, and since the estimated investment for the electric super-power station system is about 60,000,000 francs, a decided economy would result from an electrification.—*Revue Générale d'Electricité*, March 6; *Bulletin de la Société Belge des Électriciens*, October-December, 1919.

Coal Conservation in the United Kingdom.—DUGALD CLERK.—In discussing the proposition of super-power stations for England the writer feels that it is necessary to take a broader view than has been done by the government committees. Not only should the efficiency for motive power be considered, but the whole heating systems of the country should be dealt with in order to obtain a combined efficiency of heating, lighting and motive power. To this end it is necessary to study not only the distribution of heat, light and power by gas and electricity but also the other methods of generating and distributing heat for domestic and manufacturing purposes. He discusses in considerable detail the claims which have been made for the super-power stations with respect to the possible saving of coal.—London *Engineer*, April 23, 1920.

Overloads on Telephone Conductors Due to Rain and Rime.—F. LOPPÉ.—The author reviews an article by Pillonel, in the *Revue Polytechnique* of Geneva, in which a great number of interesting cases of overloads on telephone and telegraph conductors along the lines in the Alps are reported. Overload factors as high as twelve, and even twenty-four, have been observed during severe rime formation. According to direct measurements at a station on St. Bernard, the extra load on ordinary sizes of telegraph wire varies from 80 grams to 150 grams per meter wire during rain, while the overloading due to rime may reach values as high as 2,000 grams per meter.—*L'Industrie Electrique*, Jan. 25, 1920.

Switching and Protection of Transmission Circuits.—S. Q. HAYES.—The author discusses some of the principal features of switching and protection of power transmission systems, dealing principally with oil circuit breakers, relay equipment, lightning arresters, station layouts and system arrangement. A few high-voltage transformers used on some of the larger systems are described, and attention is called to their important features. The discussion is practically limited to plants furnishing energy at 22 kv. and above. *Electric Journal*, May, 1920.

Half-Wave Transmission Lines.—BRYLINSKI.—Taking one step further from the quarter-wave transmission line suggested by Bunet, the author inquires as to the feasibility of operating lines of one-half wave length. Such a line offers the advantage of rather good voltage regulation and thus could be used with ordinary alternators. In the middle of the line very high voltages may occur, which, however, may be taken care of by

providing special insulators over a certain range. A half-wave line at 50 cycles is about 3,000 km. (1,870 miles) long, but a geographically shorter line may be made into a half-wave line by inserting a few loading coils or by inserting lengths of high-tension cable at certain points. The voltage rise is greater on an inductively loaded line for given received current. This limits the amount of power possible to transmit over the half-wave line. A three-phase line of aluminum conductors with 5 sq.cm. (0.776 sq.in) sectional area thus could transmit not more than 20,000 kva. at 70,000-volt star pressure at receiving station, if inductance loaded, as against 80,000 kva. under same conditions if loaded with capacity.—*Comptes Rendus*, April 19, 1920; *Revue Générale d'Electricité*, May 8, 1920.

Relative Merits of Connections Employed in High-Voltage Generating Stations.—ERNEST PRAGST.—In planning a system of connections for a central station consideration must be given to the following factors: (1) It should not afford an undue risk to the operating force; (2) it should permit of the economic operation of apparatus; (3) it should be simple in principle electrically; (4) it should lend itself to simple and rugged mechanical arrangement and construction; (5) it should have a reasonable degree of flexibility; (6) it should assure a degree of continuity of service commensurate with the class of load served. The author presents and discusses eight different systems of station connections.—*General Electric Review*, May, 1920.

Electrical Characteristics of Transmission Circuits.—WILLIAM NESBIT.—A brief review of hyperbolic trigonometry is given before taking up the application of hyperbolic methods of calculating transmission lines. The work of Dr. A. E. Kennelly, F. E. Pernot and Edy Velander are referred to in the development of the method.—*Electric Journal*, June, 1920.

Traction

Motor Buses or Trackless Trolleys.—H. L. ANDREWS.—The trackless trolley, although practically unknown in this country, is said to be making a good record for earnings and service abroad. A comparison of its operating cost with that of the motor bus and the most modern street-railway practice shows that on an equal service basis and equal fare the motor bus cannot compete with the street car but that the trackless trolley can. A true comparison of the relative operating costs of the gasoline motor bus, the trackless trolley and the safety car, assuming that the gasoline bus can be operated with one man, is given in the following table:

	Cents per Bus Mile		Cents Per Car Mile
	Gasoline Bus	Trackless Trolley	Safety Car
Maintenance of overhead		0.5	0.5
Maintenance of way			1.5
Road taxes	0.75	0.75	
Maintenance of equipment	8.54	3.0	2.0
Platform expenses	8.0	8.0	8.0
Traffic expenses	0.04	0.04	0.04
Power	4.54	1.8	1.8
General	3.54	3.54	3.54
Depreciation	6.59	2.0	2.0
Total	32.00	19.63	19.38

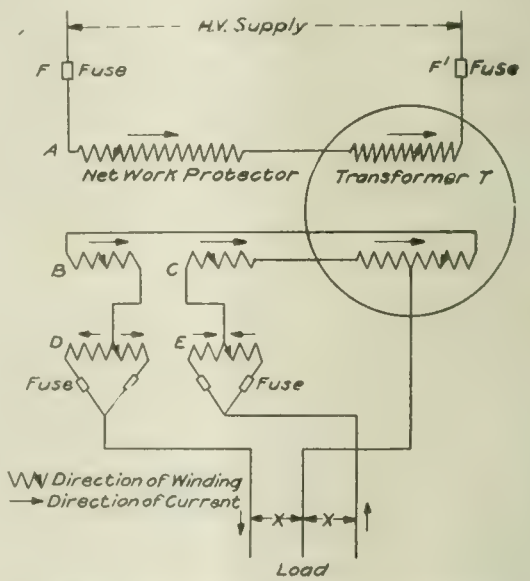
On account of the fact that the proposed equipment of the trackless vehicle and the power distribution to it are essentially the same as those of the street car, it is said to be suitable as an auxiliary to a street-car system, and the author recommends that the railway operators adopt it either as an auxiliary or to eliminate competition.—*General Electric Review*, April, 1920.

Installations, Systems and Appliances

A New Type of Arc-Welding Generator.—S. R. BERGMAN.—Where each welder is furnished with an individual generator the necessary regulation is said to be best effected through special inherent regulation in the generator itself. A machine which has been developed to embody the characteristic of constant-energy output is described in this article.—*General Electric Review*, May, 1920.

Industrial Electric Heating.—WIRT S. SCOTT.—Dealing particularly with temperatures under 600 deg. Fahr. (315 deg. C.), the author states that the question no longer is what electric heating costs but rather what are the advantages of this method. He gives some experiences in the automobile industry where the method has been highly successful because of the small amount of spoilage. The uniformity of temperature and automatic temperature control are said to be large factors in the test of electric heating; moreover, the cost of labor is reduced.—*Electric Journal*, May, 1920.

The Alternating-Current Network Protector.—H. C. STEWART.—A factor which has prevented the general adoption of alternating-current networks is the fact that there is a chance that an internal failure in



ALTERNATING-CURRENT NETWORK PROTECTOR

one transformer may impose an overload besides the short-circuit current on the adjacent transformer, thereby blowing the primary fuse. This action will progress from transformer to transformer until the entire system is disconnected. The alternating-current network protector has been developed to overcome this difficulty. It has been in use for a number of years on large network systems in New York City. The protector is a transformer device with three sets of windings, as shown in the diagram. Normally, when the current flows from the high-voltage supply, the current in the transformer and three protector windings are as shown. The protector windings are mounted on a separate core in such a way that the core is not magnetized under normal conditions. In case of a fault in the transformer *T*, however, currents in the secondary circuit are reversed. The protector core is magnetized

and heavy currents flow in the windings *D* and *E*, so that the secondary fuses blow at practically the same time as the primary fuses *FF'*, completely disconnecting the transformer from the network.—*General Electric Review*, May, 1920.

Electrophysics and Magnetism

Some Notes on Vacuum Tubes.—JOHN H. MORECROFT.—The value of the exponent connecting plate current and plate and grid potentials is experimentally investigated for a number of tubes. It is found to be markedly different for different tubes and for the same tube at different plate voltages. Particularly is this the case for low-plate voltage tubes. After discussing briefly distortion in amplifying tubes, the capacity and conductance within tubes is considered. Experimentally determined data governing these quantities are given, these being obtained on a carefully designed radio-frequency Wheatstone bridge. An experiment on the detecting action of a tube without grid condenser seems to prove that grid-to-filament circuit asymmetry of characteristic is not responsible for the detecting action.—*Proceedings Institute of Radio Engineers*, June, 1920.

Radio-Frequency Inductance Coils.—M. K. ZINN.—A discussion of some of the practical considerations which enter into the design of inductance coils for radio frequencies with particular reference to their application in circuits intended for the reception of long undamped waves. The theoretical behavior of coils at high frequencies is reviewed, and for illustration impedance measurements on a typical antenna load coal are presented.—*Wireless Age*, May, 1920.

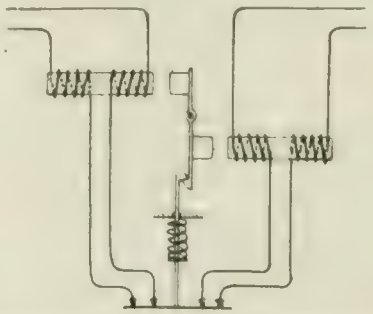
Units, Measurements and Instruments

A New Spectropyrheliometer and Measurements of the Component Radiations from the Sun and from a Quartz Mercury-Vapor Lamp.—W. W. COBLENTZ and H. KAHLER.—This device consists of a quartz spectograph and cylindrical condensing lens, placed upon an equatorial mounting. In this manner the ultra-violet absorption in heliostat mirrors is avoided. Data are given on the relative components in infra-red, visible and ultra-violet radiation from the sun and from a quartz mercury arc lamp; also data on the gas-filled tungsten lamp, the iron arc and the carbon arc. In two appendices methods are given for excluding ultra-violet light from buildings and for protecting projection lantern films from the heat of the lamp.—*Scientific Paper No. 378, Bureau of Standards*, April 9, 1920.

Telegraphy, Telephony and Signals

Radio-Frequency Alternators.—MARIUS LATOUR.—In this article, which is partly reproduced from a paper presented before the Société Française des Electriciens, the different types of alternators capable of practical application to the direct production of radio-frequency currents are described. The author pays particular attention to the French designs of alternators, which he describes as "homopolar alternators with partial utilization of the periphery" and "homopolar variable reluctance" alternators.—*Proceedings Institute of Radio Engineers*, June, 1920.

A Reversing Interrupter for Spark Coils.—FALKENTHAL.—A great part of the German portable radio sets used in the war were built for spark-coil excitation and provided with a special double-pole interrupter, or rather reversing contact, for converting the battery current into audio frequency spark impulses. The action of this device, called the "Falkenthal pendulum converter," may be seen from the figure where *cc'* is a polarized contact maker, sending the primary current alternatively through the windings *a* and *a'*, which are connected in opposition. For each full oscillation of the tongue the iron core thus will be carried through one full hysteresis cycle. This feature makes for a remarkably high efficiency (80 per cent of direct-current-



DOUBLE-ACTING SPARK-COIL INTERRUPTER

alternating-current conversion); *ded'* is an audio oscillating circuit, tuned to the tongue frequency, which prevents sparking at the contacts; *f* is a high-frequency choke coil, and to the right is indicated the radio transmitter with quenched spark-gap and antenna. The interrupter is claimed to give as good constancy of tone as an alternator and may be built to handle 250 watt primary energy.—*Jahrbuch der drahtlosen Tel. und Tel.*, October, 1919.

Characteristics of Static Frequency Doublers.—T. MINOHARA.—The author distinguishes between two fundamental modes of operating a static frequency doubler. In one system it is attempted to obtain a rather pure sinusoidal secondary current, and for this purpose a relatively low direct-current excitation is used in the frequency doubler. The output then is limited by the rule that the ratio of primary alternating current to the exciting direct current should not exceed 1.66. The other system is called the impulse system. Here the cores are almost saturated by the direct-current excitation and a very peaked secondary voltage results, the second harmonic being sifted out by use of resonant circuits. In the impulse-excited frequency doubler the primary input may be relatively greater than for the sinusoidal doubler. The iron losses per unit volume are considerably larger, but the total core volume per kilowatt may be greatly reduced. These observations follow an analytical treatment of the two systems, illustrated by a great number of curves and oscillograms.—*Revue Générale d'Electricité*, Feb. 28, 1920.

Miscellaneous

Predictions of Water Flow in Rivers.—AXEL WALLEN.—For many years the author has been working on a method of predicting water flow in rivers, and for this purpose he has made an extensive statistical analysis of water-stand data from about twenty-seven stations along Swedish watersheds. Several diagrams showing observed values and also giving such curves as were calculated beforehand indicate surprisingly small deviations and show that the author's pre-calculations give a very fair idea of the general shape of the water-stand curve. The author, however, points out certain failures, emphasizing the necessity of further refinements in the method.—*Teknisk Tidskrift, Vetenskapsplagan*, March 27 1920.

News in Brief

Summary of Market Conditions and of Recent and Approaching Happenings of Importance to the Industry

OPTIMISM prevails in business circles, the excellent grain crop prospects on the Pacific Coast and a reported large increase of new industries in the South being among the contributing causes. There is some building activity, in New England and California especially, with resultant large sales of electrical material.

SALES of fans are affected by the degree of heat prevailing in the different sections of the country. Southern stocks are largely depleted, but comparatively cool weather prevents a heavy demand in Northeastern territory. Household appliances are moving well except in the East.

SHIPPING and receiving troubles continue to handicap business, and few price changes of importance are reported. Collections are only fair.

HYDRAULIC turbines are to be manufactured in Canada by agreement with the Cramps for exclusive use in the British Empire of their waterwheel and other hydraulic designs.

PRODUCERS of electrical material are divided on the question of raising schedule material lists as recommended by the Electrical Supply Jobbers' Association last year.

A GOOD demand exists for motor-driven chain blocks, which can usually be filled from stock. Considerable difficulty is being met in getting enough motors to supply requirements.

STEEL interests are still adversely affected by traffic and labor conditions. A shutdown in sheet and tinplate mills is threatened. The effect on the steel output to the electrical trade is naturally not favorable.

A REDUCTION of one-half the 10 per cent surcharge on retail lighting bills and a 10 per cent increase in salaries and wages of all employees of the Boston Edison company became effective July 1. Combined, these mean $600,000 per year.

SHUTDOWNS of many New England industrial plants are threatened by the curtailment of coal supply, aggravated by further "outlaw" strikes of switchmen at important railroad yards in the East

A MOVEMENT to bring about closer co-operation among the New England States in water-power development is being discussed in legislative circles in Massachusetts, the coal shortage giving a sharper point than hitherto to arguments in favor of storage development and energy interchange.

TEN YEARS preceding 1920 were declared a fair period for utility valuation and cost averaging by the Vermont Public Service Commission in a decision sustaining the power rates of the Montpelier & Barre Light & Power Company.

A FIVE-MILLION-DOLLAR power plant on the Coosa River, near Gadsden, Ala., will, it is asserted, be under way before Aug. 1, as a result of the signing of the water-power bill. The Alabama Power Company is to build it.

AN ORDER from the Georgia Railroad Commission is being sought by the Atlanta City Council to compel the Georgia Railway & Power Company to make 200-ft. extensions of its wires free, as required by its franchise. Lack of funds is given by the president of the company as its reason for not doing so.

CLOSER attention to analyses of rainfall records in the operation of combined water-power and steam plants was urged at the Utica (N. Y.) convention of the Empire State Gas & Electric Association.

A COMPREHENSIVE program has been arranged for the meeting of the Ohio Electric Light Association at Cedar Point, Ohio, on July 13 to 15.

IT IS EXPECTED that the revised edition of the National Electrical Safety Code will be issued by the Bureau of Standards late in the summer.

WILLIAM S. MURRAY has been designated by the director of the Geological Survey as chairman of the engineering staff which will conduct the preliminary survey of the Boston-Washington super-power plan. The personnel of the engineering staff and of the advisory committee will be selected within the next few days.

ADDITIONAL applications for permits under the water-power act are being filed each day. President Wilson has designated the Secretary of War as chairman of the Federal Power Commission.

JUNE showed a total issue in bonds, stock and notes of electric public utilities of $22,903,000—the lowest monthly figure since February. This makes the total securities floated for the first six months of 1920 reach $172,501,440, of which $29,896,440 is in stock and $142,605,000 in notes and bonds.

MEETING at White Sulphur Springs, W. Va., the annual convention of the A. I. E. E. opened on Tuesday with more than 200 delegates in attendance. The technical and entertainment features of the program were carried through with success.

ASSERTING that the rates of the Puget Sound International Railway & Power Company are unreasonable, the Public Service Commission of Washington has ordered a reduction to a figure at which earnings will be 8 per cent on the total valuation.

APPLICATIONS to the California Water Commission for permission to extend hydro-electric resources include one from the city of Los Angeles, which asks for 1,400 second-feet from the San Joaquin River, and one from H. L. Jackman asking for 9,000 second-feet from the Klamath River.

A SOMEWHAT brighter outlook for coal supply is reported, though danger of a grave shortage is not over. The Interstate Commerce Commission and railroad executives are working to relieve the situation.

A STATEMENT dwelling on the brighter outlook for public utility securities that it feels to prevail has been issued by the National City Company of New York

PROGRESS in standardization was achieved by the Associated Manufacturers of Electrical Supplies, in session at New London, Conn.

A LIBERAL policy toward agricultural users of electrical energy was advocated by the Iowa Section, N. E. L. A., convention held at Colfax.

SIX HUNDRED members and visitors of the A. I. and S. E. E. inspected the 50,000-hp. electrical installation of the Trumbull Steel Company at Warren, Ohio.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Coal Situation Looking Brighter

ALREADY the result of the order of the Interstate Commerce Commission relative to Eastern shipments of coal in open-top cars is being felt. Where a week ago the situation looked very dark it is now more reassuring. The coal shortage, however, is still real.

Public utilities outside of New England are protesting against the Interstate Commerce Commission's order giving preference and priority to coal shipments to New England. Representatives of New York, New Jersey and Philadelphia utilities have been in consultation with railroad officials, who have assured them that every effort would be made to relieve the situation. Nothing can be done yet, however, to build up storage.

New York utilities have decided to stand together, and where one utility is short of coal the others that are more fortunate will lend it the required fuel.

Other Eastern utilities are feeling the pinch. The Potomac Electric Power Company of Washington, D. C., last week had a six days' reserve on hand and at that time was receiving much less than was required daily. Massachusetts utilities and those of New England generally are complaining of the shortage. Reports received by the Geological Survey from thirty-three out of thirty-four electric utilities in New England show an average weekly consumption during the year of 34,225 tons. On May 31 these utilities had 199,830 tons on hand, or enough for five weeks and six days.

The Michigan coal situation, while still acute, according to reports is gradually getting better.

Very high prices are being charged for coal in the open market. Many utilities find that their coal contracts expired this week, or July 1. Much higher prices in these cases must be paid for contract coal. The prices being charged for coal are receiving consideration by the Department of Justice.

Quotations of $10 and $11 on the Eastern seaboard for bituminous coal are quite common.

Six Hundred Engineers Inspect 50,000 Hp. Steel Mill Installation

THE great responsibility of electrical engineers in industry and the appreciation of their importance by the management of the companies concerned was manifested in a striking manner at the joint meeting of the Pittsburgh and Cleveland district sections of the Association of Iron and Steel Electrical Engineers last Saturday. Before noon about 600 members and visitors assembled at the works of the Trumbull Steel Company, Warren, Ohio, to inspect the company's 50,000-hp. electrical installation and to hear some of the salient features described in a paper presented that evening.

The engineers were guests of the Trumbull Steel Company from the time they arrived until the end.

W. M. McFate, vice-president of the Trumbull Steel Company, addressing the banqueters, expressed the gratification of the company at the interest displayed in its equipment and methods. A technical description of the company's strip-mill motor installation, with its Scherbius system of control, was given by A. W. Mohrman, electrical superintendent of the company.

Supply Manufacturers Meet to Further Standards

WORKING always toward a greater degree of standardization in the manufacture of electrical supplies, the various sections of the Associated Manufacturers of Electrical Supplies met individually at the Hotel Griswold at Eastern Point, New London, Conn., on June 28, 29 and 30. Considerable progress was made in the important session which the general standards committee held. Of special interest is the closer co-operation of the manufacturer of electrical supplies and the central station.

The only open meeting was on Monday evening, when Judge T. M. Debevoise spoke strongly on the benefits derived from the social as well as the business gatherings of the association, both of which fostered that spirit of co-operation so necessary to the organization. William Burgess outlined briefly the work of the International Trade Committee from its inception to the present time and indicated the extent to which German and Japanese electrical goods were being imported.

Secretary of War to Be Chairman of Water Power Commission

THE Secretary of War has been designated by the President as chairman of the Federal Power Commission. The actual selection of the executive secretary and the engineer officer of the commission will await the return of the Secretary of Agriculture to Washington. The Secretary of the Interior is en route to Alaska, but it is understood that no action with respect to the Water Power Commission will be delayed as a result.

Each day is seeing the filing of additional applications under the act. There will be a mass of work awaiting the executive secretary of the commission as soon as he is designated. The plans put forward by each of the applicants must be reviewed, to say nothing of preparing to start studies of various projects at the earliest possible moment. One of the first matters which must be taken up is the settlement of the Niagara situation. The authority to divert water expired with the passage of the act. Several important problems on the St. Lawrence River must have early consideration.

It has developed that Senator Jones gave Secretary Payne his written promise to do all in his power, as chairman of the committee on commerce, to obtain the repeal of that section of the act which allows the use of any lands within the boundaries of a national park

in connection with any water-power project. It develops that Senator Jones and Secretary Payne were in conference for the greater portion of a day discussing the provisions of the bill which had caused Secretary Payne to make an unfavorable report to the President. Secretary Payne withdrew his objection only when Senator Jones promised to exert himself in the manner mentioned. The probable effect of an amendment such as will be proposed by Senator Jones will be the adoption of new boundaries for national parks at points where it is desirable to utilize the area for power purposes.

Boston Edison Reduces Rates and Increases Wages

INCREASING revenue due to the growth of business has led the Edison Electric Illuminating Company of Boston voluntarily to announce a general 10 per cent raise in salaries and wages, effective July 1, and a reduction of half the 10 per cent surcharge lately imposed on retail customers' bills. Every employee in the company's service benefits by the wage advance, which will increase the expenses of the system by about $300,000 a year. Within the past two years the total salary increase has amounted in representative cases to more than 50 per cent. President C. L. Edgar informed a representative of the ELECTRICAL WORLD that the reduction of the surcharge to 5 per cent of the bill would also cost the company about $300,000 a year. The average increase per employee will be about $130 per year.

Only retail customers of the company will be affected by the reduction in surcharge, while the maximum rate remains at 10 cents per kilowatt-hour. The company's business is running about 25 per cent above last year's, and it is accumulating a surplus. In the last fiscal year the company supplied energy to 110,320 customers using lighting service, and its revenue from commercial lighting was $7,210,595, and its output sold for this purpose was 90,222,448 kw.-hr.

Analysis of Rainfall Records Emphasized at Empire State Meeting

CLOSER attention to analyses of rainfall records and to accurate checks on the available storage is of greatest importance to the efficient operation of a combined water-power and steam-power system. This was very forcefully brought out in the discussions of the subject at the meeting of the electric production and distribution sections of the Empire State Gas and Electric Association at Utica on June 23 and 24.

It was pointed out by R. C. Reynolds of the Empire Gas & Electric Company that the 40 per cent factor used in computing run-off is apt to be misleading. W. J. Fox, Fort Plain Gas, Light, Heat & Power Company, said that an analysis of rainfall records in that particular section of the state covering a period of forty years shows that there is a definite cycle of precipitation closing on itself every ten years. A graphic recording instrument to keep a continuous check on the elevation of the storage pond had been found by B. E. Phile of the Utica Gas & Electric Company to be very valuable.

Load dispatching was another subject that met with considerable discussion, E. P. Perk, Utica Gas & Electric Company, pointing out that the ideal load dispatcher should know his equipment, what its capabilities are during the particular operating conditions, transformers, lines, voltage drops, load-carrying efficiency of lines, substations, steam plants, distribution lines, water conditions, how much load to carry on each unit, in case of rain to be able to calculate in advance the use which will be made of the water and many such factors. That hydro-electric plant equipment will be subject to considerable development was shown by Mr. Voetsch of the Utica Gas & Electric Company in a paper on that subject. The possibility of the use of two runners on one shaft to increase speed characteristics is one possible development.

The selection of oil circuit breakers, said H. A. Travers, Westinghouse Electric & Manufacturing Company, depends on the characteristics of the breaker and of the system the circuit is to be used on.

Systematic line inspection was a topic that evoked a considerable discussion at the Thursday morning session. All companies reported on the methods in use, and it was the consensus of opinion that periodical inspection of poles in use on low-voltage power lines was more desirable. Continuous or at least weekly patrolling of high-tension lines was likewise important.

The members made an inspection trip to the Trenton Falls plant of the Utica Gas & Electric Company on Wednesday afternoon, June 23. On Thursday afternoon J. A. Vahey of the Boston Edison Company gave a demonstration of the Lundin fault locater.

Electric Light and Power Financing During First Half of Year

JUNE, with a total of $22,903,000—the lowest since February—brings the total amount of financing by electric public utilities during the first six months of 1920 up to $172,501,440. Of this total $29,896,440 is in stock, and the balance of $142,,605,000 is in notes and bonds. A survey of these issues as they have appeared each month in the ELECTRICAL WORLD shows that the companies represented have had to pay well for the use of the money. That the interest rate and the percentage yield is still on an upward trend is also evident. Yields of a little over 7 in the first few months of the year have been followed by from 7½ to 8 per cent, until in June we find five bond issues offered at prices that net the investor from 7.64 to 8.12 per cent. Of the June total $6,103,000 is in preferred stock of the United Gas Improvement Company at 7 per cent, while two bond issues of $5,000,000 each, one in five-year notes of the Commonwealth Edison Company, the other fifteen-year first mortgage bonds of the Cleveland Electric Illuminating Company, form a large part of the balance. The details of the June issues follows:

Company	Amount of Issue	Period	Class of Security	Rate of Interest	Per Cent Yield	Offered at
Commonwealth Edison Co	$5,000,000	Five year	Collateral gold notes	7	7.82	97
Cleveland Electric Illuminating Co	5,000,000	Fifteen-year	First mortgage bonds	7	7.64	95½
Duke Power Co	2,000,000	Ten-year	First lien and general mortgage	8	[illegible]	100
Stevenson Water & Power Co	4,000,000	Six year	Secured convertible gold notes	7½	8.08	97
El Paso Electric Co	800,000	Five year	Gold notes	7	8.12	96
United Gas Improvement Co	6,103,000		Cumulative preferred stock	7	7	50
	$22,903,000					

White Sulphur Springs Convention of A. I. E. E.

President Townley Speaks on Labor Conditions—Discussions on Generator Ventilation, Protective Devices and Other Technical Topics

OPPORTUNITY both to relax from the pressure of business and to exchange ideas on some important engineering questions of today was afforded at the thirty-sixth annual convention of the American Institute of Electrical Engineers, held this week at West Virginia's most attractive mountain resort, White Sulphur Springs. This was made possible by holding business sessions only during the forenoon of each day and devoting the afternoons to entertainment of various sorts. The convention, which met at the Greenbrier on Tuesday, with more than 200 delegates attending, was opened with an address by President Calvert Townley on "An Engineering Analysis of the Labor Problem" and the introduction of President-elect Arthur W. Berresford, who responded by pointing out the great responsibilities of the office and voiced the hope that the Institute might prosper during the new year.

The remainder of the first day's sessions was devoted to the annual reports of the technical committees, which marked a departure from custom this year by summarizing the features of the past twelve months' engineering developments. Abstracts of these reports are presented on pages 19 and 20.

On Wednesday morning nine technical papers were presented—five under the auspices of the electric machinery committee, B. A. Behrend chairman, dealing principally with large generator failures and generator ventilation, and four on miscellaneous subjects.

After the technical committee reports there was a discussion on the relation of the A. I. E. E. to the Association of Iron and Steel Electrical Engineers, the Institute of Radio Engineers and other allied societies. Prof. D. C. Jackson contended that the A. I. E. E. should deal chiefly with the scientific aspects of electrical engineering, leaving commercial problems to specialized societies. It appeared to be the consensus of opinion that the A. I. E. E. should act as a clearing house for all electrical societies and deal with the problems of all the electrical industries co-operating with allied societies.

Wednesday evening there was a conference of section delegates and officers. Thursday morning a most interesting session was held under the auspices of the protective devices committee, D. W. Roper chairman, at which the protection of large generating stations operating in parallel was discussed. Two of the most important papers at this session—those by R. F. Schuchardt and Dr. C. P. Steinmetz—are presented quite fully on pages 5 to 8. Electric welding and power factors were the subjects of the only evening business session Thursday, at which nineteen papers were presented. The last technical session was held Friday morning under the auspices of the power-station committee, Philip Torchio chairman, and was devoted to the consideration of which system of excitation has the greater advantages—the common bus or individual exciter.

Entertainment constituted no small part of the convention, afternoon teas being provided for the ladies each day, a piano recital by Prof. Vladimir Karapetoff, and automobile rides.

PRESIDENT'S ADDRESS

Calvert Townley, the retiring president, in addressing the convention, spoke on the relations between employers and employees. He declared that the strategic position formerly held by capital in its time-honored barter with labor had shifted until now labor had the upper hand and was itself becoming the oppressor rather than the oppressed, and he traced briefly the causes for this change of relationship springing from the war, the cessation of immigration and the coincident slackening of endeavor. He censored the labor unions because in their contracts with employers they provided no means by which the workmen could be penalized for violation except by the unions themselves. He held also that union workmen were making a great mistake in attributing their present-day success to their organization and failing to appreciate the part played by the law of supply and demand.

In conclusion Mr. Townley paid his respects to the profiteers, whose exorbitant charges he held to be a factor combining with abnormal wages to cause the prevailing era of high prices. He looked for this era to pass without bringing any material change in either the social order or the industrial structure of the nation.



GREENBRIER HOTEL, WHITE SULPHUR SPRINGS, WEST VIRGINIA

Alabama Power to Build 100,000-Hp. Hydro Plant

AS A RESULT of President Wilson's signing of the water-power bill the Alabama Power Company is planning to begin the construction of its five-million-dollar power plant at what is known as Duncan's Rifle, on the Coosa River, near Gadsden, Ala., some time before Aug. 1. The project was surveyed by the engineers some time ago. The dam across the river will be 72 ft. (22 m.) in height and develop between 90,000 hp. and 105,000 hp.

Broad and Liberal Policy Recommended in Education of Farm Users

"VALUATION and Rate of Return," "The Determination of Electric Service Rates" and farm-line committee report were discussed as closely related subjects by an enthusiastic gathering at the nineteenth annual convention of the Iowa Section of the National Electric Light Association at Colfax, Iowa, June 23, 24 and 25. The serious situation in rural distribution from the entire rate standpoint was clearly illustrated by the statement of Arthur Huntington of Cedar Rapids, who on applying the rates of eight leading Iowa and Nebraska cities to a 20-hp. motor operating at 6, 12½, 35 and 70 per cent load factor showed minimum charges ranging from nothing to $45 per month and energy charges from $26 to $60, $40 to $73, $80 to $160 and $137 to $295 per month for the four load factors. In four cities the same charge for a 20-hp. motor operating at 70 per cent load factor and a 100-hp. motor operating at 14 per cent load factor was found in face of the fact that the equipment investment for the larger motor is several times that for the smaller motor.

A broad and liberal policy of advice and help to the farmer in the purchase of his equipment and the use of the best of materials, substantial construction, safety-first equipment and the grounding of neutrals was held by the committee to be necessary. Care and patience in educating the farmer in the common technical details and the keeping of transformer sizes to the minimum to lessen losses are important items for consideration. Fly-by-night contractors are creating a serious situation because of the flimsiness of the lines they build.

The tendency in Iowa at the moment is toward the formation of rural utilities, but in the sample forms of contracts submitted provision was made for the public utility to have first opportunity of acquiring the rural lines in case of sale. The discussion developed a strong sentiment against the formation of such companies. The financing of construction, it was unanimously agreed, must be done by the farmers. In two forms of contract suggested a three-part rate was presented. While sentiment was divided, a strong feeling that the lines must be under control of the utility furnishing service was manifested, as was also a very strong sentiment for the fixed charge or "readiness-to-serve" rates.

Pointing out that a complete valuation should contain at least the cost of developing, value of physical property, miscellaneous construction expenses (overhead items), going-concern value and working capital, B. J. Denman cited court decisions supporting the contention that these are proper items.

That the time has arrived when some uniform method of determining rates must be devised was urged by W. J. Greene in presenting "The Determination of Electric Service Rates." The necessity for the multiplicity of rates shown in the National Electric Association rate book was questioned. A form of rate consisting of a primary rate sufficient to cover the consumer and demand charges when applied to a predetermined number of kilowatt-hours for a given class of consumers and an excess rate for all energy in excess of that charged at the primary rate was advocated. A minimum charge would be a part of the rate. In the discussion issue was taken with the form of rate suggested and a decided preference for a "readiness-to-serve" form of rate was indicated. It was found that minimum charges and high energy rates tend to encourage consumers to use only the minimum amount of energy.

E. V. Graham outlined methods of placing utility securities among customers. Sutherland Dows described the plan of the Iowa Railway & Light Company.

The new officers elected for the section are: President, F. J. Hanlon, Mason City; vice-president, C. N. Chubb, Davenport; second vice-president, Sutherland Dows, Cedar Rapids; secretary-treasurer, M. G. Linn, Des Moines; executive committee, C. H. Stimonds, Dubuque; David Daly, Keokuk; F. H. Brooks, Omaha, Neb.; Clarence Macy, Adel; A. W. Jones, Paterson; J. M.



DELEGATES ATTENDING THE NINETEENTH ANNUAL CONVENTION OF THE

Drabelle, Cedar Rapids; Austin Burt, Waterloo; Don Sterns, Humboldt; Paul P. Myers, Grinnell; H. Bellamy, Knoxville, and David G. Fisher, Davenport.

Thursday evening was devoted to the annual banquet, at which an address was made by M. H. Aylesworth, executive manager of the National Electric Light Association.

Holyoke Municipal Plant Adds Lighting Service Charge

A SERVICE of 50 cents per month per meter will be levied upon gas and electric consumers by the municipal lighting department at Holyoke, Mass., beginning July 1. John J. Kirkpatrick, manager, states that increased costs of operation necessitate this charge and that without it substantial advances in the meter rates would be necessary. About 10,000 electric meters are affected.

Washington Commission Orders Power Company to Reduce Rates

THE Public Service Commission of Washington has ordered the Puget Sound International Railway & Power Company to reduce its rates on electricity sold for power and lighting purposes so that the company will be earning 8 per cent on the valuation of its properties instead of making 43.6 per cent on its power rate and 11.61 per cent on its lighting rate as at present. The company has challenged the jurisdiction of the commission over electricity sold for power purposes, claiming that a Supreme Court decision in a former case held that the sale of surplus power should not be considered a public use subject to commission regulation.

The Puget Sound International Railway & Power Company operates in and around Everett, Wash., and in handing in its ruling the commission stated that it found the rates as existing at present unreasonable and more than sufficient. The commission directed the company to file within ten days a reduced schedule of rates applying to all light and power service which will yield 8 per cent upon the valuation fixed by the commission for the light and power systems singly and combined as of Dec. 31, 1918, with net additions and betterments up to June 1, 1920.

The company is also directed to file with the commission within twenty days copies of all contracts with light and power users that are in conflict with the new schedule of rates to be fixed pursuant to the reduction order. The city of Everett is also directed to file certified copies of franchises and contracts with the company.

Vermont Valuation Based on Ten-Year Average Price

INCREASED power rates established by the Montpelier & Barre (Vt.) Light & Power Company, as a result of higher costs of operation, have been approved by the Vermont Public Service Commission in an exhaustive decision recently issued. The case is one of the most important in the history of the commission and has been followed with great interest in view of the emphasis laid by both sides upon the determination of the rate base. The company is operated by Charles H. Tenney & Company, Boston. Carver, Macomber & West, Boston, engineers, and Sanderson & Porter, New York, made a valuation of the property for the company.

The new rates are 0.5 per cent kilowatt-hour in excess of those in force in June, 1918, which were about 10 per cent in excess of the rates previously in effect. The commission holds that 7 per cent upon the present value of the property devoted to public service is a fair rate of return in this case and fixes the rate base at $3,300,000. It points out that capital for hydro-electric development in Vermont must be sought outside the state and that the rate of return must be sufficient to attract such capital. Included in the system are eight hydro-electric plants, eleven substations, 91.67 miles of transmission lines, a distribution system with 5,201 services, 1,150 transformers and 918 street lamps.

In this case available original costs were shown to represent only a small portion of the company's property. Neither reproduction cost on present-day units nor upon pre-war prices was regarded as equitable in fixing the rate base; instead, the board holds that a valuation based upon average prices for a ten-year period ended Dec. 31, 1919, gives as fair results as can be arrived at. An allowance of 15 per cent on overhead construction costs, including land values, is held fair as an overhead charge. An allowance of $150,000 was authorized for working capital.



IOWA SECTION N. E. L. A. AT COLFAX, IOWA, JUNE 23, 24 AND 25

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Northwest Interconnection. — The Portland Railway, Light & Power Company has started work on the construction of a 60,000-volt line from the present terminus of the transmission line at the River Mill plant to the plant at Willamette Falls, near Oregon City. A feature of this new line will be a 500-ft. span on steel towers over the Willamette River. The rest of the line is to be wood-pole construction with pin-type insulators.

Virginian Power Company Asks Further Increase.—Application to the Public Service Commission of West Virginia for an increase of 55 per cent on its rates as of September, 1919, has been made by the Virginian Power Company of Charleston, whose power plant is at Cabin Creek Junction. In the month named this company received permission to raise its rates 40 per cent, but it claims that this increase has proved inadequate.

"Electrical Home" Meets Popular Approval.—The "electrical home" recently opened by the San Francisco Electrical Development League and the Mason-McDuffie Company in San Francisco was visited by more than 2,000 people in the first three days. This house, which is equipped with electrical appliances and is fully furnished, has been widely advertised and is proving of much service in showing the public the value of electrical outlets in private residences.

Philadelphia to Charge for Permits to Lay Conduits.—The Philadelphia Department of Public Works is drawing up a schedule of charges for permits to private concerns to lay conduits under city streets. The attitude taken by the administration is that the tearing up and use of streets for the installation of underground structures causes inconvenience to the public and that the city should be reimbursed for granting such privileges in cases where the advantage derived is purely a private one.

Electricity in Denmark.—There are 497 central stations in Denmark with a total output of 108,000,000 kw.-hr. a year, which it is thought could be increased to 450,000,000 kw.-hr. with cheaper energy. Hence the scheme of obtaining power from Norwegian waterfalls continues to attract serious attention. The distance from the nearest suitable falls to Copenhagen is about 75 miles, and it is proposed to transmit 26,000 kw. at 50,000 volts by an overhead line running through Sweden to Malmo and thence by submarine cable across the sound to the Danish capital. The engineering difficulties could be easily overcome, the chief obstacle being that of obtaining a good load factor.

Economy of Electric Operation of Mines.—In a paper read before the Yorkshire (England) branch of the Association of Mining Electrical Engineers, J. R. Haigh, a colliery engineer, asserted that by the application of electricity to a colliery nearly $1,000 a week had been saved in boiler consumption alone. The coal mines of the future, he declared, would be laid out for complete electrical operation, direct steam power and animal traction being dispensed with.

Hydro-Electricity in British India.—A project for hydro-electric development is under way in Bombay, India, which involves damming the Nila and Mula Rivers at their junction, thus taking advantage of a fall of 1,750 ft. A power station will be built at Bhira, 70 miles from the city of Bombay, whither energy will be conveyed over 100,000-volt transmission lines. The installation will have a total capacity of 150,000 hp., of which 75,000 hp. is to be developed in the first instance.

Pulverized Coal and "Colloidal" Fuel.—Trials of pulverized coal in the form both of dry dust and of colloidal fuel, or powdered coal suspended in thick oil, which have recently been made on an English railroad have a bearing on the efficiency of these fuels with stationary engines. The trials, which were made in comparison with ordinary coal, showed that the special fuels could easily maintain a full head of steam with a high degree of superheat even on heavy grades and sharp curves. Economy in the matter of cleaning and repairs and less waste of fuel during delays were also shown.

Electrical Development Under New British Act.—The first action taken by the electricity commissioners appointed under the new electricity supply act in Great Britain has been to determine provisionally a separate electricity area in the west of England to be known as the Lower Severn Electricity District. Its area, says the London *Engineer*, covers about 2,000 square miles, its extreme dimensions being roughly 75 miles north and south by 50 miles east and west. The cities of Bristol and Swindon will be included in this district. In marked contrast with its comparatively rural nature will be the area of about 2,500 square miles involved in a recently announced scheme for linking up the Northwest Midlands. That area takes in the Black Country and the industrial areas around Wolverhampton and Birmingham, but excludes the latter city. This plan, besides interconnecting existing systems, would erect for immediate purposes a 20,000-kw. station at Stoke-on-Trent, with two other stations to follow, and provide for future power requirements of from 200,000 kw. to 250,000 kw., as compared with existing capacity of 100,000 kw.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

A. I. E. E., Toronto Section.—Frank Ewart has been elected president and Perry A. Borden secretary of this section.

Madison Section, A. I. E. E.—The election of officers for the coming year at the last meeting of this section resulted as follows: Chairman, G. C. Neff; secretary, H. M. Crothers. F. R. Winders was elected as the third member of the executive committee.

A. I. E. E., Pacific Coast Sections.—A few changes in the program of the convention of the Pacific Coast sections of the Institute, to be held at Portland, Ore., July 21-24, as published on page 1019 of the Electrical World for May 1, have been made. On July 21 F. W. Peck will present a paper on "Electrical Characteristics of the Suspension Insulator at the Higher Voltages," the paper by D. M. Jones on "Power-Factor Correction on Distribution Systems" being transferred to July 23. "Bridge Methods for Alternating-Current Measurements" will be discussed by D. I. Cone on July 22. L. R. O'Neil will deal with "Use of Special Steels in Pressed-Steel Transmission-Line Fittings" on July 23.

St. Louis Electrical Board of Trade.—The first year's operation of the St. Louis Electrical Board of Trade virtually ended with the recent election of officers for the year beginning Sept. 1. The organization has increased its membership from 160 to 370. It was instrumental in preparing a bill making the city electrical inspection department self-supporting, and succeeded in keeping provisions obnoxious to contractors out of the ordinance. St. Louis manufacturers have been helped, and incidentally money has been saved to the city, by the action of the Board of Trade which resulted in a change in the cable specifications of the city whereby all manufacturers are able to bid instead of only one company. The officers elected for the ensuing year were: C. E. Michel, president; H. D. McBride, vice-president, and F. B. Adam, treasurer. Six members were elected to the executive committee: L. H. Egan, representing electric light and power companies; E. D. Smith, electric railways; J. S. Tritle, manufacturers; W. L. Rose, engineers and manufacturers' agents; A. C. Brandt, dealers, and F. D. Phillips, jobbers. Five members of the executive committee, representing consulting engineers, contractors, telephone and telegraph companies, railroads and research, hold over until next year.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Uniform Cash Deposits Inequitable.—The requirement of a cash deposit of $5 from every consumer is inequitable, in the opinion of the Montana Public Service Commission. The utility should conform to the rule that the deposit shall equal but not exceed one and one-half times the average monthly bill of the consumer, it having the power to discontinue service on the fifteenth day of the month following the month of service if payment has not been made.

Objections to Variable Rates.—In granting to subsidiary companies of the Missouri Public Utilities Company the right to add a surcharge of 20 per cent to their pre-war rates, the Missouri Public Service Commission criticised a proposed variable-rate schedule on the ground that to change the rates from a basic figure as the cost of fuel, labor and taxes vary may cause a greater change in the rates than the change in the cost of furnishing the service, because the cost of service is made up of items other than those included under fuel, labor and taxes, and a variable rate does not permit of definite knowledge of the charge at which service is being furnished.

Advisability of Limited-Hour Service for Small Utility.—In granting an increase of rates to the city plant of Culbertson, Mont., the Montana Public Service Commission, while refraining from interference with the project of the manager to establish remunerative twenty-four-hour service, he being willing to bear the loss of a fair return on his investment in order to make the attempt, pointed out that were the service reduced to ten hours a day, with special arrangements to meet the requirements of housewives on Mondays and Tuesdays, a material reduction in operating expenses would be obtained with only slight reduction in revenues. The practice of furnishing free energy to the manager's residence the commission declared illegal, and its discontinuance was ordered.

Special Rates to Schools Discriminatory.—Special rates for electric service to a municipal school district are not justified on the ground that it is a public corporation supported by taxation, according to a decision of the Missouri Public Service Commission in a complaint of the school district of St. Joseph against the electric utility supplying that city. The status of a school district is the same as that of private consumers; nor may the cumulative consumption of all its schools be held to bring it under the lesser rate chargeable against large consumers, because the cost of each service is virtually the same as the cost of furnishing individual customers. A school district can qualify as an off-peak consumer only where it receives its service during off-peak hours entirely.

Standard Frequency Rule in New Hampshire.—Five per cent variation above or below the standard frequency has been specified by the New Hampshire Public Service Commission as the normal limit of fluctuation to be permitted by public utilities, but momentary variations in excess of the foregoing are permitted by the commission when these are clearly due to no lack of proper equipment or reasonable care.

Preserving Proper Margin Between Revenue and Outgo.—The Arizona Corporation Commission has ordered an increase in the rates of the Desert Power & Water Company, although it appeared that the company had during its existence earned more than $53,000 in excess of its depreciation requirements, operating expenses and a 10 per cent return upon the value of the property as accepted by the commission. The increase was granted because of the increase in operating expenses, which, in the commission's opinion, prevented there being at the present time a satisfactory margin between the total revenues and such operating expenses.

Inequity of a City Tax on Utility Revenues.—In passing upon an application by the Eastern Oregon Light & Power Company for a new schedule, the Oregon Public Service Commission took occasion to condemn the action of the city of Baker, which is served by the company, in imposing upon it a franchise tax amounting to 3 per cent of the gross revenue of the utility within that city. This action, the commission said, by making operating expenses in Baker higher than those in other places served by the company, threw an unjust burden on the other communities, and to remove the discrimination it would be necessary either that the franchise tax be abolished or that the Baker rates be increased sufficiently to compensate the company for the extra cost.

Idaho Power Company Gets Increase in Oregon.—Following the lead of the Public Utilities Commission of Idaho (see ELECTRICAL WORLD, June 19, page 1444), and as a result of joint hearings held with that commission, the Public Service Commission of Oregon has granted to the Idaho Power Company an increase of 10 per cent on lighting and power rates and of 20 and 25 per cent on new irrigation pumping contracts in the State of Oregon. These increases constitute an emergency order and are to remain in effect for one year pending a valuation of the company's property. The commission declares that it grants them in recognition of the fact that the revenues of the company are so low that under existing rates it cannot raise the funds for necessary additions to take care of increasing demand.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Action by Commission a Prerequisite to Raising Contract Rates.—In an action brought by the village of Freeport, N. Y., against the local gas company, the Supreme Court of the state has declared that the public service commissions law does not authorize a public utility company having a contract with a municipality to increase its rates by filing a schedule without action by the commission. (181 N. Y. S. 830.)

Commission's Rate-Fixing Powers—Equal Protection—Franchises Not Property.—According to a decision of the Appellate Division of the New York Supreme Court, in Bronx Gas & Electric Company vs. Public Service Commission, First District, when a rate fixed by statute has been held invalid as confiscatory, a provision of the statute creating the commission that it shall not fix rates exceeding those fixed by law is abrogated and the powers delegated to the commission to deal with cases where no statutory provision exists come into effect. The law is not unconstitutional as denying equal protection merely because the Legislature has fixed rates in one locality while delegating to the commission the power to fix rates in other localities, the commission finds; and it also asserts that franchises from the state are not property devoted to the public use upon the value of which the utility is entitled to a return. (180 N. Y. S. 38.)

Franchise Rights, Consent of Municipal Authorities and Right to Injunction.—In the case of Holland Realty & Power Company vs. City of St. Louis, the Supreme Court of Missouri found that the ownership of fee in an alley and of franchises from the state did not permit a corporation to lay wires without the consent of the municipal authorities, which by law meant the consent of the legislative authorities acting by ordinance and could not be granted by administrative officers. A mandatory injunction at instance of a city to require an electric company to remove wires placed under an alley may, however, be properly denied as restraining violation of a technical right from which no damage would ensue and operating oppressively. The Supreme Court therefore reversed the action of the court below in granting an injunction to the Holland company which prevented the city from interfering in any way with the company's wires, but sustained the lower court in refusing to grant the counter-injunction asked for by the city to force the company to remove its own wires. (221 S. W. 51.)

Men of the Industry

Changes in Personnel and Position—Biographical Notes

Wiley F. Corl of St. Louis, Mo., has severed his relations with the Southern Illinois Light & Power Company, of which he was vice-president in charge of operation, and purchased a one-third interest in the Mexico (Mo.) Power Company, of which he is now general manager and secretary. For about two years after graduating from the University of Missouri in 1908 in electrical engineering Mr. Corl held minor positions with the Joplin & Pittsburgh (Kan.) Railroad Company and with the Empire District Electric Company of Joplin, Mo. During the next four years he was engaged in design, construction, appraisal and report work for the Arnold Company, consulting engineers of Chicago. Then he became electrical engineer of the Allen & Garcia Company,



W. F. CORL

consulting engineers of Chicago, where he specialized on coal-mine electrical problems. Through this work he became acquainted with J. J. Frey of Hillsboro, Ill., president of the Southern Illinois Light & Power Company, whom he joined in an undertaking to supply coal mines with central-station service. While with the Southern Illinois company Mr. Corl had charge of all operating and construction work in connection with the electric, gas, water, steam-heating and ice plants from which some sixty-five different communities in southern Illinois were finally served. Mr. Corl was chairman of the transmission and distribution committee of the Illinois State Electric Association and is well known as one of the first in the state to recommend small companies to expand by building extensive high-tension lines and outdoor substations.

John I. Beggs, who has been re-elected president of the Milwaukee Electric Railway & Light Company after a lapse of nine years, is essentially a financier. Mr. Beggs was in the insurance business in Harrisburg, Pa., when in 1883 he organized, installed and operated the Harrisburg Electric Light Company, which was among the first of the Edison licensee companies. The results obtained at Harrisburg attracted attention and 1886 he was called to take the post of vice-president and general manager of the Edison Electric Illuminating Company of New York, which, though small compared with the central stations of today, was then the largest in the world. Operating problems continued to occupy all of Mr. Beggs' attention until 1890, when, upon the formation of the Edison General Electric Company, he was appointed manager of the central district with headquarters in Chicago. It was while in this position that Mr. Beggs helped to build the Milwaukee traction lines, which he later operated at a profit after others had considered this an impossibility. After a period of three years in Chicago he returned to New York, this time with the General Electric Company, retiring a few months later. Before he had a chance to indulge in much rest or traveling he was prevailed upon in November, 1893, to go to the assistance of the Cincinnati (Ohio) Edison Company, which was suffering severely on account of competition from the gas company and had defaulted on a contract. Some months after the Milwaukee Electric Railway & Light Company went into bankruptcy and he agreed to act in an advisory capacity for that company also. In February, 1896, it was returned to its stockholders, but by September Mr. Beggs was again called into consultation. This time he was elected president and general manager of the company and for the next ten years the property increased its earnings 10 per cent each year compared with the earnings of the previous year. In about 1902 the North American Company became interested in St. Louis public utilities and for a number of years Mr. Beggs was directing its Cincinnati, Milwaukee and St. Louis properties. In 1909 Mr. Beggs again gradually retired from active management in North American properties only to be recalled as president of the Milwaukee Electric Railway & Light Company, on the resignation of J. D. Mortimer a few months ago. As Mr. Beggs became less active in the North American properties he became more interested in other properties in Wisconsin. He has directed the operation of the Wisconsin Traction, Light, Heat & Power Company since about 1897 and in 1915 he acquired control of the Southern Wisconsin Power Company, with a hydro-electric development at Kilbourn, and the Wisconsin River Power Company, with a water-power plant at Prairie du Sac. In connection with the two latter companies the Wisconsin Power, Light & Heat Company was organized to create a market for the energy generated. The controlling interest in the two hydro-electric companies and in the distributing organization was sold within the past few years to the Insull interests, but Mr. Beggs is still a director.

T. D. Crocker, the re-elected president of the North Central Division of the National Electric Light Association, is assistant vice-president of the Northern States Power Company in Minneapolis in charge of operation. When the new geographic section organization was launched Mr. Crocker was selected to head the section representing the Dakotas and Minnesota, and his broad-minded view and grasp of public utility problems has been a large factor in the successful launching of the work of this division of the national association and the recent enthusiastic



T. D. CROCKER

convention at Minneapolis. Mr. Crocker was born in Elyria, Ohio, Oct. 8, 1878. For two years prior to going to the State University of Ohio he was with the Lincoln Electric Company, Cleveland. Upon graduation in 1904 as an electrical engineer he became connected with the Milwaukee (Wis.) Electric Railway & Light Company. In 1912 he entered the employ of the Northern States Power Company, with which company he has been associated ever since.

Obituary

Arthur C. Walworth, formerly mechanical engineer of the Walworth Manufacturing Company and later president of the Walworth, English & Flett Construction Company, houses widely known in the engineering field, died at Newton Center, Mass., June 23, at the age of seventy-six. He was a native of Boston and was educated at Yale.

E. S. Fletcher, assistant general manager of the Texas Power & Light Company, Dallas, Tex., died June 9 following an operation at Temple, Tex., his former home. Mr. Fletcher had been assistant general manager of the company for eight years and prior to that time was manager of the company's plant at Temple for a number of years.

Trade and Market Conditions

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies Notes on Industrial Activities and Business Methods

New Canadian Firm Will Manufacture Hydraulic Turbines

RATHER than import much of their machinery and other apparatus from the United States and Europe, as has been done in the past, power and paper manufacturing interests in Canada have organized the Dominion Engineering Works, Ltd., of Montreal, Que., which has entered into an agreement with the William Cramp & Sons Ship & Engine Building Company of Philadelphia for the exclusive use in Canada and the British Empire of the I. P. Morris designs for waterwheels and other hydraulic machinery. Through this association and the acquisition of the paper-machine business and equipment of the Dominion Engineering & Machinery Company at Lachine, Que., the Dominion Engineering Works expects to be in a position to supply most recent designs in such equipment and of any size to meet Canadian requirements. Other lines of manufacture will include hydraulic valves, governors and other accessories involved in hydraulic and paper-mill installations and centrifugal and other pumps.

Those who have organized the Dominion Engineering Works are interested in plants requiring large electric generating units, according to a statement made to a representative of the ELECTRICAL WORLD by J. E. Aldred, president of the Shawinigan Water & Power Company, who is also interested in the new concern, and for this reason later on may extend its operations to the manufacture of this type of apparatus.

The company has booked orders for waterwheels and paper-mill machinery which will keep it busy for the next year. Among the additional hydro-electric installations to be made by the various Canadian companies for which the Dominion company will manufacture hydraulic turbines, Mr. Aldred said, are two 30,000-hp. units at Shawinigan Falls for the Shawinigan Water & Power Company, two 20,000-hp. units at Grand Mère on the St. Maurice River for the Laurentide Company, Ltd., and two 15,000-hp. units at Cedar Rapids on the St. Lawrence River for the Montreal Light, Heat & Power Consolidated.

Producers Divided on Raising Schedule Material Lists

JUST over a year ago the Electrical Supply Jobbers' Association, in convention at Hot Springs, passed a resolution to the effect that it was of the opinion that manufacturers of schedule material should sufficiently increase their list prices to obviate the necessity of quoting "plus list." The jobbers, individually, felt that through the method of adding discounts to list prices considerable confusion was resulting in their accounting and clerical departments and many mistakes were being made.

During the past year the jobbers have had little satisfaction from any results attendant upon their resolution, and they are still of the opinion expressed at that convention. An attempt has been made recently to get an answer from the manufacturers on the point at issue. To date three manufacturers have raised their list prices on schedule material to obviate plus discounts. Among the others opinion is divided.

Of those who answered a questionnaire sent to them—and the percentage of replies was not large—there is a feeling that present prices are at a peak and that the occasion for raising lists soon will no longer exist. At this time there is visible no evidence of a drop in prices of this material. A permanent adjustment of the situation, it was stated in one case, would be unwise in order to take care of a temporary need. At the same time, it hardly seems that a permanent adjustment would necessarily be effected in the raising of list prices at this time.

From at least one quarter comes the realization of the necessity of increasing the list prices to avoid the present complication of selling goods at list plus, and it is probable that a revision in list prices will be made in this case in the early fall.

Good Demand for Motor-Driven Chain Blocks

GENERALLY speaking, shipments of electrically-driven chain blocks can be made from stocks which are in dealers' and distributers' hands throughout the country. Manufacturers are ordered up above their present production capacity but are able to make factory shipments in about five weeks. Stocks of raw materials are in fair shape, but stocks of motors are not so good. Considerable difficulty is still being experienced in getting enough motors, and this is the main feature lengthening shipments. At the same time, the motors are so standardized that few different styles have to be kept, and therefore greater ease of stocking is experienced.

Demand for chain blocks is good and is tending constantly to the use of motor-driven blocks. Prices have been holding rather steady during the last six weeks, but it would not be surprising to see an advance, because that is the direction any change would take, it is understood from the manufacturers.

Supply of Steel Products Affected by Labor and Traffic

STILL further adverse conditions are being met by the steel interests. Unless wage adjustments are made between the sheet and tin plate mills which operate under union conditions and the Amalgamated Association, which comprises the workers of those mills, a shutdown is liable to result in those properties. The last wage agreement expired June 30, and at this writing there is no assurance that a new agreement is in force or how soon one will be placed in force.

Of especial interest in this connection is the effect a shutdown of these mills will have on the steel output for the electrical trade. Outlet boxes are in very poor supply today and the immediate outlook is not too bright. Production has been at a low figure for the last few months, while the manufacturers have been forced to substitute any kind of sheet for boxes that they could get. This frequently meant punching from whole-sheet stock instead of from strip. Certain mills are unable to make any shipments at all on a hurry order. Shortage is also being felt in sheet stocks for switch boxes and cabinet boxes. Although shipments of rigid conduit are coming in, what amounts to virtual embargoes are being placed on steel shipments coming into certain Eastern states. The coal priority order just placed in force by the Interstate Commerce Commission is taking even the open cars which steel tube mills have been forced to resort to for shipments when box cars and cattle cars became scarce. Even the open-car shipments were unsatisfactory at best because of danger of loss from rain and theft. But they were better than no cars.

Flexible armored conductor is not so liable to be affected either by sheet-mill labor troubles or by coal priorities on cars. Embargoes in the East have been providing considerable embarrassment to shippers of steel strip, and this material, and frequently also the finished conductor, have been and still are being shipped by express and motor truck. Demand in the East is lessening a bit because of a slight falling off in building requiring this material, but in the Mid-West and West the demand is still high. If these conditions remain in this relation for a time, it would not be unreasonable to expect a larger flow of armored conductor to those sections where the need is greater and away from an easier market. This material is on about an 80 per cent production schedule at this time.

Conditions Uneven in Bare Copper Wire Market

MANUFACTURERS differ on conditions of the bare copper-wire market. On one side it is declared that demand is rather quiet with few orders for export coming in. Domestic demand, however, is fair with little heavy construction work being undertaken. On the other side of the question it is asserted that the volume of orders is large, while at the factory there is underproduction owing to a shortage of raw material and labor. It is stated that production could be increased 60 per cent if sufficient men could be obtained to establish a night force of workmen

Finer sizes of copper wire are especially hard to obtain, and shipments take longer than for the coarser material. Large sizes average six to eight weeks, while the smaller stuff runs from four to six months, which is about three times longer than is normal.

The market has held steady for the past three or four months with no prospect of fluctuation in sight, but if any change occurs the probability seems to point to its being upward. Bare copper wire is averaging about 22 cents base. Manufacturers report very few cancellations of orders, and collections are fair, most customers paying within the thirty-day or sixty-day time limit.

Metal Market Situation

TRADE in all metals is at a very low ebb at present, the natural condition of midsummer dullness being exaggerated by strikes, the railroad and financial situations, and general business uncertainty.

A quiet domestic copper market is featured by the greater interest shown by consumers in future deliveries. Producers are encouraged by an increase of queries within the past few days which would seem to indicate a more active market. Producers are still firmly holding at 19 cents either for nearby or future deliveries. Standard spot copper developed a stronger tone at London as compared with the past few days, but is still £2 below the figures for June 22.

The lead situation shows great steadiness, with either not much lead to be had or else supplies strongly held.

NEW YORK METAL MARKET PRICES

	June 22	June 29
Copper	£ s d	£ s d
London, standard spot	86 15 0	85 15 0
	Cents per Pound	Cents per Pound
Prime Lake	18 50	18 50
Electrolytic	19 00	19 00
Casting	17 62½	17 62½
Wire bars	22 50 23 00	22 50 23 00
Lead, trust price	8 00	8 00
Antimony	7 50	7 50
Nickel, ingot	43 00	43 00
Sheet zinc, f.o.b. smelter	12 50	12 50
Zinc, spot	7 90	7 95
Tin	50 50	49 00
Aluminum, 98 to 99 per cent	33 00	33 00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	15 00 to 15 50	15 00 to 15 55
Brass, heavy	9 00 to 10 00	9 00 to 10 00
Brass, light	7 00 to 7 25	7 00 to 7 25
Lead, heavy	7 00 to 7 25	7 00 to 7 25
Zinc, old scrap	4 75 to 5 25	5 00 to 5 25

THE WEEK
IN TRADE

ALTHOUGH building operations are slack in the Mid-Western and Puget Sound districts, considerable activity is noted in the South, in New England and in California, with resultant large sales of electrical material.

Optimism seems to be the keynote of the business situation in general. Grain crop prospects on the Pacific Coast are reported good, while in the South a large increase of new industries is noted. The coal situation in New England is bad, though electrical utilities are in a preferential class.

Sales of fans are dependent upon the weather, Southern stocks being largely depleted by a heavy demand, while cool weather in Northeastern territory has been keeping stocks on the shelves. In the East lessened demand is felt for household appliances, but in other districts trade is brisk, with small stocks the rule.

Continued difficulty is experienced in all sections with shipping and receiving goods. Few price changes of any importance are reported. Collections are only fair, with considerable supervision of credits being exercised.

NEW YORK

No let-up in demand is noted as compared with the past few weeks, the market presenting a steady tone. Better results are found in the receipt of shipments from factory, but outgoing deliveries from jobbers are pretty poor. General shipping, however, is far below that required to satisfy the trade. Good results are being wrought by the Citizens' Transportation Committee in the clearing of freight which had tied up pier space. Because of priority coal movement, it is understood that embargoes on steel goods are on in the New York district.

Some large building enterprises have just been announced in the hotel field in Manhattan. One 2,000-room addition to the Commodore and one 3,000-room hotel to replace the Murray Hill are planned as well as an office building to replace the Manhattan Hotel. Home building in the suburbs is spotty but it is continuing on a fair scale. A great deal of wiring, however, is under way.

Fans are moving rather slowly because of unreasonable weather, and stocks are building up for the hot spell. Pipe stocks are bad and outlet boxes are found only here and there. Heating appliances are coming through only slowly. Conduit fittings, as condulets, etc, are in good demand, and the supply apparently is quite adequate.

Rigid Conduit.—Jobbers report that none is to be had, with large back orders wiping out very irregular shipments. Orders are being turned down. Prices for ½-in. black range from $86 to $100 per 1,000 ft., and for 1-in. black from $168 to $198, according to size of order.

Flexible Armored Conductor.—Stocks are coming in a little better but are still spotty, some jobbers reporting fair amounts on hand but they do not last long. Demand is a little lighter from some quarters but in general is heavy. From $105 to $115 is quoted for No. 14, two-wire, per 1,000 ft.

Rubber-Covered Wire.—Demand is good, and stocks are plentiful except for some small sizes. Shipments are coming through pretty regularly, one distributer stating that he is able to fill a 200,000-ft. order from stock. Price for No. 14 averages $11.50 per 1,000 ft.

Fans.—Demand varies, some jobbers' sales not having started strongly as yet, while others report a rapid turnover. Stocks are spotty, one company having recently received a heavy shipment of fans, while others are out of 12-in. and 16-in. sizes, which are especially popular. Ceiling fans are scarce and are in strong demand.

Non-Metallic Flexible Conduit.—Demand is inconsistent and stocks are spotty. Shipments are generally slow, one jobber receiving 5,000 ft. recently, his first shipment in three or four months. Quotations for the ⅜-in. size average, $32, and for the ½ in. from $35 to $40 per 1,000 ft.

Outlet Boxes.—Stocks are in somewhat better shape than formerly, though shipments are only fair and average from six to twelve weeks. Demand is fairly good, and no price changes are reported.

Heating Appliances.—Trade is rather quiet because no shipments are being received, and stocks are in poor shape.

Fuses.—A good supply is on hand. Shipments are fair and demand varies, some jobbers selling more renewable fuses while others have their heaviest run on the non-renewable type. The 30-amp. size or under, of either type, is quoted at about 13 cents in lots of 100.

Conduit Fittings.—Stocks are plentiful, demand is good, and shipments are coming in well. This material has a very rapid turnover. The market has been steady.

Sockets.—Large supplies are on hand; while the demand is good, it has fallen off somewhat. The pull-chain type is still in most favor. Shipments are coming in better the past two weeks.

CHICAGO

A slight reduction in the gross amount of new business placed, firm prices and continued difficulty with the shipping and receiving of goods are features of the market in Chicago. Shrinkage of demand is felt mainly by those concerns dependent on the utility corporations for trade, and this is attributed solely to money stringency. Factories are sufficiently filled with orders to prevent this causing any worry, and they are not likely to do any price cutting so long as they continue busy at prevailing price levels.

Slow traffic is coming to be accepted as a matter of course. Dealers report that shipments formerly requiring from four to six days are now averaging thirty, and that the employment of "human tracers" is frequently necessary. The most trouble is experienced with shipments coming from New England points.

The local building industry remains quiet, and labor in general is reported in better supply.

Wire.—Local stocks are still very low. Shipments are moving from the factory with greater ease, but all receipts are at once applied on back orders. In general, insulated wires require eight to twelve weeks for delivery. Bare wire is available for prompt shipment.

Underground Cable.—With output booked up solid to almost the end of this year producers are not anxious for new business. Great difficulty is being experienced not only by factories in securing raw materials but in shipping finished work from the Eastern production points here. Recent metal market fluctuations have had no effect on prices.

Potheads and Underground Equipment.—Sales are limited only by the amount of goods factories can turn out. Porcelain shortage is complained of. Prices seem firm and no indications of an advance are seen.

Motors.—Local stocks show no improvement, but manufacturers report better conditions in raw-material supplies as well as a decided shrinkage in demand. Roth Brothers & Company are booking all orders requiring over ninety days for delivery on an open-price basis, with a guarantee that delivery price will not be more than 10 per cent above current quotations.

Lamps.—Lamp stocks continue to improve. A real decrease in the amount of new business in all classes of lamp sales is noted, and with supplies produced and transported at increasing speed conditions are rapidly approaching normal.

Electric Signs.—Manufacturers report a slight relief in the pressure of new business, which is welcomed as an opportunity to catch up on orders. Difficulty in securing raw materials, particularly steel products, has complicated their problems. Prices on miniature signs have just been advanced to cover rising costs.

Line Hardware.—Deliveries are very slow and stocks depleted almost to the famine point. The Hubbard Company has withdrawn its lists on everything except Pierce specialties, on which an advance of from 15 to 20 per cent is recorded.

Household Appliances.—Jobbers report no material change in conditions, as they are still unable to secure goods in sufficient quantity to fill orders. The retail trade reports a lessening in demand, both in small cash transactions and the larger partial-payment sales.

BOSTON

Summer dullness finds little reflection in jobbing or manufacturing circles. Leading houses report 50 to 100 per cent more business in dollars than last year to date, and the difficulty of securing material persists. Shipments of orders placed many months ago, however, are coming in weekly, and the immediate needs of the trade are being met reasonably well. Collections are not so good, and credits were very sharply watched last week. One jobber among the smaller houses made an assignment to the controlling interests in a larger house, but it is understood that the concern is solvent. Prices hold firm and stocks are improving in the main, barring small motors and weatherproof wire. Labor unrest continues to disturb production conditions. New construction work for industrial uses continues to go forward in many parts of New England. The coal situation is very serious, although electrical utilities are in the main better supplied than industrial plants.

Motors.—Stocks of small motors are swept practically bare. The factory city office of a leading manufacturer wired into district offices hundreds of miles distant for a 3-hp. motor a few days ago, so acute is the shortage.

Fans.—Pre-seasonal stocks have not yet moved out of the jobbers' rooms. Cool weather and high prices are deterring sales, but stocks are none too large.

Ranges.—Considerable activity is noted in hotel and club-type ranges, increasing cost of gas being a factor. Orders for ranges, however, must be placed many months ahead in planning a distribution campaign.

Wire.—Rubber-covered wire, No. 14, is in good supply, and is quoted at from $11.25 to $11.75 per 1,000 ft. in 5,000-ft. lots. Bare copper wire is selling on a 24-cent base and weatherproof on a 29-cent base. The latter should come through in better shape soon, in view of reported early resumption of work in Rhode Island.

Flexible Armored Conductor.—Stocks are well maintained, and No. 14 single-strip brings $110, double-strip $112 per 1,000 ft., in 1,000-ft. lots.

Cross Arms.—A healthy demand is being handled, with fair deliveries. In small lots, the six-pin, 7-ft. 9-in. fir arms sell for $1.95 each, and on lots of 3,000 a price of $1.62 per arm is quoted. The high cost of overhead work is a deterrent upon central-station expansion this year.

Non-Metallic Flexible Conduit.—Prices tend toward slightly lower levels, the ⅜-in. size being quoted at $33.50 per 1,000-ft. in 1,000-ft. lots, and the ½-in. size, steady at $38.50.

Rigid Conduit.—Incoming shipments on old orders have given considerable relief to some jobbers. Stocks are not being thrown "wide open," however. Sub-normal supplies bid fair to rule for some time.

Sockets.—A plentiful supply is understood to exist throughout most of New England. Prices are very steady, the case lot quotations running at 50 cents net per socket on pulls, 28 cents for keys and 26 cents for keyless.

Household Appliances.—The market is in a curious situation, owing to the fact that many manufacturers are overloaded with past orders and that the demand for devices less essential from the labor-saving point of view seems to be easier. Shipments are coming into jobbing houses in bunches. The tendency is for considerable stocks to accumulate in many specialties, but vacuum cleaners and washing machines continue in great demand.

Portable Lamps.—Some of these are moving well, notably for summer-home use. A spurt in second-hand acquisitions may be expected about this time in retail circles in close touch with college towns.

ATLANTA

The electrical jobbing and contracting business in the Southeast shows every indication of continued prosperity. No dull times can be foreseen from the present position of the electrical industry. This is the consensus of opinion as voiced at the recent meeting in New Orleans of the Southern electrical jobbers, where optimism was the order of the day.

Reports from all over the district indicate a well-sustained building activity, which, of course, means continued demand for all classes of electrical material.

The municipal authorities of Augusta have passed a ruling requiring that all future installations of main-line switches shall be of the safety-switch type and there is a tendency throughout the section to make this ruling unanimous by all the larger municipalities.

An unusual number of new industries is reported and there is a noticeable increase in the number of inquiries by foreign corporations seeking plant sites in this territory. The proximity of the raw-material market and the better labor situation here are largely responsible for the desire to obtain factory locations.

Panelboards.—An increase in price is to be noted on cabinet boxes, due largely to shortage in the supply of thin steel. The demand is very brisk from industrial plants and drop shipments are quoted at from three to seven weeks.

Exhaust Fans.—The warm weather has sadly depleted local holdings of fans, the Ventura type being particularly hard to obtain, though there are fair supplies of the Davidson fan on hand. Shipments are unsatisfactory, particularly in the single-phase variety.

Electric Hoists.—Manufacturers of this specialty report sales on the increase, receipts of orders for large dock winches being in evidence. Shipments are very satisfactory, varying from stock to twelve weeks, dependent upon size and type.

Fans.—The unusually warm weather throughout the section has made a tremendous inroad on fan stocks. Some jobbers' stocks are completely exhausted while others report only nominal assortments on hand. The oscillating fan in 12-in. and 16-in. sizes is especially popular.

Safety Switches.—The ruling of the various municipalities and the decision of textile mills for the installation of switches of this type have created a very brisk demand, two-wire and three-wire, 30-amp. size being the most popular. Stocks are in fair shape and shipments continue to hold up well.

Meters.—Local stocks of meters are almost exhausted, none of the 5 and 10-amp., two-wire size being available in the territory. Incoming shipments are quickly absorbed by back orders. The shortage is most acute in two-wire, 110-volt type, shipments of this size being quoted at from three to four months.

Knife Switches.—The popularity of safety switches has placed this article in an unfavorable position. Stocks are reported moving very slowly, orders being received only from the smaller centers.

Schedule Material.—A slight improvement is to be noted in this line, with the exception of material requiring porcelain, which is still very hard to obtain. Likewise there are no armored conductor connectors in the territory. Shipments of other classes of schedule material are reported slightly improved.

SEATTLE-PORTLAND

Sales in the Puget Sound district show a further downward tendency as compared with the past several weeks, especially in Seattle. This applies particularly to jobbers, as the sales of large retailers, while lower than ordinary, are still being maintained as well as could be expected with the existing shortage of stocks. Building in Seattle, both residential and commercial, is at a very low ebb, and sales of schedule material are naturally very light. Reports from the "Inland Empire" and Spokane especially state that while present high prices of material and labor prevail this district will not enter into building on a large scale. This condition also applies to cities in the Puget Sound section.

In a final drive for production prior to the customary mid-season close-down, the lumber industry last week operated up to within 2 per cent of normal. Mills and camps in this district as well as in certain parts of Oregon are making ready for a shutdown of from one to three weeks and will make extensive repairs.

Grain crop prospects are good. Reports from eastern Washington are particularly favorable. Portland district jobbers report that temporarily there seems to be a slight upward tendency in business. Washing machines are now coming through to Portland in a very satisfactory manner, and present stocks are in good condition. The manufacturers seem to have caught up in this line of merchandise. Other stocks continue in a sadly depleted state, although shipments are coming through from the East about as they have been for some time; but back orders consume any such stock at once. Contractors report that business is very quiet, but the work which is being figured is of a higher grade than for some time. Retail stores report in some cases a slight improvement in business. There has been an appreciable decrease in the sale of ranges since the last price increase. Trade seems to be principally in small devices such as toasters, percolators, etc. Collections seem to be very slow and few new credits are being placed.

Washing Machines.—The demand far outstrips available supply in this territory. Both jobbers and dealers have orders far in excess of what they can reasonably expect to receive from Eastern factories for months to come.

Household Appliances.—In the Seattle district dates for deliveries on percolators, waffle irons, toaster stoves and like merchandise have lengthened to about ten months. During the past month retailers practically cleared their shelves and jobbers' stocks are all but exhausted. Sewing machine demand is far beyond the supply that is expected to exist for some time to come.

SAN FRANCISCO

Building operations, which have slowed up to a certain extent in the bay region, are proceeding at a great pace in Los Angeles and the interior cities. Unexpected rains have given the coast and the interior valleys a drenching, though little harm was done except to the cherry crop. In the mountains, the effect of these warm rains was to melt some of the packed snow.

Schedule Material.—The building and opening of various model electrical homes in California cities is to a marked degree drawing the attention of owners and architects to the importance of proper baseboards and wall outlets. Dealers are reporting a big increase in the number of inquiries for special flush receptacles.

Fans.—Several jobbers carried over considerable fan stocks from last year, but these have been nearly all sold, together with the new stocks. In fact, there is a general dearth of fans, for the early hot weather along the interior valleys and southern coast has produced a heavy demand. There is an insistent call for ceiling fans beyond that which was expected.

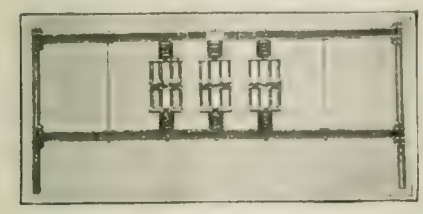
Household Appliances.—Banks and financial companies that make a specialty of handling the deferred-payment accounts of dealers in household devices report a marked increase in the amount of such sales handled through them during June. There seems to be an especial interest in dishwashers, although the various manufacturers have practically no stocks in this territory and do not expect any before the latter part of the year.

NEW APPARATUS & APPLIANCES

A Record of Latest Developments
and Improvements in Manufacturers' Products
Used in the Electrical Field

Busbar Support

Extra-heavy-duty busbar supports are being marketed by the Delta-Star Electric Company, 2433 Fulton Street, Chicago. They are particularly for use where in low-voltage distribution heavy currents are carried, and buses must



ELIMINATES HEATING ON HEAVY CURRENT SERVICE

be arranged, the manufacturer says, in order to avoid skin effect in the bars and to prevent hysteresis heating of adjacent iron parts. The accompanying bus support is for a three-phase, 60-cycle, 8,000-amp. circuit, wherein each phase is split up into four parts. Cross-beams holding the busbar insulators are of manganese bronze to eliminate heating.

High-Voltage Line Protective Apparatus

For working hot high-voltage lines with bare hands, the Bush Electric Company, Cleveland, Ohio, has developed a safety staging made of selected hard wood submitted to a



HIGH-VOLTAGE CIRCUITS MAY BE HANDLED WITH BARE HANDS

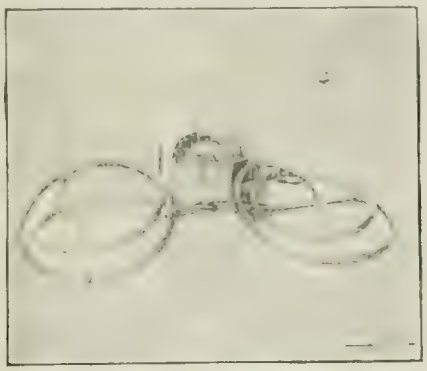
special drying and impregnating process. All insulated tools may be eliminated, the manufacturer says. Guards are placed to prevent accidental contact with grounded arms, guys or other circuits. It may be used on circuits up to 110,000 volts, it is claimed.

Single-Stage Amplifier

The International Radio Telegraph Company, New York City, is marketing its type RTA-104-A single-stage audio frequency amplifier. The amplifying transformer is hermetically sealed to keep out moisture. Variation in filament temperature changes the amount of amplification. Weight is 8 lb.

Pipe Thawer

The General Electric Company has placed the Wayne pipe thawer on the market with the idea of providing a portable device for thawing frozen water pipes electrically. It consists essentially of a transformer, consuming ordinarily about 550 watts, a 10-f.. lead for connection to the lighting circuit



PIPES THAWED FROM ALTERNATING-CURRENT LIGHTING CIRCUIT

and secondary leads equipped with cast-brass clamps for attaching to pipes from ½ in. to 1 in. in diameter. Alternating current of 50-cycle to 60-cycle frequency and 100 volts to 125 volts is used. The spread of the secondary is 15 ft

Notes on Recent Appliances

Clothes Washer

An electric clothes washer on the rocking boiler principle is being marketed by the Remmert Manufacturing Company, St. Louis, Mo

Shadow Shield

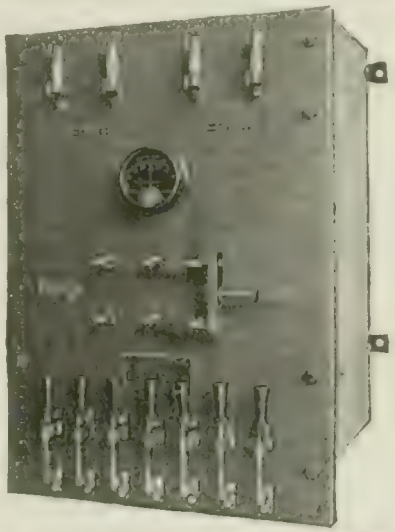
The Western Electric Company, New York City, is marketing a shadow shield for use with single-lamp fixtures.

Turbo Coupling

A fast flexible turbo coupling has been developed by the Bartlett Hayward Company, Baltimore, Md.

Battery-Charging Panel

The Meier Electric & Machine Company, 136 South Meridian Street, Indianapolis, Ind., has developed a battery-charging panel, 14 in. wide by 20 in. high. It is designed for 250 volts, direct current, having a maximum charging rate of 15 amp. in seven steps when connected to ninety cells in series. The same rate may be obtained from 125-volt service when connected to forty-five cells in series. The resist-

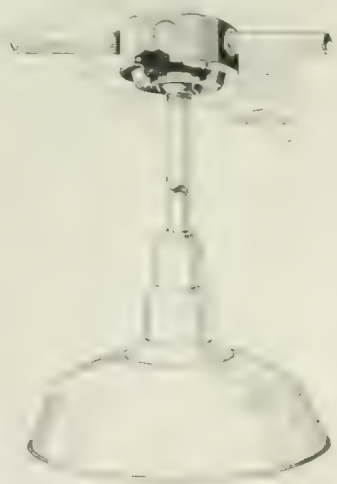


CHARGES FROM ONE TO NINETY CELLS

ance element is so proportioned that a single 6-volt battery may be charged. In this case the maximum charging rate for each unit switch will be 5 amp., the manufacturer asserts, or a total of 30 amp. with all unit switches in use. Resistance units are used in parallel.

Service Fixture Cover

For use with 4-in. round or octagonal outlet boxes, the Appleton Electric Company, 218 North Jefferson Street, Chicago, has developed a new swivel fixture cover. This cover accommodates a ½-in. conduit and owing to the swivel



FIXTURE HANGS CORRECTLY REGARDLESS OF OUTLET-BOX ANGLE

feature enables the fixture to hang correctly, says the manufacturer, even though the outlet box be installed at an angle or becomes jarred in any way.

MANUFACTURERS' ACTIVITIES

Record of Changes Affecting Sales and Distribution Together with Trade Personals and Notes on Foreign Trade, Jobbers' News and New Trade Literature

THE IDEAL ELECTRIC & MANUFACTURING COMPANY, 153 East Fifth Street, Mansfield, Ohio, has awarded contract for construction of a one-story, 160 ft. x 450 ft. and 100 ft. x 620 ft. factory building and a two-story, 35 ft. x 75 ft. office building, to cost about $350,000.

THE EAGER ELECTRIC COMPANY, Watertown, N. Y., manufacturer of generators, motors, etc., is planning to erect a one-story foundry in connection with its plant.

THE UNITED STATES ELECTRIC COMPANY, New London, Conn., has awarded contract for the construction of a one-story addition, 75 ft. x 100 ft., to its plant at Fort Trumbull, to be equipped for the manufacture of electric riveting and heating machines. Improvements will also be made to a number of existing buildings at the plant. The cost of the work is estimated at about $50,000.

THE PIONEER ELECTRIC SERVICE CORPORATION, Brooklyn, has filed notice of increase in capital stock from $20,000 to $120,000.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., has acquired about twenty acres on Elmwood Avenue between Sixty-eighth and Seventieth Streets, Philadelphia, as a site for its proposed new plant. The company, it is understood, will begin work early in the fall on the new works, to cost including equipment about $10,000,000.

THE WAGNER ELECTRIC MANUFACTURING COMPANY, St. Louis, has established a general service station at 501 Broadway, Milwaukee, Wis., in charge of S. B. Moyer. The sales office in the First Wisconsin National Bank Building, Milwaukee, under the management of F. T. Coup, will be continued.

THE WATSON-STILLMAN COMPANY, New York City, announces several changes in the board of directors of the company due to the retirement of A. F. Stillman from active interest in the management. Mr. Stillman remains as president of the company and also has full supervision of the sales. Carl Wigtel, chief engineer, was elected vice-president; A. Parker Nevin, secretary; W. H. Martin, purchasing agent. Mr. Wigtel has started on a ten weeks' trip to the Scandinavian countries, England, France, Belgium and Holland. While he is going mainly for a vacation, he will also investigate new development in the line of hydraulic machinery in all of the above countries. Mr. Wigtel has been connected with the company for thirty-three years.

THE MERMAID DISH WASHER COMPANY, Hartford, Conn., has recently been organized with a capital stock of $150,000 to take over the property and holdings of the Wolcott Manufacturing Company manufacturer of dish-washing machines for household purposes. Frank E. Wolcott is president and general manager, and S. C. Stivers is vice-president, secretary and treasurer.

THE NAZEL ENGINEERING & MACHINE WORKS, 1041 North Fifth Street, Philadelphia, announces that the character of its business has been changed from that of an individual to a corporation. Rabid W. Nazel is president.

THE WORTHINGTON PUMP & MACHINERY CORPORATION, 115 Broadway, New York, announces the purchase from the Platt Iron Works, Dayton, Ohio, of their drawings, patterns, jigs, templates, special tools, good will and name on the following lines of product: Oil-mill machinery, hydraulic turbine and waterwheel line, feed-water heaters and high pressure air compressors.

THE MUTUAL ELECTRIC & MACHINE COMPANY, manufacturer of switches, switchboards, etc., held its semi-annual sales conference at the main office, Detroit, on May 26, 27, 28 and 29. The time of the conference was divided between a discussion of the company's products, the company's needs, organization, and its selling plans and policies.

WM. G. MEROWIT, Buffalo, N. Y., in addition to the lines mentioned in the June 19 issue of the ELECTRICAL WORLD, handles the products of the Roller-Smith Company, New York City.

WILLSON GOGGLES, INC., Reading, Pa., formerly T. A. Willson & Company, has established offices in the Bush Terminal Building in New York City and the Magee Building in Pittsburgh, Pa., besides offices in Rio de Janeiro and Buenos Aires and an agency in Sydney, Australia.

THE PITTSBURGH GAGE & SUPPLY COMPANY, Thirtieth and Liberty Streets, Pittsburgh, manufacturer of electrically operated washing machines, etc., has made arrangements for an increase in capital stock from $750,000 to $2,500,000.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, East Pittsburgh, Pa., has taken a lease of four floors, providing about 50,000 sq.ft. of floor space, in the building being erected at Third and Elm Streets, Pittsburgh, Pa.

THE LIBERTY INCANDESCENT SUPPLY COMPANY has been organized with a capital stock of $30,000 by Joseph Klein, 241 South Atlantic Avenue, Pittsburgh, to manufacture incandescent electric lamps and other specialties.

THE ELECTRIC CONTROLLER & MANUFACTURING COMPANY, Cleveland, Ohio, has opened a new office at 208 North Broadway, St. Louis, Mo., in charge of R. J. Ehrhart.

THE AMERICAN INSULATOR COMPANY, New Freedom, Pa., with sales offices at 30 Church Street, New York City, and Detroit, Mich., announces the opening of another factory at Norwalk, Conn., in addition to expansion in production capacity at New Freedom, to meet the requirements of its rapidly increasing business.

THE COOLEY & MARVIN COMPANY, engineer, Tremont Building, Boston, is circulating a booklet entitled "Build for the Present and the Future," in which it calls attention to features to be considered in the construction of industrial plants.

THE SAFETY ELECTRIC COMPANY, Chicago, has removed its Chicago office from 537 North Dearborn Street to 431 South Dearborn Street. The new factory of the company at Des Plaines, Ill., has been put in operation.

THE HABIRSHAW ELECTRIC CABLE COMPANY, 10 East Forty-third Stret, New York City, is planning an extension, 60 ft. x 100 ft., one story, to its plant at Glenwood, Yonkers, N. Y., to cost about $30,000.

P. D. GIBSON, 2401 Eastern Avenue, Baltimore, Md., is planning to equip a plant for the manufacture of dish-washing machinery.

THE CIRCLE WASHER COMPANY, Belleville, N. J., contemplates the erection of a new plant, 100 ft. x 100 ft., to cost about $25,000.

THE ALLENTOWN CABLE & MACHINE COMPANY, Allentown, Pa., is asking for bids for the construction of a one-story building, 50 ft. x 100 ft., at Hamilton, to cost about $35,000.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., has started work on an addition to its plant, recently acquired, in Hudson, N. Y.

THE STEINMETZ ELECTRIC MOTOR CAR CORPORATION, Baltimore, Md., has acquired property held by Reus Brothers on Mount Royal Avenue, Arlington, as a site for its proposed plant. Work will start immediately on installing machinery and equipment for the manufacture of electrically operated trucks and delivery cars.

WESTINGHOUSE, CHURCH, KERR & COMPANY, INC., is the name which will be used to designate the merger of Dwight P. Robinson & Company with Westinghouse Church, Kerr & Company when that merger is complete.

THE DIFFERENTIAL CAR COMPANY, New York City, has purchased from the United States government the plant formerly operated by the Grant Motor Company, Findlay, Ohio, for the manufacture of munitions. The company, it is understood, will equip the plant for the manufacture of electrically operated dumping cars, dumping bodies for motor trucks, etc.

THE HOME ELECTRIC APPLIANCE COMPANY, Pittsburgh, Pa., is considering building an addition to its plant. The company recently increased its capital stock from $50,000 to $250,000.

THE HARRIS-WARREN ELECTRICAL CONSTRUCTION COMPANY, Manchester, Conn., has recently been organized by A. A. Warren and W. R. Harris. The company has opened an office in the Ferris Building on Oak Street and will do all kinds of electrical construction work.

THE BUCKEYE ELECTRIC CONSTRUCTION COMPANY, Dover, Ohio, recently organized, will do an electrical construction business and deal in electrical apparatus and supplies. The company plans to open a branch office in New Philadelphia, Ohio, in the near future. J. H. Geyer is president and general manager; John Thompson is vice-president; J. D. Crisel, 326 North Seventh Street, New Philadelphia, Ohio, is secretary and treasurer.

THE MORGANITE BRUSH COMPANY, Inc., 519-523 West Thirty-eighth Street, New York City, has been organized to take over the business and property of the Morgan Crucible Company.

THE UNDERFEED STOKERS COMPANY OF AMERICA, Chicago, has filed notice of an increase in capital stock from $1,000,000 to $1,250,000.

THE GRANITE CITY ELECTRIC COMPANY, 21 Fifth Avenue, St. Cloud, Minn., has recently been incorporated to deal in electrical devices and supplies and also to repair and rewind motors and generators. William C. Johnson is president and business manager.

THE WESTINGHOUSE ELECTRIC INTERNATIONAL COMPANY, East Pittsburgh, Pa., has made several appointments in its organization as follows: At East Pittsburgh, H. F. Griffith, assistant to general manager; R. W. Everson, manager of merchandising department, and H. C. Soule, manager of apparatus department. At New York: G. H. Bucher, assistant to general manager; J. H. Payne, supervisor of agencies, and F. M. Sammis, manager of incandescent-lamp department.

THE ELECTRIC TOOL MANUFACTURING COMPANY, Petersburg, Va., has purchased the business of the American Electric Tool Company, including patents, manufacturing equipment, good will, etc. The complete line of electric hammers will continue to be manufactured on a greatly increased scale. Louis Paulero will remain in charge as chief engineer.

THE VONDER KUHLEN ELECTRIC COMPANY, 3861 West Sixth Street, Los Angeles, Cal., successor to H. L. Vonder Kuhlen, electrical contractor, will do an electrical contracting business and will also deal in electrical appliances and supplies. H. L. Vonder Kuhlen is president and W. J. Barman is seretary and treasurer.

THE CAMPBELL ELECTRIC COMPANY, Lynn, Mass., expects to manufacture some new X-ray apparatus for the Foot-o'-Scope Corporation, which has just been incorporated with J. J. Lowe as president, Fred R. Campbell treasurer, and these two with Charles E. Campbell, president of the Campbell Electric Company, as board of directors.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia, will hold a special meeting of the stockholders on July 9 to vote on the proposal to increase the capital stock of the company from $18,000,000 to $30,000,000, the proceeds to be used for the construction of a new plant and for other business requirements.

Supply Jobbers' Notes

THE GEORGE H. WAHN COMPANY, Boston, has been named as New England jobber for the entire line of electric heating appliances manufactured by the Manning-Bowman Company, Meriden, Conn. The Wahn company is now taking occupancy of the entire building at 69-71 High Street, Boston, and is enlarging its stockroom and office facilities.

Foreign Trade Notes

A. DWIGHT SMITH, district sales manager of the Northern Electric Company, Montreal, Que., Can., has been transferred to the general sales department at the head office. In his new position he will have charge of sales to railways, marine and shipbuilding concerns and fire-alarm systems in the Dominion of Canada. N. S. Richards, who has been sales manager at Calgary for the last three years, succeeds Mr. Smith as Montreal district sales manager.

THE EUGENE F. PHILLIPS ELECTRICAL WORKS, LTD., Montreal, Quebec, Can., are installing complete equipment for the manufacture of enameled wire.

INSULATED WIRES TO BE MANUFACTURED IN JAPAN.—Ten leading electric wire manufacturing concerns in Japan have recently issued a joint statement announcing that they have completed arrangements for the production of insulated wire to meet the official standards published in October, 1919. The manufacture of the old type of wires and cords will be discontinued.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

The representative of a company in Ireland (No. 33,109) is in the United States and desires to purchase or secure an agency for the sale in Great Britain, Syria, and Palestine of electrical household appliances, etc.

The representative in the United States of a merchant firm in South America (No. 33,120) desires to purchase and secure an agency for the sale in the River Platte countries of washing machines, electric household appliances, etc.

A company in Wales (No. 33,125) desires to purchase and secure an agency for the sale of electrical fittings, lamps, cables and accessories.

Trade Publications

LIFTING MAGNETS.—Publication 855 is being distributed by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., entitled "Lighting Magnets, Circular Type."

GOGGLES.—Willson Goggles, Inc., Reading, Pa., has issued a bulletin on its goggles for industrial use.

SAFETY DEVICES, ETC.—The Square D Company, Detroit, Mich., and Walkerville, Canada, has issued its new annual catalog, No. 25, showing the complete lines of safety devices, motor starters, etc.

TIME SWITCHES.—Bulletin No. 36 is being circulated by the Albert & J. M. Anderson Manufacturing Company, Boston, Mass., on automatic time switches.

HIGH-TENSION MAGNETOS. — The American Bosch Magneto Corporation, Springfield, Mass., has issued Catalogs Nos. 50, 58, 62, 66 and 2550 and advance 1920 catalog, covering its different types of high-tension magnetos and ignition systems.

ICE-MAKING AND REFRIGERATING PLANTS.—The Balsa Refrigerator Corporation, 149 West Thirty-sixth Street, New York City, successor to the Refrigidor Corporation, is circulating a booklet entitled "Why and How to Refrigerate," in which it describes the Frigidor electric ice-making and refrigerating plants.

TURBO-GENERATORS FOR STEAM LOCOMOTIVES.—Bulletin No. 105 issued by the Sunbeam Electric Manufacturing Company, Evansville, Ind., describes its type RE-3 500-watt, 32-volt turbo-generator for steam locomotives.

New Incorporations

THE MONTGOMERY ELECTRIC COMPANY, Clarksville, Tenn., has been incorporated with a capital stock of $10,000 by Robert McFarland, John E. Hensley, N. H. Spindler and Oscar G. Henke.

THE WEST BETHEL LIGHT COMPANY, Bethel, Pa., has been chartered with a capital stock of $5,000 by J. L. Jordan, W. C. Bowers, C. W. Zollars, M. C. Bredwell and C. L. Bredwell.

THE LOCUST CENTER LIGHT COMPANY, Amelia, Ohio, has been incorporated with a capital stock of $2,500 by E. Behemeyer, W. C. Ayer, W. M. Eppert, A. R. Shapp, E. C. Meyer, F. E. Spagel and J. D. Cross.

THE DALLAS (TEX.) ELEVATOR & ELECTRIC COMPANY has been incorporated with a capital stock of $35,000 by W. O. Parker, E. B. Thomas an A. C. Bookout.

THE OSAGE (IOWA) ELECTRIC LIGHT & HEAT COMPANY has been chartered with a capital stock of $75,000. James W. Ferris is president.

THE WHITE LAKE ELECTRIC LIGHT COMPANY, Weyauwega, Wis., has been incorporated by Edward F. Munsch, Fred Schoenick and William Kneip. The company is capitalized at $5,000 and proposes to furnish electricity for lamps, heaters and motors.

THE HYSIG COMPANY, Plainfield, N. J., has been incorporated by M. P. Stadele, G. E. Hudson and H. F. Hoffman, Plainfield. The company is capitalized at $20,000 and proposes to manufacture electric bells and other electrical apparatus.

THE BUCKEYE ELECTRIC COMPANY, Dover, Ohio, has been incorporated by C. Ripple, J. H. Geyer and L. Crissel. The company is capitalized at $10,000 and proposes to do a general electrical construction business and to deal in electrical appliances and supplies.

New England States

CHELSEA, MASS.—Contract has been awarded to J. Slotnik of Chelsea for an addition and alterations to the power plant at the Soldiers' Home.

LOWELL, MASS.—Business men and residents of the Davis Square section have had a petition presented to the City Council for the installation of a "white way" street-lighting system in that district.

TAUNTON, MASS.—The City Council has approved the appropriation of $400,000 for the purchase of a new unit for the municipal electric lighting plant. Prof. D. C. Jackson of the Massachusetts Institute of Technology has been retained to supervise the work.

ALBION, R. I.—Improvements to the street-lighting system in Lime Rock is under consideration.

PROVIDENCE, R. I.—Contract will soon be awarded by the Packard Motor Car Company, Broadway and Sixty-first Street, New York, N. Y., for the construction of a garage, service station, etc., to cost about $400,000. Electric light and power equipment will be required.

HARTFORD, CONN.—The capital stock of the Hartford River Company will be increased from $200,000 to $5,000,000 for the purpose of erecting a dam, 2,000 ft. long and 30 ft. high, at Windsor Locks, to develop 40,000 hp. for the transmission of electricity to serve Hartford and northern Connecticut. Harrison B. Freeman is secretary.

MONTVILLE, CONN.—The Robert Gair Paper Corporation will soon award contract for the construction of a manufacturing plant and power house, to cost about $500,000.

WATERBURY, CONN.—The Waterbury Clock Company, Cherry Street, contemplates the erection of a power house, to cost about $12,000.

Middle Atlantic States

ALBANY, N. Y.—The Wallkill Valley Electric Light & Power Company has been authorized by the Public Service Commission to make extensions to its electric plants in Montgomery and Wallkill.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

ALBANY, N. Y.—Bids will be received by the State Hospital Commission, Capitol, until July 7, for additional electric machinery, one 250-kva. engine-driven generator set and one 25-kw. motor-generator set, to cost about $10,000, at the Manhattan State Hospital. Drawings and specifications may be obtained from L. F. Pilcher, state architect, Department of Architecture, Capitol.

ALBANY, N. Y.—Bids will be received by the Trustees of Public Buildings, Executive Chamber, Capitol, until July 7, for electric work in the insurance department, Rooms 120 and 121, Capitol, to cost about $16,000. Drawings and specifications may be obtained from L. F. Pilcher, State Architect, Department of Architecture, Capitol.

ALBANY, N. Y.—Permission has been granted to R. L. Brown and G. R. Beckwith to construct and operate an electric plant in the towns of Taylor and Cincinnatus.

JAY, N. Y.—Application has been made by the Ausable Forks Electric Company to the Public Service Commission for permission to erect a local electric power plant.

LONG ISLAND CITY, N. Y.—Contract has been awarded to the White Construction Company, Inc., 95 Madison Avenue, by the Atlantic Macaroni Company, Inc., for the construction of a factory on Vernon Avenue and Fourteenth Street, to cost about $1,000,000.

LONG ISLAND CITY, N. Y.—The National Refining Company, Dock Street, has awarded contract to A. T. Woodruff & Sons, Bridge Plaza, for the construction of a power house to cost about $[illegible].

WILMINGTON, N. Y.—The State Public Service Commission has granted authority to Frank E. Everest to construct a local electric light plant.

ATLANTIC CITY, N. J.—Contract has been awarded to the Thompson-Starrett Company, 49 Wall Street, New York, N. Y., by the Ritz-Carlton-Linnard Company, care of Warren & Wetmore, engineers and architects, 10 East Forty-seventh Street, New York, for the erection of a hotel, to cost about $2,000,000.

LAKEHURST, N. J.—Contract has been awarded to the Hughes-Foulkrod Company, Commonwealth Trust Building, Philadelphia, Pa., for the construction of power house, auxiliary building and barracks at the Naval Aircraft Station, to cost about $525,000.

NEWARK, N. J.—The Osborne Company, 759 Summer Avenue, is having plans prepared for the erection of a power house to cost about $50,000.

PASSAIC, N. J.—The Manhattan Rubber Company, Willett Street, contemplates the erection of a boiler, steam and electric power plant. Stone & Webster, 120 Broadway, New York, N. Y., are engineers.

TRENTON, N. J.—Bids will be received by the City Commission until July 16, for the furnishing of one 25,000,000 gal. centrifugal pump, motor and one 1,000-hp. steam turbine driven generator to be installed in the municipal waterworks. Alvin Bugbee is superintendent.

EASTON, PA.—The Eastern Pennsylvania Power Company of New Jersey has been granted authority to erect and maintain an overhead electric distribution system on certain grounds in Morris Park and on Morris Turnpike.

PITTSBURGH, PA.—Plans are under way by the Gearless Motor Corporation, Flavel Street, for the construction of the initial unit of a new plant, to consist of a main works with adjoining structure, and a power house, to cost about $1,000,000, including equipment.

BALTIMORE, MD.—The installation of a number of 400-cp. electric lamps on St. Charles Avenue has been ordered by Lighting Superintendent Hanson.

BALTIMORE, MD.—Plans are being prepared by Edward H. Glidden, architect, American Building, for the erection of a high school, to cost about $[illegible].

AMHERST, VA.—The installation of an electric lighting plant is under consideration.

North Central States

RIVER ROUGE, MICH.—The American Gypsum Company of Port Clinton, Ohio, will erect a local material storage and handling plant, to cost about $75,000. Electrically driven elevating and conveying equipment will be required. Louis Kamper, Book Building, Detroit, is engineer.

ST. JOHN'S, MICH.—Plans are under way for the erection of a municipal electric light and power plant, to cost about $250,000.

CLEVELAND, OHIO.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 15 for removing the present conduit, wiring and lighting fixtures and furnishing and installing a new conduit and wiring system and interior lighting fixtures in the United States Marine Hospital at Cleveland, Ohio. Drawings and specifications may be obtained at the Washington address.

DEFIANCE, OHIO. — Construction will be started at once on a modern electrically operated sugar factory for the Farmers' Sugar Company, Inc.

MARTINS FERRY, OHIO.—Plans are under way for the erection of a power plant to cost about $500,000. Herman Gamper, 219 New First National Bank Building, Columbus, Ohio, is consulting engineer.

MINERVA, OHIO.—Extensions and repairs to the municipal electric light plant, to cost about $50,000, are contemplated. H. Glass is village clerk.

TOLEDO, OHIO.—The De Vore Company, 908 Nicholas Building, contemplates the installation of electrically driven machinery in a new foundry, now under construction, to cost about $500,000.

TORONTO, OHIO. — The Follansbee Brothers Company of Pittsburgh, Pa., contemplates the erection of a power plant at its local works.

ZANESVILLE, OHIO.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 12, for additions and repairs to conduit and wiring, new lighting fixtures and furniture lighting in the United States Post Office. Drawings and specifications may be obtained at the above address or at the office of the custodian at Zanesville.

INDIANAPOLIS, IND.—Bids will be received at the office of the business director, Administration Building, Meriden and Ohio Streets, until July 8 for electric wiring in public schools Nos. 7 and 16. Plans and specifications are on file in the office of Snider & Rotz, 703 Merchants' Bank Building, Indianapolis.

WEST HAMMOND, IND.—Bids are being received by R. G. Pierce, architect, 10 South LaSalle Street, Chicago, Ill., for the erection of a steel plant for the La Salle Iron Works, to cost about $650,000, including equipment. Electrically operated machinery will be installed.

LEROY, ILL.—The Leroy Electric Light Company contemplates the erection of an electric transmission line to the village of Downs.

MANITOWOC, WIS.—The Public Utilities Commission contemplates the installation of an electric lighting system in Washington and Union Parks, to cost about $2,000.

ST. FRANCIS, WIS.—Work has been started on the construction of a power plant, to cost about $7,000,000, for the Milwaukee Electric Railway & Light Company, Public Service Building.

SHEBOYGAN, WIS. — The Board of Education will receive bids about July 15 for the erection of a high school, to cost about $750,000. Considerable electrical equipment will be required. Theodore Benefy is chairman.

WEST BEND, WIS.—The West Bend Heat & Light Company contemplates the erection of an electric power plant at West Bend and the extensions of its lines to Kohlsville, Newburg and Fredonia station, to cost between $80,000 and $100,000. The Combustion Engineering Company, 11 Broadway, New York, N. Y., is engineer.

PIPESTONE, MINN.—Bids will be received by S. W. Funk, city clerk, until July 15 for the establishment of a waterworks system to include an electric pumping plant.

DUBUQUE, IOWA.—The city officials contemplate the erection of a municipal electric light plant, to cost about $500,000. S. Stuba is city clerk.

SIOUX FALLS, S. D.—The installation of a hydro-electric plant on the Missouri River, to cost about $16,000,000, is under consideration.

Southern States

MORGANTOWN, N. C.—Bids will be received by the Board of Alderman, Town Hall, until July 5 for the furnishing of one 50-hp., three-phase, 550-volt, 60-cycle motor direct-connected by flexible coupling to one three-stage centrifugal pump with capacity of 250 gal. per minute against a total working head of 400 ft., one automatic pressure-controlled starter with no-voltage release, one 3-hp., three-phase, 550-volt, 60-cycle motor, direct-connected to single-stage centrifugal pump with capacity of 150 gal. per minute against a total working head of 25 ft., and one automatic switch controlled by float device.

MOUNT HOLLY, N. C.—The Blue Ridge Development Company, Inc., has been granted a charter to erect an electric distribution line from Mount Holly to Blowing Rock.

GREENVILLE, S. C.—The Cyclone Starter & Truck Company has awarded general contract to H. H. Ferguson, 6507 Euclid Avenue, Cleveland, Ohio, for the erection of a factory and power plant to cost about $125,000.

LANCASTER, S. C.—An issue of $45,000 in bonds is under consideration for the purchase and installation of an electric light plant in Lancaster.

SALUDA, S. C.—The Blue Ridge Power Company contemplates the installation of an additional hydro-electric unit, rated at 4,000 hp., which will increase development to 12,000 hp. W. S. Montgomery, of Spartanburg, is president.

DAVISBORO, GA.—Bonds to the amount of $15,000 have been voted for the erection of a local electric light plant.

MEMPHIS, TENN.—The Dixie Rubber Company, 770 Randolph Building, contemplates the erection of a power house to be used in connection with the proposed new works, to cost about $175,000.

SMITHVILLE, TENN.—The citizens of Smithville are contemplating the construction and equipping of an electric plant and the erection of a line from the Great Falls Power Company's plant at Rock Island, to Smithville, at a cost of about $30,000.

GADSDEN, ALA.—The Alabama Power Company, it is understood, will soon begin construction on a $5,000,000 power plant at Duncan's Riffle on the Coosa River. A dam 72 ft. high will be erected to develop between 90,000 hp. and 105,000 hp.

SHUBUTA, MISS.—An election will be held on July 13 for the purpose of submitting to the voters a proposition to issue $12,000 in bonds for the erection of an electric light plant.

OILTON, OKLA.—Plans are under way for the installation of a "white way" street-lighting system on various streets of the city.

Pacific Mountain States

GRANDVIEW, WASH.—The Pacific Power & Light Company contemplates the erection of a local substation.

SEATTLE, WASH.—Preliminary work has been started on the Gorge River project, which consists of the erection of a dam across the Skagit River, a tunnel to conduct water through the mountain to the proposed power plant, 2 miles away, and a power house to generate 50,000 hp. Plans necessitate the construction of a railroad 26 miles long and a 3,000-hp. unit to generate electric current at the temporary power and construction plant on Newhalem Creek. The cost of the project is estimated at about $7,000,000.

MALIN, ORE.—The installation of a municipal electric light and power plant is under consideration.

PORTLAND, ORE. — Plans are under way by the Elks' Lodge for the construction of a temple on Eleventh and Adler Streets, to cost about $700,000. Separate bids will be received on lighting, heating, etc.

EUREKA, CAL.—H. L. Jackman has been granted permission to divert 9,000 cu.ft. from the Klamath River, Humboldt County, for power purposes. The amount to be stored aggregates 150,000 acre-ft. The cost of the project is estimated at about $20,000,000, to include a steel pipe line and the erection of a dam.

SAN FRANCISCO, CAL. — Application has been made to the State Railroad Commission for permission to purchase the property of the California Power & Manufacturing Company of Fall River Mills by the Mount Shasta Power Company, an extension of the Pacific Gas & Electric Company. The cost is estimated at about $110,000.

HAVRE, MONT.—The Pacific Coast Fire Prevention Bureau has advised the installation of a fire-alarm system in Havre.

GREELEY, COL. — The Home Gas & Electric Company has made arrangements for the purchase of the property of the Farmers' Electric & Power Company of Eaton and the pumping plants of the Great Western Sugar Company.

EUREKA, NEV.—Petition has been circulated by W. H. Supp, representative of the Eureka Light, Heat & Power Company asking permission of the Board of County Commissioners to grant a franchise to locate and operate a local electric light, heat and power plant.

Canada

VIRDEN, MAN.—Bids will be received by the chief engineer, Manitoba Power Commission, New Parliament Buildings, until July 7 for the erection of a power house at Virden. Separate bids will also be received for two semi-Diesel engines for direct connection to alternating-current generator and two three-phase, 2,300-volt generators and switching equipment.

ALEXANDRIA, ONT.—The installation of a local electrically driven pumping plant is contemplated; and energy is to be furnished by the Hydro-Electric Power Commission of Ontario. Major Palmer is in charge.

HAMILTON, ONT.—Bids will soon be received for the construction of a steam auxiliary plant of the hydro-electric system.

KITCHENER, ONT.—In connection with the erection of a proposed motion-picture theater, to cost about $350,000, the Lasky Film Corporation, King Street, contemplates the installation of an electrically operated mechanical ventilation system, blower and electric motor, heating coils, electrical switchboard and lanterns.

LUDBURY, ONT.—The Board of Education has awarded contract to Sherwood & Sherwood, Harbor Building, Toronto, for the erection of a mining school, to cost about $250,000. An electrically operated ventilation system and electric light equipment will be installed.

TORONTO, ONT.—The Board of Education contemplates the erection of a technical high school, to cost about $400,000. An electrically driven mechanical ventilation system and electrical laboratory equipment will be installed. Dr. McKay, Central Technical School, College Street, is in charge.

TORONTO, ONT.—The Ontario Hydro-Electric Power Commission contemplates the purchase of the Niagara, St. Catharines & Toronto Railway, the Toronto Suburban Railway and the Eastern Railway and plans extensions.

WALKERVILLE, ONT. — General contract has been awarded by Hiram Walker's Sons to R. Westcott & Company, Sheppard Street, Windsor, for the construction of a power plant, to cost about $175,000.

SHAWINIGAN FALLS, QUE.—Arrangements have been made by the Shawinigan Water & Power Company for the issue of $4,000,000 in bonds, proceeds to be used for expansion and improvements, including the erection of a second transmission line from Shawinigan Falls to Montreal and the installation of a new 50,000-hp. unit at the local plant.

Miscellaneous

SANTIAGO, CUBA.—The power plant of the Santiago Electric Light, Railway & Power Company, it is reported, has been destroyed by fire, causing a loss of about $1,000,000.

Directory of Electrical Associations

Printed in the First Issue of Each Month

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co.

AMERICAN ASSOCIATION OF ENGINEERS. Secretary, C. E. Drayer, 63 East Adams St., Chicago, Ill. Annual convention, Buffalo, N. Y., May 10, 1921.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, E. B. Burritt, 8 West 40th St., New York City. Annual convention, Atlantic City, N. J., Oct. 11-15.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, Bethlehem, Pa. Annual meeting, Cleveland, Ohio, Sept. 30-Oct. 2.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS, INC. Secretary, F. A. Molitor, 35 Nassau St., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York City. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country. Annual convention, White Sulphur Springs, W. Va., June 29-July 2.

AMERICAN PHYSICAL SOCIETY. Secretary, Dayton C. Miller, Case School of Applied Science, Cleveland, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary-treasurer, C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

AMERICAN WELDING SOCIETY. Secretary, H. C. Forbes, 29 W. 39th St., New York City.

ARKANSAS UTILITIES ASSOCIATION. Secretary, S. E. Dillon, Hot Springs, Ark.

ASSOCIATED MANUFACTURERS OF ELECTRICAL SUPPLIES. General secretary, C. E. Dustin, 30 East 42d St., New York City.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, Preston S. Millar, Electrical Testing Laboratories, New York City.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, John F. Kelly, Empire Building, Pittsburgh, Pa.

ASSOCIATION OF MUNICIPAL ELECTRICAL UTILITIES OF ONTARIO. Secretary, S. R. A. Clement, 190 University Ave., Toronto.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Joseph A. Andreucetti, Chicago & Northwestern Railway, Chicago, Ill. Annual meeting, Chicago, Ill., Oct. 28-31

BRITISH COLUMBIA ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary-treasurer, Capt. W. J. Conway, 406 Yorkshire Building, Vancouver, B. C. Annual meeting, Vancouver, B. C., Oct. 19.

CANADIAN ELECTRICAL ASSOCIATION, affiliated with N. E. L. A. Secretary-treasurer, Eugene Vinet, Shawinigan Water & Power Co., Montreal, Canada.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary-treasurer, F. O. Safford, Denver Gas & Electric Co., Denver, Col. Annual convention, Glenwood Springs, Col., September.

CONFERENCE CLUB. Secretary, Sullivan W. Jones, 19 West 44th St., New York City.

COMMERCIAL SECTION, N. E. L. A. Secretary, R. H. Tillman, Baltimore, Md.

EASTERN NEW YORK SECTION, N. E. L. A. Secretary, J. L. Hemphill, General Electric Co., Schenectady, N. Y.

ELECTRIC HOIST MANUFACTURERS' ASSOCIATION. Secretary-Treasurer, E. Donald Tolles, 52 Broadway, New York City.

ELECTRIC FURNACE ASSOCIATION. Secretary, Dr. C. G. Schluederberg, Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

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ELECTRICAL SAFETY COUNCIL. Secretary, Dana Pierce, 25 City Hall Place, New York City.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General secretary, Franklin Overbaugh, 411 South Clinton St., Chicago, Ill.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION, ATLANTIC DIVISION. Secretary, E. Donald Tolles, 52 Broadway, New York City.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION, PACIFIC COAST DIVISION. Secretary, Albert H. Elliot, 502 Flatiron Building, San Francisco, Cal.

ELECTRICAL TRADE ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Canada

ELECTRIC POWER CLUB. Secretary, C. H. Roth, 1410 West Adams St., Chicago, Ill.

EMPIRE STATE GAS AND ELECTRICAL ASSOCIATION. Secretary, Charles H. B. Chapin, Grand Central Terminal Building, New York City.

FLORIDA ENGINEERING SOCIETY. Secretary, J. R. Benton, Gainesville, Fla.

ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary-treasurer, R. V. Prather, Springfield, Ill.

ILLUMINATING ENGINEERING SOCIETY. General secretary, Clarence L. Law. Sections in New York, Philadelphia, Pittsburgh, Cleveland, Chicago and Boston. Annual convention, Cleveland, Sept. 27, 28, 29 and 30.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Thomas Donohue, Lafayette, Ind. Annual convention, Sept. 15-17, French Lick, Ind.

INDUSTRIAL ELECTRIC HEATING ASSOCIATION. Secretary, Homer Kunz, Toledo Railways & Light Co., Toledo, Ohio.

INSTITUTE OF RADIO ENGINEERS. Secretary, Alfred N. Goldsmith, College City of New York, New York.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria Street, Westminster, London, S. W., England.

IOWA SECTION, N. E. L. A. Secretary-treasurer, M. G. Linn, Des Moines, Iowa.

JOVIAN ORDER. Jupiter (president), Arthur J. Binz, Houston, Tex.

KANSAS PUBLIC SERVICE ASSOCIATION. Secretary-treasurer, W. W. Austin, Cottonwood Falls, Kan.

MICHIGAN SECTION, N. E. L. A. Secretary, Herbert Silvester, Ann Arbor, Mich. Annual convention, Ottawa Beach, Mich., Aug. 24-26.

MISSISSIPPI ELECTRIC ASSOCIATION, affiliated with the N. E. L. A. Secretary, E. S. Myers, Vicksburg, Miss.

MISSOURI ASSOCIATION OF PUBLIC UTILITIES. Secretary-treasurer, F. D. Beardslee, 315 N. 12th St., St. Louis, Mo.

NATIONAL ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary, W. H. Morton, 110 West 40th St., New York City, N. Y. State associations in Alabama, Arkansas, Connecticut, Georgia, Kansas, Illinois, Indiana, Iowa, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Missouri, New Jersey, New York, Ohio, Oregon, Pennsylvania, Tennessee and Wisconsin. Annual convention, Baltimore, Md., Oct. 4-8.

NATIONAL COUNCIL OF LIGHTING FIXTURE MANUFACTURERS. Secretary, C. W. Hoffrichter, 8410 Lake Ave., Cleveland, Ohio.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, William L. Smith, Northeastern College, Boston, Mass.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive assistant to president, M. H. Aylesworth, 29 West 39th St., New York City.

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NEW ENGLAND GEOGRAPHIC DIVISION, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass. Annual convention, Kineo, Me., Sept. 14-16.

NEW MEXICO ELECTRICAL ASSOCIATION. Secretary-treasurer, Charles E. Twogood, Albuquerque, N. M.

NEW YORK ELECTRICAL CREDIT ASSOCIATION. Secretary, E. Donald Tolles, 52 Broadway, New York City.

NEW YORK ELECTRICAL SOCIETY. Secretary, George H. Guy, 29 West 39th St., New York City.

NORTH CENTRAL ELECTRIC ASSOCIATION, N. E. L. A. Secretary, M. Barnett, St. Paul, Minn.

NORTHWEST GEOGRAPHIC DIVISION, N. E. L. A. Secretary, L. A. Lewis, Washington Water Power Co., Spokane, Wash.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio. Annual meeting, Cedar Point, Ohio, July 13-16.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus.

OKLAHOMA UTILITIES ASSOCIATION. Secretary, H. A. Lane, 611 State National Bank Building, Oklahoma City.

PACIFIC COAST GEOGRAPHIC DIVISION, N. E. L. A. Secretary, A. H. Halloran, Rialto Bldg., San Francisco, Cal.

PENNSYLVANIA ELECTRIC ASSOCIATION, State Section N. E. L. A. Secretary, H. M. Stine, 211 Locust St., Harrisburg, Pa. Annual convention, Bedford Springs, Pa., Sept. 8-11.

PUBLIC SERVICE ASSOCIATION OF VIRGINIA. Secretary, W. J. Kehl, Virginia Railway & Power Co., Richmond, Va.

PUBLIC UTILITIES ASSOCIATION OF WEST VIRGINIA. Secretary, W. C. Davisson, West Virginia Water & Electric Co., Charleston, W. Va.

RADIO CLUB OF AMERICA. Secretary, T. J. Styles, 1112 S. Curtis Ave., Richmond Hill, Queens Borough, N. Y.

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SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. General manager, J. M. Wakeman, Guaranty Building, 522 Fifth Ave., New York City.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa. Annual Meeting, Ann Arbor, Mich., June 29-July 2.

SOUTHEASTERN DIVISION, N. E. L. A. Secretary-treasurer, Charles A. Collier, Georgia Railway & Power Co., Atlanta, Ga. Annual convention Sept. 17-19, Asheville, N. C.

SOUTHERN CALIFORNIA ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary-treasurer, J. E. Wilson, 425 Consolidated Realty Building, Los Angeles, Cal.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, H. S. Cooper, 403-4 Slaughter Building, Dallas, Tex.

SOUTHWESTERN SOCIETY OF ENGINEERS. Secretary, C. E. Barglebaugh, 721 First National Bank Building, El Paso, Tex.

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WISCONSIN ELECTRICAL ASSOCIATION. Secretary, J. P. Pulliam, 1408 First National

(Issued June 8, 1920)

1,342,478. Engine Starter; Frank E. Watts, Detroit, Mich. App. filed Dec. 14, 1917. Mounted on flywheel case.

1,342,511. Terminal Seal for Storage Batteries; McConnell Shank, Akron, Ohio. App. filed Feb. 10, 1919. Tightened by wedge.

1,342,546. Multiple-Unit Safety Switchboard; Hubert F. Krantz, Brooklyn, N. Y. App. filed Aug. 2, 1917. Removable switch units.

1,342,547. Multiple-Unit Safety Switchboard; Hubert F. Krantz, Brooklyn, N. Y. App. filed June 6, 1918. Has removable switch units.

1,342,548. Switch Mechanism; Hubert F. Krantz, Brooklyn, N. Y. App. filed Aug. 2, 1917. Cannot operate when guard is set.

1,342,553. Internal-Combustion Engine; Frederick H. Leinweber, Chicago, Ill. App. filed Nov. 6, 1916. Several spark plugs in one cylinder.

1,342,579. Trolley Signal; Joseph Basil and Frank Giardi, Detroit, Mich. App. filed Feb. 17, 1919. Signals "Stop" to traffic behind.

1,342,581. Telephone Transmitter; William Birrell and James Birrell, Chicago, Ill. App. filed Aug. 18, 1917. Means for securing parts of transmitter diaphragm.

1,342,582. Telephone Transmitter; William Birrell and James Birrell, Chicago, Ill. App. filed June 27, 1916. Two relatively fixed electrodes vibrated in unison.

1,342,583. Mounting for Dynamo Brushes; Henry E. Borger, Newark, N. J. App. filed Nov. 3, 1917. For motorcycles.

1,342,594. Variable-Resistance Device; John Parkin, Jr., San Rafael, Cal. App. filed July 31, 1919. For rheostats and potentiometers.

1,342,607. Ignition Magneto; John R. Stark, Racine, Wis. App. filed April 26, 1919. Good spark at low speed.

1,342,611. Storage-Battery Separator and Process of Producing Same; Theodore A. Willard, Cleveland, Ohio. App. filed Oct. 5, 1917. Ribs securely attached to separator blanks and properly positioned.

1,342,636. Electrometallurgical Furnace; François Louvrier, Paimbœuf, France. App. filed April 5, 1919. For reduction of zinc ore.

1,342,645. Grounding Device; Charles W. Pen Dell, Chicago, Ill. App. filed Jan. 9, 1918. Grounding wire and cone of same material welded together.

1,342,658. Electric Light Socket; Louis E. Wood, Farrell, Pa. App. filed Dec. 27, 1918. Ejector to force out bulb.

1,342,664. Construction of Bodies of Motor and Other Vehicles; Fernand M. Charles, Iver Heath, Eng. App. filed Feb. 26, 1919. Making curved shapes by electro-depositing.

1,342,717. Process of Metal Welding; Evrah C. Lipps, Detroit, Mich. App. filed Nov. 9, 1917. By a series of spot welds.

1,342,729. Synchronized Airplane-Gun-Control System; Frank Wenner, Washington, D. C. App. filed Aug. 26, 1919. Gun fired between blades of rotating propeller.

1,342,737. Method of Recovering By-products from Waste Liquors; George M. Bradford and James E. Broadhead, Bay City, Mich. App. filed Sept. 16, 1918. Recovering potash and other products as a by-product of sugar factories.

1,342,787. Grip Fitting for Electric Cord; Ernest C. White, New York, N. Y. App. filed Aug. 26, 1918. Prevents strain on joints.

1,342,788. Direction-Indicating Device; Thomas B. Wright, Chicago, Ill. App. filed May 14, 1917. For automobiles.

1,342,792. Telephone System. Leonard C. Bygrave and Thomas M. Inman, London, England. App. filed July 25, 1917. One thousand trunk-line groups.

1,342,797. System of Marine Propulsion; Angelo Conti, Washington, D. C. App. filed Dec. 9, 1915. Two motors for different speeds acting alternately as generators.

1,342,804. Metallurgical Process; William E. Greenawalt, Denver, Col. App. filed Dec. 21, 1916. For copper refining.

1,342,809. Method for Heating of Material or the Performance of Chemical Processes in Electrical Furnaces, Together with Apparatus Intended Therefor; Torsten A. F. Holmgren, Stockholm, Sweden. App. filed July 24, 1919. Two pairs of electrodes or groups of electrodes.

Record of Electrical Patents

Notes on United States Patents

1,342,816. Spark Gap; Oren W. Kinley, Des Moines, Iowa. App. filed July 8, 1919. Between spark plug and service wires.

1,342,819. Connector Plug; Clair D. Lake, Endicott, N. Y. App. filed Jan. 15, 1919. Switchboard plug.

1,342,823. Telephone-Exchange System; Alben E. Lundell and Edgar H. Clark, New York, N. Y. App. filed Nov. 2, 1917. Semi-automatic type for tandem trunking.

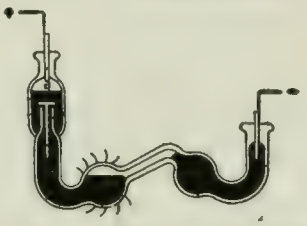
1,342,835. Electrical Detecting Machine; Emery L. Welch, Lima, Ohio. App. filed Jan. 19, 1918. Prevents unauthorized interruption of telephone conversation.

1,342,837. Ignition Device; Robert N. Wood, Dallas, Tex. App. filed April 7, 1919. Test switch on spark plug.

1,342,842. Resistance Element; Theodore W. Case, Scipo, N. Y. App. filed March 15, 1920. Varies with intensity of light to which element is exposed.

1,342,860. Apparatus for Facilitating the Landing of Aircraft; William Mortimer and Frederick Potten, Dover, Eng. App. filed May 13, 1919. Indicates at distance direction of wind.

1,342,864. Electric Sadiron; John P. Nionow, New York, N. Y. App. filed Aug. 6, 1919. Detachable heater.



1,343,037 Mercury-Vapor Lamp

1,342,885. Method of Receiving High-Frequency Oscillations; Edwin H. Armstrong, Paris, France. App. filed Feb. 8, 1919. For waves of short length.

1,342,899. Metal-Plating Machine; Charles W. Eddy, East Providence, R. I. App. filed April 29, 1919. Washing, plating and drying in one continuous operation.

1,342,902. Telephone System; Charles L. Goodrum, New York, N. Y. App. filed Sept. 14, 1917. For selective switching.

1,342,905. Switch Attachment for Electric Irons; Charles H. Helling, Oakland, Cal. App. filed April 3, 1919. Automatic and manual operation.

1,342,910. Process of Coloring Iron or Steel Articles; Herbert F. Jermain, N. H. App. filed Jan. 7, 1920. Coloring and rust-proofing.

1,342,915. Electric Feed Mechanism for Planers and Current-Controlling System Therefor; Sven P. Johnson, Philadelphia, Pa. App. filed March 16, 1916. Automatic feed and cut off.

1,342,940. Carriage-Return Mechanism for Typewriters; Franklin C. Breuckman and George T. Arnold, Mackinac Island, Mich. App. filed July 28, 1919. By solenoid.

1,342,941. Combined Incidence and Side-Slip Indicator for Aëroplanes and the Like; Oscar A. Danielson, New York, N. Y. App. filed Sept. 30, 1916. Free from effects of gravitation.

1,342,952. Storage-Battery Construction; William Gardiner, Chicago, Ill. App. filed June 9, 1919. Improved separator.

1,342,953. Active Material for Battery Plates; William Gardiner and William H. Duggan, Chicago, Ill. App. filed Aug. 23, 1919. No buckling.

1,342,954. Cover for Storage Batteries; William Gardiner, Chicago, Ill. App. filed Oct. 1, 1919. Means for permitting escape of gases.

1,342,957. Method of Resistance Welding; James H. Gravell, Elkins Park, Pa. App. filed July 11, 1919. Butt-welding tubes, high-speed steel to low-carbon steel, and welding cast metal to wrought metal or steel.

1,342,995. Electrical Apparatus; John J. Frank, Pittsfield, Mass. App. filed Sept. 2, 1919. Three-phase transformers and reactances.

1,343,018. Protective Device; Edmund B. Wedmore, Hendon, England. App. filed Oct. 24, 1919. Capacity current compensated for.

1,343,020. Engine-Starting Apparatus; Lionel M. Woolson, Detroit, Mich. App. filed June 20, 1919. Automatically engages and disengages.

1,343,021. Controller for Electric Motors; Paul H. Zimmer, Schenectady, N. Y. App. filed Jan. 8, 1919. For compensator starting.

1,343,022. Starting Device for Electric Motors; Paul H. Zimmer, Schenectady, N. Y. App. filed Jan. 25, 1919. By magnetic contactors.

1,343,026. Rotary Transformer; Theophilus F. Barton, Schenectady, N. Y. App. filed May 27, 1919. Rotary converter with commutating poles.

1,343,028. Engine-Starting Apparatus; Joseph Bijur, New York, N. Y. App. filed May 5, 1913. Automatically disengaged on starting.

1,343,029. Engine-Starting Apparatus; Joseph Bijur, New York, N. Y. App. filed June 25, 1913. Automatically disengages after starting.

1,343,030. Engine-Starting Apparatus; Joseph Bijur, New York, N. Y. App. filed June 25, 1913. Automatically disengaged when engine starts.

1,343,037. Mercury-Vapor Lamp; Marie J. Cornu, Paris, France. App. filed Jan. 5, 1918. Arc of small length but high brilliancy.

1,343,053. Fuel Vaporizer for Combustion Engines; Chester G. Hedges, Chase, Kan. App. filed April 9, 1918. Applied to manifold of engine.

1,343,127. Electrical Toy Gun; Thomas Hallinan, Paterson, N. J. App. filed March 3, 1919. For rapid fire.

1,343,134. Electric Water Heater; William D. Huff, Lafayette, La. App. filed July 3, 1919. Delivers cold, warm or hot water.

1,343,141. Electric Sign; Paul J. Kenagy, Newton, Kan. App. filed July 9, 1917. For medical advertising and demonstrating.

1,343,165. Submarine Radio System; Peter E. Stogoff, New York, N. Y. App. filed Feb. 20, 1918. Under-water radio communication.

(Issued June 15, 1920)

1,343,194. Electric Arc-Welding System; Albert M. Candy, Wilkinsburg, Pa. App. filed Sept. 3, 1919. Prevents shock to operator.

1,343,196. Signaling System; Roy D. Conway, Chatham, N. J. App. filed Sept. 21, 1918. Signals when circuit is energized.

1,343,199. Arc-Welding System; Otto H. Eschholz, Wilkinsburg, Pa. App. filed Sept. 8, 1919. Easy starting characteristics.

1,343,200. Arc-Welding System; Otto H. Eschholz, Wilkinsburg, Pa. App. filed Sept. 8, 1919. High starting voltage.

1,343,201. Arc-Welding System; Otto H. Eschholz, Wilkinsburg, Pa. App. filed Sept. 8, 1919. High starting voltage.

1,343,202. Electric Arc-Welding System; Otto H. Eschholz, Wilkinsburg, Pa. App. filed Sept. 8, 1919. High starting voltage.

1,343,203. Electric Arc-Welding System; Otto H. Eschholz, Wilkinsburg, Pa. App. filed Oct. 6, 1919. High voltage when operating.

1,343,204. Electric Arc-Welding System; Otto H. Eschholz, Wilkinsburg, Pa. App. filed Oct. 6, 1919. High voltage for starting.

1,343,205. Alternating-Current Welding System; Otto H. Eschholz, Wilkinsburg, Pa. App. filed Oct. 6, 1919. High start-ink voltage.

1,343,206. Electric Arc-Welding System; Otto H. Eschholz, Wilkinsburg, Pa. App. filed Oct. 11, 1919. High starting voltage.

1,343,207. Electric Arc-Welding System; Otto H. Eschholz, Wilkinsburg, Pa. App. filed Nov. 24, 1919. High voltage for starting.

Electrical World

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Profiting from Failure

NOT to talk about failures is human nature. Still, what better way is there of finding out what not to do and how to avoid the pitfalls that engulfed our grandfathers? Exchange between operating men of experiences that were not successful as well as of those that were may often prevent fresh mistakes. The Northwest is setting an example in telling what not to do in burning hogged fuel and powdered coal. Let all engineers follow the spirit of the progressive West and give others the benefit of what they have learned.

Spreading the "Self-Interest" Idea

THE "self-interest plan" is producing results on the Pacific Coast in popularizing public utility securities. Why should it not be adopted nationally? When people are asked to invest they naturally have to be shown the benefit. If the immediate return on their money cannot be made sufficiently attractive, the indirect returns to them from station development must be made clear. This is not difficult. It is being done, but not extensively enough. The central-station company can itemize a dollar spent in its development and point out to manufacturers where they will receive new business that may not be created if they will not help finance the project. Going further, each producer of a raw product required in the equipment used may be shown where he will make more sales. Every class of labor can be shown where it will find a market for its services in the production of material for the proposed development. If a company will only explain where the money spent for construction goes, it will find little difficulty in developing "self-interest" in public utility securities.

The Manufacturers' Political Program

SMALL direct trace of the nine-plank platform on industrial issues adopted by the National Association of Manufacturers and advocated by it before the resolutions committees of the Republican and Democratic national conventions can be found in the declaration of principles adopted by either of these political parties. In this respect, however, the manufacturers' proposed planks did not fare worse then those submitted by various other associations of citizens, including labor bodies. The platforms of both parties, it is needless to say, are enthusiastic for progress, reform and retrenchment. They always are. When it comes to specific promise on industrial problems they are alike elusive and non-committal. However, neither platform squints in the direction of government ownership or operation of industry, opposition to which was the manufacturers' first plank, while both platforms declare for a sweeping revision of war taxation, for intelligent handling of transportation problems, for encouragement of foreign trade and for an enlarged merchant marine. With such crumbs of comfort, so far as the proclaimed articles of Republican and Democratic belief in 1920 are concerned, the National Association must content itself as best it can.

Progress Phenomenal

DETROIT'S spectacular jump from the ninth to the fourth place among the cities of the United States and from less than half a million to nearly a million inhabitants stands out as the most striking fact disclosed by the 1920 census of population. Thirty years ago Chicago made an equal record, but never since has so large a city doubled its population in ten years. Naturally the public utilities had their work cut out for them in keeping up with this rapid growth. The problem would have been great had everything save the rate of increase been normal. When in the latter part of the decade the war made every condition abnormal the difficulties became tremendous. Difficulties, however, do not terrify the American central-station manager but put him on his mettle. The Detroit Edison Company, under the guidance of Alex Dow, rose to the occasion, obstacles were overcome, and the system expanded with the city. In 1909 the total gross earnings of the company were $2,199,143; in 1919 they were $16,498,391. The output rose in the same decade from 86,882,900 kw.-hr. to 872,500,000 kw.-hr. a year. The investment now totals $62,520,624, including the two great plants, Delray and Connors Creek. Besides Detroit itself, the company serves six near-by cities and more than forty villages, some of which—notably Highland Park and Hamtramck—have grown at a rate far greater even than that of the Michigan metropolis itself. The company's achievement is an encouraging exhibition of successful enterprise on a vast scale.

Interconnection in France

IN ANOTHER column this week there is printed an account, based on an article in *Le Génie Civil*, of the French government's proposals for the rehabilitation of the electrical systems in the devastated sections of the republic. The government's intention is to afford liberal state aid in the building of power houses and transmission lines to take the place of those destroyed by the invaders, and eventually to supply electrical energy not only to the ruined districts but to contiguous districts in Lorraine and in the region of Paris. The total length of network is to be almost a thousand miles and the cost is put at 135,000,000 francs. Perhaps the most interesting feature of the plan is that by which the territory covered will be served, not by a series of disconnected systems, but by a uniform and interconnected network with all the advantages of economy and efficiency thereby attained. The greatest of evils some-

times bring with them a small amount of compensation. Against the ruthless destruction by the Germans may be set as a slight alleviation the fact that it has rendered easy in the northeast of France what vested interests will make very difficult in other parts of the nation when the Government is ready to go forward with a still more extensive plan that it has prepared.

Pitfalls Engineering Societies Should Avoid

AMONG many prominent engineers there was an attitude of indifference to and lack of confidence in the work of the organizing conference of engineering societies before it so successfully ushered into being the Federated American Engineering Societies at Washington, D. C., as reported in the ELECTRICAL WORLD June 12. In one case no representative was present because the organization involved felt that the program was so full that proper discussion could not be had and that therefore the expense of representation was not justified and men of the right caliber should not be asked to give up their time. This is not, we think, the kind of thinking that should be displayed by members of influential engineering organizations. There is an apparent development of two types of ideas that will need careful attention as the work of the new federation is planned. The first is the type that can direct results only through the individual societies; the other is of the far-seeing character that is willing to search out the defects that have hindered the engineer's progress, and carefully and thoroughly correct them in the most effective way. To this type the new federation is that most effective way. Men who think on these lines foresee the necessity of a long and patient schooling, including thorough and honest self-analysis, that has no appeal to the radical type. A clash between these two schools is inevitable, and unless the vast body of soberly thinking engineers take an active part and control the discussion there will be a battle royal between the extremists of both factions.

If the individual engineer is to be educated to a broader point of view, the problem is much more than a question of co-operation between the various engineering bodies. It becomes a question of co-ordination of all engineering activities, which is a propostion reaching very much farther. Co-operation means essentially the working together of equals, with neither surrendering the right to independent action should self-interest demand it. Co-ordination means the surrendering of certain individual prerogatives and the submission to the authority of a superior for the common good. This, more often than not, means the subordination of self-interest. The whole question involved in the movement of engineers to attain a higher standing for their profession is a movement for the common good. If it is to be successful, controversies that will attract the attention of the fight-loving onlooker must be avoided. This does not mean suppressing discussion, for complete and thorough discussion is an essential to the development of the problem; but it does mean the existence of somebody that will be recognized as having authority to hold the discussion within proper bounds, co-ordinate the work that may be undertaken, and insure the elimination of any moves directed primarily toward the self-interest of this or that group. That body is the Federated American Engineering Societies, an organization that already represents the co-operative and co-ordinating thinking of more than three score individual societies and clubs. It may be that as time goes on and this body extends its activities the hitherto jealously guarded prerogatives of the organization that are or may be involved will be called into question and conditions will be found such that some of these will be trampled under foot. In meeting these conditions the ability that the engineer has acquired in studying physical facts and accepting the conclusions they force will be subjected to a severe test. If the situation is faced with the same honesty of thought and breadth of vision with which engineering problems in general have been faced, the answer will never be in doubt. On the other hand, if self-interest and petty prejudice rule, the movement will gather the momentum it deserves slowly and the great good that can be accomplished will be unnecessarily delayed. Indifference and lack of confidence in the new organization form a type of resistance that sooner or later the large current of opinion will overcome. It will be well for every engineer to bear in mind the trite saying, "The mule makes no progress while he is kicking," and urge the societies with which he is affiliated to join the ranks of the new federation and actively take up its work.

Tariff on Scientific Instruments

THERE has recently appeared in one of our English contemporaries a most interesting discussion to which America should give serious consideration. England, next door to the Continent and quick to resume commercial relations, was early to feel the pressure of Continental competition, made all the more active by the difference in exchange, especially in the vanishing value of the mark. As protection against this extraordinary condition an anti-dumping bill is under serious consideration whereby apparatus of foreign make is to be excluded entirely except as imported under license on showing that similar articles of equally good quality and of British manufacture cannot be regularly obtained. This is akin to the suggestion made here that, granted a stiff tariff, this tariff should be lifted in cases where the American manufacturer does not regularly produce articles of quality equal to the foreign.

In the correspondence alluded to the attitude of important British manufacturers toward a tariff as against the proposed prohibition is extremely interesting. One, of worldwide reputation, puts the case thus: "We have very little sympathy with those who would bolster up our industry by levying heavy duties on imports, and we think that the result of such a policy would be to increase the cost of home-made goods without improving their quality; but there is a good deal to be said for preventing goods made abroad being dumped in this country at prices lower than those prevailing in the country of their origin." Another manufacturer, equally well known, says frankly that individual pieces of apparatus equal to any produced on the Continent have certainly been produced in England, but that only a very small proportion of the supply ever reached that standard, and goes on to enforce this wholesome statement of fact by intimating that the purchasing public would have no reason for buying foreign-made instruments if the English standard of inspection were higher. What is true of England is also true here.

Co-operation in Power Supply

A PETITION made some time ago by a street-railway company in Massachusetts for authority to sell energy in bulk in the general commercial field was vigorously opposed by central-station interests on the ground that the policy of the state has long been one of declared demarcation between these different classes of utilities, allowing the business of electrical supply to be and continue a regulated monopoly within a stated territory upon the condition of adequate and satisfactory service. In cases of this kind an *entente cordiale* between the central-station interests and the railway company, in order that the ideal capacity may be as far as practicable utilized and the industrial power needs of the district be met in a wholesale way, is worth working for. A railway company may have the right to organize an independent power company and so to proceed in competition with existing agencies if it so desires: but its chances of success would seem to be far greater if a satisfactory operating agreement could be entered into whereby the energy generated in its steam plants could be distributed by the existing electric service utilities. Where the latter are meeting their requirements well the local authorities, and probably the state commissions, would be slow to indorse the entrance of a competitor. A better way lies along the line of co-operative production and distribution, with interconnection and maximum use of existing facilities as the basis of enlarged and improved service.

Increasing Rupturing Capacity of Circuit Breakers

AS STATIONS have grown bigger and bigger the circuit-breaker difficulty has increased almost in geometric ratio, and the time is apparently drawing near when, unless improvements are made, the apparatus to protect the generator will cost more than the generator itself. In view of this serious situation experiments to determine the rupturing capacity of circuit breakers on short circuit are evidently worth the while, and if they can show means for increasing the emergency capacity a considerable saving can be effected.

Some very interesting tests have been conducted in Chicago to obtain higher switch rating, and the results are briefly related in this issue by C. J. Hejda. A 300-amp. nominal breaker was connected to three-conductor cable short-circuited between two phases and fed by a 12,000-volt, 20,000-kva. generator which was started at reduced voltage and pushed upward step by step until the breaker began to give trouble. With the breaker regularly equipped this point was reached on short circuit at about 10,000 volts. The ordinary transil oil was then removed from the breaker and another liquid substituted consisting of a chlorine derivative much less volatile than carbon tetra-chloride. The repetition of the tests under this condition showed material improvement because the breaker could handle fairly a short circuit at the normal pressure of 12,000 volts.

As another modification hollow contact rods were used, having a pressure venting device at the upper end closed normally by a weighted valve capable of opening freely under pressure in the well. With the tubular rods the gas pressure created in the well by the arc forces the liquid across the arc into the tube and the gases can escape through the vent. In addition to this device the new filling liquid (chlorine derivative) again produced material improvement in the operation of the break. Finally, extra pressure vents set to release at about 150 lb. were provided in each well, and when the breaker was operated this pressure seemed to be about the limit of that reached in the well, showing the effectiveness of the venting in the hollow electrodes. In general it was found that the increase of working capacity by change of liquid and the use of hollow vented electrodes approximated 50 per cent increase in kva. rupture, a gain of no small consequence in installing a station of large capacity.

Taking Full Advantage of Relays

IN THE last few years marked results have been obtained by the application of relays. In the early days of central-station development relays were utilized mainly to protect generating apparatus or transformers from excess current by operating oil switches. While such a function is still a part of the duties of relays, it is only a small part. Later the idea was conceived that relays should not only protect apparatus but should also protect service by disconnecting automatically any portion of a line when trouble occurred. The principle was first applied to parallel lines and to very simple networks. Now experience has proved that, with judicious use of relay timing and various relay actions, protection of service can be given to an elaborate network. The possibilities of such dependence on relays appear to be quite unlimited in scope.

The proper use of relays results necessarily in interconnection. During the war the value of interconnection between companies to effect a transfer of power to the places where there was shortage was vividly realized. In this manner of operation also it was found that economies were obtained by taking advantage of the diversity factor between the loads of the connected plants. Exactly the same advantages are present inside of any one system. It should also be remembered that operating many lines in a network reduces the losses of the system as a whole and that the actual saving in energy losses may be of great magnitude. It is fair to assume in nearly all instances that any expense incurred in providing relay installation will be repaid manyfold through the saving in energy losses.

Many operators have objected to operating any considerable portion of their system as a connected network for fear of service shutdowns due to the failure of some relay to operate; and they have seemingly been justified by some very serious accidents that have occurred where interconnection has been practiced to a large extent. It would be hard to prove that the shutdowns thus caused were more costly to the companies than the continuous cost of operating many disconnected lines. Nevertheless, it is evident that such shutdowns should not occur, and therefore success in interconnection will depend largely upon the care taken in the installation and setting of relays and an ever-vigilant inspection system.

Means must be found to insure relay operation rather than to condemn the practice of interconnection on such weak ground as that just mentioned. Better service, a saving in line investment and a large saving in energy losses can all be credited to proper use of relays. Not only the necessity of meeting increased costs but the duty of practicing conservation makes this incumbent..



Francis Bacon Crocker

Pioneer in electrical manufacturing, educator and father of American electrical standards

AS FAR back as 1886, when the electric motor was just beginning to be used commercially, F. B. Crocker was thinking of standardization. In that year the C. & C. Electric Motor Company, in which he was a partner with Charles G. Curtis, produced under standard specifications 100 ¾-hp. motors, probably the first standardized output of the kind. Professor Crocker, then head of the department of electrical engineering of Columbia University, became ten or eleven years later chairman of the first standardization committee of the A. I. E. E. This committee drew up the original standardization rules of the Institute. Later Professor Crocker was chairman of the committee which revised these rules. He was also chairman of the conference of insurance and engineering representatives that formulated the National Electrical Code. Had he done nothing else, the excellence of this pioneer work in standardization, the groundwork of which has remained virtually unchanged for almost a quarter of a century, during which time the industry has undergone a most remarkable period of enhancement and advancement, would be sufficient to make his name immortal in electrical history. Besides this, however, Professor Crocker is considered one of the best posted men on electrical patents. While he has not taken out many patents in his own name, he has been able to aid greatly in the development of many uncompleted devices which have been brought to him. He has contributed much to technical literature, his best known work being probably a two-volume treatise on "Electric Lighting." Moreover, it was he who proposed the name of "henry" for the unit of inductance.

Professor Crocker has given unusual service to the profession of electrical engineering. In addition to his other activities, he has served the A. I. E. E. as president and as manager as well as having been vice-president for two terms. At the World's Columbian Exposition, in 1893, he was made permanent secretary of the International Congress. He was active in the first standardization congress held in London in 1906 and is now American vice-president of the International Electrotechnical Commission, which will hold its plenary meeting this fall in the United States. He is one of the pioneers in the electrical manufacturing industry. Besides establishing in 1886 with C. G. Curtis the C & C Electric Motor Company, already referred to, two years later with Dr. S. S. Wheeler he formed the Crocker-Wheeler Electric Company. He is also past-president of the Electric Power Club.

Professor Crocker celebrated his fifty-ninth birthday on Sunday last at his summer home on Cape Cod.

Technical Sessions

of A.I.E.E. Convention at White Sulphur Springs

Abstracts of the Papers and Discussions to Which Three Days Were Devoted—Problems of Reactor Layout, Temperatures in Electrical Machinery, Selection of Excitation Systems and Progress in Electric Welding Draw Animated Discussion from the Members—Papers Covered Live Engineering Subjects

ENGINEERING problems having a direct application to modern electric power and industrial systems were discussed with enthusiasm in the technical sessions of the convention of the American Institute of Electrical Engineers at White Sulphur Springs, W. Va., last week. Six general sessions dealt with electrical machinery, protective devices, electric welding, power factor in polyphase, unbalanced systems, excitation methods and miscellaneous subjects.

Of particular interest were the papers dealing with the use of power-limiting reactors in central stations. The contributions of R. F. Schuchardt and Dr. C. P. Steinmetz, dealing with stability of operation of large central stations, were given rather fully in the July 3 issue of the ELECTRICAL WORLD. The subject attracted particular attention because of the present rapid growth of interconnected systems and its bearing on the super-power-plant problem.

A report by Philip Torchio of failures of large turbo-generators, dealing with their causes and remedies, added a very practical aspect to the problems of temperature detection and control in electrical machinery. At the excitation session chief interest was centered in recent tendencies toward the use of direct-connected exciters for hydro-electric plants and the operation of exciters separately rather than on a common bus. A comparison of excitation systems by J. T. Barron and A. E. Bauhan, giving advantages and limitations of each, will be reported in more complete form in an early issue of the ELECTRICAL WORLD.

High-Tension Insulator Porcelain

Mechanical strength is obviously one of the prime factors to be considered in insulator material, said W. D. A. Peaslee, adding that under the stimulus of the demand of transmission engineers certain types of porcelain bodies are now available whose strength runs from 65,000 lb. per square inch (4,550 kg. per sq.cm.) in compression to 12,500 lb. per square inch (875 kg. per sq.cm.) in tension. This is not the ultimate limit according to present indications.

Many insulator failures are traceable directly to inability of certain porcelain bodies to resist sudden changes in temperature, Mr. Peaslee continued. Any porcelain when completely equipped with hardware should be able to withstand an indefinite number of alternate immersions in boiling and freezing water. The statement that non-porous porcelain cannot be produced was denied.

One of the most baffling characteristics of insulators is the deterioration of seemingly perfect units after a time and the acquiring by non-porous porcelain of a certain porosity. Some recent investigations indicate that this may be intimately connected with the Piezo electric qualities of quartz crystals.

The Corona Voltmeter as a Secondary Standard

A series of experiments were described by J. B. Whitehead and T. Isshiki in which the values of corona-forming crest voltages were determined by precision measurements made in the high-voltage circuit. These showed that the law followed is so definite and the indications of the instrument so constant that it constitutes not only an accurate measuring instrument but also, through the results of the present investigation, a natural secondary standard of high voltage possessing many advantages over others in present use.

In a study of large corona rods, especially at higher pressures, it was found that plotted data departed from the straight-line law which had been established for smaller rods at lower pressures. The fact suggested either a departure from the simple corona law or the presence of some error in the method of observation.

C. L. Fortescue commended the work of developing the corona voltmeter for use as a secondary standard, but pointed out that a galvanometer is required in the measurements—a device too delicate for ordinary work. The sphere gap, he said, is accurate enough for most purposes and the kenetron method is suitable if there is no zero point in the half wave of voltage.

Dr. A. E. Kennelly called attention to the fact that corona may be detected by the eye, ear or nose, but that in the present instance electrical instruments may be used to detect ionization instead of the physical senses.

The use of the corona voltmeter for the measurement of impulse voltages such as lightning discharges is limited, according to J. Slepian. It was, however, maintained by F. W. Peek, Jr., that transient discharges having a duration of the order of one-millionth of a second can be detected by visual corona. Mr. Peek felt that the crest-voltmeter was accurate enough for practical purposes. L. W. Chubb said that the corona voltmeter should prove to be a good standard. Work is in progress to replace the galvanometer by an ordinary indicating instrument, Dr. Whitehead informed the delegates. In the hands of unskilled observers he recommended the telephone method of corona detection.

Speed and Power-Factor Control of Induction Motors

The use of neutralized polyphase commutator machines to control the speed and power factor of wound-rotor induction motors was explained by John I. Hull with the aid of circle diagrams. It was first shown

how speed and primary power factor depend upon induced voltage in the secondary and then how voltages may be introduced into the secondary from suitable sources to get whatever speed characteristics may be desired. Power factor is controlled by the same means.

Mr. Hull considered single-range speed (below synchronism) and power-factor control by means of a constant-speed series commutator motor, a constant-speed shunt commutator motor and a constant-speed compound excited commutator motor. He also showed how the double range (all speeds above or below synchronism) could be obtained by means of a constant-speed shunt commutator motor.

The quantitative relation between reactive power and the magnetic field was given by Joseph Slepian, and its utility was illustrated by several examples. The total reactive power is directly related to the volume of iron in electrical machines, whereas in a condenser circuit it is related to the volume of dielectric in the condenser.

Concerning the definitions of power factor, Mr. Slepian favored: Power factor is the cosine of the angle of lag between the direct-rotational component of voltage and the direct-rotational component of current. With this definition, a balanced rotating machine will show the same power factor irrespective of the voltage unbalance.

Electrical Machinery Session

PROBLEMS *of temperature and ventilation of large turbo-generators were considered and the contributing causes of failures in the cases of fifty-five large generators were classified. Some excellent experimental work was reported which throws light upon the best methods of installing detectors for the determination of maximum temperatures in armature coils. It was shown that it was impracticable to get actual maximum temperatures, but relative temperature rise may be estimated when the most serious sources of error are avoided.*

PHILIP TORCHIO classified fifty-five generator failures of which he has a record or report. The machines were installed in different parts of this country and their capacities ranged from 5,000 kw. to 30,000 kw., the smaller size dating back from twelve to sixteen years and the larger being of more recent manufacture.

The failures, several occurring on the same unit, are summarized as follows:

Mechanical damages	3	
Heating of windings	17	
Heating of iron	2	
Loose laminations	1	
Moisture in cooling air	3	
Corona shield breaking	2	
Heating at end turn clamping	1	
Overload damaging end turns	2	
Causes undiscovered	2	33
Field failures due to:		
Open-circuited connections	3	
Grounding	7	
Grounding caused by bus short circuit	4	
Loosening of damper windings	2	16
Armature and field failures due to:		
Moisture	1	
Undiscovered	3	4
Terminal failures due to:		
Moisture	2	2

To avoid similar troubles, designing engineers should use insulating materials of proved dependability, maintain low copper temperatures, by proper subdivision of copper and transposition of strands in windings, and provide liberal ventilation throughout the machine. The operating copper temperatures should be limited at or closely to 100 deg. C. Too great a range of operating temperatures is bound to cause generator failures. Mica insulation in hydro-electric generators operated at steady load will last indefinitely at high temperatures, while under similar conditions mica insulation in steam turbo-generators operated intermittently will fail.

If operating companies are finding that generator failures are caused by excessive temperatures, said W. J. Foster, they can reduce the heating considerably by improving the power factor—an increase from 80 to 100 per cent almost halving the energy loss. With the specifications regarding output and power factor it is almost impossible to limit the copper temperature to 100 deg. C. Furthermore, the insulation test of the three-times normal plus 1,000 volts, prescribed by Mr. Torchio, would require such thick insulation that reduced heat conductivity and increased eddy-current losses due to the greater magnetic leakage would result.

F. D. Newbury contested the statement of Mr. Torchio that excessive temperatures are the chief cause of generator failure except where machines are purposely overloaded. To substantiate his contention he presented observations regarding all Westinghouse generator failures for the last seven years involving units rated at 15,000 kw. and more, saying that the manufacturer accepted the responsibility for eight out of a total of twenty-two, the users accepted the responsibility for eleven (caused by outside fires, abnormal voltage surges, ice and water and overloads), and three cases were in dispute as to cause. The majority of failures were caused by operating hazards and not armature heating. In the cases involved one-third of the failures were in 11,000-volt units or higher ones, and two-thirds were in units of lower voltage.

Where failure of insulation has occurred, W. F. Dawson said, abrasion of covering and air voids are serious contributing causes. He advocated mica insulation for 4,000 volts and higher.

Philip Torchio called particular attention to the fact that assuring reliable operation is vastly more important than getting the maximum rating out of a certain mass of metals!

B. G. Lamme pointed out some of the problems in turbo-generator ventilation practice, without taking up the quantitative solution of such problems. In radial

ventilation all air must flow through the gap, and this makes it necessary to use high air pressures for machines of compact design. Another difficulty is that equal quantities of air do not flow through all of the ducts along the length of the stator and that air temperature is higher when it reaches centrally located ducts. In axial ventilation the tendency is toward the use of many axial ducts for the passage of air rather than a few large ones, he said. Most ventilation systems are a combination of the two methods. He pointed out that, theoretically, the air should be coolest where machine temperatures are highest—that is, near the center—but, while this has been impracticable, radial is somewhat better than axial ventilation in this respect.

Both the length of air passage to the parts to be cooled and the effectiveness of contact must be considered. In case of laminated iron, air passing through ducts parallel to the laminations is far more effective than air flowing across the ends.

The characteristics of insulation and metal in heat conduction help to equalize the higher temperatures at the center of the machine, particularly with rotors of moderate length. Heat flows readily toward the end connections in the copper and far more readily along the insulation layers than across them.

Illustrating the air requirements of large turbo-generators, Mr. Lamme said that a 30,000 kw. unit requires about 90,000 cu.ft. (2,500 cu.m.) per minute.

Mr. Williamson illustrated the importance of satisfactory insulation between laminations by pointing out that leakage of eddy currents through a restricted area may seriously overheat sections of the laminations. Inserting paper punchings midway between ventilation ducts is particularly beneficial.

The amount of air required for ventilating large generators was vividly pictured by Mr. Foster, who said that modern units demand an amount of air equal to their weight every forty to sixty minutes. On the average unclarified air for a 30,000-kw. unit carries about 1¼ cu.ft. (35.4 cu.cm.) of dirt per day, which, if deposited on oily surfaces, would soon clog up ducts and possibly be the cause of surface fires later.

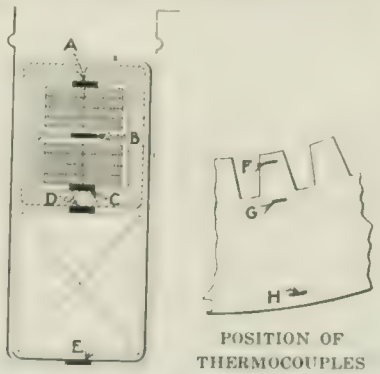
Experience with Temperature Detectors

Dealing particularly with the maximum temperatures in embedded portions of armature coils, F. D. Newbury and C. J. Fechheimer pointed out that considerable error may result from improper installation of detectors. Even if properly installed between coil sides, the detector does not read the maximum copper temperature. The principal reasons for this are that there is a flow of heat from the adjacent sides of the copper in the upper and lower coils to the slot sides and that there is a difference of temperature between the upper and lower coils. The difference in temperature between the copper in the two coils is due principally to difference in eddy-current loss arising from the cyclic change of leakage flux.

Test data were obtained on a 12,000-kva. alternator and on a model of an armature with thermocouples on the bare copper as well as between coils, and with wide and narrow resistance exploring coils. These indicate that there is a greater difference between the maximum and minimum readings with detectors between coils exposed to the cooling air than with detectors similarly placed but protected from the air, and the difference is smallest with detectors on the bare copper.

Detectors at the bottom of a slot in the 12,000-kva. alternator and under a wedge in a 3,750-kva. turbo-alternator showed (in conjunction with readings on the bare copper) that detectors so placed cannot read the copper temperature nor in any way give an indication of the thermal drop through the insulation. The detector reads the temperature of that part of the iron or wedge with which it is in contact.

Measuring temperatures by detectors in the upper coil is not customary, therefore it would be best to continue with detectors between coils, protecting them from external air currents. The detector reading is then a means of judging the maximum copper temperature and as such may be used for comparison of readings between machines.



POSITION OF THERMOCOUPLES

Mr. Fechheimer referred to investigations which indicated that detectors placed at different positions between coils may vary considerably in their readings and from the true copper temperature, especially when there is a high eddy-current loss in the upper coil.

In considering the temperature problems W. J. Foster said that the first and most fundamental consideration is the relation of the space occupied by the object to the total heat losses to be dissipated. Below a certain value of this constant it is absurd to use ventilation housings, no matter how great the rating of the machine, as such housings have the effect of preventing the natural means of heat dissipation, *viz.*, convection and radiation. Water is an ideal agent for cooling purposes by reason of its high capacity for heat, he pointed out, but it is difficult and almost impossible to use it for removing the heat generated in the rotating element of a generator. There are objections to its use in the stationary element, such as danger from leaks developing in the pipes and condensation on surface of pipes. He advocated conservatism in temperature for both classes of generators, the so-called low-temperature and high-temperature machines.

While the conductivity of insulation is known, that of a composite insulation is indefinite, said Mr. Newbury, so copper temperatures cannot be accurately based on external temperatures but must be actually measured. He favored the rise-in-resistance method becouse of the consistency in readings compared with those of detectors.

B. L. Barnes referred to a case in which lower internal temperatures were obtained by removing the casing of a totally inclosed forced-ventilation generator than with it on. However, the room temperature was increased by its removal.

A. S. Loizeaux expressed the belief that lack of rigid supports for end windings may be responsible for failures attributed to temperature. To assure reliability of service the main leads should be adequately insulated and spaced and current transformers should not be placed in the air-intake ducts where their burning up would endanger the generator.

Mr. Foster pointed out that while increasing copper losses would not affect the present high efficiencies

much, the increased heat generated might introduce a hazard. Regarding Mr. Loizeaux's statements, he contended that to withstand sudden blows end winding braces must be flexible and not rigid. Nevertheless they should be rugged. He also called attention to some unreasonable specifications and urged that requirements be made more specific.

The development of the general formula for the loss ratio in a conductor carrying current when located in any position in a slot with reference to other conductors which carry currents of the same or different phase was outlined by R. E. Gilman. This loss ratio is the ratio of actual alternating-current loss (including the effect of eddy currents) to the loss in the conductor carrying the same effective value of direct current. A series of test results were given where various combinations of strands and groupings were used, and the loss ratio from these results was compared to the calculations from the formulas.

S. L. Henderson presented some practical applications of Gilman's formulas for determining eddy-current losses and showed that the size of conductor which can be provided is limited by total heat losses caused by I^2R loss plus the eddy-current loss. Deeper slots can be used with 25-cycle machines than with 60-cycle units.

Excitation Systems Session

TENDENCY *among central-station engineers toward individual exciters rather than the common-bus method. Direct-connected units used where speed will not make them too expensive. Excitation systems very commonly separated from the drive for auxiliaries, to isolate trouble. Operating men seem to mistrust compound-wound exciters on account of difficulties that have been experienced with operating them in parallel.*

OF THE two common methods of providing excitation, one from a common bus, the other by means of individual exciters, J. W. Parker and A. A. Meyer set forth the advantages of the latter method. First, it does not entail the maintenance of an additional energy system. Second, disturbances in the individual excitation system are limited to a single generator, instead of endangering the power plant. Furthermore, the scheme lends itself well to expansion and increase in station capacity. With the individual exciter scheme the direct connection of the exciter to the main generator shaft gives it the advantage of good speed regulation. There is, however, one objection raised to direct connection—the possible loss of the exciter puts the main unit out of service. This chance, however, may be minimized to a very small hazard, it was said. Control of excitation is also much more simple than if common bus excitation is employed. With individual exciters only a small field rheostat is necessary, whereas in the latter case a large field rheostat is required in addition to the exciter field rheostat. It was also asserted that a direct-connected exciter being driven by a large turbine affords the maximum of economy as well as greater reliability.

Exciter Practice in the Northwest

The automatic regulator, J. D. Ross asserted, is little used in Northwestern plants on account of the complication and tendency to build up voltage on short circuit. However, for the new 15,000-kw. hydro-electric unit being added to the Cedar Falls station of the Seattle municipal system a regulator and an exciter large enough for a 36,000-kw. plant—the full development of the entire station—have been selected, so that only one exciter will be required at a time. This design was preferred to an individual exciter for each generator because of its greater simplicity. Auxiliaries are driven from an auxiliary bus energized by a prime mover and a battery, entirely separate from the exciters, thus assuring a steady voltage for auxiliaries and removing a complication from the exciter system.

Mr. Ross said he did not favor the compound-wound exciter because it tends to pile up the voltage on a short circuit and to give trouble in paralleling. The shunt-wound machine with ample voltage range is ideal, he believed. The trend on the coast is away from small generators of different characteristics to large and uniform generating units. A number of plants are using combined waterwheel and induction-motor drive for at least one of the exciters.

The ideal exciter system for an entirely new plant is one in which each generator has its own shunt-wound exciter and regulator. This allows a new generator to be ordered with its proper exciter regardless of changes in design of machines.

Continuity of Service the Primary Requirement

In laying out excitation systems for central power stations continuity of service is the primary requirement, while first cost and economy in operation are of secondary importance, said H. R. Summerhayes. Reliability depends not only upon exciter design but on method of drive, wiring and connections, method of control and reserve capacity. While the common excitation bus has predominated in American practice for many years, Europe has shown more preference for individual exciters, and America is tending that way.

Of the steam turbines of 7,500 kva. and more sold by one manufacturer during the past five years, about 45 per cent were equipped with direct-connected exciters, and of the hydro-electric generators of 1,000 kva. and more, about 75 per cent had direct-connected exciters and an additional percentage had individual motor-driven exciters.

Mr. Summerhayes held that common excitation plants have the chief advantage of constant bus voltage, permitting floating a storage battery on the exciter bus,

a plan much used in important lighting stations to insure against shutdown due to exciter trouble.

Regarding methods of drive, he said that for large plants direct-connected exciters are most reliable, efficient and less costly whenever speed requirements allow their use. Attention was also called to the fact that field switches should be non-automatic on overload, Exciter breakers should operate automatically on reverse current and field switches automatically only in connection with balanced or reverse-current protective systems which operate the oil circuit breaker in the alternator circuit.

He recommended shunt exciters for individual excitation and for operation in parallel with batteries, but preferred compound exciters for parallel operation without battery on account of the better maintenance of voltage and smaller need for rheostat adjustment.

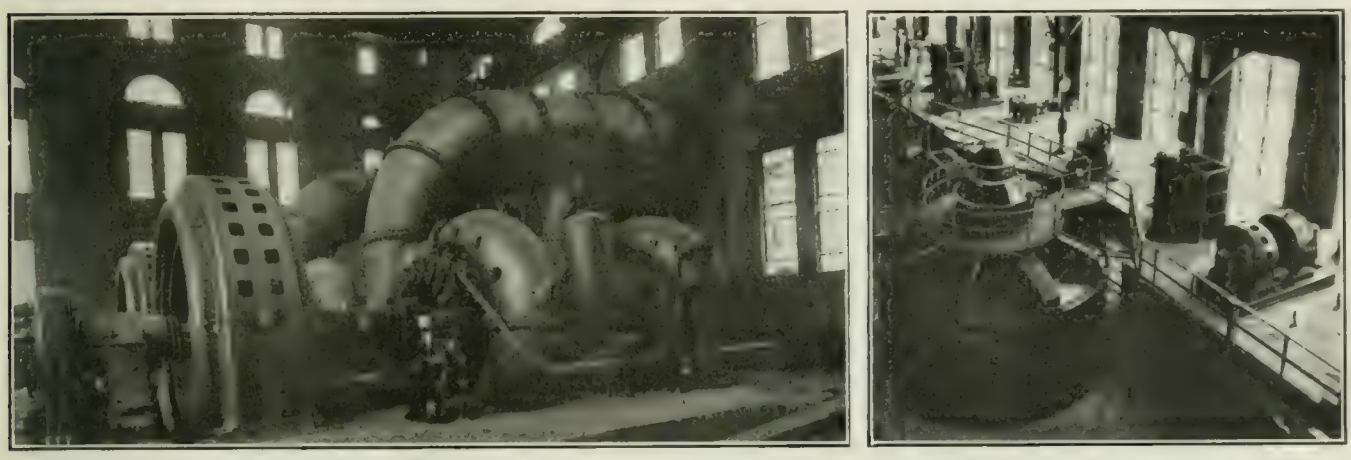
DEVELOPMENT OF EXCITATION SYSTEMS IN SOUTHERN CALIFORNIA

H. H. Cox and H. Michener explained the practice in excitation for the hydro-electric plants of the Southern California Edison Company.

house, not connected to any motive power, to replace a burned-out exciter on the generator in case of accident.

Exciters used in connection with automatic regulators were discussed in some detail by C. A. Boddie and F. L. Moon. Where automatic voltage regulators of the Tirrill type are employed a responsive system is necessary to avoid hunting of the regulator. The responsiveness of the system depends chiefly upon the quickness with which the exciter responds to changes in its field resistance and upon the speed with which the alternator field current responds to changes in the exciter voltage. The time rate of change of the voltage of a direct-current machine when its field resistance is altered is proportional to the instantaneous difference between the *IR* drop in the field circuit and the terminal voltage of the machine—that is, the "opening" between the magnetization curve and the volt-ampere characteristic of the shunt field circuit, as measured in volts—and is inversely proportional to the interlinkages of flux and field turns at rated voltage.

Differential series windings are not detrimental to regulator performance, it was held, and in some cases may be of benefit in promoting stability of parallel



TWO EXAMPLES OF INDIVIDUAL EXCITERS WHICH ARE BECOMING FAVORED—DIRECT-CONNECTED AND SEPARATE

At the Big Creek plants Nos. 1 and 2, each with two 17,500-kva. generators, there are two 150-kw. exciters respectively, one exciter of each set being also coupled to an induction motor. The exciter fields in station No. 1 are supplied from a motor-generator set consisting of a 250-volt direct-current and a 125-volt direct-current machine connected in series opposition and driven by an alternating-current motor. The 250-volt machine is under control of a standard-range Tirrill regulator controlling it from 125 volts to 250 volts. The resultant voltage, 0 volt to 125 volts, of the two machines is taken to excite the fields of the main exciters, giving them complete range from 0 to maximum. At plant No. 2 the exciters are under control of a broad-range regulator controlling their voltage from residual to maximum.

In the new Kern River No. 3 power plant, with two 17,500-kva. generators, each generator is to be equipped with a direct-connected exciter and there will be one spare one, each of the three exciters being controlled by a separate broad-range voltage regulator. In the plans for the Big Creek power house No. 8, the initial development of which will consist of one 25,000-kva. unit, an exciter will be directly connected to the generator shaft. A spare exciter will be kept at the power

operation. Cumulative series windings, if they constitute a considerable portion of the total field strength, may seriously impair the quality of regulation obtained. In some cases trouble from polarity reversal of compound-wound machines under abnormal conditions has been experienced. Sufficient cumulative series effect to balance the demagnetizing armature reaction in a non-commutating-pole machine is not only harmless but desirable. It is very necessary where broad range regulating is used, in order to avoid polarity reversal.

R. C. Miner contended that the separate exciter system is relatively simple and inexpensive. Prime-mover-driven exciters should not be used in water-power plants unless they require driving units large enough not to be likely to be shut down because of the presence of trash or similar interference.

F. W. Sims said that shaft-driven exciters and one motor-driven exciter for emergencies make for reliability and have been adopted on all horizontal turbo-units of his company.

E. G. Merrick urged against providing protection from trouble that may occur only 1 per cent of the operating time if these provisions may introduce an operating hazard at other times.

W. F. Dawson favored automatic regulators for small

plants or where load fluctuations are excessive and the use of shunt-wound exciters on account of the difficulties encountered with parallel operation of compound units.

V. Karapetoff referred to a French system of automatic control without use of contactors developed by Blondel. The exciter is like a converter except that it has separate direct-current and alternating-current windings, the latter energized by series transformers in main leads. At low power factor the armature reaction helps the excitation, and it has zero effort at unity power factor. W. J. Foster declared that the General Electric Company had embodied in a machine a principle similar to that described by Professor Karapetoff, but it was found impracticable.

R. E. Doherty pointed out that the responsiveness of an exciter can be improved by increasing the resistance of the field as well as by decreasing the number of field turns. With motor-driven exciters having small responsiveness a drop in speed of 10 per cent may reduce the voltage 50 per cent.

C. J. Fechheimer said that if an alternator on a high-capacity line is operated at zero excitation or for leading power factor the operation may be unstable. He described a type of field compensating winding that can be used to change the saturation curve to a more desirable form.

H. R. Summerhayes emphasized importance of keeping control circuits separate from the excitation system.

C. A. Boddie called attention to the limitations to increasing the field resistance and said that Tirrill regulator contacts should not be worked above 20 amp. to give the best operating results.

Protective Devices Session

TESTS TO *determine possible over-voltage stresses in reactors during short circuits or other abnormal operating conditions are recommended. The use of shunt resistance is advocated as the most effective method of preventing the piling up of destructive voltage stresses at reactors. For the determination of magnetic forces acting on disconnecting switches some convenient formulas are presented. Protection of stations operating in parallel receives particular attention.*

The papers on protection of large systems by reactors presented by R. F. Schuchardt and Dr. C. P. Steinmetz and abstracted quite fully on pages 5 to 8 of the July 3 issue were very cordially received, and several delegates expressed the hope that other companies would take as broad a viewpoint as the Commonwealth Edison Company by making their operating troubles and investigations of the causes and possible remedies available to the Institute in the future. The subject of these papers was discussed by R. E. Doherty, A. E. Bauhan, R. A. Hentz, D. C. Jackson, Philip Torchio, J. R. Lyman, B. G. Jamieson, V. Karapetoff, H. R. Woodrow, E. G. Merrick, J. A. Johnson, H. R. Summerhayes and others.

Mr. Doherty pointed out that even generators in the same station may break synchronism if there is not sufficient reactance between them during a short circuit, or if there is too great a reduction in voltage, since the synchronizing power is proportional to the voltage. To detect hunting between stations, he said, indicating power-factor meters might be used.

Mr. Bauhan said it is inadvisable to have the emergency steam trips set so low on turbines that the driving power will be shut off during a short circuit.

While bus reactors and generators with fairly high inherent reactance are employed in Philadelphia, chief reliance is placed on feeder reactors, said Mr. Hentz.

Professor Jackson declared that it is startling to hear that large units like the Commonwealth Edison Company's will not drop out of synchronism if the voltage is not reduced more than 50 per cent. If this is true, particular attention must be given to balancing reactance in busbars for current limitation and synchronizing power.

With 5 per cent station-tie reactors and proper relay protection, Mr. Torchio said that the New York Edison Company has experienced dead short circuits on station buses without any failure to clear the trouble. In selecting reactors he pointed out that the problem is to determine what rupturing capacity can reasonably be expected with each oil switch and then to use such reactance in series with them that this limiting value will not be exceeded.

Mr. Lyman referred to some highly satisfactory results which have been obtained with feeder reactors and bus reactors which are interlocked with generator switches so that no more than one reactor is between adjacent units.

Where a company serves consumers demanding 10,000 kw. or more, Mr. Jamieson said there is almost as much need of providing reactor and relay protection as there is in substation feeders.

Referring to the calculation of synchronizing power, Mr. Doherty said that great care must be taken in the assumptions which form the basis of calculations or the results will be far from correct. He then went into some detail to show how this factor must be calculated under different conditions.

Professor Karapetoff urged reviving E. Arnold's energy formulas for calculating stability of oscillating systems, since he considered energy a more secure basis than its components—voltage and current.

Mr. Woodrow favored basing the synchronizing power on the power received by a unit rather than on that transmitted, and said that this factor is greatest when $X = R\sqrt{3}$, but Mr. Doherty declared that this is true only when the bus voltages are constant. Mr. Woodrow favored having comparatively small bus reactance where a network is served—not more than 30 per cent of the total capacity connected to the bus. With radial systems larger bus reactors may be used with satisfaction. He agreed that feeder reactors are very effec-

tive in isolating trouble. Eighty thousand amperes is the ultimate which can be consistently ruptured with present oil switches, he contended; beyond this point the current must be limited.

Where hand control is used for generators or where governors are omitted, as in automatic plants to increase simplicity, the difficulties resulting from short circuits may be aggravated, Mr. Merrick declared.

In hydraulic plants where the driving power of the generators is not shut off immediately after a short circuit by the governors and where the governors themselves may oscillate, forced vibrations may be set up, Mr. Johnson said, which will sustain hunting and eventually pull the machines out of synchronism.

Professor Jackson declared that it is the quadrature current and not the I^2R loss that tends to pull together machines which are out of place. Since the energy equations developed for studying mechanical oscillations do not provide for the complexities occurring in electrical systems, he declared that they would not be so suitable as equations based on voltages and currents. Mr. Doherty concurred in this view.

Mr. Summerhayes pointed out that Dr. Steinmetz's paper gives information which can be used to determine the size of breaker to use and the time setting to select after the protective reactance has been chosen which will prevent machines pulling out of step.

Voltage Stresses in Reactors in Service

A large number of test cases have been made by F. H. Kierstead and Royal Meeker by means of a 10,000-kw. generator short-circuited through reactors, and it was impossible to observe the presence of high-voltage stresses in the reactors by oscillographic means. Attention was called to the fact, however, that reactors in service may have greater voltage stresses in them than those caused by short-circuit tests. They may be subjected (1) to lighting impulses or (2) to high voltages due to reasonance.

Voltage stresses at instant of short circuit may appear as steep waves produced by the sudden drop in voltage caused by a short circuit. A resistance shunting an inductance reduces the voltage stresses caused by steep waves, however.

At the instant of interruption of a short-circuit current it was shown that, in the case of direct current, the voltage obtained across the reactor is independent of the applied voltage and depends on the current interrupted and the rate at which it is interrupted. In the case of alternating current, however, with commercial switches the voltage across a reactor is in general independent of the current interrupted and depends on the impressed voltage. It will be approximately equal to double the impressed voltage. If, however, the circuit is opened by a switch so quick-acting that the current is interrupted before it can reach its zero value in accordance with its normal curve, then the voltage will depend upon the current interrupted and the rate at which it is interrupted.

It was also shown that impulse waves may cause non-uniform distribution of the stresses in a reactor. Resistance connected to the reactor winding, however, effects a reduction of these voltage stresses. Extra spacing of the end turns and end layers of the reactor winding cause greater concentration of the voltage stresses on the extra space parts.

In considering the paper by Messrs. Kierstead and Meeker, J. F. Peters did not think the conditions selected for test were representative of practical cases. He said that where the tests showed shunted resistance reduced the voltage across the reactor, the remainder of the impressed voltage was developed at the apparatus to be protected. This view was also shared by A. Nyman, J. Slepian and C. L. Fortescue, who said that protecting a protecting device was introducing an unjustified complication. Dr. A. E. Kennelly said that the shunting resistance was designed for high-frequency disturbances such as lightning, and Philip Torchio added that the energy of the high-frequency disturbance should be absorbed in the resistance. He did not believe arcing over at the end turns of the reactance has caused trouble.

Regarding voltages developed across the end turns of a reactor, H. R. Woodrow showed how increasing the insulation but not the spacing increased the capacity and lessened the accumulation of voltage at the end turns. He also pointed out that the use of resistance should be fully justified if this added complication was to be introduced.

Magnetic Force on Disconnecting Switches

The calculation of the forces acting on disconnecting switches was worked out by H. B. Dwight. The results of his analysis may be expressed in the two following equations:

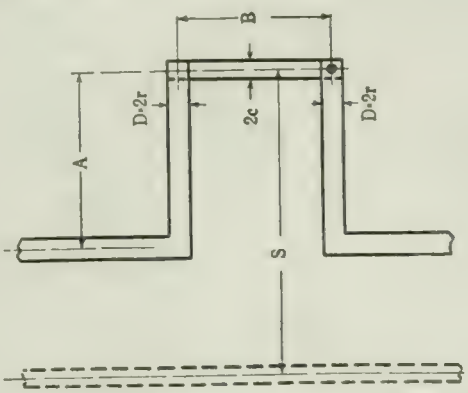
The total force at the break jaw when A is greater than B (see figure) is:

$$I^2/4.45 \times 10^7[2.3 \log_{10}(B/r) + \tfrac{1}{3} - B/A + \tfrac{1}{3}B^2/A^2 + 3.20r^2/A^2 - 1.32B^4/A^4 + B/S] \text{ lb.}$$

When A is less than B the force is

$$I^2/4.45 \times 10^7[2.3 \log_{10}(2A/r)\tfrac{2}{3} - \tfrac{1}{2}A/B - \tfrac{1}{3}C^2/A^2 + 3.20r^2/A^2 + 1.24A^2/B^2 + 1/24AC^2/B^3 + B/S] \text{ lb.}$$

The letters used in these equations are shown in the accompanying figure, and the writer gave curves for



TYPICAL LAYOUT OF DISCONNECTING SWITCH AND RETURN CIRCUIT

common ratios between these dimensions for their determination and insertion in the equations.

Prof. V. Karapetoff asserted that the problem undertaken by Mr. Dwight could have been much more simply solved from the energy equation. He stated that the force acting on the disconnecting switch should be represented by the simple equation

$$F = \tfrac{1}{2}I^2 dL/ds,$$

where L is the inductance of the circuit loop, s is the displacement of the switch blade and I is the current.

The method advocated by Professor Karapetoff was also favored by A. Nyman, who said he had used it in calculating forces acting on oil-switch contacts and rods. E. G. Merrick said that the peak value of current should be used in the force equation.

Electric Welding Session

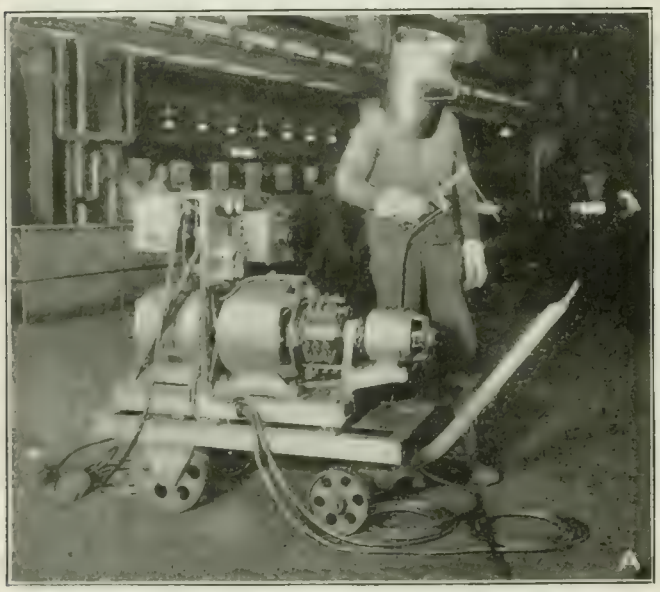
SIMPLICITY and reliability appear to be the chief requirements of electric welding devices. Because of the comparatively few trained welders it is desirable to make the welding outfits as automatic as possible, particularly in current control with changing arc length. This is being accomplished by the use of generators in which the desirable characteristics are inherent

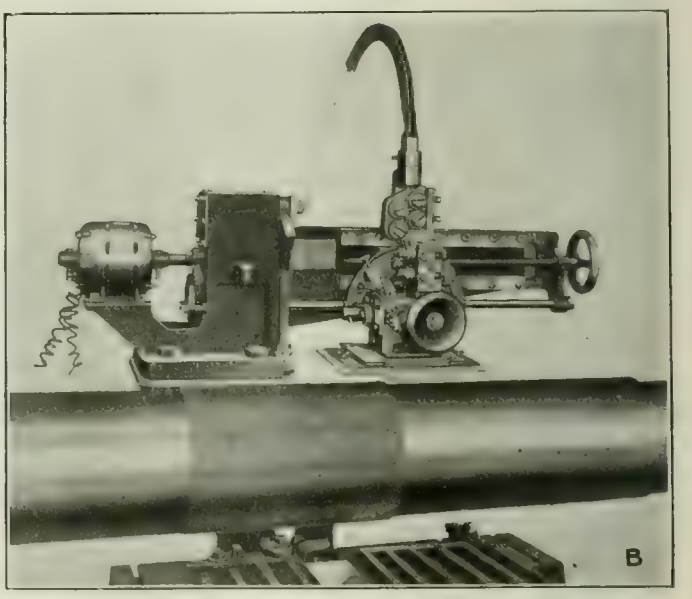
AN INTERCONNECTED constant-current, variable-voltage, direct-current generator and exciter which has been developed recently was described by A. M. Candy. The generator is a commutating-pole machine provided with a series-field winding, a shunt-field winding separately excited continually by means of a small exciter coupled to the generator shaft, and a second shunt-field winding connected to both the generator terminals and the exciter terminals, so that under open-circuit and normal welding conditions it is self-excited by the generator voltage, whereas under short-circuited conditions it is excited in the opposite direction by current from the exciter terminals. With this machine drooping characteristics are obtained such that the short-circuit current is substantially the same as the normal welding current.

Within the last year electro-percussive arc welding equipment has been developed, said D. F. Miner, which successfully welds stock up to ½ in. (1.27 cm.) diameter, and larger sizes will apparently offer no difficulty. In this device the stored electromagnetic energy replaces electrostatic energy. Establishment of a strong direct-current field in a reactance coil with a primary and secondary winding is followed by rupture of the primary current with the secondary circuit closed. Transfer of energy of the collapsing field to the secondary results, and a subsequent separation of electrodes in this circuit establishes an intense arc. When the surfaces of the electrodes (pieces to be welded) are sufficiently melted a hammer forges the parts together. The total time of these operations is of the order of one-tenth second.

Welding machines of the single-operator type were described by W. A. Turbayne, one a direct-current generator separately driven by any form of motor and the other a direct-current converter fed from 160-volt to 125-volt direct-current source. The generator is a self-exciting cumulative compound-wound machine, and current regulation is effected solely by the reaction of the armature current upon the field flux. The converter combines the functions of a shunt-wound motor and a variable-voltage generator.

A new type of arc-welding generator was described by S. R. Bergman and R. L. Unland which inherently possesses the electrical characteristics desirable for







CONSTANT-CURRENT WELDER; DEVICE FOR FEEDING WELDING ELECTRODE AND SAMPLES WELDED BY ELECTRO-PERCUSSIVE METHOD

1. ¼-in. copper rod welded to steel disk.
2. ¼-in. steel rod welded to steel disk and tested in bending without failure.
3. ¼-in. copper-copper weld bent sharply without failure.
4. Nickel-steel valve head welded to cold-rolled steel stem. Failed in bending outside weld.
5. T-weld of cold-rolled steel.
6. Cold-rolled steel rod and disk polished.
7. ⅜-in. drill lengthened with low carbon stock.
8. Nickel-steel head to valve stem.
9. ½-in. hollow steel rod welded to steel plate.

single-operator arc-welding generators. A drooping volt-ampere characteristic, which is advantageous for successful electric arc welding, is obtained by what is known as a dual magnetic circuit.

The design consists of a four-pole field structure and an armature wound for the two poles. The field poles are paired to give two adjacent poles of each polarity. While slow regulation and the lag between the sudden variation in the arc and the corrective electrical or magnetic adjustment in the machine make some machines unsuitable for welding, the regulation of this generator is produced chiefly by the armature itself so no such trouble is experienced.

A new development was also described for automatically feeding a barb-wire electrode into the welding arc at the exact rate required to maintain constant electrical conditions in the arc. This device consists of a small direct-current motor geared to feed rolls and electrically connected across the welding arc through control, with the result that the speed of the motor and consequently the rate at which the wire is fed into the arc vary with the voltage across the arc. The result is that practically constant voltage is maintained across the arc and therefore the current will be constant.

In the results of a large number of experiments, K. L. Hansen said, he had found nothing to support the contention that the constant-arc wattage characteristic is particularly suited for arc welding. Some persons think it is desirable that the starting current should be larger than the working current in order to heat the point of contact rapidly. The speaker's experience, on the contrary, had been that a large current at the instant of striking the arc merely increases the tendency of the electrode to freeze or stick. While a large reactance makes it easy to strike and maintain the arc, it seems that the penetration is seriously affected.

With a long arc a high-carbon wire loses most of its carbon while going through the arc, said Alexander Churchward, but not so with a normal arc. A system was therefore developed whereby a long arc cannot be drawn, 16 volts to 19 volts being used for the normal arc. This was obtained without more than 5 per cent fluctuations in the arc current by using a carbon-pile in series with a 35-volt generator.

C. J. Holslag refuted a statement that bare-wire electrodes cannot be used with alternating-current welders, saying that several have been in satisfactory operation which have used nothing but bare wire. Regarding relative efficiencies of direct-current and alternating-current welders, he said the ratio is about 170 to 156.

S. R. Bergman referred to a tapering slotted type of air gap used in welding transformers which is particularly suitable for a wide range of currents.

D. F. Miner declared that the energy which is required for steel-to-steel welds is less than is required for copper-to-copper.

R. E. Kinkead pointed out that long-arc welders can have arc lengthened more rapidly than short-arc machines without breaking. He called attention to the need of a uniform method of rating welders, suggesting pounds of metal deposited per hour, although this depends on human factor.

P. O. Noble pointed out that the penetration of a weld depends upon the current and relative rate of movement of the parent metal with respect to the electrode and contended that direct-current welding gives the greatest penetration.

Power Factor Session

THERE ARE MANY *developments in types of industrial power loads which are attended by unbalanced conditions between the phases, unbalanced as to amount of loads and as to phase relations between current and voltage. In such cases the numerical value of power factor may vary widely with different definitions. On account of the importance of this development a joint committee representing both the N. E. L. A. and the A. I. E. E. has been deliberating on the definition and measurement of power-factor in polyphase circuits*

TWO definitions covering different forms of power factor in polyphase circuit have been arrived at by a joint committee of the N. E. L. A. and A. I. E. E., together with some suggestions as to proper qualifying terms to apply to each definition. These definitions follow: (1)—Power factor in a polyphase circuit is the ratio of the total watts to the arithmetical sum of the volt-amperes in the several phases, each measured to a non-inductive neutral point. This definition may be otherwise expressed as the weighted mean of the individual power factor in the phases (weighted according to the volt-amperes in each phase). (2)—Power factor in a polyphase circuit is the ratio of the total watts to the vector sum of the volt-amperes in the several phases.

It was urged by H. L. Walau that as technicians the membership would probably agree that definition 2, which is mathematically accurate, should be adopted to represent that quantity which is referred to today as power factor. As commercial engineers, however, it should be recognized that definition 1 has a broad field of usefulness when applied to unbalanced circuits. He called attention to the loads consisting of welders having very poor power factor (20 to 40 per cent), single-phase arc furnaces of relatively better power factor (35 to 70 per cent) and in some cases single-phase railway loads also of poor characteristics. Increased costs of supply result from such conditions. Either the rates in industrial schedules should reflect the added costs and they should be proportioned over all consumers alike, or some means of penalizing the consumer causing the added burden must be incorporated therein.

In order to get at all the results of the application of definition 1, Philip Torchio submitted the following

table giving comparative load capacities of electrical equipment required for generating and transmitting a unit amount of power under different conditions of unbalancing, all giving the same average value of power factor by definition 1.

Power Factor by Definition 1, Per Cent	Capacity of Electrical Equipment Required for Generating and Transmitting 1,000 Kw. of Balanced Load, 33-33-33 Per Cent	Unbalanced Load, 27-33-40 Per Cent	Unbalanced Load, (Single-Phase) 100-0-0 Per Cent
100-99.5	1,000 kva.	1,100 kva.	.....
86.6	1,150 kva.	1,250 kva.	1,740 kva.
75.0	1,330 kva.	1,425 kva.	2,000 kva.
50.0	2,000 kva.	2,175 kva.	3,000 kva.

This comparison shows that with apparently the same value of polyphase power factor, the capacity of electrical equipment required for generating and transmitting the same amount of power varies as much as one to one and one-half.

Improvement Depends Upon Accurate Metering

Within the last two years practically all power companies have come to the conclusion they must penalize for lower power factor, according to Will Brown. The greatest obstacle is the chaotic condition of metering. He urged that the manufacturers and the central stations co-operate for the solution of the metering problem.

Symmetrical Co-ordinates in Power-Factor Representation

The paper by C. L. Fortescue was a more complete presentation of the subject of power representation by means of symmetrical co-ordinates, which was outlined by him before the A. I. E. E. in 1918 and resulted in the following definitions: Power factor shall be determined from measurements of three-phase power by means of two or more wattmeters connected in the usual manner and from reactive power measured by a reactive power meter with the same connections as those used in measuring the true power. If P be the true power and Q the reactive power, power factor $= P/(\sqrt{P^2 + Q^2})$. The ratio of one unit of the negative phase sequence component of a quantity to the corresponding unit of its positive phase sequence component is defined as the unbalance factor of the quantity under consideration. Usually the ratio of the magnitudes only need be considered.

In conclusion Mr. Fortescue stated that the power factor defines, is easily measured and completely determines all the quantities it is necessary to know in order to make proper charges for energy.

Measurement of Power Factor in Unbalanced Polyphase Circuits

It was shown by R. D. Evans that an unbalanced system may be readily resolved into its two component balanced systems and that each may be readily measured.

Definition 2 was advocated by F. C. Holtz, who also outlined a method of measuring power factor in polyphase unbalanced circuits, in accordance with this definition.

W. H. Pratt summarized his opinions of the two definitions by saying that definition 1 most nearly extends the idea of the single-phase definition to polyphase conditions and results in a quantity that is well suited for the evaluation of volt-amperes in the lines. Definition 2 gives a quantity that has wide applicability and, when the currents and voltages do not depart greatly from sine waves, is easily measured. It is, however, a characteristic of the load as a whole and is the result of the vector addition of its parts. It merits a distinctive name of its own. The analysis by symmetrical components suggests a balance factor, which, if readily measured, could be very useful. The resulting power factor is equivalent to definition 2. Finally, there is no one factor that can describe all that it may be necessary to know under the general head of power factor, using the word in the very general sense that has been current up to now.

Definitions proposed by Carl J. Fechheimer are given as follows: Power factor is the ratio of the true watts to the volt-amperes in the balanced positive sequence systems of volts and amperes. The unbalance factor is the ratio of the negative sequence amperes to the positive sequence amperes.

For technical purposes it is highly desirable to separate the effects of phase displacement, unbalance and wave form, since the causes and remedies for each are quite distinct, pointed out Francis B. Silsbee. This can readily be accomplished by defining one or more additional quantities so that one quantity (such for example as "vector power factor") indicates the phase displacement as distinct from unbalance, and a second quantity (such as balance factor) shows the symmetry of the loading as distinct from any general phase shift.

It was urged by P. M. Lincoln that definition 2 gives results which are entirely independent of the question of unbalance. He strongly recommended that definition 2 be the one adopted for polyphase power factor.

F. V. Magalhaes emphasized the fact that manufacturers and central stations are seriously in need of a standard definition of polyphase power factor, which would most properly eminate from the A. I. E. E.

V. Karapetoff pointed out that there is no such thing as power factor of a polyphase circuit, therefore an attempt to define it should not be made. For practical as well as theoretical purposes it would be better to measure the reactive power by wattmeters with the voltage elements displaced 90 deg. The ratio of the reactive power-to-power would then be the idle power factor and would give all conditions required. Central-station customers could be told that it is in their power to reduce this factor and secure a better rate.

C. J. Fechheimer agreed with Professor Karapetoff and said power factor and unbalance factor should not be combined in one factor.

Dr. A. E. Kennelly urged an agreement regarding the definition of power factor and method of measuring. When a three-phase system is balanced and there are no harmonics, power factor may be readily measured by a polyphase wattmeter and reactive wattmeter. The effect of harmonics can be neglected for all except precision results. Dr. Kennelly recommended definition No. 2, presented by the joint committee. (See last issue.)

Philip Torchio said that it is unnecessary to allow for load unbalance in a definition of power factor since it can better be taken into account separately. A motion was carried that it was the consensus of opinion at the meeting that polyphase power factor be defined as the ratio derived from the active power and reactive power. The committee on this subject was instructed to proceed to devise definitions on the basis of the discussion at this meeting, to be acted upon later.

Increasing Oil-Circuit-Breaker Capacities

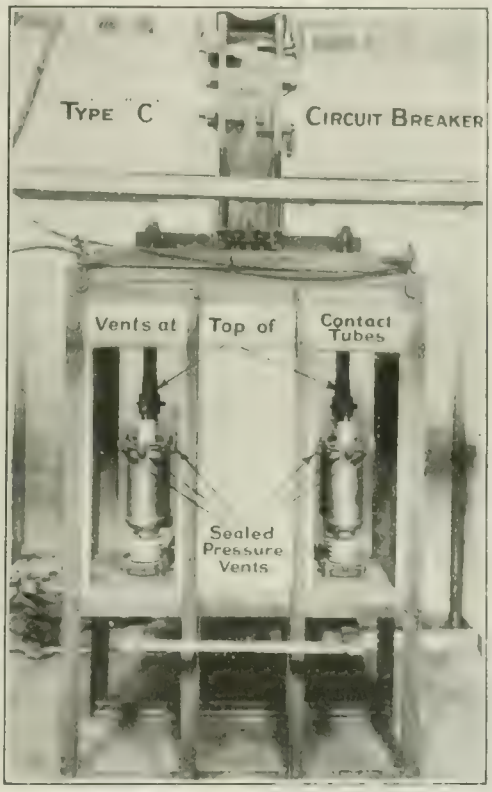
A Standard Oil Breaker, Equipped with Pressure Vents, Hollow Contact Rods and an Improved Liquid for Quenching the Arc, Showed Greatly Increased Rupturing Capacity Under Actual Tests

By C. J. HEJDA
Testing Engineer Commonwealth Edison Company

AS CENTRAL-STATION systems continue to grow new problems arise concerning switching unit performance under extreme conditions. These switches at the time of their installation proved quite adequate, with the limited size of the system, but later became inadequate in rupturing capacity because of the increased volume of energy available at the switch at the time of trouble.

In the study of this problem tests were recently made at a substation of one of the largest central-station companies, on a "type C" oil circuit breaker, with a view of determining the extent to which the rupturing capacity at short circuit of switching units in present use may be increased in order to avoid, if possible, the expense of replacing them by units of larger capacity or of a different type. In some instances, moreover, the greater space required by the new units is not available.

A 300-amp. "type C" oil breaker was connected to a three-conductor 300,000-circ.mil underground cable 20,000 ft. (6,100 m.) long and short-circuited between two phases. The energy was supplied from a 12,000-volt, 20,000-kva. turbo-generator, operated at a normal frequency of 60 cycles. The tests were first started at reduced voltage, and on each successive short circuit the voltage was increased in small steps until the oil breaker began to show stress. Under normal conditions—that is, with the usual mineral oil in the wells and no modifications—the breaker began to show considerable distress on a 10,000-volt short circuit. Contacts were badly burned, fire and burning vapor were expelled from the wells to a height of 2 ft. or 3 ft. (60 cm. to 90 cm.), and insulators at the top of the wells were broken from the pressure caused by the vapor.



VIEW OF CIRCUIT BREAKER USED IN TESTS. NOTE SEALED PRESSURE VENTS AT TOP

The breaker was then filled with "S. & C. Excello Liquid" in place of transil oil and tests were repeated. Under these conditions the breaker showed a marked improvement in performance. While the porcelain insulators again broke during the opening under short circuit, no flames were expelled and the contacts gave little evidence of burning.

The breaker was then equipped with a venting arrangement, developed particularly for use with "S. & C. Excello Liquid." Instead of the usual solid contact rods, hollow brass or copper tubes were used with a venting arrangement at the upper end. These vents are normally closed by a disk or sphere held in place by gravity and opened with pressure in wells. In the ordinary oil breaker using solid rods the arc formed at the contacts generates gases, which force the oil away from the arc, thus retarding the action of the liquid in quenching the arc. With the use of the tubular rods the quenching action is more effective, in that the gas pressure created in the wells by the arc at the contacts forces the liquid across the arc into the tube, where the gases are free to escape through the top vents. The wells were filled with the "S. & C. Excello Liquid" to the usual level and the tests again repeated. One test was made at 10,000 volts and two at a normal operating pressure of 12,000 volts. On all these tests the circuit breaker opened the short circuit successfully without showing any distress.

To determine the effectiveness of the hollow rod venting, three soldered-disk pressure vents were mounted on each well and were sealed to open at a pressure of approximately 150 lb. (70 kg.). On each of the above tests only one of the twelve pressure vents opened, which indicates that the pressure in the wells was not much in excess of 150 lb. (70 kg.) and proves the effectiveness of venting in the hollow rods.

The efficiency of the "S. & C. Excello Liquid," combined with the venting arrangement, is also shown by the small amount of burning or fusing at the end of the contact tubes. The tubes in each of the tests showed only about $\frac{1}{8}$ in. (3.2 mm.) of the circumference burned away, although the thickness of the tube wall was only $\frac{1}{8}$ in. (3.2 mm.). This amount of burning is much less than was obtained with oil in the wells and solid rods even at the lower short-circuit voltages.

The accompanying photograph shows the circuit breaker which was used on the tests. The sealed pressure vents are plainly visible in the illustration at the top of the wells.

The tabulations on page 68 summarize the results obtained in the tests on the circuit breaker under the various modified conditions.

The fluid which is referred to in this article as improving the rating of the oil switch under test is a chlorine derivative, but is much less volatile than carbon tetrachloride, which has already been tried as a substitute for switch oil.

With usual transil oil in wells and no modifications on switch:

Test No.	Terminal Pressure of Generator, Volts	Short-Circuit Current, Amp.	Kva Ruptured (Single-Phase)	Remarks
1	5,000	900	4,500	No fire. No oil expelled from wells. Contacts burned considerably at tips.
2	7,900	1,650	13,000	Considerable oil expelled from both compartments. Contacts burned considerably. No flames.
3	10,000	2,220	22,200	Flames shot up along rods in both compartments to a height of 3 ft. Top insulators on two out of four wells broke. Contacts badly burned at tips. About one-third of oil expelled from wells. Oil badly carbonized

With the low-volatile chlorine derivative in place of usual transil oil—other conditions the same:

Test No.	Terminal Pressure of Generator, Volts	Short-Circuit Current, Amp.	Kva. Ruptured (Single-Phase)	Remarks
4	10,000	2,100	21,000	About one-quarter to one-third of liquid expelled from wells. No flames. Three insulators out of four broke as in test No. 3. No appreciable burning of contacts.

With the low-volatile chlorine derivative and bakelite disks at the top of wells in place of porcelain insulators to guide the rods:

Test No.	Terminal Pressure of Generator, Volts	Short-Circuit Current, Amp.	Kva. Ruptured (Single-Phase)	Remarks
5	8,000	1,860	15,000	Slight burning of contacts. Small amount of liquid expelled from wells around rods.
6	10,000	1,800	18,000	No appreciable burning of rod contacts. Small amount of liquid expelled from wells.
7	10,000	2,100		No appreciable burning of contacts.

With the low-volatile chlorine derivative and vented tube contacts in place of solid rods:

Test No.	Terminal Pressure of Generator, Volts	Short-Circuit Current, Amp.	Kva. Ruptured (Single-Phase)	Remarks
8	10,000	2,100	21,000	About $\frac{1}{16}$ in. of tube contact burned. From $\frac{1}{2}$ in. to $2\frac{1}{2}$ in. of liquid expelled from wells.
9	12,070	2,520	30,400	Contact tubes burned off $\frac{1}{16}$ in. to $\frac{1}{4}$ in. About $1\frac{1}{2}$ in. to $2\frac{1}{2}$ in. liquid expelled from wells.
10	12,100	2,580	31,200	Very slight burning of contact tubes. No appreciable amount of liquid lost.

Park Lighting with Flood Lamps



IN ORDER to minimize shadows there has been installed in the Syracuse (N. Y.) park system a system of flood lighting which is somewhat novel for this kind of work. Ordinarily parks have only a few low-power lamps which dimly light some of the paths. In four of the Syracuse parks are 144 Western Electric 1,000-volt floodlamps.

Re-establishing Electric Service in France

Chamber of Deputies Adopts a Measure Providing State Aid for High-Tension Distribution of Energy in Devasted Areas Over a Distance of 1,500 Km.

NOT very long since *Le Génie Civil* contained an account, by G. Tochon, of a law adopted by the French Chamber of Deputies, and at the time the article was published awaiting acceptance by the Senate, which is of more than national interest. It concerns the speedy resumption of electrical service in those parts of France which were overrun by the invaders and suffered the destruction of their electrical power houses and transmission lines. Without waiting for the effects of a more general law previously introduced and applying to the whole of France, the act now proposed is intended to meet the immediate needs of the devastated regions by reducing the number of central stations as compared with their number before the war, by augmenting their generating capacity and installing identical machinery in all, thus permitting their operation in parallel, and by erecting high-tension lines tying the stations together and distributing the energy throughout the districts affected. The execution of this program is a necessary preliminary to the resumption of industrial activity in those regions, and it will not meet with the obstacles that the existence of power houses in full operation will, in other parts of the nation, impose to the more general program.

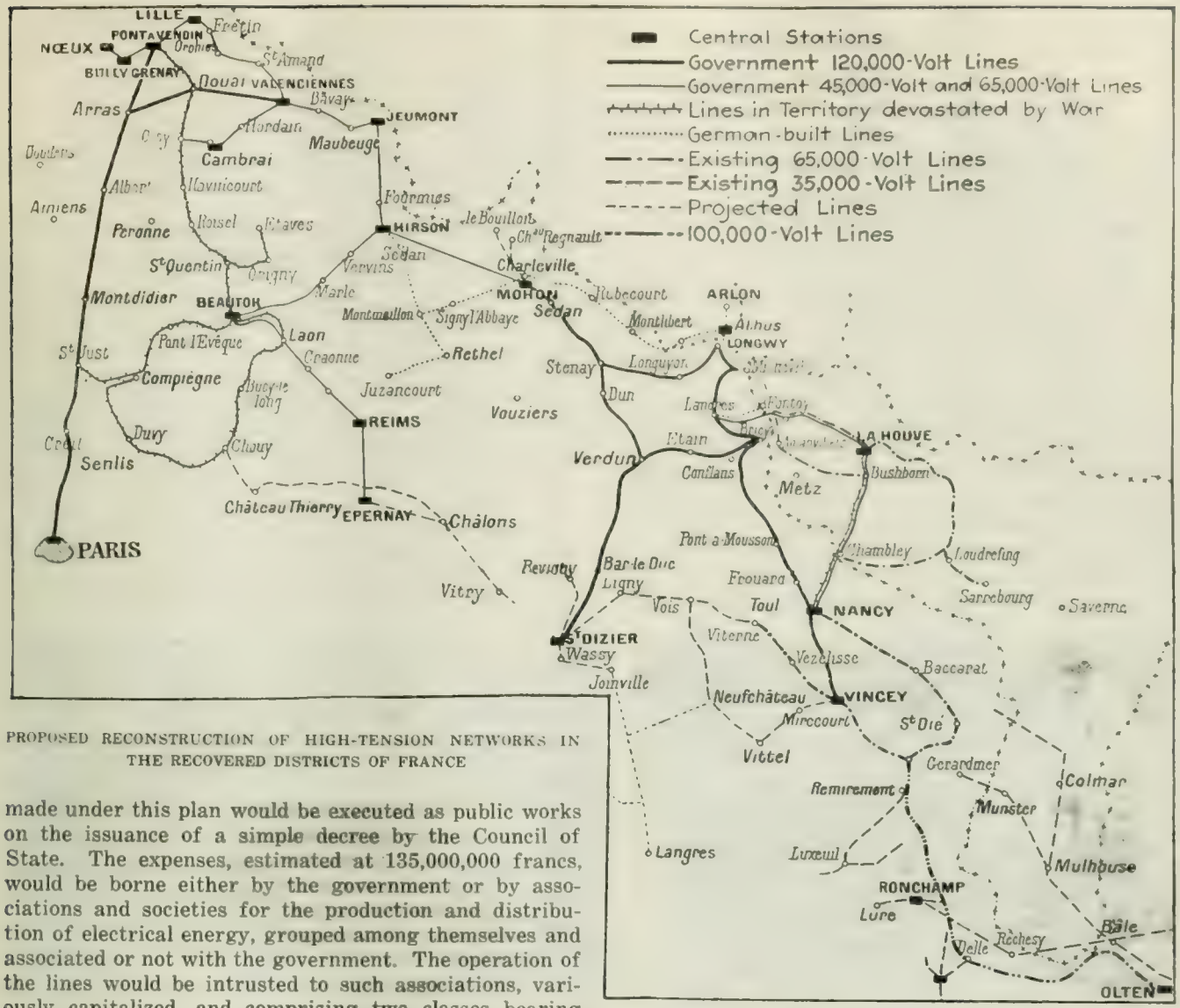
Features of French Government's Proposal

The methods of war followed by the Germans wrought the destruction in part or whole of many central stations and transmission lines. Against this tremendous loss can be set the acquisition of a few power houses built by the foe for military purposes, notably an unfinished edifice at Hirson, near Sedan. It is imperative to repair what is reparable, to reassemble scattered fragments—in short, to reorganize the entire production and transmission of energy. Rather than leave this great work to the caprice of individuals or companies, the French Government has thought it right to draw up a program to which all operators will be obliged to conform. The main features of this program are these:

To make possible the restoration of central power houses the government will advance to the operators part of the indemnities to which their loss by the war entitles them on condition that they devote these sums to the purchase, under the control of the government, of electrical machinery and equipment. The government will at its own expense finish the German-built central station at Hirson.

High-tension lines (45,000 volts) are to be erected from Lille to Paris and from Saint-Dizier to Chambley, in Lorraine, thus extending at each end beyond the devastated region, the total length reaching 1,500 km. (935 miles). This program of construction will, for financial reasons, be divided into two parts, according to the degree of urgency, the branch networks into the devastated districts being constructed first and a double line connecting these networks with the Parisian region, by way of Arras, Albert, Montdidier and Creil, afterward.

The projects for electrical central-station installation-



PROPOSED RECONSTRUCTION OF HIGH-TENSION NETWORKS IN THE RECOVERED DISTRICTS OF FRANCE

made under this plan would be executed as public works on the issuance of a simple decree by the Council of State. The expenses, estimated at 135,000,000 francs, would be borne either by the government or by associations and societies for the production and distribution of electrical energy, grouped among themselves and associated or not with the government. The operation of the lines would be intrusted to such associations, variously capitalized, and comprising two classes bearing the respective titles of managers and concessionaires. The first class would put into effect, under the control of the State, all the acts of administration involving the receipts and expenses of operation, paying to the State a rent equivalent to interest and amortization at 6 per cent on the capital first advanced, paying on the capital invested by the managing association a rate equal to the highest average rate of French *rentes* plus two points, and dividing any excess in the proportion of 50 per cent to the State and 50 per cent to the managing company. The second class would work under similar financial arrangements, but the exploitation of the network, or that portion of it constituting the concession, would be under the direct control of the State. The government authorities would choose one or the other of these alternative methods of operation in accordance with the public interests.

The regulations made by operating associations would be subject to the approval of the government, and government representatives would sit on the administrative councils. The president of an association would in every case be chosen by the Minister of Public Works. The official tariff of charges, in the case of operation by concessionaires, or a special agreement, in case of operation by managers, would fix the division of the charges and the profits. It is hoped the expenses of the undertaking will be in part met by the receipts.

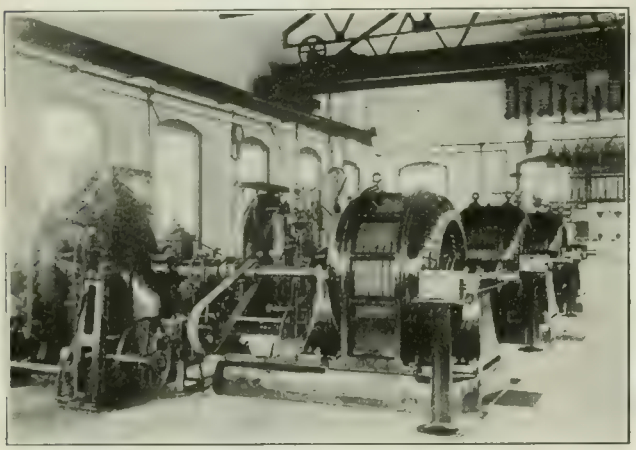
M. Tochon expressed the hope that the project would speedily become a law by the acquiescence of the Senate; for, though it has been found possible to begin the work under the authority of previous legislation, it has proved difficult, in the absence of a declaration of public utility, to vanquish the resistance of landowners who refuse to permit the erection of towers on their property. The projected law, he said, would mark the first attempt at a methodical organization of the distribution of electrical energy in France.

IF EVER *there was a time when the country in general believed in the research being done in colleges, it is now. This sentiment is based upon the work done by scientific men in the war. There is a demand for research men in connection with all big corporations. They go to the universities for their men, and this is proof in itself that the universities provide their students with the proper methods of research. Notable fields where scientific research has been the underlying foundation are sound ranging, the detection of submarines by sound, and a complete revision of the whole method of firing projectiles. This was done by men who had never studied these things, but who were familiar with the mathematical and physical principles that lie at the base of them.*—PROF. L. P. EISENHART *of Princeton University.*

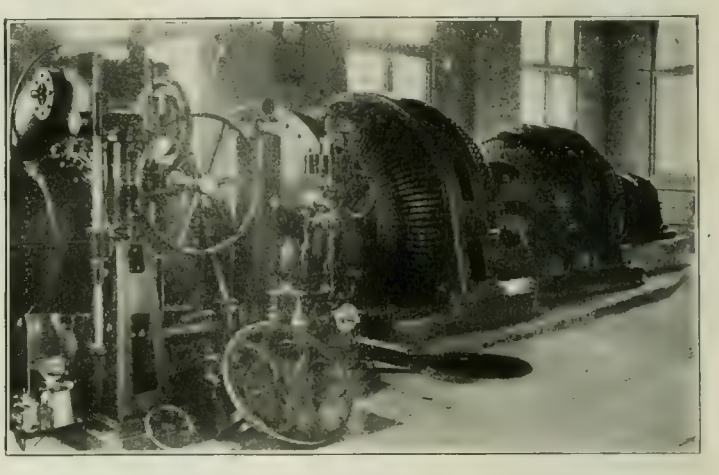
Interconnection in Southern Vermont—II

Tying Hydro-Electric Properties Together for Co-operative Service Saves Fuel and Water—Centralization of Dispatching Function Helpful — Graphic Analysis of Intercompany Operations

CONSOLIDATION of isolated utilities in southern Vermont into an interconnected electric service system has made it possible to operate much more economically and at the same time to increase the reliability of service and to extend the availability of the total power resources. Five important systems of hydro-electric supply and several industrial plant generating stations are connected so that they can now interchange energy and give a co-operative service. Low, medium and high heads are involved, and several old plants had to be rehabilitated and the equipment standardized as much as possible. For this reason the method of handling the interconnection problems should interest engineers who may have a similar problem to face elsewhere in the country. This information was given in the last issue of the ELECTRICAL WORLD, July 3, 1920. In the current issue features of one of the hydro-electric plants, which has the highest head east of the Rockies, are presented, and information is given regarding future system developments expected, nature of load in Vermont, and some of the operating practices on this interconnected system.



Vermont Hydro-Electric Corporation



Hortonia Power Company, Lake Dunmore

INTERIOR OF TWO OF THE SOUTHERN VERMONT GENERATING STATIONS

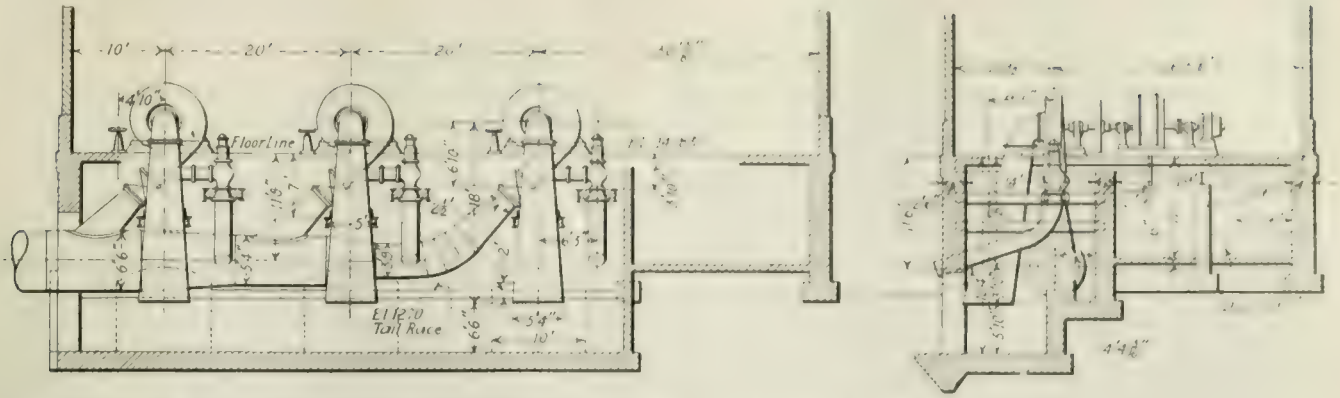
HIGHEST HEAD PLANT EAST OF ROCKIES

Of the eight active plants of the Hortonia company, the most noted from the engineering standpoint is the Silver Lake station. Containing a single unit of 2,260 kw. rating, divided into two generating sets of 25 cycles and 60 cycles driven from a common waterwheel, this station operates under the highest known head east of the Rocky Mountains, 675 ft. (206 m.). The Silver Lake station was built in 1917 and is located in the town of Salisbury, on the shore of Lake Dunmore. It utilizes the waters of Silver Lake and two nearby streams. Silver Lake lies 700 ft. (214 m.) higher than Lake Dunmore, and at its outlet a concrete dam has been built, raising the level of Silver Lake 15 ft. (4.6 m.), and impounding about 287,000,000 cu.ft. (8,140,000 cu.m.) of water. From the intake a 5-ft. (1.5-m.) wood-stave pipe is carried for 3,000 ft. (915 m.) to a 12-ft. (3.7-m.) diameter by 90-ft. (27-m) high surge tank. From the tank a 36-in. (91.5-m.) lock-bar steel pipe is run down the hillside to the station, the length of run being 2,300 ft. (701 m.).

The tailwater from the station is discharged into Lake Dunmore, a 1,200-acre (486-hectare) reservoir with a drainage area of 30 square miles (76 sq.km.), and this lake in turn discharges into the Salisbury plant through a wood-stave penstock 2,800 ft. (855 m.) long and 5 ft. (1.5 m.) in maximum diameter. A 2,100-kw. generating set is installed, consisting of a 1,625-kva., 25-cycle generator and a 1,000-kva., 60-cycle generator direct-connected to a horizontal waterwheel operated under a head of 178 ft. (54 m.). These two stations are similar in delivering energy at two frequencies and illustrate the practice of reutilization of water so frequently taken advantage of in this district. The supply of energy to an electric railway load required the use of 25-cycle generating equipment in addition to the 60-cycle outfit, rotary converters operated at that frequency furnishing direct current for traction service. The Hortonia company also supplies 25-cycle energy to an important industrial load in New York State, to be mentioned later, and the transmission line of the company running westward from Lake Dunmore to Lake Champlain is operated at this frequency.

In eastern Vermont the Hortonia company interests operate a group of locally interconnected stations, which, with industrial plant generating capacity tied into the system, will add about 1,200 kw. in hydro-electric energy to the resources of the western lines and plants when a 44,000-volt line is constructed from the Pike Hill copper mines to Bethel. The stations in this eastern network range in hydro-electric capacity from 160 kw. to 500 kw. and are interconnected by 13,200-volt lines.

At Port Henry, N. Y., the Hortonia company operates a hydro-electric plant of about 1,200 kw. rating, delivering both 25-cycle and 60-cycle energy. A single waterwheel drives two generators as in other plants noted before. All the 25-cycle energy from this station is sold to the Witherbee-Sherman Company through the Port Henry Light, Heat & Power Company, at Mineville,



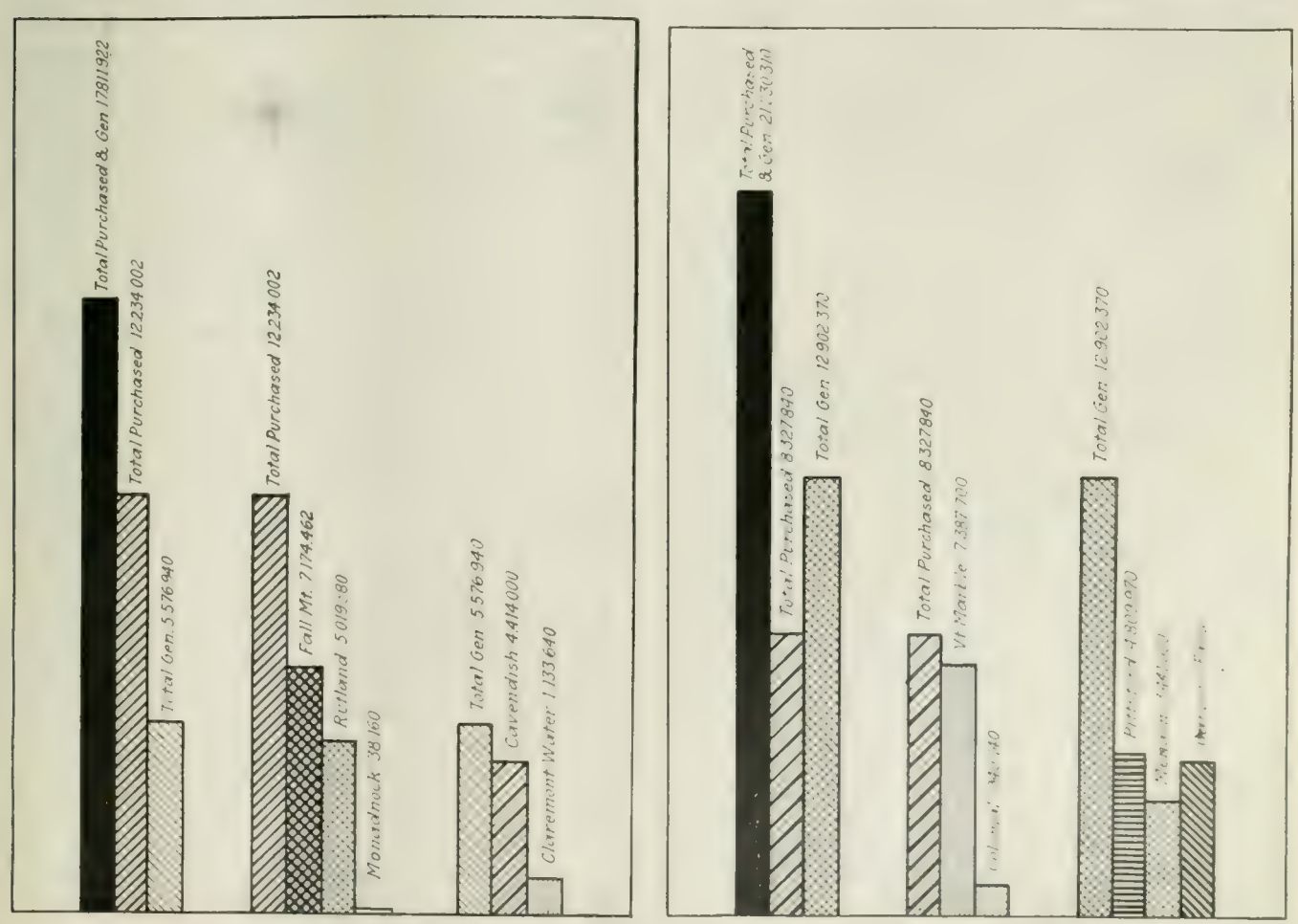
ELEVATION AND CROSS-SECTION OF RUTLAND STATION

N. Y. This industrial company owns the largest magnetic iron-ore field in the country, the annual output being about 1,250,000 tons and the annual energy consumption about 12,000,000 kw.-hr. .

Future Developments Expected

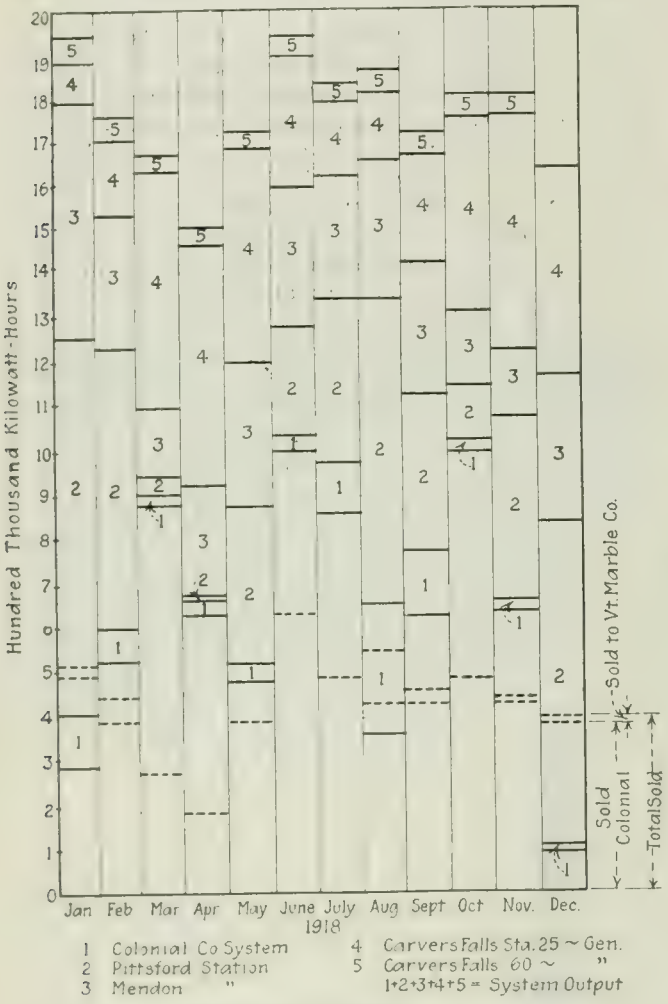
Other power and reservoir sites are owned by the various companies for future development in this district, and as the interconnection program is worked out on the local and adjacent systems a much larger degree of co-ordination than is at present feasible is likely to be accomplished. The Hortonia system is at present connected with the Vermont Hydro-electric system by a tie line recently built between Brandon and Pittsford, operated at 13,200 volts but designed for ultimate operation at 44,000 volts. Near Salisbury the Hortonia lines are connected with the 44,000-volt lines of the Vermont Marble Company. The use of 44,000 volts on the trunk transmissions affords much greater opportunity for effective co-operation in service between the different companies than lower voltage ties, on account of the increased amounts of energy which can be interchanged. On some of the later line construction the wishbone type of cross-arm is used, but comparatively little has been done in this territory as yet to standardize the high-tension overhead work. Opportunities exist for improving the line loss after the distribution of loads and co-ordination of plants are studied. Thus far comparatively little has been done in the way of installing parallel or loop lines, but as time goes on this will undoubtedly receive much more attention in districts where alternative feeds are seen to be feasible.

Although the idea is widespread that Vermont is largely an agricultural state, the various interconnected



SEGREGATION OF PURCHASED AND GENERATED POWER FOR COLONIAL AND RUTLAND SYSTEMS

systems handle very substantial industrial loads and are at present seriously considering the development of water rights additional to those now in service in order to meet the rapidly increasing demands for power. Among its larger customers, the Hortonia company serves tanning, granite, talc, box, marble, kaolin, mines and public utility interests. The Vermont Hydro-Electric Corporation serves a slate mill which has a 3,000-hp. twenty-four-hour load and a range in motor rating of 1 hp. to 250 hp., a scale manufacturer, a marble company, a stone-working machinery manufacturer, a railroad machine shop, a mine machinery company, a large machine-tool manufacturer, and other important industrials, besides the railway, lighting and small power service in Rutland and other communities. The plants



SEGREGATED SYSTEM OUTPUT

of the Vermont Marble Company supply hydro-electric energy to over 100 miles (160 km.) of industrial transmission lines, about seventy-five quarries, and a connected motor load of about 14,000 hp.

In operating these interconnected plants it is the effort of the load-dispatching organizations to conserve water in the reservoirs so far as practicable, utilizing the daily stream flow to maximum advantage. In the Rutland district the Chittenden Reservoir is the mainstay of the hydraulic situation. The variations in the elevations of water in this reservoir above the Rutland base for 1917 and 1918 are shown, with the corresponding rainfall, in the accompanying diagrams, and from these it will be seen that it is customary to draw down the reservoir in the late summer and in mid-winter, passing the water through the Pittsford and Mendon stations, while at other periods, when the stream flows are more ample, the "flash" stations are depended upon to a greater extent.

The operation of the plants is well brought out in the accompanying diagram of daily station outputs for October, 1919. At that time the flow of the Black River at the Cavendish plant, of the Poultney River at Carvers Falls, and the Connecticut River at Vernon permitted the liberal use of these stations, together with the plants of the Vermont Marble Company, while the Pittsford and Mendon stations were run at very moderate outputs. The twenty-four-hour load curve of the system on Oct. 30, 1919, shows how evenly loaded some of these plants were and how little need existed for drawing down the stored water back of the Pittsford and Mendon stations. The block diagram of monthly plant outputs for 1918 also shows how well the stations

INTERCONNECTED HYDROELECTRIC STATIONS
SOUTHERN VERMONT

Station	Location	Operating Company	Kw. Available	No. Units	Head (Ft.)
Pittsford	East Creek	Vermont Hydro	2,200	3	48
Mendon	East Creek	Vermont Hydro	2,100	4	220
Cavendish	Black River	Vermont Hydro	1,500	3	120
Claremont	Sugar River	Vermont Hydro	320	1	20
Carvers Falls	Poultney River	Vermont Hydro	1,040	2	120
Vernon	Connecticut River	N. E. Power System	3,500	8	34
Huntington Falls	Otter Creek	Vermont Marble	1,600	2	40
Beldens	Otter Creek	Vermont Marble	1,600	2	40
Proctor	Otter Creek	Vermont Marble	2,400	3	120
Center Rutland	Otter Creek	Vermont Marble	275	1	30
Hortonville	Benson	Hortonia Power	750	1	176
Brandon	Neshobe River	Hortonia Power	250	2	63
Bristol	New Haven River	Hortonia Power	250	1	115
Silver Lake	Lake Dunmore	Hortonia Power	2,260	1	675
Lake Dunmore	Salisbury	Hortonia Power	2,100	1	178
Gaysville	White River	Hortonia Power	300	1	27
Bethel	White River	Hortonia Power	560	2	16
Middlebury	Otter Creek	Hortonia Power	2,160	3	30
Port Henry, N. Y.	McKenzie Brook	Port Henry Lt. & Pwr.	1,200	1	38

were co-ordinating, with the interchange of energy between the several plants recorded. In 1918 the operating organization took 4,849.760 kw.-hr. from the Chittenden Reservoir, against 4,808,870 kw.-hr. in 1917, and by the efficient co-ordination of interconnected stations the water level in this basin at the close of the year was actually 8 ft. (2.7 m.) above that at the beginning. In other words, efficient plant handling yielded an increased output from the reservoir during the year and added about 1,000,000 kw.-hr. in storage besides. The rainfall at Chittenden Reservoir in 1918 was 43.28 in. (110 cm.) and the Pittsford station used 847,665,000 cu.ft. (24,000,000 cu.m.) of water from the reservoir, or about 176 cu.ft. (50 cu.m.) per kilowatt-hour. During that year the Vermont Marble Company sold the Rutland system 7,377,300 kw.-hr. and purchased from the latter 235,200 kw.-hr. The total energy generated and purchased on the Rutland system was 21,219,810 kw.-hr.

THE *underlying principle of government is justice. Ours might be called the court of the penniless man. A laborer may come who has a grievance, and this court is commanded by law to provide that man with expert advice for the full development of his side of the case. If the aggrieved person is not satisfied, he may appeal directly to the State Supreme Court, still without one penny of cost. They say, "You have taken away the only weapon we had, the weapon of the strike." It is adequate to answer that in every honorable controversy we have given them the much more effective weapon of the state government.*—GOVERNOR ALLEN *of Kansas on the State Industrial Court.*

Calculation of Feeder Voltage Regulation

Through the Use of the Accompanying Chart the Voltage Regulation of a Given Feeder May Be Obtained Readily for Any Load and Power Factor

By W. C. CHAPPELL
Electricity Commissioner, Melbourne, Australia

THE calculation of feeders is recognized by designing engineers to be somewhat tedious, and, while shortened methods have been proposed, they do not give voltage drop and power loss for more than one load. In this article a method is given which, to the writer's knowledge, has not yet been published, whereby this tedious calculation is eliminated. In order to present the method in a clear manner an example will be worked out giving the preliminary calculations for obtaining the size of wire. No attempt will be made, however, to prove the formula used, as this has already been dealt with in the many books on feeder design, and any other formula may be used which the engineer may choose for himself, provided that the voltage drop for a given load is obtained.

The method of calculating feeders radiating from a substation is usually based on an assumed load at the end of the line, an assumed power loss and the requisite size of feeder to suit the requirements of the engineer. Further, the voltage at the substation is constant and the load at the consumers' motors variable. The calculation, however, is based on the maximum load with perhaps provision for some further additional load, and should it be desired to know what voltage and power loss would be obtained at the consumers' terminals if additional motors were installed, the engineer would ordinarily have to make fresh calculations in order to say whether it would be economical.

For the purpose of showing how such calculations may be avoided by the construction of suitable curves, the following illustrative example is worked out.

Assume:

Load at consumers' terminals,	kw	= 0 3,000 kw.
Voltage at substation,	Vs	= 11,400 volts (constant)
Voltage at consumers' terminals,	Vc	= 10,600 volts
Frequency		= 50 cycles
Power factor,	PF	= 90 per cent
Spacing of conductors,	S	= 30 in.
Distance,	L	= 3 miles
Percentage power loss at 3,000 kw., 90 per cent P.F.,	Q	= 7 per cent

Area of conductor in million circular mills is given by:

$$A = \frac{1.04 \cdot F}{Q} \tag{1}$$

where

$$F = \frac{L \cdot kw}{(PF \cdot Vc)^2} \tag{2}$$

Substituting F in (1), we have

$$A = \frac{1.04 \cdot L \cdot kw}{Q \cdot (PF \cdot Vc)^2} \tag{3}$$

Inserting the numerical values in (3), we have

$$A = \frac{1.04 \times 3 \times 5{,}280 \times 3{,}000}{7 \quad (0.90 \quad 10600)^2} = 0.0775$$

From wire tables the nearest size of wire corresponding to this area is No. 1 B. & S., which has a

Resistance $= r = 0.678$ ohm per mile.
Reactance $= x = 0.560$ ohm per mile.

Having obtained the size of the wire, the resistance and reactance, the voltage drop can now be calculated:

$$\text{Voltage drop} = P = \sqrt{3} \times I \times L(r \cos \theta + x \sin \theta) \tag{4}$$

where

$$I = \frac{kw \times 1000}{1.3 \quad Vc \cdot PF} \tag{5}$$

Substituting I in equation (4), we have

$$P = \frac{L \times kw \times 1{,}000\ (r \cos \theta + x \sin \theta)}{Vc \times PF} \tag{6}$$

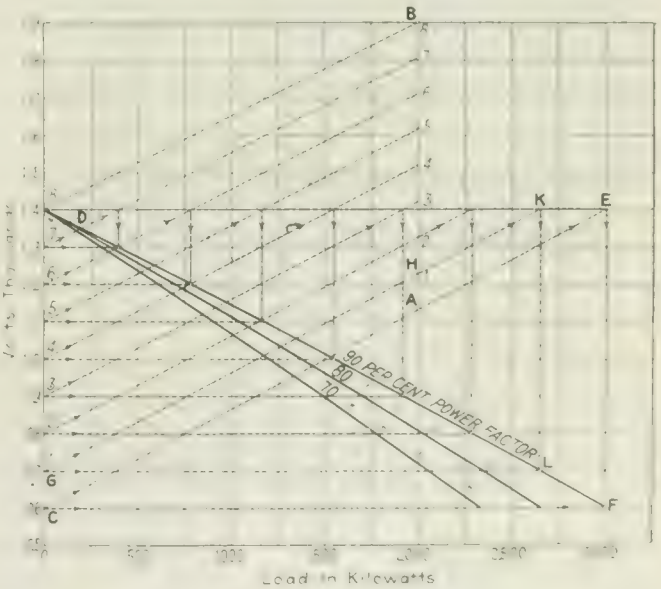
Putting

$$(r \cos \theta + x \sin \theta) = D, \tag{7}$$

we have

$$\text{voltage drop} = \frac{L \times kw \cdot 1000 \quad D}{Vc \times PF.} \tag{8}$$

The values of $r \cos \theta$ and $x \sin \theta$ can easily be calculated or may readily be taken from Frederick Warren's "Curves." The formulas for voltage drop given in (8)



CONSTRUCTION OF CURVES FOR FINDING FEEDER VOLTAGE DROP

will only give the drop for values of Vc which are assumed at the consumers' end. What the engineer wants to know is what voltage the consumer will get with different loads with constant voltage at the substation. This can be obtained as follows:

Take any load and power factor, say 2,000 kw. and 90 per cent, and insert in (8), having previously worked out values of D (equation 7).

$$D = (0.678 \times 0.90 + 0.560 \times \sqrt{1 - (0.9)^2} = 0.85$$

$$P = \frac{3 \times 2{,}000 \times 1{,}000 \times 0.85}{Vc \times 0.90} = \frac{5{,}655{,}000}{Vc} \quad (9)$$

Two values of Vc need only be taken (a) the voltage at the substation, 11,400 volts; (b) the lowest voltage that it is desirable to supply, say 10,600 volts. Inserting these in (9) we have:

	V	P	$V + P$	
(a)	11,400	496	11,896	(10)
(b)	10,600	534	11,134	(11)

On squared paper lay off on the axes load in *kw.* and V (see diagram 1). On the perpendicular through 2,000 kw. find points A and B, namely, 11,134 and 11,896; divide the distance between A and B in eight equal parts or into as many spaces as required between the voltage limits. Draw a line from C through A and continue until it cuts the horizontal line through D, this being the substation voltage. From D drop a perpendicular until it cuts the horizontal line through C at F.

This is one point on the curve for 90 per cent power factor. The same operation is carried out for the rest of divisions, *i.e.*, from G through H to K and down to L and C, and the last point of course must be at D. Connect all these parts together and we now have a curve which will give the voltage at the consumers' terminals for any load with constant voltage at the substation.

With the help of a slide rule, by formulas (3) and (8) any feeder can quickly be calculated, and the voltage drop obtained and plotted on squared paper. Similar curves for 80 and 70 per cent are also drawn in power factor.

Power loss curves may be drawn on the same sheet, thus making a complete set for the particular feeder. The voltages taken are those from the curves just obtained, and the power losses are worked out at these voltages.

Handling Lignite Coal to Prevent Spontaneous Combustion

Fuel Is Mined and Burned Within Twenty-four Hours at Lacombe Plant of Denver Gas & Electric Company

By Alex. W. Morgan

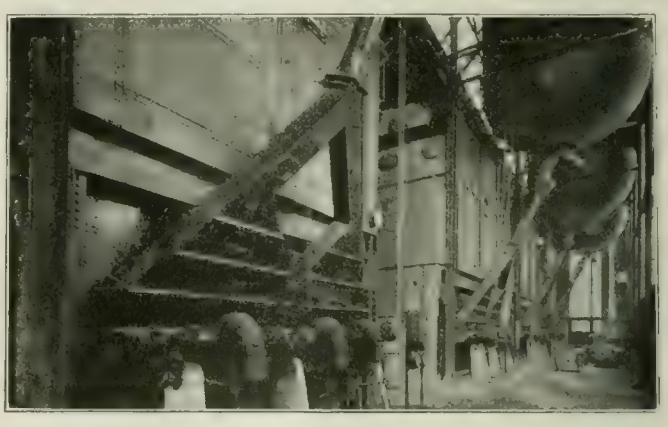
THE Denver (Col.) Gas & Electric Light Company's new Lacombe station is being operated almost entirely with lignite coal as a fuel. As a raw lignite cannot be stored economically and as it would take fire quickly from spontaneous combustion, its safe storage is exceedingly difficult.

Denver is within 30 miles (48 km.) of a very large lignite coal field, and coal that is mined one day is delivered to the power plant the next. This being the case, a continuous supply of coal is always assured to the plant, and therefore no attempt is made to store lignite coal at the plant for emergency use. Whenever coal is to be stored for emergency use a bituminous coal from the southern part of the state is purchased.

There is nothing novel in the coal-handling equipment, and only a brief description of it need be given here. Coal is dumped into a track hopper and from there passes through a Jeffery 24-in. (60-cm.) single-roll crusher which reduces the size of the coal to ¾-in. (19 mm). The coal then drops onto a 20-in. (50-cm.) belt conveyor, which carries it a distance of 114 ft. (34 m.) up 7½ deg. incline and delivers it to a vertical bucket elevator. This elevator carries the coal a distance of 67 ft. (20 m.) to the top of the boiler house and discharges it into a scraper conveyor. The scraper conveyor runs 127 ft. (39 m.) along the top of the four bunkers and is so arranged that coal can be delivered to any bunker. The belt speed is 222 ft. (68 m.) per minute. The scraper speed is 100 ft. (30 m.) per minute, and the entire equipment has a capacity of 60 tons (54 t.) per hour.

Bunkers of Peculiar Design to Meet Varying Needs of Denver Company's Plant.

The fact that lignite cannot be stored safely was borne in mind when the bunkers were designed. From the photograph it will be noticed that the bunkers are of peculiar shape and design. They have received various names, such as "inverted parrot cage," "beehive" and "wasps' nest." They are built up of a skeleton steel work consisting of sixty-eight ½ in. (12-mm.) round iron rods bent to shape and fastened at the top into the building steel and at the bottom into a special angle-iron circular form and plate. Two loops of 6-in. (15-cm.) channel iron serve as the main horizontal tie members. Rings of ½ in. (12 mm.) round iron are fastened securely to the vertical members at various intervals, and expanded metal lath is fastened to the inside of the skeleton steel work. On the inside surface of this metal lath was spread a thin coat of concrete, which served as a backer, and then to both inside and outside surfaces of the bunkers was given a 1-in. (25-mm.) coat of cement, shot on with a cement gun, making a total thickness of the walls slightly over 2 in. (5 cm.).



COAL BUNKERS AND COAL SPREADERS ARE FEATURES OF DENVER PLANT FITTED UP FOR LIGNITE COAL

The bunkers will hold between 75 tons (67 t.) and 80 tons (72 t.), which is about the amount of coal that will be used by one boiler in twenty-four hours. From this it may be seen that the engineers have reduced the chance of spontaneous combustion to a minimum. However, there is still one precaution which must be taken even with this arrangement; that is, to see that whenever a boiler is taken off of the line the bunker is emptied. Failure to do this caused two bad fires.

Readers' Views and Comments

Publication of Verbatim Proceedings Wasteful

To the Editor of the ELECTRICAL WORLD:

SIR: Contrary to its former practice, the Southwestern Electrical and Gas Association has not this year and did not last year take stenographic notes of its operating sessions or publish its proceedings.

I believe that there has been an immense amount of money wasted by organizations similar to ours in the publication of the verbatim proceedings of their conventions and other meetings. While these are interesting and possibly valuable to a few of the members and others, the larger portion of them might as well be immediately sold to the junk man. A long-continued inquiry and observation among our members and among those of other similar organizations has elicited the fact that the printed proceedings of the organizations have very seldom been looked into after the glance given them on their receipt, and while in some cases they make an imposing addition to the office bookcase, I have found nearly always that that has been their only benefit.

H. S. COOPER,
Secretary.

Dallas, Tex.

Safety Features of the Double-Base Lamp

To the Editor of the ELECTRICAL WORLD:

SIR: The writer of the criticism of the double-base lamp appearing on page 1267 of your May 29 issue evidently did not notice that this lamp is supplied with a threaded and insulated receptacle permanently attached to the free end. By this means the supposed dangers to which he refers are eliminated just as completely as they are in any standard socket.

The device is not a complicated arrangement, but on the contrary is extremely simple, symmetrical and sightly—statements that can scarcely be made in many cases of the current taps and double plugs on the market. The "complications" referred to are evidently the attachments which the inventor suggested for use with the lamp, whereby ordinary chain pendent fixtures might be converted into modern lighting units.

I can scarcely agree that it is "neither desirable nor economical" always to have the light burning when the lower end is in use. This might be true if one looked at the matter exclusively from the viewpoint of the manufacturer of wiring devices, but if viewed broadly, it is seen that this feature of itself is one of the valuable points of the device. This is the case because it gives a reliable indication that the appliance is connected on the circuit. This, in the almost universal absence of pilot lamps, tends to make the use of appliances of all kinds more safe, and this assurance and freedom from appliance burnouts should much more than offset the small waste of light which might or might not occur. For the larger sizes of lamps, if found desirable, a switch might easily be incorporated whereby the use of the appliance would be made independent of the burning of the lamp.

EDWIN D. TILLSON.

Commonwealth Edison Company, Chicago.

The Problem of Inductive Interference

To the Editor of the ELECTRICAL WORLD:

SIR: I feel that the report of the committee on inductive interference presented at the recent National Electric Light Association convention was somewhat disappointing, owing to the fact that it caused alarm in the commercial and administrative departments of the N. E. L. A.

Such a state of affairs is unnecessary, as we know what we are facing in the fact that wherever power circuits are built communication circuits will be operated also and of necessity will soon reach places where parallel lines cannot be avoided. The recent voluminous report of the California committee on inductive interference has presented some very valuable technical data which should be sufficient for solving the technical problems involved in parallel-circuit operation.

Inductive interference can in large measure be reduced to a negligible quantity by scientific transposition. In this connection it is well to point out that many of our present high-voltage transmission lines are not transposed and that it will be very expensive to rebuild them, although this seems unavoidable.

New prime movers should be ordered with a wave form that will reduce inductive interference to a minimum. This would be in accordance with the standardized rating of the American Institute of Electrical Engineers. However, since there are so many prime movers in operation which have wave forms productive of voltage waves containing the injurious harmonics, some method should be evolved for correcting their wave forms. These prime movers cannot be thrown away, of course, and I would suggest that the committee of inductive interference conduct experiments toward correction of the wave forms.

The following method of suppressing harmonics appears not impossible of application: After the amplitude and phase angle of the harmonics have been determined, a small generator set having the necessary characteristics may be attached to the generator shaft which would produce current corresponding to the harmonics in the main generator wave. The current produced by the correcting generator set would be superimposed on the primary wave at 180 deg. phase angle and thereby counteract the original harmonics. The size of the correcting generators would, of course, be proportional to the size of the prime mover and to the quality and quantity of the harmonics.

If the inductive interference troubles were confined to a few communication lines, it would be possible to eliminate the interference in the way pointed out by the connection of small generator sets directly to the telephone line. An alternative would be to install tenatron generators tuned in opposition to the interfering wave induced in the communication circuit. In the case of long communication circuits which utilize the high-frequency carrier waves, interference will not be experienced due to parallels with power circuits, but it is not anticipated that the system of using carrier waves will become universal.

In conclusion, I believe that if the Technical Section of the N. E. L. A. will work in harmony with the technical representatives of the telephone company, a great many of the difficulties will be ironed out to the profit of both.

J. A. LIGHTHIPE,
Chief Electrical Engineer.

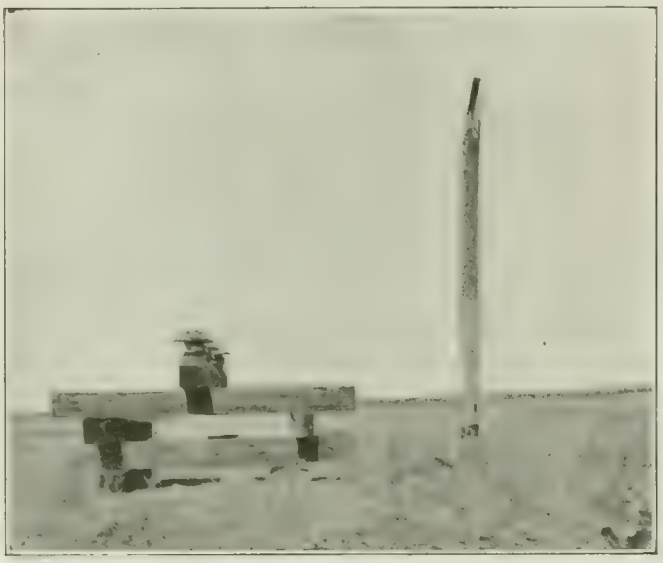
Southern California Edison Company, Los Angeles, Cal.

Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Stack of Cross-Ties as Emergency Support for 60,000-Volt Line

BY USING stacks of railroad ties for supporting a 60,000-volt line, service was quickly resumed after a recent storm blew down several poles of the Pacific Gas & Electric Company. These piles of ties were built



RAILROAD TIES USED TO SUPPORT 60,000-VOLT LINE AFTER POLES WERE BLOWN DOWN

up high enough to keep the wires clear of the ground, and the pin-type insulators which were on the poles were set, with the wires attached, on the top tie. After the line was reported clear a watchman was stationed to guard it. Service was successfully maintained over the temporary line until other arrangements were made.

San Francisco, Cal. P. M. DOWNING.

Four-Valve Engine Shows Economy Over Turbine

THE fuel consumption of a small Kansas central station burning oil was about cut in half by substituting a four-valve Ridgeway engine for a horizontal type turbine operated non-condensing. The original installation consisted of two 650-kva., 3,600-r.p.m. turbines operated without condensers and discharging into a heating system against a back pressure of 5 lb. to 8 lb. (0.35 kg. to 0.56 kg. per sq.cm.). With this installation the consumption of oil in December, 1919, was 1.5 gal. (5.3 l.) per kilowatt-hour, and there was always more exhaust steam than was required for heating. When the new unit was put in, a 500-kva., 150-r.p.m., four-valve simple engine, this consumption dropped to 0.8 gal. (3 l.) per kilowatt-hour, including the oil used to generate some live steam for heating. On account of this difference in consumption one of the turbines has been removed and the other has been equipped with a condenser to increase its efficiency. Other improvements are being made in the method of burning the oil, and still better consumption records are expected later.

FRANK M. STONE, General Manager.

Fort Scott (Kan.) Gas & Electric Company.

Chart Facilitates Steam-Flow Calculations

FOR calculating velocity, size of pipe, steam flow or steam pressure, when any three of these conditions are given, the chart shown here has been found to save time. To illustrate the use of the chart, suppose it is necessary to find the size of pipe required to deliver 6,000 lb. of steam per hour at 110 lb. gage pressure, allowing a velocity of 4,000 ft. per minute. On the 4,000-ft.-per-minute line trace diagonally to the intersection with the dotted 110-lb. pressure line. From this intersection trace horizontally to a point on the 6,000-lb.-per-hour line. The nearest pipe-size line to this point (4 in.) shows the size of pipe to use.

Taking another example, suppose that it is required to find the pounds of steam delivered per minute through an 8-in. pipe at 100 lb. pressure and with a velocity of 6,000 ft. per minute. To solve this, trace the 6,000-ft. velocity line to intersect the dotted 100-lb. pressure line. Follow horizontally from this intersec-

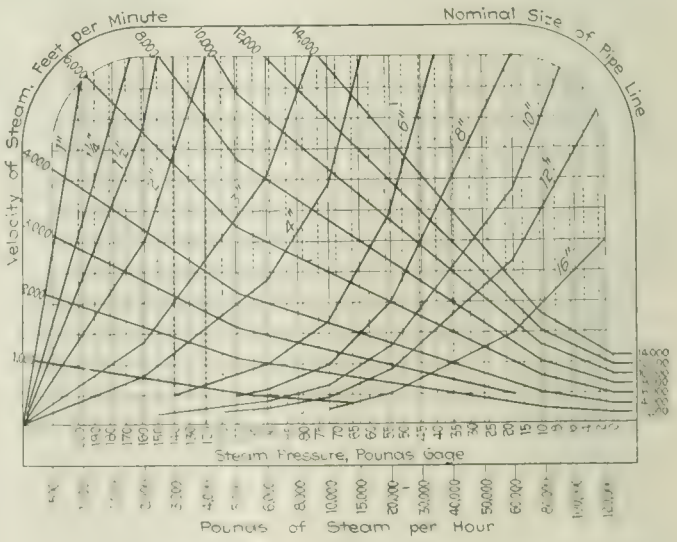


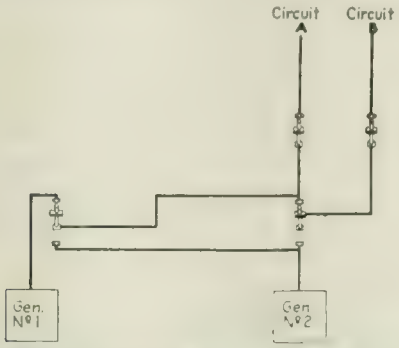
CHART FOR CALCULATING STEAM FLOW

tion to a point on the 8-in. pipe line and directly below this point is found the discharge, which is 32,300 lb. of steam per hour.

The chart shown here is an abridgment of a large chart made by the Republic Flow Meters Company, Chicago.

Feeding Two Circuits with Generators Which Cannot Be Paralleled

WHERE two generators which cannot be paralleled are required to feed two circuits on which the load varies the scheme illustrated herewith has proved useful. By means of this connection both circuits may be fed from generator No. 1, both circuits may be fed from generator No. 2, or A may be fed from No. 1 while B is fed from No. 2. If only one of the circuits is to be made alive, it may be fed from either No. 1 or No. 2. With such an arrangement it is impossible to tie the



THESE DISSIMILAR GENERATORS CANNOT BE PARALLELED, ALTHOUGH THE CIRCUITS MAY BE TIED TO EITHER OF THEM

two generators together no matter which way the switches are thrown. As there is no arrangement for even temporarily tying the two generators together, one outgoing circuit cannot be transferred from one generator to another without temporarily dropping the load on the circuit.

W. A. DARTER.
Brenham Compress, Oil & Manufacturing Company.
Brenham, Tex.

Waterproofing Overhead Coal Bunkers

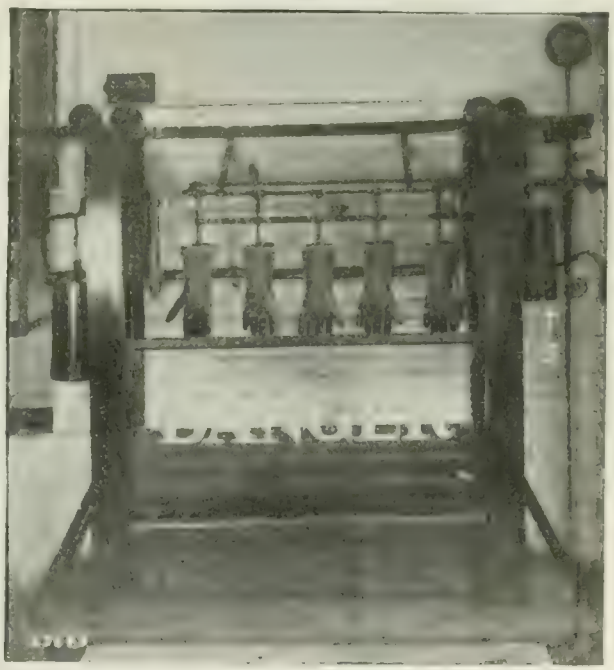
TO PREVENT acid water from coal bunkers falling into the boiler room and attacking the metal parts, the United Light & Railways Company, Davenport, Iowa, has waterproofed the bottom trough of the bunker in its new Moline (Ill.) boiler house. This was accomplished by covering the lower sections of the bunker with a membrane waterproofing consisting of three independent layers of asbestos felt secured together and held to the initial concrete surface by layers of hot asphalt water-proofing cement.

C. S. LLOYD.
Chicago, Ill.

Tank for Quick and Safe Tests on Rubber Gloves

FOR safely and quickly making voltage tests on rubber gloves, a large central-station company makes use of a wooden tank, metal lined, filled with water so arranged that it can be raised or lowered in an insulated wooden testing rack while the gloves are held stationary at the top of the rack. Metal cables fastened at each end of the tank are attached to heavy counterweights. A glass shield is attached to the tank and moves up and down with it. The advantages of this arrangement are that there are no exposed ungrounded high-voltage parts. The two high-voltage testing terminals are arranged as follows: One is placed inside of a fiber tube, the upper end of which is sealed and insulated and the lower end left open, so that when the water tank is raised the water enters the bottom of the tube and makes contact with this terminal. The other high-potential terminal consists of the entire water-piping system, with the glove holders and pipes used for filling the gloves, all of which are permanently grounded at all times and remain in a fixed position, irrespective of whether the tank is raised or lowered. When the tank is lowered the ungrounded circuit is always broken, so that the tester has plenty of room to adjust the gloves on the disks in their test position without coming in contact with any live terminals. The tops of the gloves are kept perfectly dry and the insulation intact, as the gloves are gradually submerged until the water reaches a point about 1½ in. (3.8 cm.) from the top of the gauntlet. When the tank is raised electrical contacts are automatically made and all live parts are inclosed within the glass shield, thus effectively protecting the operator.

The gloves are stretched over grooved metallic disks and fastened to them by two thick rubber bands stretched over the top of the gloves. The water pipes extend through the disks, project down into the water inside of the glove and act as a high-potential testing terminal. They are also used for filling the gloves with water and, after the test has been completed, emptying them by siphon action when the valve in the exhaust pipe leading to the sewer is opened. Stopcocks are provided on the metallic glove-holding disks so as to allow the air to escape while the gloves are being filled with water. As soon as the water begins to flow out of the cocks they are turned off and a pressure gage is used to adjust the water pressure in



NO LIVE PARTS OF THIS GLOVE-TESTING TANK CAN BE TOUCHED BY OPERATOR

the gloves, which is usually held at about 1½ lb. to 2 lb. per square inch (0.1 kg. to 0.14 kg. per sq.cm.).

Among other safety features of the equipment is an insulated testing stool always left in front of the glove-testing rack. The high-potential control panel is provided with an automatic spring switch, which remains open unless held closed by the operator. The distance between the control-switch panel, the testing transformer and the test rack is ample but so adjusted as to permit the results of the test to be

easily observed through the glass shield inclosing the gloves under test.

This equipment was described at the Los Angeles convention of the N. E. L. A. by the committee on accident prevention.

Drying Transformer Insulation and Oil Before Operating

BEFORE transformers are put in operation the insulation should be thoroughly dried if the transformer is for over 10,000 volts, and the oil should be tested for moisture for voltages even as low as 2,200 volts. The best method of drying transformer insulation is to send current through the coils. Direct current can be used for this method, but it is usually not available. When using alternating current about 3 per cent of the high tension voltage should be employed. For instance, on a 60,000-volt transformer 1,800 volts should be used. Before applying this voltage the low-tension winding of the transformer should be short-circuited and an ammeter and fuse should be put in the circuit for protection. With about 3 per cent of the high-tension voltage on the high-tension leads, full-load current will be flowing in both windings. The temperature should be watched closely to see that it does not run over 80 deg. C.

During drying, tests should be made at least hourly on the resistance of the insulation. These tests may be made with a 500-volt voltmeter, a megger or a good Wheatstone bridge. When heat is first applied the insulation resistance will drop off, but it will gradually begin to rise and should be several megohms between the high-tension and the low-tension windings, and between each winding and ground, before the drying is discontinued.

Oil shipped in tanks, cars or drums is sure to contain some moisture and it is not safe to use even in 2,200-volt apparatus without testing and if necessary drying to remove the moisture. The only sure way for testing oil is in a spark gap. On a 0.015-in. (0 37-mm.) gap the oil should stand 25,000 volts for a 6,600-volt transformer, and for higher voltages it should stand 30,000 volts or more. The best dry oil obtainable will stand about 50,000 volts. A rough test for moisture in oil is to plunge a red-hot iron into it and note the sound. A hissing noise indicates the presence of considerable moisture. Before the oil is passed into any kind of a filter it should be allowed to stand a few minutes in order that the water may settle.

As oil thickens in cold weather, this will take a longer time than in hot weather. Even if the oil test is satisfactory, it should be strained through doubled cheese cloth to remove drum scale and other dirt. For drying oil which contains moisture a filter made up of layers of sand and quicklime may be used, or a blotting paper filter press. A slow and laborious method is to drive the moisture out as steam by heating the oil.

When quicklime is available oil may be strained into a large funnel containing lumps of the lime, with two thicknesses of cheese cloth tied over the spout. The oil can then be passed through the cheese cloth into the filter press, if one is available, or if not, it may be passed through a new batch of quicklime a second and a third time. As soon as this lime is half pulverized by taking up water, it must be renewed. This treatment of oil must be done in a room free from moisture in the air, as oil will absorb moisture from air nearly as fast as lime takes it out.

If a filter press is available, after the oil is passed through one funnel of lime it is pumped through the press. The blotting paper in the press must be changed frequently, about every fifteen minutes, until all the oil has passed once through the pump. This paper will take out only as much oil as it can soak up, after which it will pass the water through. When this occurs the pump gage will indicate excessive pressure, rising from the ordinary pressure of 20 lb. to about 150 lb. (1.4 kg. to 10.5 kg. per sq.cm.). With a great deal of sediment the pressure may run as high as 160 lb. (11.2 kg.). The best results are obtained with the press by thoroughly drying the paper and using about five sheets in each space of the filter.

Before placing the filtered oil in a transformer the tank should be wiped clean with dry rags (not waste). Clean rags wet with pure alcohol should be used for the second wiping if the tank is at all damp.

Cleveland, Ohio. JAMES DIXON.

Changing 25-Cycle Meters for 60-Cycle Operation

CHANGING 25-cycle meters to operate on 60 cycles was done recently without a great deal of expense or labor by the Choctaw Power & Light Company, McAlester, Okla. This change was necessitated by the changing of the distribution system from the old 25-cycle frequency to the standard 60-cycle frequency. For making the change on General Electric type I meters, the lag coils and the light-load adjustment plates were removed and standard 60-cycle lag coils and light-load plates were substituted. The cost per meter, including labor, was 77 cents. The difference in the 25-cycle and the 60-cycle lag coils lies in the fact that the 25-cycle coils have one very heavy turn of copper in addition to a large number of small turns. This single heavy turn is not in the 60-cycle coils. Moreover, it cannot be removed from the 25-cycle coils without destroying them; therefore, it was necessary to install new coils. To change the meters to standard 60-cycle meters would have required changing the shunt coil and the register as well as the lag coil and light-load plates, which would have increased the cost of the change about $2.60. On the General Electric type D-3 polyphase meters the same change was made at an expense of about $1.50, including labor and calibrating. For making the change on a number of Fort Wayne type K-5 meters it was only necessary to remove the upper or fixed lag plate used in 25-cycle meters to make them correct for 60-cycle service.

After the change it was found that the meters had very nearly as good characteristics as the standard 60-cycle meters. No change was made in the register, shunt coils, series coils or disk constants. The torque being practically the same as in the 25-cycle meters, the disks run at half the speed of the standard 60-cycle meters. No trouble was experienced in calibrating the meters, although it was thought at first that new magnets would have to be installed to obtain the desired calibration over the entire range. However, all meters had to be relagged and calibrated on inductive load.

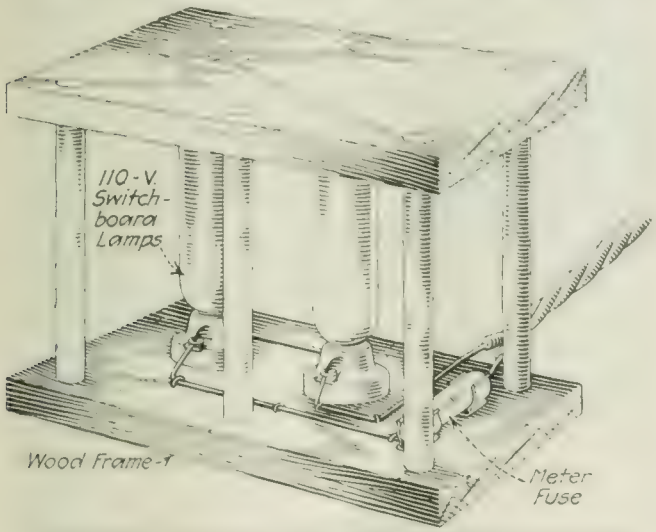
Choctaw Power & Light Company, P. M. CORDELL.
McAlester, Okla.

Industrial Applications

The Economical Utilization of Electrical Energy
in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

Light and Small Test Lamps

BY MOUNTING in a light wooden frame two small 110-volt lamps such as are used in signal lights on switchboards an Eastern testing department has made a very convenient device to be used in the same manner as the ordinary larger testing lamps. These two lamps are mounted in series, and a small meter fuse such as is



LIGHT TEST-LAMP OUTFIT FOR LOCATING SHORT CIRCUITS, GROUNDS, ETC.

used on the back of switchboards is inserted in the circuit to prevent damage in case one or both of the lamps are short-circuited. Two flexible leads about 5 ft. (1.5 m.) long are attached to the lamps. This device is used for roughly ascertaining the voltage on 110-volt and 220-volt lines, for testing for grounds, short circuits, open circuits, etc. EDWARD HATCH.

New York, N. Y.

Keeping Electrical Machines Warm Prevents Sweating

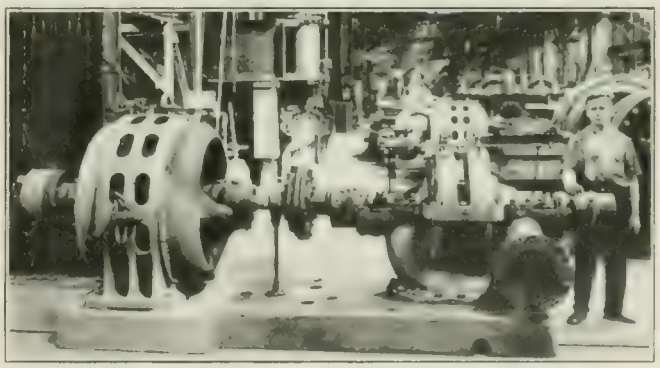
IF THE room temperature where electrical machinery is kept is uniform at all times, or if the machines are kept slightly warmer than the surrounding air, sweating of the machines will be prevented. Sweating is the result of a difference of temperature between a machine and the surrounding air. If the air is saturated at a certain temperature and is cooled below this point, it gives up some of its moisture. When the temperature of a machine is low enough to reduce the temperature of the air below the dew point all excess moisture is precipitated upon the machine. This is very injurious to the insulation of electrical apparatus. For this reason the room in which electrical apparatus is stored by the user should be kept at an even temperature. The apparatus should also be covered to keep out dust and dirt.

After machines are installed arrangements should be made to keep them slightly warm. During periods of more or less extended shutdown the machines should be covered by tarpaulins, and a small amount of external heat should be applied to keep the machines at a temperature that will prevent sweating. Where high-voltage alternating-current machines are installed in localities having high humidity, schemes have been worked out whereby 220-volt alternating current can be applied to the motor windings by simply switching the motor from its power line to the shop circuit. This can be done very quickly and only a small amount of power is required. The heat is applied internally, and it is only necessary to keep the temperature a few degrees above that of the surrounding atmosphere to prevent precipitation. Some operators have arranged electric heaters made up from grids, and others place steam pipes under the motors to keep them warm during shutdowns.

East Pittsburgh, Pa. O. NEEDHAM.

Synchronous Motor Starts Primed Pump Through Magnetic Clutch

ONE of the disadvantages of using synchronous motors to drive centrifugal pumps is the large pull in torque which is required when the motor is started after the pump has been primed. To overcome this difficulty the city of Coffeyville, Kan., decided to use a magnetic clutch between the motor and pump, as shown in the illustration. This clutch permits the load to be



MAGNETIC CLUTCH PERMITS SYNCHRONOUS MOTOR TO START CENTRIFUGAL PUMP UNDER LOAD

gradually applied to the motor so that it starts without trouble.

The hydraulic part of this equipment consists of a 10-in. (25-cm.) two-stage hydraucone centrifugal pump rated at 2,080 gal. per minute (130 l. per second) when operating against a head of 233 ft. (71.). The electrical end consists of a 200-hp., 2,300-volt, three-phase, 60-cycle, 1,200-r.p.m. synchronous motor. Both of these machines were manufactured by the Allis-Chalmers

Manufacturing Company. The magnetic clutch, which is energized from the direct-current exciter on the opposite end of the synchronous motor, was manufactured by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis.

Insulating Ends of Motor Coils with Cambric Saves Time

BY USING sheets of varnished cambric between the overhanging ends of motor coils instead of wrapping them with tape, an Eastern repair shop saves much time in rewinding alternating-current motors. Triangular strips of the varnished cambric are cut out of sheet material and these triangular pieces are inserted underneath the protruding end of every coil just after the coil is put in place. Between coils of the same phase only one thickness of the fabric is used, and between different phases two thicknesses are employed. The triangles are cut large enough to extend across the end of the coil and leave no part uninsulated from the adjacent coil. After all the coils are in place the varnished cambric is trimmed to the shape of the coil. The pressure of the coils against one another is sufficient to hold the fabric securely in place. Both rotor and stator coils are insulated in this manner.



INSERTING VARNISHED CAMBRIC BETWEEN ADJACENT COILS TO SAVE TIME OF WRAPPING WITH TAPE

This method of insulation is much quicker than the commonly followed method of wrapping the ends of the coils with tape. It is estimated that about two-thirds of the time of wrapping is saved by using the sheets of varnished cambric, and the cost of material is not much greater when using the cambric. C. A. Johnson.

Bronx, N. Y.

New Devices Increase Safety of Automatic Elevator

A TIME relay which holds the elevator at a stop for a definite time and an arrangement for quickly changing from automatic operation to manual are features of the electric elevators recently installed in the Los Angeles (Cal.) County Hospital. This time relay necessitates the lapse of a limited time, adjustable from a few seconds to a minute, after the car has stopped before it can be moved again. This gives invalids or nervous persons ample time to open the doors and make their exit from the elevator before the car can be started by any person on another floor. On the same panel with the relay is mounted a two-way switch by means of which the elevators can be operated by hand control or by automatic control. By touching the corridor button the elevator is automatically brought to the landing at which the button is pressed, and by touching the same button when the hand control is on a call is shown on the enunciator in the car.

As a safety precaution the contact block on the door is mechanically removed from the switch box when the door is opened, thus breaking the operating circuit when any door is open. In the switchbox there is a pawl which drops into a ratchet on the door when the car is away from the landing, making it impossible to open any doors when the car is in motion. When the car stops at a landing the pawl is automatically prevented from engaging the ratchet, thus enabling the door at which the car has stopped to be opened.

The time relay switch also operates when the elevator is run in the usual manner by an attendant. Because of the noise made in closing a sliding door, a noiseless hinged door is employed. C. W. Geiger.

San Francisco, Cal.

Expanding Sleeve Method of Fastening Slip Rings to Shaft

BY MEANS of an expandable metal cylinder into which a steel core is pressed slip rings may be fastened onto the shaft without the bolts, etc., used in the ordinary method. This expanding cylinder consists of a simple sheet of metal made into cylindrical form, as shown at the right of the photograph. The insulation, consisting of layers of sheet material, is placed inside the rings, which are then slipped over the cylinder. After the cylinder and rings are arranged a metal core is pressed into the inside of the cylinder, expanding it and causing the rings to tighten against the insulation. In order that the core may enter the cylinder, a slight taper is given to the bottom end of the core. The pressure with which the rings are held against the insulation depends upon the thickness of the insulation. While the pressure is being applied the slip rings are held apart by small spacing blocks.

In the center of the illustration is shown the condition of the insulation when the core has been removed from the slip rings. It will be noted that the slip ring has pressed grooves in the insulation so that it evidently was firmly held on the core. When the rings are put on the shaft the core, of course, remains inside.



CORE PRESSED INTO EXPANDING SLEEVE HOLDS SLIP RINGS TIGHT
In the center is cylinder with one ring removed, showing how the ring has compressed the insulation.

This method of applying slip rings is controlled by the Elektrotechnische Industrie, voorheen Willem Smit & Company, Slikkerveer, Netherlands, and patents have been applied for.

Electric Tractor Does Heavy Hauling on 25 per Cent Grade

AN ELECTRIC tractor hauled all the heavy machinery exhibits up a 25 per cent ramp from the first floor to the third floor for the recent Cleveland electrical show. This building, the large new Winton garage building, was not equipped with elevators, and as it was not desired to use a block and tackle, which would have been very slow, a "QTQ" Baker tractor of the four-wheel-drive type, equipped with twenty-four-cell batteries, was



HAULING HEAVY EQUIPMENT UP A 25 PER CENT GRADE WITH AN ELECTRICAL TRACTOR

employed. This tractor handled all the loads satisfactorily, sometimes carrying as much as 10 tons at one trip. This 25 per cent ramp is so steep that the owners of the building have now decided to tear it down and to replace it with one having an easier slope.

Cleveland, Ohio. D. L. DARNELL.

How to Remedy Some Synchronous Motor Troubles

SOME temporary repairs to synchronous motors which can be made to restore service quickly are outlined in the following paragraphs. The possible troubles which may develop in synchronous motors are: (1) Burned-out coil in stator; (2) short-circuited or grounded coil in rotor; (3) auto-transformer burned out; (4) motor will not start although all connections are correct.

Regarding the first of these troubles, a burned-out stator coil can be cut out of circuit in the same manner as a coil in an alternator or an induction motor. To do this the coil is disconnected and a jumper is put across in place of it. If the coil is also short-circuited between turns, it must be cut in half to prevent overheating. After the coil has been disconnected the motor will operate, but the currents will not be balanced and a new coil should be put in the motor as soon as it can be taken out of service.

The second trouble, a short-circuited coil in the rotor, is very uncommon. Such a shorted coil will decrease the magnetism of its pole and cause unbalanced magnetic pull which may result in bearing trouble and mechanical stresses in the stator. For temporary repairs a jumper may be put around the bad coil and also around the good coil, which is exactly opposite on the rotor, so the rotor will be balanced magnetically. These jumped poles will be weaker than the other poles, and the ability of the motor to correct power factor will be reduced. The motor speed will not be changed. As rotor coils are often wound with bare strip copper, any trouble is likely to include grounding the rotor winding. If the exciting circuit which feeds the rotor is also grounded, as is frequently the case, the result is to shunt out entirely a part of the rotor coils. Such a grounded rotor coil may be cut out and service restored in the same manner as a shorted coil.

A common trouble is burn-out of the auto-transformer. This is particularly frequent on older installations made before the unusually severe duty required of starting devices for synchronous motors was appreciated, when the auto-transformers were made too small and with parts not properly braced and supported. Burn-outs in the coils can sometimes be repaired in the field by cutting out damaged sections or by retaping if the coils are strap-copper-wound. When reassembling, the joints should be made with the utmost care and the coils and core should be well braced and bolted down.

When a synchronous motor will not start with all connections correct and current actually reaching the motor on all phases the trouble is usually overload or low voltage.

To determine if the load which the motor is required to start is too heavy, the starting power required should be compared with the starting ability of the motor. The starting ability of synchronous motors is not great. Usually such a motor will not start more than 30 per cent of its rated full load. The exact starting ability of a motor may be obtained from its manufacturer.

To determine the power required to start the load a suitable lever arm is attached to one of the driven shafts or the motor shaft and weights are put on the end of the lever which will just turn the loaded shaft. Then by application of the following formula the power required is calculated:

Starting hp. $= (W \times L \times 6.28 \times \text{r.p.m.}) \div 33{,}000$, where W = weight in pounds, L = length of lever in feet, r.p.m. = speed of the shaft when motor is running at full speed.

If the required starting power as determined by this formula is greater than the starting ability of the motor, the load is too great. It may happen that the power required is within the ability of the motor and still the load may not start owing to excessive drop in line voltage caused by the heavy starting current. This can be overcome by connecting the starting leads in the auto-transformer to the next higher tap, thus supplying the motor with higher voltage for starting. Increasing the starting voltage to overcome excessive starting load is likely to result in severe strains on the stator windings. This should be avoided.

It is important in starting up a synchronous motor to avoid touching the metal parts of the rotor circuit before it is closed. During starting an alternating voltage is induced in the rotor circuit by transformer action. This voltage is sometimes 1,500 or more, and making contact with the rotor collector rings, brush gear or field switch is dangerous. JAMES DIXON.

Cleveland, Ohio.

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

Advantages of Simplifying Ledger Accounts

MANY of the large utilities have the custom of keeping separate accounts for each meter and flat-rate account. This frequently results in three or four ledger sheets for one customer and in an equivalent number of bills being sent out monthly. Aside from the expense to the company, it is confusing to the customer and may result in misunderstandings.

After experiencing some difficulty under this method, the Washington Water Power Company adopted the practice of confining all accounts under the name of one customer to one ledger sheet, provided that they originate from the same address. On this page are entered the flat-rate and metered accounts and also any sales through the appliance sales department. This has materially lessened billing expense, and at the same time it obviates the possibility of the customer being annoyed by a second bill following on a few days after the first.

Increased Operating Costs Affect Both Newspaper and Utility

IN RENEWING its subscriptions to 300 newspapers throughout the state the Illinois Committee on Public Utility Information points out that subscription prices have largely increased and in the following letter addressed to the editors draws an interesting parallel of increased operating costs affecting the newspaper and the utility alike:

DEAR SIR: Inclosed find check covering renewal of our subscription for the coming year. While we note by the bill of practically all Illinois newspapers to which we subscribe that the price has been largely increased, we appreciate that newspapers have been confronted by the same after-the-war dilemma as the public service companies—that of having a fixed price for their commodity and no strangle-hold on rising costs of production. We appreciate that if a newspaper proprietor continues to stay in business—buy paper, ink, machinery, pay current labor costs and serve his community and patrons as capably as in the days when production costs were not so high—he must have revenues commensurate to meet the increased prices, just as we have been insisting in behalf of the utilities over the last year. And we believe his customers should be fair with him about it.

Were a newspaper "starved" we would not renew our subscription to it, for the inefficient service it would render in the way of presenting the news of the community would be dear at any price. Our belief is that a well-supported newspaper can do a much more constructive and useful work in the community than a poorly supported one.

We have been gratified to find that the press of the state, with but few exceptions, appreciates the problems of the utility industry in these difficult times and is fairly presenting to the public what underdevelopment, resulting from "starvation" of electric light and power, gas, electric railway and telephone service, would mean to the growth and prosperity of the state and to all business. Liberal use has been made of material contained in the weekly news bulletin issued by the committee, but this is not extraordinary, as Illinois newspapers can usually be counted upon to aid in promoting any movement which is for the public good and intended to stimulate development of the state. The news service will be continued and we hope you will find increased use for it. Very truly yours,

ILLINOIS COMMITTEE ON PUBLIC UTILITY INFORMATION,
By B. J. Mulloney, Director.

Utility Issues Stock in Exchange for Bonds

THE advantage of having utility securities held in the communities served was demonstrated when the Mexico (Mo.) Power Company came to consider ways and means of retiring 6 per cent bonds for $235,000 due in October, 1920. An investigation showed that almost $100,000 of the bonds were held locally, and it was decided to try to change these creditors into partners by inducing them to buy 7 per cent cumulative preferred stock at par in exchange for their bonds. A preferred stock issue of $400,000 was authorized to retire the bonds and to make improvements and additions to the property. The stock was first issued on Oct. 1, 1918, and within four days E. R. Locke, vice-president and treasurer of the company, was able to report that every bondholder in and around Mexico had been converted into a holder of the company's non-maturing securities. The remainder of the bond issue, amounting to $135,500, was held by banks and widely scattered investors who were not susceptible to the same appeal, but the company's customers are supplying the money, in exchange for stock, to retire all the outstanding bonds.

Since the summer of 1919 the company has constructed 75 miles (120 km.) of transmission lines to supply service to practically all towns within a radius of 25 miles (40 km.), and all the work has been financed by the sale of the company's 7 per cent preferred stock. The new communities supplied with service were asked to buy a sufficient quantity of the company's preferred stock to cover the cost of the line, and in every case the money has been forthcoming. The stock has also been sold locally to finance plant extensions.

From July 1, 1919, to June 1, 1920, Mr. Locke sold $160,000 of the 7 per cent stock at par, and, including the former bondholders, the company now has 181 holders of preferred stock with an average investment of over $1,400 apiece. None of the stock was sold on time payment, and the field of the small investor who buys five shares or less has scarcely been touched. The books of the company do not show any expense for this financing because so far it has simply meant that when the company needed money Mr. Locke went out and sold some more stock.

Mr. Locke says that if a community needs public

utility service the people who are to be served should provide the necessary capital. However, the utility should be well managed and conservatively financed. The property at Mexico, Mo., was appraised at over $500,000 in 1915, and, based on pre-war costs, the minimum value of the property by this fall will equal the par value of the outstanding securities, consisting of $400,000 preferred stock, $300,000 common stock and $50,000 in notes. The net earnings are about three times the dividend requirements of the preferred stock.

Maine Company Instructs Employees Through Weekly Bulletins

OVER the signature of the general superintendent the Central Maine Power Company, Augusta, Maine, publishes in its weekly house organ, *The Exciter*, interesting and instructive information for its employees. The articles appear under an official heading and discuss a different topic each week. Following is a typical specimen of one of the official bulletins:

Do not condemn the meter or assume that it is out of calibration when your customer complains of his bill being too high. The meter ninety-nine times out of a hundred is all right.

When a customer complains about his account, take steps to show him that the meter is right and that he is actually using all of the energy shown on the dial. This can be accomplished by a very simple test, so that the customer can also understand and see that the meter is correct.

When a customer claims that he is being overcharged, do not try to remedy the matter by telling him that you will take his meter out and put in another one. This is the equivalent to admitting that he is justified in his complaint and is not only an injustice to the meter, which may be all right, but detrimental to your own interests.

It is very rarely that an electric meter runs too fast, and this is found to be so only about once in every forty complaints.

It is the duty of the customer to watch his lights and see that none of them are turned on when not needed, or in use in out-of-the-way places where they are often forgotten.

GEORGE S. WILLIAMS,
General Superintendent.

How a Power-Factor Penalty Works in Boston

ALL CONTRACTS of the Edison Electric Illuminating Company of Boston for power of 50 kw. demand or over carry a power-factor penalty, stated R. S. Hale recently before the New England Section of the National Electric Light Association. The company's experience in enforcing the penalty is, on the whole, satisfactory. A fair number of customers who come under this rate operate so as to keep their power factor at the time of their demand above 80 per cent, this result being due to the careful selection of motors and careful operation. In a few cases the customers have put in correcting apparatus. In perhaps half of the cases the power factor at the time of the maximum load is less than 80 per cent, which results in their paying a penalty in that the company charges them 80 per cent of the kva. in such cases instead of the true kilowatts.

"There is one objection to it in my mind," said Mr. Hale, "in that our present method of determining the billing demand is the average of 150 readings, which involves the computing of the power factor for each reading, resulting in considerable figuring, although the expense is small in proportion to the total bills of these fairly large customers. We have in mind a change whereby the power factor will be assessed against the average power factor and not against the power factor at the time of the maximum demand. While theoretically this is not right, investigation of a number of cases indicates that in practice it will work out even better than our present method, and in addition will be very much simpler to apply. We measure the power factor now by a watt-hour meter connected so that the phase angle is just 90 deg. away from connections of the ordinary watt-hour meter.

"In our new method we shall have merely a reading of the so-called kilo-reactive-watt-hour meter once a month. We shall then provide that for, say, every 100 kw.-hr. the customer may have, say, 75 k.r.w.-hr. without paying a penalty, this corresponding to the average power factor of, say, 80 per cent. We would then provide that for any excess kilo-reactive-watt-hours above the specified minimum allowed free there should be a charge of so many mills per k.r.w.-hour, or else the k.r.w.-hours over and above the minimum should be considered as the equivalent of, say, one-fifth their number of kilowatt-hours, and this number of kilowatt-hours should be added to the number of kilowatt-hours on the kilowatt-hour meter."

Power "Prospect" Form Saves Useless Work

TO SAVE the time and labor involved either in making up a detailed estimate for an extension to a consumer that might not meet the approval of the head office or in getting the terms on which the company would make the extension, the Pacific Gas & Electric Company has evolved a preliminary form that


PACIFIC GAS AND ELECTRIC COMPANY

REPORT OF POWER PROSPECT

INSTRUCTIONS

LOAD

POWER

LIGHT

CHARACTER OF LOAD

DISTRICT MANAGER'S RECOMMENDATIONS

REVENUE

APPROXIMATE COST

APPROXIMATE COST

PRELIMINARY FORM FOR SERVICE EXTENSION

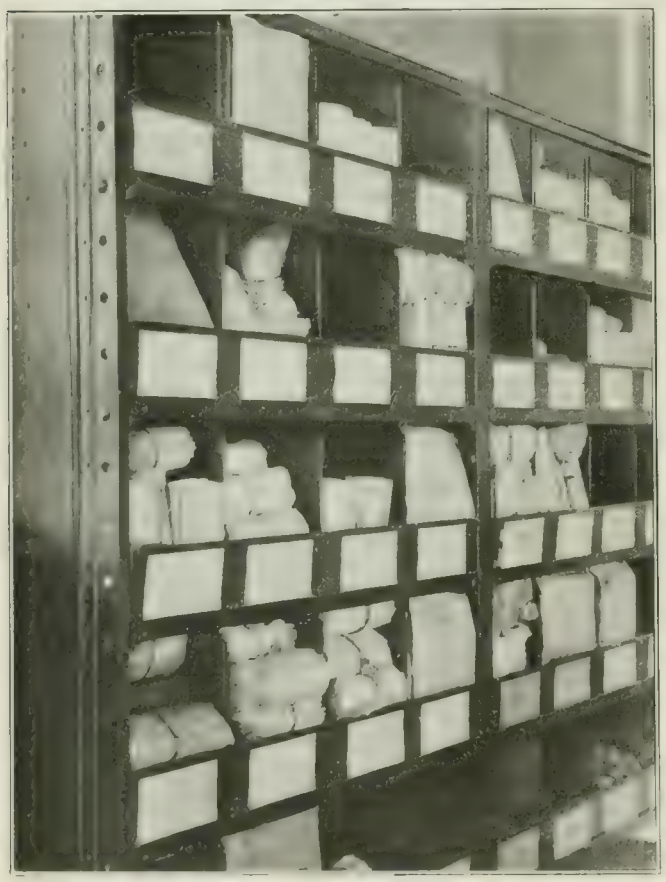
can be filled out with very little labor but which shows the size and character of the load, revenue and approximate cost to the company and the consumer. This form is filled out by the district manager of the

company and sent to the head office for approval by the commercial manager and the general manager. The form is sent back to the district manager within twelve hours, and he is then able to close the contract with the prospective consumer before the latter has had an opportunity to change his mind. Another advantage of this form is that where a local manager is able to anticipate a consumer's call he can, by filling out the blank and receiving its approval from the head office, close the transaction as soon as the consumer comes in.

The old form, containing detailed information on the extension, number of poles, insulators and all other items of material and labor, is filled out after the "prospect" form has been approved and is sent in to the engineering department. This system saves time to the consumer, and helps the local offices.

Industrial Power Charts Stored Compactly

WHAT to do with the recording-meter charts obtained on the premises of large power customers is a question that the New England Power Company has solved acceptably by the steel cabinet illustrated herewith. At its Greendale substation the company has a cabinet 6 ft. (1.83 m.) long, 64 in. (1.62 m.) high and



STORAGE CABINETS FOR INDUSTRIAL CHARTS

24 in. (0.61 m.) deep, which contains forty compartments 9 in. (23.8 cm.) wide and 12 in. (30.5 cm.) deep, with front barriers 3½ in. (8.9 cm.) high to prevent rolling of records upon the floor. The cabinet, of sheet steel, is provided with adjustable shelf holes and is framed with 1⅝ in. x ⅞ in. x 1 in. (4.15 cm. x 2.2 cm. x 2.5 cm.) angles. Within this small space from 500 to 1,000 bundles of charts can be stored, depending upon size, and concentrating the records of customers within a radius of 10 miles to 15 miles (16 km. to 24 km.).

Coal Contract Should Be Based on Unit Cost of B.T.U.

ALTHOUGH many companies have been forced recently to buy coal without any very definite assurance as to its heat value, they should properly pay only for the heat value received. This is commonly done by specifying in the contract a certain number of B.t.u.'s which are to be delivered for 1 cent. The contract guarantee is based on some given analysis, such as 5 per cent moisture, 11.5 per cent dry ash, 13,000 B.t.u. per pound (1,480 cal. per kg.) of dry coal, and a price of $3 per ton. The guaranteed B.t.u. for 1 cent is then obtained in the following manner: Reduce the B.t.u. per pound by a percentage equal to that of the moisture in the coal. In this particular case the moisture is 5 per cent, and 95 per cent of 13,000 B.t.u. equals 12,350 B.t.u. per pound (1,210 cal. per kg.) of coal as delivered. Multiply this figure by 2,000 lb. (907 kg.) and a figure of 24,700,000 is obtained, which is the total B.t.u. per ton as delivered. Divide this by the contact rate per ton expressed in cents plus one-half of the dry ash percentage expressed in cents. In this particular case the divisor will be $300 + \frac{1}{2}(11.5)$ or 305.75. It follows then that the net B.t.u. for 1 cent, according to this contract, would be 80,785.

Suppose the coal as delivered, instead of having the analysis given in the contract, has 6.5 per cent of moisture, 11.9 per cent of dry ash and only 12,886 B.t.u. per pound (1,470 cal. per kg.) of dry coal. The total B.t.u. per ton as delivered are figured out in the manner shown above, and the result is 24,098,000. This figure is divided by 80,785, which is the guaranteed net B.t.u. for 1 cent. The result would indicate that the coal dealers should be paid $2.98 per ton. However, the dry ash amounts to 11.9 per cent, and half of this percentage in cents, or virtually 6 cents, must be deducted from the $2.98 to offset the decrease in burning efficiency due to the presence of ash. The $2.98 minus 6 cents leaves $2.92, which is the amount per ton which should be paid the dealer.

Providence Company Establishes House-Wiring Records

MORE meters for house wiring have been set so far this year by the Narragansett Electric Lighting Company, Providence, R. I., than were placed in the entire year 1919. Up to June 10 1,527 meters were set for all services, and of these 1,326 were in houses. The average price on 986 contracts analyzed was $154.50, and the average number of outlets on the first seventy-seven jobs, which the company states are typical of all, was 14.5. Last year the average price of each house-wiring job was $146. An active advertising campaign is being conducted in the local press. This year the work is done at a cash price, the former 10 per cent allowance of the central station for carrying the account after the contractor completed the job having been eliminated. To offset this reduction, the time to complete all payments by the customer has been reduced this year from twenty-four to eighteen months. A payment of 10 per cent down is required on each contract, with monthly installments thereafter. Recently there has been such a shortage of meters and service boxes at Providence that the company has been supplying many new customers on the basis of estimated monthly bills.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Predetermination of the General Dimensions of Electric Machinery.—H. DE PISTOYE.—This article contains a number of general theorems regarding the relations between output and certain general dimensions such as rotor diameter, iron length, width of air gap, speed, etc. It is shown, for instance, that for geometrically similar machines, with the same angular velocity of rotation, the output varies as the 3.5 power of the linear dimensions. In another theorem the author states that the air gap must be increased in a ratio proportional to the 1.5 power of the linear dimensions in order that geometrically similar machines shall have similar no-load characteristics, at the same percentage of excitation ampere turns. A general formula is derived, which shows the most economical relation of diameter to axial length for rotating machinery.—*Revue Générale d'Electricité*, Jan. 24, 1920.

Lamps and Lighting

Walls and Floors—Their Effects on Lighting.—VAN RENSSELAER LANSINGH.—This paper gives the utilization factors of several different units of the direct, semi-indirect and totally indirect designs for the gas-filled lamp when tested under varying conditions of walls and floor. An interesting table giving the reflection factor of trim, ceiling, floor and wall coverings follows:

	Per Cent Reflection Factor
Trim:	
Ivory white	47
Floors:	
Average of dark and light cork squares	17
White paper	55
Black cloth	2
Walls:	
Sand color	31
Brown shades	11
Green shades	11
Grey mat paper	22
White paper	55
Ceiling:	
Cream white	52

The effect of variable wall and floor coverings with their interaction is also analyzed.—*Transactions I. E. S.*, March 20, 1920.

Arc Lamp with Rotating Arc.—GARBARINI.—This lamp is especially designed for use with optical systems where a source of light of small dimensions, high brilliancy and great constancy is required and where the position of the luminous point must be fixed in space. Only the positive electrode is made of carbon, the other being a metal ring, which is water-cooled and surrounds the end of the carbon, so that the length axis of the carbon coincides with the axis of the ring. Concentrically with respect to the ring there is a coil of several turns, passed by the arc current. This coil gives rise to a magnetic field, which always cuts the arc at right angles, thus causing the arc to rotate with very great speed around the end of the positive electrode, which will be heated in a perfectly even manner to a white glow. A special feeding mechanism is provided, which keeps the end of the carbon at a given position with respect to the ring electrode.—*Bulletin Officiel de la Direction des Recherches et des Inventions*, No. 3, January, 1920; abstracted in *Revue Générale d'Electricité*, April 19, 1920.

Generation, Transmission and Distribution

Electric Power in Holland.—This article gives a map showing the network of high-tension transmission lines in Holland and also some information regarding the generating plants. The increased use of electrical energy in Holland in recent years is given in the following table:

	Maximum Load, Kw.	Total Consumption, Kw.-hr.
1913	45,600	114,000,000
1914	53,600	134,000,000
1915	69,600	173,000,000
1916	88,400	221,000,000
1917	90,000	216,000,000
1918	100,000	240,000,000

The scheme of locating generating plants at the coal mines has been considered, but it is said that the advantages of centralization still prevail.—*Electrical Industries* (London), May 26, 1920.

Grounding of Electric Machinery and Installations.—J. DAMIEN.—The author cites the French rules regarding grounding of electrical installations and criticises their vagueness in wording. Advantages and disadvantages of different methods of grounding are briefly discussed, and some practical suggestions are given. According to regulations of the French marine, the grounding conductor should be "a copper conductor with as few bends as possible. Its section to be computed on the basis of 1 mm.^{2} (1,970 circ.mils) per 10 amp. normal current of the machine to be protected, but with a minimum area of 10 mm.^{2} (19,700 circ.mils). The Verein Deutscher Ingenieure has adopted the rule that the grounding resistance should be less than $50/I$, where I is maximum short-circuit current. Assuming that $\sqrt{L/C} = 70$, this corresponds, in an alternating-current case, to a resistance of grounding less than $3{,}500\ E$, where E is the line voltage.—*Revue Générale d'Electricité*, Jan. 24, 1920.

Traction

Modern Devices and Control for Automatic Railway Substations.—CASSIUS M. DAVIS.—This article deals with the improvements which have been made in the controlling devices and describes in detail the automatic operation of the substation, including the starting up, shutting down, protection and adjustment of the equipment.—*General Electric Review*, April, 1920.

The Auxiliary and Lighting Control Equipment of the Chicago, Milwaukee & St. Paul Locomotives.—JOHN

A. Clarke, Jr.—From the locomotive cab must be supplied the means by which speed is regulated, the heat for the train and in this case light for the train as well. For this auxiliary service a 35-kw. motor-generator set was chosen, together with a 378-amp.-hr. storage battery. The battery floats across the terminals of the generator, assisting it on the peak loads and receiving charge when the load is light. In addition there are two 40-kw. axle-driven generators mounted on the bogie trucks. They are used to supply current for the traction motor fields during regeneration. The details of this auxiliary system are given in the article. —*Electric Journal*, June, 1920.

Installations, Systems and Appliances

A New Type of Gathering Locomotive.—John Liston. —The gathering locomotive is said to be one of the most important factors in securing a high per capita output in mines, and its development and refinement have been the subject of continuous study by both mining engineers and electrical manufacturers. The particular type covered by this article embodies the latest developments by one company for the attainment of a positive and simple system of control which, it is said, makes it possible to secure maximum operating economy.—*General Electric Review*, May, 1920.

Automatic Protective Devices for Alternating-Current Systems.—A. E. McColl.—A broad discussion of relay protective schemes, particularly those of modern origin, according to electrical practice in Great Britain. —London *Electrician*, May 21, 1920.

Arc-Welded Building Construction.—Arc-Welded trusses for a one-story building covering approximately 22,000 sq.ft. (2,100 sq.m.) are reported to have been used at Brixton, England. Details of the assembly of the trusses are given in the article.—London *Engineer*, May 14, 1920.

Units, Measurements and Instruments

The Thermal Storage Demand Wattmeter.—Paul M. Lincoln.—The thermal storage demand meter developed by the author is discussed as a means of determining maximum demand for rate purposes. It is compared with other methods of accomplishing this purpose and the characteristics of these several methods are enumerated.—*Electric Journal*, June, 1920.

Instrument Transformers.—R. S. J. Spilsbury.—A discussion of the design and characteristics of current transformers, including the consideration of accuracy and methods of testing for ratio and phase angles.—*Beama*, May, 1920.

Measuring Large Direct Currents at a Distance.—H. Ring remarks upon the article of Besag on this subject (recently referred to in these columns) that a distance indicator for large continuous currents was devised by him as early as 1913. The apparatus works as follows: A small induction or synchronous motor drives a little direct-current generator, which is compounded by a one-turn winding connected across a shunt in the direct-current bus. The voltage of the dynamo may be measured at any distance and is a function of the direct-current strength in the compounding turn, which makes it possible to calibrate the voltmeter directly in terms of current in the bus. The interesting point of the system is that a negative compounding is used. When the compounding current increases the generator excitation thus diminishes, but never so far down that any considerable indefiniteness is caused by hysteresis in the iron. The magnetic induction of the core will describe a very narrow, unsymmetrical hysteresis curve, and errors due to hysteresis may be kept down to 1 or 2 per cent.—*Elektrotechnische Zeitschrift*, Jan. 29, 1920.

Telegraphy, Telephony and Signals

Simultaneous Transmission and Reception in Radio-Telephony.—Noburo Marumo.—After reviewing the methods of duplex radio communication previously proposed, the author describes a divided branch antenna arrangement with supplementary balancing coil for this purpose. The theory and mode of adjustment of the system are explained. The application of this method in practice to ship-to-shore radio-telephony is described, and reference is made to the necessary wire-to-radio and reverse transfers. Guided radio telephony and telegraphy over high-tension transmission lines is considered. The use of a single oscillation generator for a number of stations is shown to be possible. An actual transmission of this type is described in detail.—*Proceedings of the Institute of Radio Engineers*, June, 1920.

Carrier-Wave Telegraphy and Telephony. — Fassbender and Habann.—We have already in these columns (Feb. 7, 1920) briefly referred to the system of multiplex-wire telephony and telegraphy with high-frequency carrier waves which was developed in Germany during the war. In the present article the original authors of this multiplex system give a detailed account of the more important features of the system and describe the various types of connections employed. In the multiplex telephony an important point is the use of ordinary audio-frequency transmission from subscriber to exchange, the carrier-wave transmission being resorted to only for long-distance trunking service. Carrier waves in the radio range are used, corresponding to wave lengths between 1,000 m. and 2,000 m. During silence the modulator does not generate any high-frequency waves, but when the effective plate or grid voltage of the modulator bulb is boosted by induced alternating emfs. from the microphone circuit, conditions change so that sustained oscillations build up, their amplitude depending on the instantaneous value of the impressed sound waves. A difficulty with multiplex is the tendency of the call currents to operate all bells on the system. It is claimed that this has been overcome by use of carrier-wave transmission also for call currents, although the details of this system are omitted. The multiplex telegraphy depends on interference reception with telephones, one transmitter at the sending end giving audible beats with a certain transmitter at the other end of the line. Morse inker reception also has been successfully tried, the necessary audio selectivity being provided by special mechanically tuned polarized relays. The system also proved adaptable for high-speed operation in multiplex by means of Hughes' and Siemens' machine telegraphs, etc. —*Jahrbuch der drahtlosen Tel. und Tel.*, October, 1919.

Miscellaneous

Steel-Mill Electrical Repair Shop Practice.—A. J. Standing.—The writer states that it has been proved that the majority of repair work can be handled to better advantage in the steel-mill repair shop than by contracting it out. He then discusses just what is necessary in the way of equipment, force and methods of handling the general plant electrical repairs.—*Proceedings Association Iron and Steel Electrical Engineers*, April, 1920.

Books of Technical and Industrial Interest

ROBISON'S MANUAL OF RADIO TELEGRAPHY AND TELEPHONY. By Capt. S. S. Robison, U. S. N. Annapolis, Md.: United States Naval Institute. 308 pages, 144 illustrations.

This is the fifth revised edition of a well-known manual of radio communication intended primarily for the use of operators in the United States Navy, but incidentally well adapted to the needs of student radio operators generally. It is an elementary textbook on radio-telegraphy and radio-telephony. It is brought up to date in a number of particulars. A valuable feature of the book is that it contains much practical information concerning the radio circuits and apparatus employed in United States naval stations. For example, a full list is given of 140 United States naval stations and also of fifty radio-compass stations, at which electric goniometric measurements can be made. The book is divided into seventeen chapters relating to the following subjects: High-frequency currents, waves, electric units, capacity and inductance, power and efficiency, transmitting apparatus, continuous-wave transmitters, radio-telephones, receiving apparatus, antennas, high-power stations, radio compass, aircraft radio, installations, care and operation, tables, laws and regulations. The book is practical, easy to understand and free from all but the simplest mathematics. It is well adapted to the purposes the authors have held in view. It could be improved by a page index of subjects.

ELECTRIC OSCILLATIONS AND ELECTRIC WAVES. By Prof. G. W. Pierce. New York: McGraw-Hill Book Company. 517 pages, illustrated. Price, $5.

Prof. G. W. Pierce's new book on "Electric Oscillations and Electric Waves" is remarkable in more than one respect. It has so much of the personal touch of the active research man and gives so much of the author's recent original contributions to the art that it should not be classified as a mere textbook; and still it is a textbook in the highest sense of the word. The book does not cover the entire field of radio engineering, nor does it pretend to. Instead, three or four of the most difficult and advanced problems in this field are taken up for the very thoroughgoing analysis. In each case the theory is built up step by step from the very rock bottom of mathematical physics and successively developed into a form where the results may be applied to problems of practice. The first half of the book deals with the theory of electric oscillations in coupled circuits. After some introductory chapters devoted to fundamental notions of electricity, use of complex algebra in the treatment of alternating-current circuits and so on, the simple oscillating circuit is studied; then the mutual reaction between two coupled circuits is taken into consideration, and finally the extremely complicated problem of three coupled circuits is attacked. In the last part of the volume the theory of electromagnetic waves is developed from the fundamental field equations, and on the same basis the radiation field of an oscillating dipol is analyzed. By means of an ingenious device, equivalent to a superposition of a number of infinitesimal dipols, the theory is extended to oscillators of finite dimensions and in the last few chapters is applied to the problem of computing the radiation characteristics of flat-top antennas. Every chapter of the book shows the author's decision to present a mathematically rigid theory, based, however, on physical conceptions rather than mathematical symbolism. An outstanding feature of the volume is its conciseness in the use of symbols and units and its definiteness in stating the reasons for successive steps in the mathematics. After every more important development there is given, in italics, a clear statement of the physical significance of the results, of the approximations made, etc., and of the methods to be used in order to extend the results to new fields of application.

SERVICE AT COST PLANTS. By Harlow C. Clark, editor of *Aera*. New York: American Electric Railway Association.

This "identical analysis of statutes, ordinances, agreements and commission orders, in effect or proposed, together with a discussion of the essentials of local transportation franchises," contains, first, a consideration of the fundamentals which must, if private capital is to be obtained, underlie any expression of legal right to conduct a local transportation utility; second, an analysis of the various measures, with the idea of ascertaining the extent to which such principles have been applied; third, an identical analysis of the "cost of service" plans now in effect, similar provisions being grouped together in order that the provisions covering any particular point may be quickly ascertained, and fourth, a similar analysis of "service at cost" plans proposed but not effective. Although confined to electric railways, there is much in the principles of valuation and rate of return discussed that has also an application to central station and other utilities.

Books Received

MOTOR VEHICLE ENGINEERING. By Ethelberg Favary. New York: McGraw-Hill Company, Inc. 333 pages, 133 illustrations.

ELECTRICAL MACHINERY. By Terrell Croft. New York: McGraw-Hill Book Company, Inc. 318 pages, 302 illustrations.

TELEPHONE TRANSMISSION. By J. G. Hill. London, England: Longmans, Green & Company. 398 pages, illustrated. Price, $6.50.

INVENTIONS, THEIR DEVELOPMENT, PURCHASE AND SALE. By William E. Baff. New York: D. Van Nostrand Company. 230 pages. Price, $2.

THE ORGANIZATION OF INDUSTRIAL SCIENTIFIC RESEARCH. By C. E. Kenneth Mees. New York: McGraw-Hill Book Company, Inc. 175 pages. Price, $2.

ELECTRICIAN'S HANDYBOOK. By T. O'Connor Sloane. New York: Norman W. Henley Publishing Company. 824 pages, 600 illustrations. Price, $4.

TRANSIENT ELECTRIC PHENOMENA. By Dr. C. P. Steinmetz. New York: McGraw-Hill Book Company. 696 pages, illustrated. Price, $6.

SCHOOL OF PRACTICAL ELECTRICITY. Book II. Fundamentals of Continuous Currents of Electricity. By O. Werwath. Milwaukee, Wis.: Electroforce Publishing Company. 134 pages, 90 illustrations.

News in Brief

Summary of Market Conditions and of Recent and Approaching Happenings of Importance to the Industry

VOLUME of business for all classes of electrical material shows no decrease in the East and South, but a noticeable diminution of demand is reported from the Middle Western and Northeastern sections, attributable to summer dullness.

TRANSPORTATION has improved, especially in Chicago and Boston, and more goods are being shipped by express. Collections on the Western coast are in better shape than in New England or the South. Building activities are slackening in the West, but a good total of new construction is reported in Eastern states.

COMPARATIVELY cool weather is retarding the sale of fans. There is a marked shortage of rigid conduit, but armored conductor is coming through in better shape except in New York. Porcelain is scarce. Fair stocks of loom are accumulating. In general the market has held steady. Stocks of carbon brushes are good. The market for stranded steel wire remains steady, and manufacturers are having difficulty in meeting orders.

CARE on the part of men associated in the electrical industry is urged in view of a federal court's action under the Sherman act in enjoining member companies of the American Hardwood Manufacturers' Association from exchanging information bearing on their stocks and prices.

FIGURES for the winter of 1919-1920 show a heavy sale of electric heaters, surpassing all previous seasons. Business in the coming season promises to be good in all sections of the country, though large stocks were carried over by jobbers in the South.

A DECISION upholding the Coolidge wrought-tungsten patent, in the suit for infringement brought by the General Electric Company against the Independent Lamp & Wire Company, has been handed down in the United States District Court.

A POWER HOUSE that will operate under a head of 2,400 ft., probably the highest in the United States and among the highest in the world, is to be built on the Stanislaus River in California by the Pacific Gas & Electric Company on the property acquired from the Sierra & San Francisco Power Company. This plant will be rated at 7,500 kw. A third penstock is being installed on the present Stanislaus plant to increase its efficiency.

SWITZERLAND has issued $25,000,000 in 8 per cent twenty-year government gold bonds as part of a program for the gradual electrification of her railway systems. It is announced that the entire proceeds will be used in the United States.

ELECTRICAL engineering schools are unable to meet the demand for technical graduates, according to a report made at the Ann Arbor meeting of the Society for the Promotion of Engineering Education.

NEGOTIATIONS between Springfield, Ill., and the Springfield Gas & Electric Company for the purchase of the company's electric light and power and heating properties by the city have been renewed.

AN OFFERING of $1,000,000 of 7 per cent cumulative preferred stock on the installment plan is being made to the public by the Alabama Power Company.

A TRANSMISSION line from Gadsden, Ala., to Lindale, Ga., a distance of 52 miles, is to be built to connect hydro-electric systems of those states.

A FIVE-YEAR course in business engineering will be inaugurated this fall at Harvard University, through the co-operation of the Harvard Engineering School and the Graduate School of Business Administration.

THE ANNUAL report of the Pacific Gas & Electric Company shows that three-fourths of its stockholders are residents of California. It announces an increase in the price of fuel oil in six years amounting to more than 128 per cent.

A RECORD price of $23 a ton was paid for coal a few days ago in Boston Harbor, against a maximum war-time price of $13. Public Utilities Commissioner Ellis of Massachusetts asserts that 400,000 tons are being sent abroad monthly at the peril of a fuel famine in New England next winter.

OPPOSITION to compulsory arbitration of private industrial disputes is expressed in the platform adopted by the Democratic National Convention, which, however, holds that in government service the rights of the people are paramount to the right to strike. The Mississippi and St. Lawrence waterways are indorsed and an increased supply of petroleum is declared a necessity.

A SPECIAL two weeks' "short course for metermen" was conducted by the University of Illinois from June 21 to July 3.

W. S. MURRAY has been appointed chairman of the engineering staff to make an investigation and report in the matter of the super-power survey between Boston and Washington. He will work with an advisory board representing engineering, railway and technical-publication interests and the N. E. L. A. and other organizations.

THE COAL situation remains highly critical. The smaller utilities are in the worst shape, being largely without proper reserves.

OSCAR C. MERRILL, chief engineer of the United States Forest Service, has been appointed chairman of the newly created Federal Power Commission and has begun to shape the procedure of that body.

MAJORITY stock ownership of the public utilities in Maine controlled by Maynard S. Bird and Hugh J. Chisholm has been acquired by the Central Maine Power Company.

REPORTS received by the Geological Survey from 350 electric utility plants showed a total bituminous-coal supply on May 31 of 1,372,880 tons, or a supply for three weeks and three days.

MINNESOTA is planning a state federation of Engineering societies.

A PRIORITY order for 12,000 tons of bituminous coal has been granted by the Interstate Commerce Commission to the Philadelphia Electric Company.

THE WISCONSIN Industrial Lighting Code has been put into effect for all existing installations. Hitherto it has applied only to new installations.

A SUCCESSFUL "no accident week" campaign was held in several Pennsylvania counties under the auspices of the Penn Central Light & Power Company of Altoona.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Smaller Utilities in Worst Shape on Coal Supply

WHILE the immediate supply of coal for utilities is not altogether as short as it was a few weeks ago, there seems to be a very definite opinion that the open-top car order of June 21 has not relieved the situation very much. Among the smaller utilities the coal situation is most acute. Unless this condition is relieved before long, numbers of utilities, even if not forced to shut down, will enter the winter season with no reserve on hand. There is consequently a growing demand on the part of the utilities for coal priorities. A meeting to consider the entire coal question was scheduled for Thursday before the Interstate Commerce Commission in Washington.

In preparation therefor the National Electric Light Association, Executive Manager M. H. Aylesworth stated, wired to various parts of the country to operating members asking if this recent order of the I. C. C. had made any noticeable improvement in coal supply and also for information on the number of days' supply of coal on hand and asking for suggestions to be made to the commission. A number of replies were received, all of which, Mr. Aylesworth stated, indicated that the situation is still very acute, particularly among the smaller utilities all over the country. The replies further indicated, he said, that the open-top car order had improved the situation but slightly, and there seemed to be an immediate need for a priority order over the less essential industries if the utilities are to go into the winter with coal in storage. Generally speaking, Mr. Aylesworth pointed out, there is only enough coal on hand for immediate need.

The meeting this week is but one of a series to be held with the I. C. C. The electrical interests are to be represented by the National Committee on Gas and Electric Service, which has headquarters in Washington.

Insull Tells Why Commonwealth Edison Has Not Asked for Higher Rates

THE Commonwealth Edison Company has not as yet found it necessary to ask for any increase in rates because of increasing costs of doing business. In commenting on this situation, which is exceptional in the utility field, Samuel Insull, president of the company, said to a representative of the ELECTRICAL WORLD:

"While increased efficiency of equipment and its operation has played its part, there are two basic reasons for the situation, the first being the ownership by the Commonwealth Edison Company of its own sources of coal supply and the second the large amount of energy sold wholesale, 80 per cent of the output being so sold. By owning our own sources of supply we have been able to keep down the cost of fuel. Accounting, meter reading, customer service and the other forms of expense entering into the cost of service to the consumer are pratically as great for a small consumer as for a large one. Because of the large percentage of energy wholesaled to a comparatively few customers, our expense per unit has not risen so rapidly as it would have done had we been distributing this 80 per cent of our output to a large number of small consumers. The situation is the outgrowth of a consistent policy of a quarter of a century's standing in the development of ownership of our own fuel supply and the wholesaling of energy to the large consumer."

Merrill Appointed Executive Secretary Federal Power Commission



O. C. MERRILL

SECRETARY OF WAR BAKER, chairman of the newly created Federal Power Commission, has appointed Oscar C. Merrill, now chief engineer of the United States Forest Service, executive secretary of the commission. The first three official acts performed by Mr. Merrill following his appointment were the following: Formal presentation to the Solicitor of the Treasury of the questions pertaining to the employment of personnel of the power commission itself; formal inquiry of the War, Interior and Agricultural Departments as to what personnel is available for temporary transfer to the power commission, and request for appointment of an advisory committee to draft regulations under the act.

Complying with this last request, the War Department designated General Crowder to serve on the advisory committee, the Interior Department selected Herman Stabler and the Department of Agriculture named Mr. Merrill himself to look after its interests. It will require two or three months, it is believed, to draft the regulations.

Gen. Lansing H. Beach, the chief of engineers, has designated Major Max C. Tyler as the officer who will conduct the investigation of the Great Falls Power project and the matter of an additional water supply for the District of Columbia. The report on this investigation must be made to Congress on or before Jan. 1. An appropriation of $25,000 is provided for the work.

The selection of Oscar C. Merrill as executive secretary of the Federal Power Commission is regarded in Washington as a particularly happy one. So pre-eminent

were Mr. Merrill's qualifications for this position that the name of no other man was even suggested. The water-power act has its entire foundation in the water-power regulations drafted by Mr. Merrill to apply to water powers under the jurisdiction of the Forest Service.

Before entering the Forest Service in 1909 Mr. Merrill already had made a name for himself as a water-power specialist as a result of extensive private work in water-power engineering. Owing to the limited amount of work done by the government which pertains to water powers, Mr. Merrill has the distinction of being practically the only government engineer who could classify as a water-power specialist.

Mr. Merrill is a native of Maine. He was born in Manchester, near Augusta, in 1874. Most of his early education was obtained in Augusta, and in 1899 he was graduated from Bates College. His engineering education was obtained at the Massachusetts Institute of Technology, where he was graduated in 1905. While attending school he devoted his summers to work for the United States Geological Survey.

The first year following his graduation was spent by Mr. Merrill as an instructor in the engineer department in the University of California. He then became associated with Charles G. Hyde and began his specialization in water-power consulting work. He investigated the adaptability of power sites along the lines of the Southern Pacific in Oregon and in Washington, with the idea of their utilization in connection with a proposed electrification of sections of that railroad. Later, he made a general reconnaissance of such water powers in Oregon as might lend themselves to any scheme of railroad electrification. Following that work, he undertook, in association with Professor Hyde, the valuation of the power system of the California-Oregon Power Company.

Mr. Merrill began work for the Forest Service by making a special study of water powers in California. He soon became district engineer with headquarters in San Francisco. In 1910 he was placed in immediate charge of all water powers coming under the jurisdiction of the Forest Service. In 1914 he was ordered to Washington to become chief engineer of the Forest Service. In addition to his enlarged duties, he retained under his personal direction the matters pertaining to water powers. It was he who negotiated the important permits for the Southern California Edison Company, the Great Western and the Montana Power companies, in addition to handling the permits for numerous smaller developments.

Stocks of Coal on Hand at Electric Utility Plants

THE Geological Survey published this week preliminary figures showing the stocks of bituminous coal on hand at representative electric utility plants as of Feb. 29 and May 31, 1920, in net tons. Reports were received from 350 plants having a weekly consumption of 398,656 tons.

Stocks on hand on Feb. 29 amounted to 1,320,368 tons, or a three weeks and two days' supply, and on May 31 to 1,372,880 tons, or a supply for three weeks and three days.

The figures for May 31 ranged anywhere from a twelve weeks and three days' supply, reported by four plants in Montana and Washington, to a supply for one week and two days reported by eight plants operating in Virginia.

On the basis of the latest published figures the 350 companies reporting consume about two-thirds of the coal requirements of the electric utility industry. In view of the transportation situation it is doubtful if the stocks of coal on hand were materially increased during June over the figures reported. Furthermore, since these are average figures, it is reasonably certain that many utilities have a much lower supply than the above average.

Philadelphia Electric Gets Coal Priority

TO PREVENT a possible curtailment of electric light and power supply in Philadelphia the Interstate Commerce Commission on June 30 granted the Philadelphia Electric Company a priority order on the Pennsylvania and East Broad Top railroads for transportation of 12,000 tons of coal. The railroads were ordered to assign cars to the Rock Hill Coal & Iron Company for the transportation of the 12,000 tons of bituminous coal now above ground at the rate of twenty cars per day for twelve consecutive working days beginning July 1, excluding Sunday and legal holidays, in addition to and without regard to the existing ratings and distributive shares for the mines on these railroads.

Brighter Outlook for Public Utilities, Says National City Company

CONFUSION in the mind of the investor has been the greatest factor in holding back a merited improvement in the popularity of public utility securities as desirable investments, according to a statement issued last week by the National City Company of New York. The investor has not been sufficiently educated as to the merits of these securities and in associating all public utilities with some of the unfortunate street-railway situations has failed to realize the strong position of electric power and light companies, telephone companies and certain of the gas and traction properties. Concerning the status of electric utilities, the statement reads in part as follows:

> Corporations furnishing power and light are enjoying unequaled prosperity. There has been an enormous increase in motor-driven machinery within the last few years. Ease of operation, the slight expense involved in the installation of power in the factory, the elimination of the dangers and labor incident to the operation of small steam or gas plants and the increasing cost of fuel and labor in the operation of such plants have resulted in a constantly increasing demand on the power companies to supply the energy.
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> Under old methods of power production the handling of fuel, firing and operation generally called for much heavy work and many laborers working in unpleasant surroundings. Now power is produced by mechanically perfected methods which eliminate a large part of the drudgery, and a considerable percentage of power is generated by hydro-electric plants. Large central stations have demonstrated their ability to produce and distribute power at such an economical unit cost that their position is permanently assured. The growth of cities and increased density of population is reflected in the growing demand for light. As an indication of the future growth of this business it has been estimated that there are now fourteen million homes in the United States still to be supplied with electric light.
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> More and more we find discriminating investors analyzing the public utility situation, and as a result there is an in-

creased interest regarding this class of securities. The field is one which requires careful study. It is one, however, which will repay the investor through liberal return and strong security. The power and light businesses have not approached the limit of their growth. The transportation business, through readjustments that must surely come, will also offer many attractive issues.

Before the war public utility securities issued by corporations of undoubted strength and based on strong values and earning power were sold on a basis to yield around 5 per cent to 5½ per cent. Now, with largely increased values and increased demand for the output, the same class of securities can be bought on a basis to yield from 7 per cent to 8 per cent. Investors are now turning to such issues, and we believe that it is only a matter of time when the yields will again approach lower levels.

Gas and Electrical Interests Get Together on Classification of Accounts

REPRESENTATIVES of the American Gas Association and the National Electric Light Association met at N. E. L. A. headquarters in New York on June 30 to discuss and agree upon the form of presenting certain classifications of accounts to the sub-committee of the National Association of Railroad and Public Utility Commissioners. This sub-committee is to report at the next annual meeting, which will be held next month.

Agreement was reached on several items, but final decision on the complete recommendation of the conferees was withheld pending receipt of further data and information from various parts of the country. The meeting was adjourned to be called again by the N. E. L. A. as soon as the data is at hand, which in all probability will be the first of the week.

Wisconsin Lighting Code Now in Effect for Old Installations

THE Wisconsin Industrial Lighting Code, which has been in operation for the past two years on new installations, went into effect July 1 on all existing installations. Some of the important requirements of the code are as follows: Adequate lighting of all working or traversed spaces of buildings or yards, uniform distribution of artificial illumination, shading of overhead lamps, reflector depth sufficient to provide a 14-deg. screening angle, and compulsory use for local lighting of reflectors covering the entire lamp.

The State Industrial Commission has stated that too shallow reflectors on overhead lamps do not necessarily have to be replaced, but that the requirements can be met by using bowl-frosted lamps, bowl-enameled lamps or an opal cap or shield.

Public Utilities Promote Successful "No Accident Week"

A SUCCESSFUL and effective "no accident week" was observed from June 6 to June 12 in the counties of Blair, Huntington and Mifflin, Pennsylvania, under the auspices of the Penn Central Light & Power Company of Altoona. J. F. Cole, superintendent of electric operation for this company, was chairman of the safety committee which promoted and arranged the campaign. The State Department of Labor and Industry co-operated in the work, supplying speakers and films. Films were also furnished by the National Electric Light Association, the General Electric Company and others.

The method of campaign included personal letters to organizations, churches, physicians, etc., as well as to every employee of the Penn Central company, "follow-up" letters and "accident prevention" posters, banners, "safety" buttons and tags. Publicity matter pertaining to the movement was furnished to newspapers with a combined daily circulation of 55,000. Rallies were held in the evenings at Hollidaysburg, Altoona, Tyrone, Juniata, Lewistown and Huntington. Employers gave hearty support, and work was often suspended to permit workmen to attend daytime exercises. A material reduction in the number of accidents in the communities taking part was reported for the week of the campaign, and the movement for safety received an impetus and awakened interest in quarters where it had previously aroused no response, or had even been regarded with suspicion.

W. S. Murray Heads Super-Power Zone Engineering Staff Investigation



W. S. MURRAY

THE appointment of W. S. Murray as chairman of the engineering staff to make an investigation and report in the matter of the super-power survey between Boston and Washington has just been announced by the United States Geological Survey, under the auspices of which the report will be made.

Prior to his appointment Mr. Murray recommended a plan for investigation which has since been approved by the Survey, whereby the work is to be divided into three departments—one of railway investigation, one of industrial investigation and one of power and transmission investigation, and men of known experience in these fields are about to be selected by Mr. Murray as chiefs in charge of the three respective divisions. In addition there will be selected for the staff a secretary-engineer whose duty will be the collaboration of the field data and preparation thereof for the report text. The organization is to be further supplemented by the necessary assistants.

Mr. Murray further suggested that, in order to secure interest of power producers, power consumers and the nation as a whole (the last named standing behind the establishment of a national power policy), a board in an advisory capacity be created of men representative in the above-mentioned classes. To that end the following will be represented: (1) Engineering, (2) railways, (3) technical publications, (4) the National Electric Light Association and others associated organizations consistent with not too large a board. Already acceptances have been received from Prof. L. P. Brackenridge, head of the department of mechanical engineering at Yale University, representing engineering; James H. McGraw, president McGraw-Hill Company, Inc., representing the technical publications, and F. G. Buckland, vice-president New York, New Haven & Hartford Railroad, representing the railroads. In addition, Dr. George Otis Smith, director of the Geological Survey, and Mr. Murray will serve upon the board.

Mr. Murray will call meetings of this board at periods of not less than every two months, on which occasions the progress of the engineering staff will be stated so that the board may be informed upon what has been done and proposed procedure and thus secure from the general board its counsel and advice in the development of the investigation.

Mr. Murray has established engineering headquarters in New York City at the Buckley-Newhall Building, 709 Sixth Avenue. Announcement is expected soon of the completed organization for the investigation. The Geological Survey will be represented on the engineering staff by N. C. Grover, chief hydraulic engineer of the Survey, and the Bureau of Mines by its chief mechanical engineer, O. P. Hood.

Manufacturers Ask Increased Rate for Public Utilities

REALIZING that a cessation of public utility development would hamper the business and industry of the state, John M. Glenn, secretary of the Illinois Manufacturers' Association, recently addressed the following communication to the Public Utilities Commission of Illinois:

"Several months ago the Illinois Manufacturers' Association urged action on your part in reference to authorizing the utility companies of Illinois to change their rates to meet changed conditions. A great many industrial plants are dependent upon the services of these companies for power, fuel, light, communication and transportation. Poor service makes bad manufacturing conditions. The cost of materials, labor, transportation and other items included in production have so increased that it is absolutely essential that gas rates, electric light rates, telephone rates and street-car fares be increased or some other method adopted that will enable those who manage such properties to make both ends meet. Blood cannot be squeezed out of a turnip."

Asks $40,000 to Investigate Alaska's Water Powers

IN ADVISING the Secretary of the Interior what it is necessary to do to stimulate development in Alaska, the Alaska Advisory Committee makes, among others, the following recommendation:

"The committee finds that there are extensive water powers in Alaska and that the exact information about them is exceedingly meager. These water powers are important to the development of the mining, cannery and pulp-wood industries. The only investigations made of the water powers are carried on by small allotments made from the appropriations for the investigations of the mineral resources of Alaska, thereby decreasing the funds available for other important surveys of mineral wealth. The committee therefore recommends that Congress be asked for an appropriation of $40,000 to investigate the water resources of Alaska with reference to their use in mining, wood pulp and other industries."

Pacific Gas & Electric Gets 15 per Cent Rate Increase

ON JULY 1 the California Railroad Commission announced that a rate increase of 15 per cent had been allowed the Pacific Gas & Electric Company. This increase will take the form of a surcharge to be added to bills between July 10, 1920, and April 10, 1921. It is estimated that the gross income for the nine months noted will be increased $2,200,000 by this additional rate.

Harding Shows Knowledge of Utility Problems

WARREN G. HARDING, Republican nominee for the presidency of the United States, seems to realize the fundamental principles upon which the government regulation of public utilities is based. When speaking before a gathering of electric railway men in Chicago last January on the subject of electric transportation and the industrial situation at that time, Senator Harding said:

"I believe in strictest regulation without conflicting authority because all public utilities must yield to the voice of public interest; but the same power that protects the public must protect the public servant, whether that servant is capital or the workman who operates the utility.

"Destroyed credits must be restored and flexible scales of charges must be provided, so that a public may pay justly for that which it demands. The exploitation of ten or twenty years ago justifies no failure in good faith today. The public which is served has an obligation no less than that of those who serve it."

Minnesota Planning State Federation for Engineering Societies

THE organization of a body that would have greater power and more definite representative functions than the present Minnesota Joint Engineering Board was considered at a meeting in Duluth, Minn., on June 19, to which all Minnesota engineers were invited. A committee composed of the present Joint Engineering Board and a representative of each engineering society was appointed to work out a detailed plan looking toward the organization of a state federation of societies. The committee's report is to be submitted not later than Nov. 1.

Central Maine Power Acquires Smaller Properties

ACQUISITION of a majority of the stock issues of the public utilities controlled by Maynard S. Bird of Portland, Me., and Hugh J. Chisholm of New York by the Central Maine Power Company has recently been announced by the Maine Public Utilities Commission. Stockholders in these corporations, which include the Oxford Electric Company, furnishing light and power in Norway and South Paris; the Interurban trolley line between Augusta and Lewiston and the light and power company serving Rockland, Thomaston and near-by towns, have received in exchange shares in the Central Maine Power Company.

Stockholders are receiving every reasonable assurance of the advisability of this merger in order to provide additional power facilities of transmission and utilization on the numerous corporations and municipalities now being served by the Central Maine Power Company. A much heavier capitalization by the power company will be necessary, and petition for authority to make such issue was included in the petition to the commission and was readily granted.

Swiss Loan of $25,000,000 for Railroad Electrification

ANNOUNCEMENT was made this week of the sale of $25,000,000 government of Switzerland twenty-year 8 per cent gold bonds, the entire proceeds of which are to be used in the United States, according to a statement to a representative of the ELECTRICAL WORLD by Lee, Higginson & Company, fiscal agents of the Swiss government. This loan is part of a program for the gradual electrification of the government railway system of Switzerland. The country has estimated waterpower resources of 2,700,000 hp., and the progressive utilization of this waterpower will effect large economies by substituting hydro-electric power for fuel, which Switzerland now has to buy at high prices.

Los Angeles Wants to Develop 139,800 Additional Water Horsepower

THE most important of the applications received by the California Water Commission in the month of June was that of the city of Los Angeles, which asked for a total of 1,400 second-feet of water from the San Joaquin River and its tributaries. The application calls for the erection of four power houses with a total capacity of 139,800 hp., divided as follows:

	Hp.
Power house No. 1, north branch	19,600
Power house, south branch	14,800
Power house No. 2	14,200
Power house No. 3 east branch	14,300
Power house, west branch	11,900
Power house No. 4	65,000
Total	139,800

Another application came from H. L. Jaskman, Eureka, for 9,000 second-feet from the Klamath River for power purposes, his plan being to store 150,000 acre-feet and develop 300,000 hp., to cost $20,000,000.

Democratic Platform Discusses Labor's Rights and Duties

DECLARING its opposition to the compulsory arbitration of private labor disputes, the Democratic national convention at San Francisco none the less announced: "With respect to government service, we hold distinctly that the rights of the people are paramount to the right to strike." "Labor, as well as capital," the platform declares, "is entitled to adequate compensation. Each has the indefeasible right of organization, of collective bargaining and of speaking through representatives of their own selection. Neither class however, should at any time nor in any circumstances take action that will put in jeopardy the public welfare. Resort to strikes and lockouts which endanger the health or lives of the people is an unsatisfactory device for determining disputes, and the Democratic party pledges itself to contrive, if possible, and put into effective operation, a fair and comprehensive method of composing differences of this nature."

"That workers should participate in the formation of sound laws and regulations governing the conditions under which labor is performed, recognize and obey the laws so formulated and seek their amendment when necessary by the processes ordinarily addressed to the laws and regulations affecting the other relations of life," is another declaration of the platform.

Other pronouncements of the Democratic body on questions affecting industry are a demand for a Congressional survey of existing taxes," a reaffirmation of the traditional Democratic policy of tariff for revenue only, indorsement of the budget system, and a clause favoring amplification of the Federal Trade Commission's authority along the line of preventing the unfair use of patents in restraint of trade.

The platform recognizes "the importance of connecting the Great Lakes with the sea by way of the Mississippi River and its tributaries as well as by the St. Lawrence River," a clause of special interest to electrical men in view of the water-power possibilities.

Ohio Association Convention Program

THE program for the twenty-sixth annual convention of the Ohio Electric Light Association, to be held at the Breakers Hotel, Cedar Point, Ohio, on July 13 to 16, inclusive, has been announced as follows:

Tuesday, July 13, 10:30 a.m.—President's address; reports of officers and committees. 2:30 p.m.—Report of illumination committee, G. S. Merrill, chairman; address, "Taxation of Utilities," C. Dalton, Toledo Railways & Light Company.

Wednesday, July 14, 10 a.m.—Report of station-operation committee, Prof. Henry B. Dates, chairman; paper, "Operating Troubles," C. W. DeForest, Union Gas & Electric Company, Cincinnati. 2:30 p.m.—Report of transmission and distribution committee, W. E. Beaty, chairman; address by William McClellan, vice-president Cleveland Electric Illuminating Company.

Thursday, July 15, 10 a.m.—Report of new business cooperations committee: Lighting and merchandising section, C. G. Eichelberger, chairman; power and heating section, J. C. Matthieu, chairman. 2:30 p.m.—Report of meter committee, J. L. Wright, chairman; address by George H. Cushing, managing director American Wholesale Coal Association, Chicago.

Friday, July 16, 10 a.m.—Address, "Heat Treatment of Steel," R. T. Kaighan, Cleveland Electric Illuminating Company; round-table discussion on farm business.

It is planned to have the exhibits in the meeting hall this year. Entertainment for ladies accompanying delegates will be provided during the business sessions.

Closing of 52-Mile Gap to Give Southern Interconnection of 900 Miles

HYDRO-ELECTRIC power systems of Georgia and Alabama will soon be connected by a transmission line 52 (83 km.) miles long, extending from Gadsden, Ala., to Lindale, near Rome, Ga., according to an announcement made in Atlanta by officials of the Georgia Railway & Power Company. Joining of the power lines of the Alabama Power Company and the Georgia Railway & Power Company was urged by the War Department during the period when the power companies were under Government regulation.

The Georgia Railway & Power Company has connections already established with the Tennessee Power Company between Cleveland, Tenn., and Lindale, Ga., and with the Columbus Power Company at Newman, Ga., with the Central Georgia Power Company at Atlanta, and with the Southern Power Company at Tallulah Falls, Ga.

In Georgia the connection extends through Floyd County only. With the gap closed the extent of the entire interconnection will be about 900 (1,450 km.) miles. The voltage is 110,000, and the capacity of the line is 22,000 kva. The cost of this project is estimated at about $450,000.

Alabama Power Offers $1,000,000 Preferred Stock Locally

TO OBTAIN funds for development work and extension the Alabama Power Company is offering to the public in the territory it serves $1,000,000 of 7 per cent cumulative preferred stock on the installment plan. Any number of shares may be purchased on a cash basis at 93 and accrued dividend, but on the partial-payment plan the number of shares is limited to twenty-five. An initial payment of $10 per share is required and $5 monthly per share.

The Alabama Power Company either directly or indirectly serves a population estimated at more than 550,000 people and supplies electric service in forty cities.

Springfield, Ill., Renews Negotiations to Purchase Utility Properties

NEGOTIATIONS between the city of Springfield, Ill., and the Springfield Gas & Electric Company for the purchase of the company's electric light and power and heating properties by the city have recently been renewed because of the application of the company for a new heating and electric franchise. It is agreeable to the company to include in the new franchise a provision allowing the city to purchase the property at a fair value to be determined by arbitration after a physical appraisal has been made, provided that the city is able to make payment either in cash or in negotiable securities acceptable to the financial institutions of the city. No satisfactory plan of raising the money has yet been made, although city officials have proposed foregoing the issue of $400,000 in bonds voted for extensions to the municipal plant and resubmitting to the voters a proposal for a larger bond issue.

Revised Edition of Safety Code Expected Late in Summer

THE text of the new edition of the National Electrical Safety Code is now almost completed. Lists of proposed changes in the various parts of the code have been circulated for criticism (abstracted in the ELECTRICAL WORLD, page 387, Feb. 14; page 1280, May 29, and page 1387, June 12). Comments upon these have now been received, and the Bureau of Standards is about ready to go to press with the revised edition. Points upon which disagreement exists, it was stated at the bureau, have been resolved almost entirely with respect to the rules governing power stations and those governing utilization apparatus and the grounding of circuits and equipment. The rules dealing with overhead-line construction, it was said, have always been the most difficult to handle on account of the widely differing opinions regarding such construction on the part of the different utilities. It has not been possible to obtain complete agreement on this part of the rules and, it was pointed out, future revisions in this part of the code will no doubt be more intensive than in the other parts. They will involve the collection of more complete data and probably the carrying out of experiments to determine appropriate strength requirements.

It is expected that copies of the new edition of the National Electrical Safety Code will be available late in the summer. It will be printed in pocket-book size, and the discussion of the rules will be entirely segregated from the rules themselves, probably being placed under a separate cover. A pictorial edition of the code, in which the meaning of the rules will be shown largely by illustrations, is in contemplation.

Five-Year Business-Engineering Course at Harvard

A NEW five-year course in business engineering is announced at Harvard University through the cooperation of the Harvard Engineering School and the Graduate School of Business Administration. Hitherto it has been possible at American universities to secure instruction in business or in engineering, but it is stated at Harvard that no combination of the two has been effected which has not involved a diminution in the quality of the egineering training given. The plan, which will be launched at the fall term, is to have three five-year programs, administered by the Engineering School, which will include all the engineering training in the four-year courses in mechanical, electrical and civil engineering and also an adequate training in business administration. Simultaneous instruction in engineering and business will be given during the fourth and fifth years.

Three-fourths of Pacific Gas & Electric's Stockholders Live in California

ACCORDING to the report of the Pacific Gas & Electric Company for the year 1919, which has recently been issued, 6,694 of its 8,813 stockholders, or 76 per cent, were residents of California. This gives the company high rank as an exponent of local ownership of utility securities. Another striking fact found in the report is that, though oil has increased in price 128.6 per cent, labor 45.6 per cent and material and supplies 76.6 per cent in the last six years, these three items constituting 83 per cent of operating and maintenance expenses, the price of electrical energy in the same period has risen only 13.4 per cent and that of gas 10.7 per cent.

The gross operating revenue for 1919 was $25,938,372, an increase of $3,342,856 over 1918; net earnings were $8,180,245, an increase of $324,058, and after paying interest and dividends and setting apart $1,000,000 as additional reserve for depreciation there was a net balance of $103,297, a decrease of $1,477,543 as compared with 1918, when no dividend on common stock was paid.

Industry	Power Sales 1919	Power Sales 1914	Increase, per Cent
Agriculture	$1,094,092	$350,551	212.1
Mining	949,678	591,314	60 6
Transportation	1,021,145	756,343	35.0
Manufacturing	2,682,785	1,553,640	72 7
Commercial and miscellaneous power	1,181,488	487,714	142.3
	$6,929,188	$3,739,562	85 3

The total number of electrical customers was 235,719, a gain in the year of 26,307, and total electric sales were $14,474,884, an increase of $2,090,385. Production reached 994,557,418 kw.-hr., of which 522,234,204 kw.-hr. was hydro-electric, 330,914,990 kw.-hr. steam and the rest purchased, the percentage of increase in total production over 1918 being 7.87.

The intimate relation of the company to the economic life of the large territory served by it will be understood from the accompanying table showing the growth of electric power sales in five years.

Tenney Convention at Boston Notable Success

WITH more than 250 in attendance, the executives and leading employees of Charles H. Tenney & Company, Boston, and of the companies managed by that organization held a highly successful convention at the Engineers' Club on June 24-25. The program included accounting, new business, operating and general sessions, and the following program was carried out: Opening and closing addresses, A. B. Tenney; "Service Sidelights in Customers' Accounting," A. Nelson Lattie; "Keeping the Coal Records Right," G. E. Teel; "The Historical Value of a Good Record of Plant Investment," Kenneth H. Goss; "Checking Up the Appliance Business," L. A. Galbraith; "Advanced Ideas in Customers' Accounting," Harry B. Chase; "The Future of the Gas Business," F. S. Clifford; "Ways of Increasing Electric Revenues," V. M. F. Tallman; "Present-Day Opportunities for Industrial Gas Installations," L. B. Crossman; "Selling Campaigns—Why They Pay," Cyrus Barnes; "The Appliance Department as an Asset in Gaining the Good Will of the Public," H. J. Walton; "Our Fight Against Rising Costs," A. S. Hall; "Present-Day Purchasing Problems," G. A. Rust; "Emergency Operation When Short of Gas-Making Materials," C. E. Paige; "A Consistent Engineering Program as a Factor in Building for the Future," C. R. Hayes. On June 26 an outing was held at Idlewild Grove, Wenham, Mass.

Electrical Credit Men Discuss Cost-Accounting System

THE urgent necessity of contractor-dealers adopting the standard cost-accounting system of the association was the keynote of the twenty-first annual convention of the National Electrical Credit Association, held in New York City on June 17 and 18. About 300 of these companies have already installed this system, but the aim of the credit men is to bring about its widespread operation for the purpose of checking overbuying and preventing dealers from stocking up on merchandise which has little turnover.

After the meeting was opened by President Benjamin P. George, J. H. Pardee, president of the American Electric Railway Association, in reviewing the "Trend of the Times," laid stress on the essential character of the electric railways and their present deplorable condition, giving the restoration of credit as the major task for those who would rehabilitate the industry. Closer co-operation with the contractor-dealer in a business service way and the gaining of the salesman's viewpoint were urged by W. E. Rice of the Western Electric Company, New York City, in his talk on "Constructive Credit Service."

The feature of the second day's program was an address by W. Y. Conrad, vice-president of the Liberty National Bank, New York City. Mr. Conrad analyzed the financial situation and discussed credit from the viewpoint of the banker. George J. Murphy of Boston and W. H. Morton of New York brought out the essential features of the standard cost accounting system.

The president expressed very strongly the appreciation on the part of the association of the entertainment committee's efforts in filling the time between meetings with golf, motor and boat trips, a shore dinner and a theater party.

Election of officers for the coming year was announced as follows: President, Charles R. Oliver, Wetmore-Savage Company, Boston; vice-president, Robert Edwards, Jr., Edwards & Company, New York; secretary-treasurer, Frederic P. Vose, Chicago; assistant secretary-treasurer, Walter S. Vose, Chicago.

Closer Co-operation Between Electrical Schools and Industry Needed

THE close of the university year finds the schools of electrical engineering unable to meet the demands made upon them for technical graduates. This is the report of the committee on electrical engineering of the Society for the Promotion of Engineering Education, which met at Ann Arbor, Mich., on June 29 to July 2.

The probable causes suggested are the necessarily poor preparation in lower college classes and secondary schools during the war, inadequate recognition of the value of the trained engineer as compared with the salesman and laborer, failure to employ sufficient technical graduates in less prosperous years adequately to man engineering staffs, difficulty of eliminating students not fitted for successful engineering work in entrance examinations and during the course, and lack of proper adaptation of courses to the work engineers are called upon to perform—particularly as sales engineers and engineering executives. Co-operation by the society with large corporations to obtain proper recognition of the value of trained engineers and the employment of adequate technical staffs is suggested, while the technical schools must take measures for the elimination of unsuitable students and the adaptation of their courses to the demands which are made by industry upon graduates.

Increased co-operation between the schools and industry to the end that school work and practical experience may combine to produce graduates better fitted to the needs of industry is suggested.

Longest and Highest Span in New England



THE LINE from Hartford, Conn., crossing over the Connecticut River en route to Manchester, Conn., is the latest high-voltage line and has the longest and highest span erected in New England. The line is designed for 66 kv. The towers are each 235 ft. high, erected on concrete piers 17 ft. square. The span is 1,645 ft. There are two three-phase circuits with steel-reinforced No. 4/0 aluminum cable.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Industrial Lighting Code for Utah.—Utah is drafting an industrial lighting code that will in all probability become a law at the next session of the Legislature. This code is to specify only such systems and intensities of lighting as are essential to the safety of workers.

Rates Advance in Spokane.—Spokane, Wash., is to raise the rates on light and power supplied to commercial users starting July 15. The amount of the increase will be 50 per cent, and it will apply to mercantile establishments, offices, public buildings and all commercial accounts.

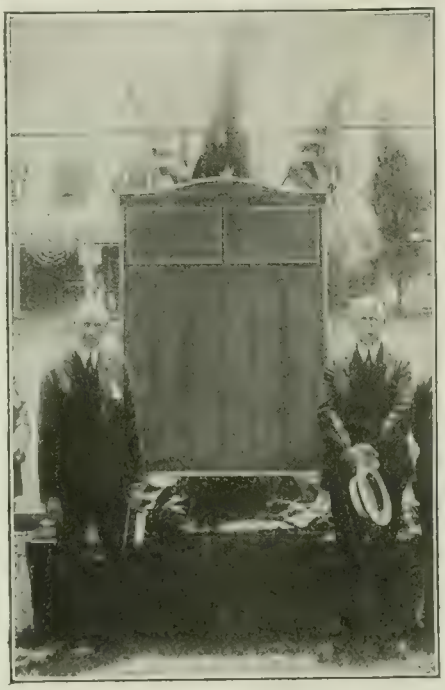
Richmond (Ind.) Municipal Plant Asks Increased Rates.—Asserting that the city will soon face a heavy deficit in the returns from its electrical plant unless rates are increased, the Board of Works of Richmond, Ind., has applied to the Indiana Public Service Commission for permission to increase charges to all classes of consumers. Under former conditions the plant earned a profit.

Prohibition and Lighting Bills.—Prohibition enforcement agents in New York City and elsewhere are examining the bills for electricity and gas of places formerly saloons and now supposed to be dispensing non-intoxicating beverages only. The theory is that a large bill shows late hours and that late hours are inconsistent with a thirst-quenching business run on strictly legal lines.

Electricity Furnishes All Power to Big By-product Plant.—The great by-product coke plan of the Sloss-Sheffield Steel & Iron Company at North Birmingham, Ala., which contains 120 ovens on a 25-acre site, is driven by electricity throughout, two 2,000-kw. turbo-generators being installed in the plant and an additional 2,000 hp. of energy being generated by the exhaust steam heat from a company furnace two miles away. Besides driving the by-product plant, this energy is to be transmitted to four blast furnaces at Birmingham, to coal and iron mines many miles distant, to rock quarries and other industries of the company.

Wireless Telephony Grows in Favor.—Successful tests of wireless telephony between fire department headquarters and the scene of a fire have been made in London, and as a possible result wireless telephones may come to be an adjunct to firehouses everywhere. In South Africa, where the chief industry is farming, installations permitting communication between farmers and their foremen and neighbors, as well as with distant towns, are contemplated. In the United States Forest Service the radio instruments have proved their value, and, being less liable to flames, they have in some cases been found superior to line telephones. For instance, as against the destruction by fire of 90 miles of telephone line recently, causing a discontinuance of service for more than a week, the *Wireless World* tells of a case where wireless apparatus was floated on a log raft in a forest lake while the fire swept by and communication was afterward re-established in less than one hour.

Boston Edison Company Honors Its Service Men.—The bronze tablet here shown has been erected by the Edison Electric Illuminating Company of Boston in honor of its 444 employees who served in the war, eleven of whom gave their lives for the nation. The tablet was unveiled at the Edison Service Buildings on the annual field day, June 26, when 10,000 persons took part in



the outing. J. W. Cowles was chairman of the tablet committee. President C. L. Edgar is shown on the right and General Superintendent William H. Atkins on the left of the memorial.

Hydro-Electricity in Dutch Indies.—Gold mines at Tambang Sawah, in the Dutch Indies, are now being served with electricity from a government-built central station at the Tes Lake equipped with water turbines from Switzerland and generators from America. The energy is transmitted over a 20-mile high-tension line. Other water-power and steam stations are being built at Dago, Tjihapit, Tjibadak, Dajeah Kolot and other places equally unknown to the Western world, the intention being the electrification of the railways centering at Batavia, as well as the rendering of lighting, power and industrial service. These ambitious plans, however, will take several years.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

American Association of Engineers.—Buffalo has been selected as the place for holding the next annual convention of the A. A. E. on May 10, 1921.

Telephone Pioneers of America.—This society will hold its seventh annual meeting at Montreal, Canada, on Sept. 10 and 11, with headquarters at the Windsor Hotel.

American Electrochemical Society.—The next meeting of this society will be held at Cleveland, Ohio. The date is not yet determined, but it will probably be Sept. 30 to Oct. 2.

International Association of Municipal Electricians.—The twenty-fifth annual convention of this association will be held at New Orleans on Oct. 19 to 22. Clarence R. George of Houston, Tex., is the secretary.

Western Association of Electrical Inspectors.—This association has decided to hold its next convention at Detroit, Mich., on Jan. 25, 26 and 27, 1921. W. S. Boyd, 175 West Jackson Boulevard, Chicago, is secretary of the association.

Annual Meeting of A. S. C. E.—The yearly convention of the American Society of Civil Engineers, which was to have been held at Houston, Tex., in October, has been set forward and will be held in Portland, Ore., on Aug. 10-12.

A. I. E. E., Schenectady Section.—These officers have been elected, the vice-chairmen to hold office for two years beginning Aug. 1 and the other officers for one year: Chairman, H. R. Summerhayes; vice-chairmen, A. G. Darling, H. H. Dewey and R. C. Muir; treasurer, F. L. Kemp; secretary, H. Goodwin, Jr.

N. E. L. A., Michigan Section.—At the annual convention of this section, which, as already announced, will be held at Ottawa Beach, Mich., on Aug. 24, 25 and 26, it is expected that consolidation with the Great Lakes Geographic Division of the parent body will be accomplished. H. Silvester is the secretary of the Michigan Section.

Indiana Electric Light Association.—The dates set for the 1920 convention of the Indiana Electric Light Association are Sept. 15, 16 and 17 and the place is French Lick Hotel, French Lick, Ind. Arrangements for the convention are being made by Thomas Donahue, manager of the Northern Indiana Gas & Electric Company, Lafayette, Ind., who is the secretary-treasurer of the organization.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Indiana Law on Service Extensions.—It has been held by the Indiana Public Service Commission, in a recent decision, that an application for an order requiring an electric utility to extend its service to prospective consumers within an incorporated town must be dismissed since under the state law city and town authorities and not the Public Service Commission have jurisdiction over extensions of all utilities operating within corporate limits.

Commission Refuses to Question Books Kept in Accordance with Its Rules.—A suggestion in a rate proceeding that a large utility company was keeping a double set of books for the purpose of deceiving the commission was declared by the Washington Public Service Commission to be entitled to no consideration, inasmuch as the books were kept according to the commission's official classification of accounts and were subject to unexpected calls by the commission's accountants for personal investigation.

Responsibility of Electric Company for Interruptions to Service.—In ordering a careful record of interruptions to the electric service furnished the city of Bremerton by the North Pacific Public Service Company to be kept, the Washington Public Service Commission expressed the opinion that when the power upon which a city relies is transmitted over a line 92 miles in length passing through a heavily timbered belt of country interruptions will result regardless of reasonable care on the part of the utility. Before ordering the installation of larger steam auxiliary plants the commission decided to await the result of efforts made by the utility to remove the causes for interruption of service.

Undesirability of Different Rates for Competing Companies in Same Territory.—Granting the petition of the Southern Sierras Power Company for permission to charge the same rates in San Bernardino as were charged by its competitor, the Southern California Edison Company, under a ruling authorizing a temporary surcharge of 27 per cent on all its electric rates, the California Railroad Commission observed: "For very substantial reasons the rates of these two companies where they are in competition should remain the same. A marked difference in rates, such as would result if this application were not granted, would cause a transfer of business from the high-rate to the low-rate company, thus imposing a burden resulting in a denial or breakdown of service. From every standpoint it is better that the rates of these two companies be kept on a parity, at least until final rate schedules are established."

Abnormal Transformer Losses as a Factor in Rate Making.—In an action for increased rates brought by the Amity Light & Power Company before the Public Service Commission of Oregon it developed that because of the sparsely settled communities served by the company and the small total load the line and transformer losses are extremely heavy, ranging from 55 to 60 per cent of the total energy purchased, or more than twice the losses on the average electric system. While granting a substantial increase in rates, the commission strongly recommended that the utility investigate the feasibility of limiting the day service to about two days per week and the night service from about dusk until midnight in order to minimize the heavy losses attending twenty-four-hour service and to make lower rates profitable.

Principles Governing Massachusetts Department in Fixing Rates for Electricity.—The selectmen of the town of Orange having applied to the Massachusetts Department of Public Utilities to order a reduction in the rates charged for electrical energy by the Athol Gas & Electric Company, the department, ordering a maximum rate of 14 cents a kilowatt-hour pending consideration of the company's revised schedules, laid down a number of principles governing its action, among them the following: (1) A fear that depreciation allowances will be dissipated in dividends is not a ground for denying to the company earnings adequate for its needs; (2) rates made to large industries must take into consideration shutdowns and periods of depression and cannot be based solely on the experience of prosperous years; (3) special rate contracts with large consumers cannot be considered objectionable where there is no evidence that such contracts throw a burden upon the other consumers; (4) while there may be excuse for making new rates and special contracts to obtain business beyond the scope of existing rates, there can be no justification for giving any advantage to one customer not offered to all under like conditions; (5) it is desirable and even necessary to take into account not only the load factor but the power factor of large customers, penalizing failure to maintain a reasonably good power factor and offering inducement for its improvement; (6) failure to raise rates to the street railway at the time rates to all other customers were raised cannot be justified upon the theory that the company purchased power primarily for the street railway company and that the cost of purchased power had not been increased, nor upon the theory that as the street railway company was finding it difficult to earn revenue enough to keep its cars in operation such discrimination operated to the benefit of public transportation.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Electric Burglar-Alarm Company a Public Utility.—The New York Court of Appeals finds that an electric burglar-alarm company incorporated under the telegraph act of 1848, with the right to use public streets for its lines or condemn private property therefor, is a public service corporation and subject to regulation as such. (127 N. E. 315.)

Damages from Flooding Land.—In an action against the Rutland Railway, Light & Power Company for damage caused by the flooding of plaintiff's land by obstruction in stream, where the evidence showed that at first only a small portion of plaintiff's land was flooded, but that the quantity increased from year to year, an easement by prescription could only affect the damages as to the land which had been flooded for a term of years and not as to land flooded within recent years, the Supreme Court of Vermont has declared. The owner of an easement cannot increase the burden upon the servient estates nor impose a new burden thereon. (110 A. 4.)

Title to Water Rights at Dolgeville, N. Y.—In a suit brought by S. R. Inghain against the Herkimer Light & Power Company, the Supreme Court of New York, Appellate Division, has found that where an owner of riparian lands, having first leased and afterward contracted to sell these lands to a hydro-electric company of which he was himself the virtual owner, subsequently made an assignment and some of the property concerned was sold by the assignee, the purchaser thereof had no right to any portion of the rent named in the original lease, that lease having, in the absence of any reservation, been superseded by the contract of sale. (181 N. Y. S. 863.)

Power of Utility to Increase Rates Without Sanction of Commission.—Declaring that the Public Service Commission of the state is a body of limited powers and may do only that which the statute specifically prescribes it may do, the Supreme Court of New York has decided that a gas company can make effective an increase in rates thirty days after filing a new schedule with the commission though the increase has not been sanctioned by the commission and a proceeding involving the issue is pending. The commission is required to hear evidence to determine the reasonableness of rates before entering an order holding them unreasonable, and an order entered before hearing does not support summary proceedings. (182 N. Y. S. 55.)

Richard C. Carter, for many years connected with the Central Maine Power Company, has been appointed superintendent of the Belfast district, relieving Merton L. Taylor, who has been acting superintendent since the transfer of H. P. Blodgett to the Rockland district as superintendent of the company there.

Prof. Carl E. Magnusson, who was elected a vice-president of the American Institute of Electrical Engineers for the coming year, is professor of electrical engineering and acting dean of the College of Engineering at the University of Washington. Professor Magnusson received his degree of doctor of philosophy from the University of Wisconsin in 1900 and for several years was professor of physics at the New Mexico School of Mines and the University of New Mexico. Since 1904 he has been at the University of Washington and since 1906 has been head of the department of electrical engineering at the university. He spent a year at the General Electric Company's plant at Schenectady studying under Charles P. Steinmetz.



C. E. MAGNUSSON

E. S. Purington has resigned his position as associate physicist, Bureau of Standards, to accept a position as a research engineer with the Hammond Radio Research Laboratory at Gloucester, Mass. Mr. Purington has for the last year been engaged in research work in connection with the applications of electron tubes in power equipment, especially in radio-telephony.

Edwin B. Katte, chief engineer of electric traction of the New York Central Railroad, has been chosen chairman of the newly organized railroad section of the American Society of Mechanical Engineers.

Frederick A. Anderson has recently been promoted from electrical inspecto of the Southern Pacific district of the United States Shipping Board to senior electrical engineer of the same district with headquarters at San Francisco, Cal.

Men of the Industry

Changes in Personnel and Position— Biographical Notes

C. S. Kennedy has resigned as general superintendent of the Indiana & Michigan Electric Company, South Bend, Ind., effective July 1, to become general manager of the Iowa Southern Utilities Company with headquarters at Centerville, Iowa. Mr. Kennedy has been connected with the Indiana & Michigan Electric Company for the past twelve years.

C. S. MacCalla has resigned as manager of the Rochester works of the General Electric Company to become vice-president of the Virginian Power Company, Charleston, W. Va. Mr. MacCalla was made manager at Rochester only a short time ago. He was vice-president and general manager of the Washington Water Power Company from 1903 to 1918, having previously been associated with the foreign department of the General Electric Company for two years at Sydney, Australia. For four years he was with the Brooklyn Edison Company.

H. A. Kidder, electrical superintendent in the motive power department of the Interborough Rapid Transit Company and the New York Railways, New York, has been appointed assistant superintendent of motive power of these companies pending final severance of the relations of W. S. Finlay, Jr., with those organizations in the near future, at which time Mr. Kidder will become superintendent of motive power. Mr. Kidder began his career with the above companies as assistant electrical superintendent in 1906, prior to which time he was connected with the General Electric Company in its railway engineering department, and in the following year he became electrical superintendent in charge of all electrical operating equipment.



H. A. KIDDER

Prof. Hector James Hughes has been appointed dean of the Harvard Engineering School, succeeding Dean Comfort A. Adams. Professor Hughes was born at Centralia, Pa., in 1871, was graduated from Harvard College in 1894 and received the degree of S. B. from the Lawrence Scientific School in 1899, in the course in civil engineering. Dean Hughes has had a wide experience in municipal, railroad, drainage, bridge and hydraulic engineering. He has been engaged in consulting engineering since 1905, including industrial and power-plant construction. He became instructor in civil engineering at Harvard in 1902 and in 1903 was made assistant professor and later full professor. Dean Hughes is a member of many engineering societies and is a partner in the firm of Burke & Hughes, Cambridge.



H. J. HUGHES

Stacey Hamilton, who for a number of years has been devoting his time to light and power problems and general statistical and engineering work for the Portland (Ore.) Railway, Light & Power Company, has been appointed organization inspector of that company. His new duties will include the making of special inspections, investigations and reports pertaining to the various departments and operating details of the company and he will report directly to the president of the company, F. T. Griffith.

Obituary

Brig.-Gen. William L. Marshall, United States Army, who from 1908 to 1910, when he retired, was chief of engineers, died July 2 after a short illness. General Marshall was the inventor of various lock gates, valves and other hydraulic equipment.

Trade and Market Conditions

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

United States District Court Upholds Coolidge Lamp Patent Suit

THE Coolidge wrought-tungsten patent, under litigation for nearly five years, has been declared valid in all of its claims, and to have been infringed, in a decision handed down on June 29 by Hugh M. Morris, judge of the United States District Court, in the matter of the suit brought by the General Electric Company against the Independent Lamp & Wire Company, Inc. Considerable importance is attached to the outcome of the case because of its fundamental application to the manufacture of incandescent lamps.

In the opinion of the court, the solution of the tungsten problem involved invention, and in that invention the specific problem was to make tungsten ductile and eliminate brittleness. It has been held that Dr. Coolidge accomplished this in the production of his wrought tungsten from the natural tungsten metal. The main product and process claims are held valid in the court's opinion.

Dr. Liebmann, of the Independent Lamp & Wire Company, when questioned by a representative of the ELECTRICAL WORLD, preferred to make no statement at the present time as to the probable course of that company regarding an appeal of the case.

Heavy Buying of Heaters in Winter Just Passed

THAT the winter of 1919-20 would be a good season for the sale of electric heaters was well anticipated by jobbers in the volume of orders placed before last summer closed. These distributers bought in the early season more socket heaters than ever before, and shipments were as a whole in such condition that stocks were sufficient to care for the demand when the winter started in cold and early. At the same time, scattered jobbers had rather large stocks carried over from a previous warm winter and one in which some late deliveries were made.

The past season, however, surpassed all previous ones in heater sales. It was long and rather severe, and after the first of the year shipments were badly delayed. In the metropolitan district the severity of the weather was attested in the high volume of sales, and right up to the month of May jobbers reported fair movement of stock because of disagreeably cool weather.

Very few jobbers in this territory have any great number of heaters to hold over. Where this is the case it is because shipments made from the factory in the early months of the year were received too late to be of much use in that season. But some small delayed receipts were quickly disposed of among the trade. In several instances jobbers report no stocks at all and, as a whole, stocks at present are low. There are probably 5,000 heaters in the metropolitan district in jobbers' hands, more than half of which were received too late for cold weather. From reports to date from about a dozen representative jobbers, an estimate of sales has been made of a minimum of 40,000 heaters in just that small area. Consequently the holdover is less than 10 per cent if shipments delayed by bad transportation are not considered.

Early reports of anticipated future business show that in general the pre-season orders are not going to be quite so large as last year. On the other hand, some jobbers expect to order from a number equal to that of last season to half as much again. At the same time, it would appear that the coming season should be at least as good as the last season in view of the progress in building that has been made during the year and the threatened shortage of coal next winter through inadequate transportation.

New England Sales Heavy

Notwithstanding delayed deliveries, New England jobbers report in the main a better season recently closed in socket radiators than last year. As usual, individual sales vary widely, but several of the larger houses disposed of 25 to 30 per cent more outfits than in the winter of 1918-19. Estimates vary considerably as to the total market per annum for radiators in New England, but from 25,000 to 35,000 minimum were disposed of last winter and spring, and the market is rapidly growing with the rising cost of anthracite coal and the intensive publicity which the trade is applying to these devices.

Seventeen leading jobbers had about 1,800 radiators in stock on July 1, the individual inventories showing totals from 500 down to bare shelves. Among the smaller houses, stocks are very low and are likely to be cleaned out by the summer demand, which is of course small but selective, with the vacation camp and cottage a valued buyer. The outlook is excellent for fall and winter business, partly because the price of domestic heater coal threatens to rise further before snow flies and also because the consumer of central-station service is rapidly becoming acquainted with the real economy of short-time intensive and localized heating compared with the expense of "starting up" the furnace with its large bulk of fuel for such work.

A few jobbers are carrying over small stocks from late spring because deliveries were too slow to permit disposal of pre-season orders before warm weather. Thirteen jobbers report that they will purchase probably 3,700 radiators for fall trade this year, and in addition about 2,400 are on order from the manufacturers. Prices have not appeared to affect sales very much, in view of the acute coal situation.

Large Stocks in the South

Despite the phenomenal sale of air heaters last season large stocks of this specialty were carried over by local jobbers, owing in a measure to receipts of shipments late in the season. Jobbers indicate a tendency to go slow on the placing of orders for fall delivery, as they seem to feel that the peak of popularity of this device has been passed and that air heaters will not be in so heavy a demand for the coming winter as they were last winter.

West Coast Expects Good Increase

The bulk of the electric radiators marketed along the Pacific Coast are manufactured in California, thus securing prompt service and preventing to a certain extent any great accumulation of stocks at the end of the season. The unusually early, mild and dry spring, however, spoiled the usual demands holding from January to March, and most of the dealers carried over pretty fair stocks through the season. Another fact to be remarked is the greater variety of heater stocks carried, nearly all dealers carrying at least two different makes, often parallel types. An increasing demand for fireplace types is also noticeable.

Nearly all radiators for the 1920-21 season have already been ordered, there having been keen competition among

jobbers for this business, which has been solicited in advance. In general a 50 per cent advance over the previous season's business is anticipated. During 1919 business, by the way, measured a 41 per cent advance over the 1918 business.

Decision in Lumber Case Sounds Warning to Associations

TOO much care cannot be exercised by associations of men in the electrical industry interested in one activity or another in always keeping before their members the legal bounds which must not be overstepped through enthusiasm or lack of knowledge of the conditions. A case in point has just come to notice where such an association in the industry has ceased to transmit certain information among its members, not because that information contained any reference to prices in any shape or manner—it did not—nor because it believed it was running contrary to law, but merely in order to eliminate any possibility of the searching glance of Federal authorities which might bring it into notice and provide the slightest murmur of a question. It was a matter of playing on the safe side to avoid suspicion.

It is interesting to recall in this connection the result of the suit instituted by the United States of America against the American Column & Lumber Company and 332 other defendants, heard last March. It was the Government's suit under the Sherman act against the so-called "open competition plan" of the hardwood lumber manufacturers who are members of the American Hardwood Manufacturers' Association. The Government showed in this case that the members continuously exchanged with one another, through a common secretary, reports showing their respective rates of production and stocks on hand and also showing the prices which each member had received on actual sales of lumber. Furthermore, it was established that the tendency of such an interchange of information among the defendants was to increase their prices, as the Government had charged.

John E. McCall, United States District Judge, enjoined the defendants from continuing to exchange the reports in question in the application for preliminary injunction. From the evidence on file, the common note running through it all was that of increase of prices, and the conclusion could not be escaped that the purpose and intention of the plan was to suppress competition among its members and create a condition in that industry wherein production was to be kept low enough to maintain prices on an ascending scale, but not low enough, because of price heights, to induce resort to substitutes.

Armored-Conductor Market Expected to Continue Strong

AS FAR as can be learned there is no evidence of any weakening in the market for flexible armored conductor. Several jobbers in the East have recently let fall a remark that they thought the market on this material was beginning to show a little falling off. It is probably true that the trade is not ordering so far ahead as it has done in the past because of the general feeling of aversion to such long futures. Conductor has been coming into the market in better volume of late because more effort is being placed on obtaining raw materials and getting the finished product through.

Jobbers have been applying almost every bit of armored conductor which has come to them of late on the pile of back orders which are still unfilled. The common price in this case has been in the nature of $110 to $125 per 1,000 ft. for two-wire. Little difference has been made between single-strip and double-strip because of the shortage of both. The material which has been sold on new orders has for the most part been on accommodation orders and on rush work, and has been sold to as high as $150.

Manufacturers of rubber-covered wire find that market keeping up in good shape but do not report any great increases in business in No. 14 wire. The market for this size has a bearing on the market for flexible armored conductor. With a good supply of knobs, tubes, cleats and loom, the demand for No. 14 rubber-covered wire is in general greater than when those wiring materials are in poor supply. This open wiring is the most common kind used in the less congested districts of the country, but when the supply of porcelain is low flexible armored conductor has a heavier call as a substitute. In addition, it has its own field to supply. Porcelain stocks are low now and there is no evidence of their bettering in a long time. So the armored-conductor demand can be expected to hold up to a certain extent because of this one fact as long as so much building and repair work is necessary.

Factory shipments of porcelain, loom, No. 14 rubber-covered wire and armored conductor are much behind, and every bit of this material that can be produced is needed to satisfy the building demand. Consequently it hardly seems that there is any foundation for even the faintest consideration of a weakening in the armored-conductor market for some time to come. Building activities are fluctuating in various localities because of high prices, lack of material, etc., but at the same time the need still exists.

Stranded-Steel-Wire Market Steady Under Short Supply

ALTHOUGH demand for stranded steel wire is not extra heavy, manufacturers are having considerable difficulty in meeting orders. The volume of buying has increased slightly over a year ago, but is still subnormal if anything. Little new construction work is being undertaken, repairs and replacements accounting for most of the orders. Where formerly the electric railways would stock ahead on suspension and guy wires, money tightness is now causing them to cut expenditures to the bone; consequently stranded wire is ordered only as absolutely needed.

In spite of this circumstance production is generally inadequate to meet demands, one of the largest wire producers reporting operation at only about 65 per cent of capacity owing to raw material and transportation difficulties. Another manufacturer has been hindered by labor troubles, the mills of this company operating only seven months last year because of strikes. Zinc is reported hard to obtain; hence the process of galvanizing stranded wire is one more factor delaying some producers, although other mills which own their own zinc and coal mines are free from this trouble.

As a result of these conditions orders are running further and further behind, with deliveries ranging from ten weeks to five months. Stocks in this field seem to have gone out of existence. Transportation difficulties continue to tie up shipments at the mills; in fact, with the recent coal priorities order in force, manufacturers report no relief in that quarter.

The encouraging features of the situation seem to be the entire absence of order cancellations and the continued steadiness of the market, prices having remained firm during the past year, although the tendency would seem to be up at the present time.

Manufacturers Assist Yardmen in Freight Movement

RATHER than face curtailed production because of inability to obtain raw materials or to ship finished products, manufacturers of the country are beginning to realize that the freight congestion in the terminals must be relieved. In order to help out there is a growing movement among the manufacturers to supply switchmen, yardmen, etc., to the railroads from their own organizations. As each manufacturer has only to furnish a few men, the strain on the organization is not severe, and yet at the same time the help rendered the railroads in the move-

ment of cars at the terminals is extremely valuable. Boiler-room equipment producers and those of certain types of bearings have been active in this connection, it is learned.

One of the practices which have been rather harmful to the movement of terminal freight as a whole is that of giving gratuities to the yardmen. No doubt it is worth $50 or $100 to a company to have a car moved, but at the same time the effect on the general movement is to slow it down. In the opinion of some industrial men there have been evidences of collusion among yardmen due to these gratuities from the receiver or the sender and intended to extort further bonuses.

Stocks of Carbon Brushes in Good Supply

MANUFACTURERS of carbon brushes report the situation as being very favorable. Production has increased generally, and though only nominal stocks of finished brushes are on hand, stocks of unfinished material are in good shape to handle any orders likely to come in.

Deliveries are being made more promptly than heretofore, averaging from ten days to three weeks. Shipments of the standard railway type of carbon brushes are a little slower because these orders are being placed in larger quantities. One local agent who recently returned from a tour of the country states that electric railways are quite heavily stocked up on brushes.

Demand is good, much of the ordering being for replacements as well as for the construction of new motors. The market has held steady for some months, and manufacturers say no fluctuation is in sight at present. Labor, however, is the chief item in the cost of carbon brushes, and because the labor market has been unsteady indications are that any price change would be upward.

Stocks of foreign brushes are in sufficient condition in this country to supply normal orders, while new material can be quoted on six weeks' delivery. French production is about 50 per cent above pre-war volume.

Metal Market Situation

MORE activity is being shown in the copper market than for some few weeks past. The outside market has raised its prices to nearer 18.50 and 18.75 cents from the 18.25 cents for which it could have been bought a week ago, and some sales have been made. Producers, who have been quoting 19 cents for several weeks and who have held that figure despite the small amount of metal which they have sold, are finding the beginnings of a returning market. Sales to regular domestic consumers have been recorded at that figure for delivery over the present quarter. Where consumers have expressed a desire to cover at this figure for fourth quarter the producers do not seem to be especially anxious to book for so far ahead at that figure. A slightly better condition of transportation is reported this week.

NEW YORK METAL MARKET PRICES

	June 29	July 6
Copper	£ s d	£ s d
London, standard spot	85 15 0	87 0 0
	Cents per Pound	Cents per Pound
Prime Lake	18 50	18 75
Electrolytic	19 00	19 00
Casting	17 62½	18 00
Wire base	22.50-23.00	22 50-23 00
Lead, trust price	8 00	8 00
Antimony	7 50	7 50
Nickel, ingot	43 00	43 00
Sheet zinc, f.o.b. smelter	12 50	12.50
Zinc, spot	7.95	8 15
Tin	49 00	48 25
Aluminum, 98 to 99 per cent	33.00	33.00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	15 00 to 15 50	15 00 to 15.55
Brass, heavy	9 00 to 10 00	9 00 to 10 00
Brass, light	7 00 to 7 25	7 00 to 7.25
Lead, heavy	7 00 to 7 25	7 00 to 7 25
Zinc, old scrap	5 00 to 5 25	5 00 to 5 25

THE WEEK
IN TRADE

NO DECREASE in the volume of sales for all classes of electrical material is noted in the East and South, but an appreciable slackening of demand is reported from the Middle Western and Northeastern sections as the natural outcome of summer trade dullness.

Transportation conditions show some improvement, especially in Chicago and Boston territory, and an increasing resort to shipping goods by express is noted. Collections on the West coast are in better shape than in the East, where, in the New England and Southern states particularly, collections of bills are becoming increasingly difficult.

Fan stocks are still generally awaiting prolonged warm weather. Rigid conduit shows a marked shortage throughout the country, but supplies of armored conductor are coming through in slightly better shape except in New York territory. Porcelain is conspicuous by its absence, minor price increases being reported on one or two items. With fair stocks of loom accumulating, jobbers are beginning to catch up on back orders. In general, the market has held steady the past week

NEW YORK

The volume of sales generally reported by jobbers shows little sign as yet of the expected advent of summer trade dullness. In some quarters the business from contractor-dealers is said to be falling off, but on the whole demand is as stiff as ever.

Incoming shipments are still bad, but in many cases relief is being found by resorting more and more to the express companies. Collections are good considering the general tightness of money.

Building activities and industrial work, as reflected in sales of electrical material, are being well maintained. The city has recently awarded contracts totaling more than $5,000,000 for the construction of new freight sheds on Staten Island.

Lamps.—Demand is holding up well, and shipments are coming through better than previously. Stocks are still spotty though somewhat improved.

Rigid Conduit.—The situation presents almost a famine aspect, with supplies shot to pieces and very irregular shipments in the face of an excellent demand. One jobber just received a quantity ordered last July. Orders are turned down quite regularly, and many jobbers will not quote prices.

Flexible Armored Conductor.—Recent isolated shipments in good quantity caused talk of a break in the market, but these receipts were only a drop in the bucket. No hope of relief is held out, the trade being on an allotment basis. Demand continues very strong, back orders at once absorbing inconsequential shipments. Connectors are reported in fair shape. Prices for No. 14, two-wire, average $115 in 1,000-ft. lots.

Fans.—Demand with some jobbers is strong, while for others it has not yet started strongly. Shipments are fairly good, some distributers now resorting to trucks for supplies. Stocks are spotty, one jobber having to buy several hundred fans from other jobbers as a result of ordering late. Ceiling fans have a rapid turnover this year.

Rubber-Covered Wire.—Stocks vary all the way from "poor" to "good." Some jobbers report normal shipments, but not so with all, as one company has received no supplies for a month. Demand is only fair, the smaller sizes moving fastest. The price for No. 14 ranges from $11.50 to $13.

Porcelain.—Reports on knobs, tubes, cleats, etc., are uniformly the same—strong demand, stocks absolutely de-

pleted, and no supplies coming in. Several manufacturers recently withdrew prices on rosettes, sockets, etc.

Wall Panels.—Demand is strong, with considerable shortage being met, especially in the larger sizes, although here and there jobbers report plentiful stocks. Irregular shipments are applied on back orders. Steel mills are loath to accept new orders for sheets, and the price remains well up.

Tape.—A general scarcity is being relieved by the arrival of back orders with some jobbers, but stocks are generally low and embargoes holding up shipments. Friction tape is in slightly worse shape than rubber. Demand for both kinds is strong. Friction tape in 100-lb. lots averages around 58 cents, and rubber tape 55 cents.

Schedule Material.—Demand is strong and stocks are spotty. Some devices are slow while others are moving easily. One jobber is short on candelabra fittings and receptacles; another has not a single pull or key socket in the house. Waterbury factories are reported closed down.

BOSTON

Orders flowed into jobbers' offices without much diminution the past week. Deliveries are improving somewhat, owing to vigorous efforts by the railroads and consignees to move material. Heavy passenger traffic, however, handicapped freight movement over the Fourth. Collection reports are less favorable and a close watch is still being kept on credits. Small motors are almost unobtainable for the moment. Stocks of schedule material, lamps, rubber-covered wire and flexible armored conductor are sufficient to meet immediate requirements, and some rigid conduit is coming in from time to time. Contractors are very busy and a large amount of rewiring in industrial plants is being handled. Building and engineering contracts in New England to July 1 totaled $179,568,000, against $80,552,000 for the first half of 1919. Increasing activity is evident in steel shipyard work, and considerable buying of supplies from jobbers is under way in prospect in connection with government and merchant ship construction. Labor difficulties still persist in the Naugatuck Valley.

Fans.—Retail stocks are plentiful, owing to poor fan weather. A few fans are still on order for jobbers' stocks. The demand this year is greatest for the oscillating type. Some price-cutting in smaller sizes appears likely.

Washing Machines.—Stocks are irregular, with very active demand. Less trouble regarding wringers is noted, and motors are ordered so far ahead that little is heard about delayed outgoing shipments on this score. A representative make sells for list less 25 per cent off in lots of three.

Fixtures.—Excellent sales are reported. Stocks purchased well ahead are minimizing the effect of labor troubles in the brass industry. Brass canopies are somewhat short, however. Prices are showing signs of weakening a little under close competition.

Wire.—Rubber-covered No. 14 is quoted at $11.50 per 1,000 ft. in 5,000-ft. lots; weatherproof base is 30 cents to 32 cents per pound, with uneven supply, and bare copper wire sells on a 26-cent base. In some jobbing circles higher prices for copper are anticipated by fall. Weatherproof shipments are improving somewhat.

Flexible Armored Conductor.—Good stocks are on hand. No. 14 single-strip is quoted around $112 per 1,000 ft. in 5,000-ft. lots.

Non-Metallic Flexible Conduit.—Fair stocks are reported. The ½-in. size and ¾-in. size are selling at $35 and $38.50 per 1,000 ft., in 1,000-ft. lots, respectively.

Flatirons.—Sales are active for both summer and year-round use. A standard make sells for $4.85 in lots of forty-eight and for $5 in lots of twelve. Deliveries are too long to suit many buyers.

Toasters.—Trade is brisk, with stocks running low.

Tubes.—Porcelain tubes, 3-in. size, recently were increased in price from about $10 to $11.35 per 1,000 in barrel lots. This material is hard to get on account of railroad conditions.

Rigid Conduit.—Jobbers are caring for old customers as shipments of past order "come into port." Modest stocks are reported but these are spotty as to sizes.

Friction Tape.—In 100-lb. lots, a quotation of 55 cents per pound was current at the week-end on ¾-in. black tape. Fair supplies are now obtainable.

Sockets.—Owing to the scarcity of composition handles, key sockets are not quite so plentiful in some localities, though no serious shortage is reported. These are quoted in case lots at 28 cents, with keyless at 26 and pulls at 50 cents.

CHICAGO

The gradual improvement in freight conditions, coupled with a general decrease in demand for all classes of merchandise, is tending toward more rational conditions in the electrical goods market in this district. An embargo was this week laid on all intercity shipments except perishable ones in the Chicago area, with a view to finally clearing out the accumulation of through-billed cars which are stalled in this territory. Perhaps as a result of this most jobbers report increased receipts during the week and a proportionate relief in famine conditions. Various wires, particularly in larger sizes, lamps and flexible and rigid conduit are reported in better supply.

A general weakening of demand in all lines is felt with the single exception of pole-line equipment. The porcelain, hardware and tool situation is very acute, with no sign of relief. Demand on the part of all public utilities for new and replacement line equipment has been quite light all spring, but the month of June shows an increase, due, probably, to the measure of relief granted certain power and light companies by the various public utility commissions.

Flexible Armored Conductor.—Recent receipts have been in increased volume, the major portion, however, being applied on back orders, leaving stocks badly broken. Jobbers are unable to name delivery dates with accuracy. In coil lots, No. 14 single-strip is quoted at $110 per 1,000 ft.; $10 higher in smaller quantities.

Non-Metallic Flexible Conduit.—The ½-in. size is quoted at $35 per 1,000 ft. in quantity, $55 in short lengths; ¾-in. at $37 and $60. Stocks remain in bad shape, but the quantity of goods on back order is decreasing. Jobbers report diminished demand.

Rubber-Covered Wire.—Improvement in stock conditions is noted with shipments arriving with increasing promptness. While nearly all dealers' stocks are broken, all sizes are obtainable in reasonable quantities if sufficient effort is made to locate them.

Rigid Conduit.—Substantial quantities have been received, but the amount required to fill back orders on file is so great as still to cause a marked shortage. With improved freight service no further serious difficulty is anticipated. Three-quarter-inch and half-inch sizes are particularly hard to obtain.

Fans.—As is usual, the 16-in. oscillating fan is in greatest demand, but delayed shipments cause small sizes to be also almost unobtainable. Dealers report that retail demand in all sizes is somewhat below expectation. This is in line with decreased retail sales in all classes of household utilities.

Line Material.—No amelioration of short stock conditions is reported in hardware, insulators or tools, indicating that the shortage is due to manufacturing rather than transportation difficulties. Demand is brisk, with jobbers largely unable either to fill orders or promise delivery. This is a situation that will require much time to straighten out.

Heating Appliances.—Jobbers' receipts are still far behind orders, but retail sales are likewise less than expected. This may be attributed to recent price increases, to frequent substitution required by reason of lack of popular makes, or to general retail conditions. In spite of low stocks; dealers are able to handle all demands that are now pressing.

ATLANTA

The first six months of 1920 have set a new building permit record for the city of Atlanta, the month of June having overtopped permits of any previous month in the city's history by a considerable degree. The grand total of permits for the first six months was $8,812,573, and June contributed $2,324,662 to this total. Despite the large number of buildings under construction, a considerable break in the lumber market is to be noted in the large industrial centers, attributable to the great difficulty in obtaining cars for outgoing material, shipments for the week for 146 mills being 34 per cent below production.

There is a tendency on the part of the general public to offer increasing resistance to exorbitant prices, and this is reflected by a disposition of the wholesalers and retailers to tighten up in the placing of orders. On the whole, however, there is little or no fear expressed regarding the future of business in the territory and the volume of retail trade continues large.

A heavy demand for money is reported throughout the district and this naturally has caused an increase in the interest rate. Collections as a result are tightening up, and jobbers report increasing difficulty in obtaining remittances promptly from their rural trade, especially in the southern districts.

Flashlights.—As a probable result of the national advertising campaign, demand is holding up unusually well. Cases, batteries and lamps are moving well, and stocks, as a rule, are in good condition. Good shipments are reported by all jobbers.

Wire.—One of the largest jobbers reports his stocks of wire, weatherproof excepted, in fair shape, though he has little or no weatherproof on hand. Other jobbers report a shortage of weatherproof and No. 12 rubber-covered. On the whole demand is out-running the supply.

Interphones.—A slackening in the demand of this article is reported, owing to the fact that contracts for apartment-house construction were let early in the spring in anticipation of slow deliveries. As a result jobbers have been able to accumulate fair stocks of this material.

Lamps.—While some difficulty in obtaining sufficient quantities of lamps was reported several weeks ago, one of the largest jobbers reports that stocks are now in such condition as to meet all reasonable demands. All types of lamps are moving satisfactorily, but a particular activity is to be noted in type-C lamps in 100-watt to 200-watt sizes.

Non-Metallic Flexible Conduit.—The shortage existing in the territory will be somewhat relieved by large incoming shipments expected daily. These shipments will be sufficient to fill a large number of outstanding back orders, but will not leave any stocks on hand. Price, $\frac{7}{32}$-in., lots of 250 ft. to 1,000 ft., $5.06 per 100 ft.

Porcelain.—A large shipment of porcelain, consisting of knobs, tubes and cleats in sufficient quantities to take care of back orders, is reported by one of the local jobbers. No stocks will remain after filling back orders, while the demand continues exceedingly strong. Prices, tubes, $\frac{5}{8}$ in. by 4 in., standard packages, $1.57 per 100; No. 1 "Nail it" knobs, lots of 500 to 4,000, $4.99 per 100; cleats, lots of 300 to 1,850, two-wire, unglazed, $3.28 per 100.

Heating Devices.—Very poor stocks of heating devices are reported by all jobbers, who are complaining strenuously of their inability to accumulate any stocks for fall trade. The retail trade is being urged to place all orders for holiday material at the earliest possible date in order that dealers may receive their allotment of material.

SEATTLE—PORTLAND

Trade conditions in the Puget Sound district remain in about the same condition as reported for the past few weeks, though, if anything, jobbers' sales are lighter. Retailers, however, say that sales show no fluctuation and that as a whole they have been comparatively satisfactory. The sudden advent of warm weather last week made fans in good demand, although sales were not of enough moment to affect the general volume of sales Irregular and delayed shipments are still a cross to the jobbers. Prices as a whole show no particular change. Collections are fairly good. Logging and lumber production in Oregon and Washington may be seriously interfered with by a shortage of fuel oil. Recently one of the leading oil companies gave notice that the fuel supply is becoming more stringent daily and that orders are anticipated to discontinue deliveries of fuel oil to all not protected by written contracts, and when these contracts expire deliveries are to cease.

The Portland district reports that owing to the Shriners' Convention and the rose festival the business of jobbers, contractors and dealers fell flat during the latter part of June. Retailers state that trade for June was materially below that of May. Collections and the credit situation in Portland territory appear to be about the same as for some time past. No price changes have been recorded. The Enterprise Electric Company at Enterprise, Ore., plans immediate construction of a large hydro-electric plant utilizing the waters of the Wallowa River. The first unit will develop 1,500 hp., and unofficially it is stated that 15,000 hp. will be ultimately developed.

Fixtures.—Further decreases are noted in fixture sales because of the reduction in residence construction. Stocks are fair and shipments are coming through sufficient to care for needs.

Schedule Material.—During the past week sales in this line showed very little activity, especially during the latter part of the week, owing to the exodus from the city for the Fourth of July holiday. Slackness of demand is giving jobbers an opportunity to build up their stocks, which are sadly in need of replenishment.

Porcelain.—The demand for knobs, tubes and cleats is light owing to lack of new construction. Jobbers are replenishing stocks, and prices are unchanged. Deliveries range from four to six months.

Motors.—Anticipated demand from the logging and lumber industry for equipment to be installed during the midsummer shutdown did not materialize to the degree expected.

SAN FRANCISCO

Despite an undercurrent of rather pessimistic feeling, for which there is no actual justification, business continues very good. The electrical contracting business is in the throes of the usual summer let-up, but the number of big jobs under way is gratifying. Credits are being very jealously extended, and banks are lending money sparingly.

Schedule Material—There is a big and constant demand for all kinds of schedule material, and even manufacturers and jobbers who anticipated this demand find that past accumulations of stock are not sufficient in themselves. Deliveries are good, although retarded by the Eastern freight embargoes. These have been minimized by some firms, which have routed their shipments, partly at least, through Canada.

Wall Boxes and Covers.—The market is in a very disorganized state, for deliveries are poor and apparently are being scheduled with strictness by Eastern manufacturers.

Conduit.—Local deliveries are better, several carloads having been received and redistributed. There are signs that some stocks will actually accumulate during the next few weeks.

Heating Material.—Recent advances in certain lines, especially in irons, have apparently retarded business, although some of this may be due to the usual decrease in demand. Indications are that other manufacturers will raise their prices. For hollow ware, such as percolators, etc., there is an increase rather than a decrease in calls. Waffle irons are especially popular.

Line Material.—Cross-arm braces, machine bolts, lag screws and other pole-line hardware are well stocked, and the call is justifying the large coast stocks accumulated during the past two months.

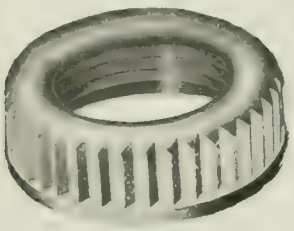
Sewing Machines.—Demand for sewing machines has dropped to a certain extent, and most dealers are well stocked or even overstocked.

New Apparatus & Appliances

A Record of Latest Developments
and Improvements in Manufacturers' Products
Used in the Electrical Field

Rigid Conduit Bushings

Walker Brothers & Haviland, Otis Building, Philadelphia, are marketing "knurled bushings" for rigid steel conduit. They are made of solid zinc and

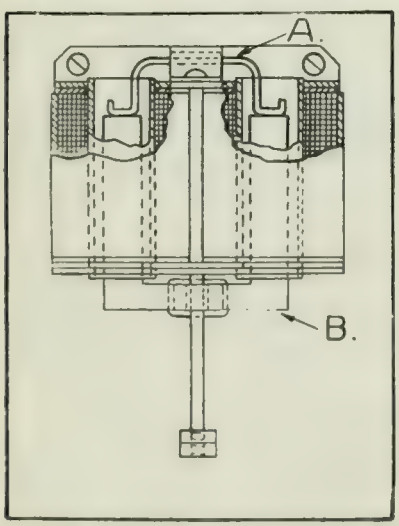


MADE OF ZINC TO OFFSET RUST

are rust-proof, the manufacturer says. The entire outer surface is knurled to fit pliers, and the flange at the bottom covers the hole in the outlet box.

Alternating-Current Magnet

A no-voltage trip coil for use on alternating current is being marketed by the Palmer Electric & Manufacturing Company, Cambridge, Mass., and combines the features of the solenoid and the electromagnet. It consists of a pair of solenoid coils having two opposing U-shaped armatures, which, when the solenoid is energized, float freely in the magnetic field. An alternating-current magnet of this type embodies the long range of action



FOR USE WITH PREDETERMINED LOW-VOLTAGE CONDITIONS

characteristic of the solenoid, with a drop-out feature adjustable through 90 per cent of the voltage range, according to the manufacturer, and chattering is eliminated. In usual construction this magnet operates as a relay, and its use is applicable to low-voltage breakers on circuits subject to a wide range of potential variation and in which it is desirable that the automatic trip be arranged so that it will not operate except upon predetermined low-voltage conditions.

Electric Fountain

An electrically driven fountain has been placed on the market by the Jewel Electric & Manufacturing Company, Ravenswood, Chicago. No water connection is needed as the same water is used over and over. A small universal motor, connected to a small centrifugal pump, circulates the water, drawing it from the basin and projecting it upward through small nozzles to a height of about 14 in., whence it falls over a luminous globe back into the basin. The fountain holds three quarts of water, about one quart a day evaporating into the air.

Lamp-Cord Adjuster

The "Gem" lamp-cord adjuster for ceiling attachment is being marketed by the M. B. Austin Company, 700 Jackson Boulevard, Chicago. An insulator, which carries the lamp cord, is attached to a sheet-metal drum by a heavy cord which is wound up by a spring. Three brass dogs on the drum catch on a shoulder in the steel hanger.

Notes on Recent Appliances

Automatic Arc Welder

The General Electric Company is marketing an automatic arc welder.

Flexible Woven Cable

The Flexible Woven Cable Company, Boston, Mass., is marketing its "Hard-service" flexible woven cable for portable work.

Appliance Connector Plug

The Gray-Heath Company, 1440 Michigan Avenue, Chicago, has brought out a connector plug for household appliances.

Induction-Motor Starting Switch

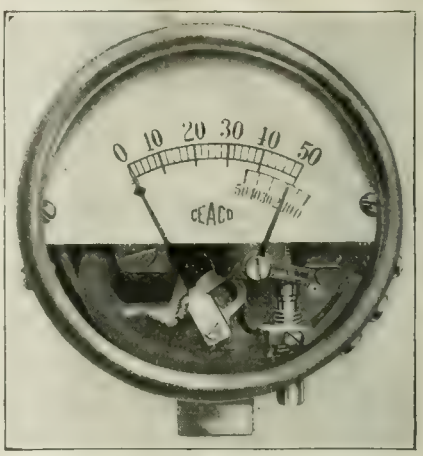
A star-delta starting switch for induction motors is being made by the Union Electric Manufacturing Company, Milwaukee, Wis.

Wireless Regenerative Tuner

The Precision Equipment Company, Cincinnati, Ohio, is marketing a new type of regenerative tuning instrument for wireless receiving circuits.

Automatic Control for Industrial Heating Service

An electric control capable of holding temperatures within 1 deg. and pressures within 0.5 lb. from any set point, says the manufacturer, has recently been placed on the market by the Cobb Electric Appliance Company, Forest Hills, Boston. The device, known as the "Ceaco" control, does away with thermostatic or rheostatic regulations and is designed to control

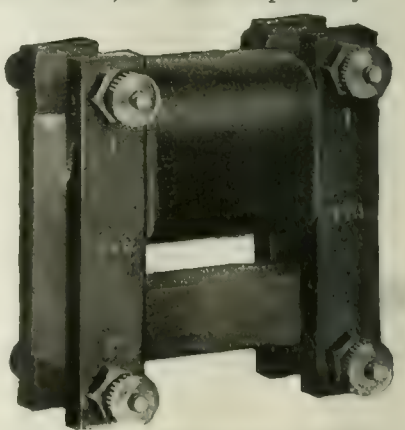


KEEPS CLOSE REGULATION OF TEMPERATURE AND PRESSURE

temperature from 3 deg. Fahr. above zero to any desired degree and any steam or air pressure. For heavy current work a relay contact is used. The control is being used on celluloid tables, dipping tanks, vulcanizers, etc., and is designed to maintain its sensitiveness without adjustment during long periods of continuous use.

Amplifying Radio Transformer

In the amplifying radio transformer, "Arco," developed by A. H. Corwin & Company, 4 West Park Street, Newark, N. J., the coils are wound on a laminated core with a ratio of four to fifteen. The direct-current resistances of the primary and secondary are 1,000 ohms and 5,000 ohms respectively. A



CAN BE MOUNTED IN ANY POSITION

simple mounting is provided, consisting of four binding posts mounted on strips of black bakelite, permitting the instrument to be mounted in horizontal or vertical positions. The weight of the instrument is 2 lb

MANUFACTURERS' ACTIVITIES

Record of Changes Affecting Sales and Distribution Together with Trade Personals and Notes on Foreign Trade, Jobbers' News and New Trade Literature

SAMUEL H TAYLOR, general manager of the Electrical Railway & Manufacturers' Supply Company, San Francisco, Cal., was chairman of the business program committee at the convention of the Electric Supply Jobbers' Association held recently at Del Monte. Mr Taylor has the distinction of being the oldest jobber, in years of service, on the Pacific Coast as he has directed the destinies of the Electric Railway & Manufacturers' Supply Company since its organization in 1898.

W M. McKINSTRY is in charge of the Chicago district sales office, McCormack Building, of the George T. Ladd Company, Pittsburgh, Pa.

THE FAFNIR BEARING COMPANY, New Britain, Conn., has recently appointed Rufus N Hennenway manager of the industrial bearings division, which includes the sale of double bearing transmission boxes.

THE ELECTRIC SPECIALTY COMPANY, Stamford, Conn., manufacturer of fractional-horsepower motors for special requirements, during the past year has made extensions to its plant, more than doubling the former capacity. It has a large volume of unfilled orders and finds it necessary to decline a large percentage of the business now being offered.

CHARLES F. KETTERING, president of the Delco Light Company, was recently elected president of the Engineering Club of Dayton, Ohio.

THE ROLLER-SMITH COMPANY, 233 Broadway, New York City, held a sales conference at its works at Bethlehem, Pa., on June 14, 15 and 16. In addition to regular business conferences and inspection trips through the works, there were several social functions.

THE FRANK ADAM ELECTRIC COMPANY, St. Louis, has recently opened warehouses in Detroit, Pittsburgh, New Orleans and Minneapolis, where stocks will be carried for local distribution.

THE ALLAN MANUFACTURING & WELDING CORPORATION announces the removal of its plant from 520 Ellicott Street to 163 Adams Street, Buffalo, N. Y., effective July 1.

THE YALE & TOWNE MANUFACTURING COMPANY, New York City, has elected Willard L. Case as secretary, effective July 1, though he will not take office till Sept. 1. Mr Case succeeds John B. Milliken, who recently resigned.

THE SUNLIGHT ELECTRIC COMPANY is now located in the Insurance Exchange Building, 175 West Jackson Boulevard and Wells Street, Chicago.

THE ELECTRIC SUPPLY & EQUIPMENT COMPANY, Hartford, Conn., has filed a notice of an increase of $184,950 in capital stock.

THE PETTINGELL-ANDREWS COMPANY, Boston, Mass., held its employees' outing at Nantasket Beach last month, at which about 250 persons were present.

THE HOPEWELL INSULATION & MANUFACTURING COMPANY, Hopewell, Va., will soon place in operation a plant for the manufacture of hard-rubber, composition and molded insulation parts and high-tension insulators for wireless and transmission purposes.

THE FEDERAL BATTERY SERVICE, INC., 1525 Seventh Street, N. W., Washington, D. C., manufacturer of batteries, etc., is planning extensions to its service, including the establishment of stations in other large cities.

THE H S B W—COCHRANE CORPORATION, Philadelphia, successor to the Harrison Safety Boiler Works, has acquired a group of factory buildings, including machine shops, foundry and offices, at 3120 North Seventeenth Street. The new plant will be utilized by the company in connection with its standard power-plant equipment and specialties.

THE ST LOUIS ELECTRICAL WORKS announce the appointment of J. F. Jones as sales manager. Mr Jones was connected with the sales department of the Wagner Electric Manufacturing Company for eleven years. Previous to that he was with the General Electric Company for eight years in the sales department.

E. T. USTICK, JR., formerly with the Blue Bird Washing Machine Company, St. Louis, has taken over the distribution of the lighting plants manufactured by the Universal Products Company, Sandusky, Ohio, and Oshkosh, Wis., in Missouri territory tributary to St. Louis and the southern portion of Illinois. Mr. Ustick has established an office at 416 Title Guaranty Building, St. Louis, and has associated with him William Attebury, formerly of the Mississippi Valley Trust Company.

THE ANDERSON ELECTRIC & EQUIPMENT COMPANY has removed its works to a factory building at 154-160 Whiting Street, Chicago, where it has much larger quarters.

THE NEBRASKA MOTOR POWER COMPANY, Grand Island, Neb., has established a main office at 202 South Twenty-fourth Street, Omaha. The company acts as distributer for the Matthews electric light and power plants, "Motor Marvel" electric washing machines, "America" vacuum cleaners and McClelland ice refrigerating plants for western Iowa, Nebraska and part of South Dakota. It also contemplates handling a large number of other electric household specialties.

THE CARBORUNDUM COMPANY, Buffalo Avenue and Eighteenth Street, Niagara Falls, N. Y., has made arrangements for rebuilding the portion of its works recently destroyed by fire. The cost is estimated at about $50,000.

THE HERTNER ELECTRIC COMPANY, Cleveland, Ohio, contemplates the construction of a factory for the manufacture of electrical supplies on Elmwood Avenue, near Berea Road.

THE KUHLMAN ELECTRIC COMPANY, Bay City, Mich., has filed notice of an increase in capital stock from $75,000 to $150,000 to provide for extensions and its increasing business.

THE AJAX ELECTRIC SPECIALTY COMPANY, St. Louis, Mo., is issuing $100,000 in 8 per cent cumulative preferred stock and $5,000 in common stock in order to permit the company to increase its facilities to handle the business in view.

FREDERIC W. ERICKSON and HENRY M. TAYLOR, consulting engineers, announce the opening of offices at 886 Madison Avenue, New York City, for the practice of electrical, civil and mechanical engineering.

J. E. JENNINGS, vice-president and secretary of Milliken Brothers Manufacturing Company, New York City, has recently sailed for Europe for an extended tour. The company has recently secured a large European contract for galvanized-steel transmission towers.

E. S. LINCOLN, INC., 534 Congress Street, Portland, Me., consulting electrical engineer, is successor to Lincoln, Hanson & Abbott, Inc. Mr. Hanson and Mr. Abbott are no longer connected with the firm.

PARSONS, KLAPP, BRINCKERHOFF & DOUGLAS, formerly Barclay, Parsons & Klapp, announce the removal of their general and engineering offices from 60 Wall Street to their own building at 84 Pine Street, New York City; also the executive offices of their subsidiary and operated corporations and properties and the Parklap Construction Corporation.

THE JACKSON ELECTRIC MOTOR REPAIRING COMPANY, Bellevue Avenue, Trenton, N. J., is planning to erect a one-story building, 42 ft. x 100 ft., to cost about $10,000 on property recently acquired on Belvidere Street.

THE DOMESTIC VACUUM CLEANER COMPANY, 41 Jackson Street, Worcester, Mass., has recently acquired the plant of the Worcester Machine Screw Company, which it will remodel and put into operation before the end of the year.

DWIGHT P. ROBINSON & COMPANY, INC., 125 East 46th Street, New York City, is the name of the organization resulting from the consolidation of Dwight P. Robinson & Company with Westinghouse, Church, Kerr & Company, Inc. The name of Westinghouse, Church, Kerr & Company, Inc., as used in these columns last week, was used in error, attributable to an absence from the city.

Supply Jobbers' Notes

THE ERNER ELECTRIC COMPANY 4500 Euclid Avenue, Cleveland, Ohio, has appointed Warner Jones manager of sales. Mr. Jones has been connected with sales work in the electrical field for nearly twenty-two years, having been with the Nungasser Carbon & Battery Company until that company was consolidated with the National Carbon Company; since then he has been sales manager of the Dayton Fan & Motor Company.

THE WESCO SUPPLY COMPANY, Seventh to Eighth Street and Clark Avenue, St. Louis, Mo., distributer of electrical supplies, announces that it has taken on several new lines this year and has abandoned lines. Under a reorganized operating personnel, John L. Buchanan is president, George M. Ellis vice-president and general manager, and L. R. Link secretary and treasurer.



PETTINGELL-ANDREWS OUTING NUMBERED ABOUT 250 PERSONS

THE WESTERN ELECTRIC COMPANY, 195 Broadway, New York City, has opened a new supply sub-warehouse at 930 West Ryan Avenue, Youngstown, Ohio. C. A. Strouss is in charge of sales.

Foreign Trade Notes

S. FUKUNAKA, chief engineer of the Nippon Electric Power Company, Osaka, Japan, is in America to buy equipment for a new hydro-electric development which will transmit power about 200 miles into Osaka. Headquarters are established at the Japanese-American Trade Bureau, Longacre Building, Broadway and Forty-second Street, New York City.

GLASS INDUSTRY IN CZECHOSLOVAKIA.—The production of the glass factories in Czechoslovakia is constantly increasing. Twenty-four factories manufacturing lighting fixtures, globes, shades, etc., are operating at 60 per cent capacity. Before the war 80 per cent of these products manufactured in the former Austro-Hungarian Empire were exported.

THE WESTINGHOUSE ELECTRIC INTERNATIONAL COMPANY, East Pittsburgh, Pa., has appointed the following as foreign managers: F. M. Rodgers, London, England, European manager; J. W. White, Royal Bank of Canada Building, Havana, Cuba, manager for Cuba, and L. T. Peck, Bartolome Mitre, 754, Buenos Aires, manager for Argentina.

SMALL ELECTRIC LIGHT PLANTS IN CHINA.—With the return from abroad of numerous wealthy Chinese who are establishing themselves in the Amoy district, at a distance from the regular electric service stations, it is thought in that country that a market will develop for small electric generating plants. A branch of a Shanghai agency for such plants has already been opened there, in charge of an American-trained Chinese electrical engineer.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning this number.

A man in Costa Rica (No. 33,155) desires to purchase electrically driven emery wheel grinders.

A manufacturing company in Austria (No. 33,170) desires to purchase for immediate shipment about 300 metric tons of sheet iron for generators and about 100 tons of high-alloy sheet iron for transformers.

An electrical engineer in Scotland (No. 33,175) desires to purchase open-air switches and fuses for transmission lines of 22,000 volts.

Trade Publications

INSULATION.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued miniature catalog 5-A-1, in which it describes its insulating materials and supplies.

SUPERHEATERS.—The Locomotive Superheated Company, New York City, has issued bulletin No. T-6, on superheaters for stationary power plants.

TRANSMISSION LINES.—The British Aluminum Company, Ltd., 109 Queen Victoria Street, London, England, is circulating a booklet entitled "From the Falls to the Factory" in which it gives special attention to American practice in transmission-line engineering.

ELECTRIC SUPPLIES.—The Electric Service Supplies Company, Philadelphia, New York and Chicago, has issued catalog No. 6, covering all its products. The book contains 608 pages giving price lists and other data on its apparatus, including marine searchlights, turbo-generators, headlight switches, armature repair machinery, coil-winding machinery, etc.

OIL CIRCUIT BREAKERS.—The Westinghouse Electric & Manufacturing Company has issued six bulletins, Nos. L-3965-70, on oil circuit breakers.

New Incorporations

THE COURTLAND (MINN.) ELECTRIC COMPANY has been incorporated with a capital stock of $25,000 by Max Friederich and others.

THE ROLETTE (N. D.) MILL & LIGHT COMPANY has been incorporated by George Mongeon and others. The company is capitalized at $15,000 and proposes to operate a flour mill and light plant.

THE HOUSTON POWER COMPANY, Dothan, Ala., has been incorporated with a capital stock of $100,000 by J. L. Crawford and others, to construct and operate an electric light and power plant.

THE EMPIRE POWER COMPANY, Anacortes, Wash., has been incorporated to develop water power on the Skagit and Cascade Rivers. The officers are: H. A. Hull, president; Charles Freeman, vice-president, and Fred Lyons, secretary.

THE MADAWASKA LIGHT & POWER COMPANY, Edmundston, N. B., has been incorporated with a capital stock of $300,000 by John M. Stevens, Aaron Lawson and J. Frank Rice, all of Edmundston.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

LEBANON, N. H.—The Grafton County Electric Light & Power Company of Lebanon contemplates increasing its developments on the Mascoma River. A new plant will be erected and equipment rated at 800 kw. will be installed, with the possiblity of 400 kw. more. The cost of the project is estimated at about $800,000.

BARRE, VT.—Work will soon be started on construction of a foundation for a new generating unit to be installed in the Pioneer station, of the Montpelier & Barre Lighting & Power Company affording an additional capacity of 3,500 hp.

ST. ALBANS, VT.—The Hemlock and Green Mountain water powers have been sold to the Public Electric Lighting Company of St. Albans, and improvements, including the erection of dams, are contemplated. It is estimated that the plants will generate about 5,000 hp.

LOWELL, MASS.—Commissioners Murphy and Marchand have reported favorably on the petition of the Lowell Electric Light Corporation to lay and maintain underground conduits in West Adams, Wilder and Marginal Streets.

WORCESTER, MASS.—The committee on street lamps is considering the extension of ornamental street lamps from Venice Square to the Lake Bridge and on Main Street from Castle to May Streets.

WORCESTER, MASS.—An appropriation of $31,000 has been made for the purchase of new equipment for the municipal electric light plant, to take care of increased service.

BERLIN, CONN.—The installation of a street-lighting system on Worthington Ridge is contemplated.

NEW HAVEN, CONN.—The Board of Directors of the Springside Farm contemplate the installation of new electrical equipment at the institution.

SOUTH NORWALK, CONN.—The question of increasing the capacity and improving the facilities of the South Norwalk Electric Works is under consideration.

Middle Atlantic States

BROOKLYN, N. Y.—The General Laundries, Inc., Myrtle Avenue, contemplates the construction of a power plant to be used in connection with its factory service.

MARCY, N. Y.—The Utica State Hospital (Marcy Division) contemplates underground electric service connections. Plans call for twelve transformers of various sizes and running electric three-wire feeder in present ducts. The estimated cost is about $18,000.

MORRISTOWN, N. Y.—The Brier Hill Electric Light Company has made application for permission to construct a local electric light plant.

NEW YORK, N. Y.—Contract has been awarded to the Kenn-Well Contracting Company, 841 Broadway, by the New York Edison Company, for the erection of a transformer station on Seventy-third Street, to cost about $150,000.

NEW YORK, N. Y.—Contract has been awarded to John C. Williams, Inc., 233 Broadway, by the Fletcher Company for the erection of a power plant at its factory on Varick Street.

RUSSELL, N. Y.—Application has been made to the Public Service Commission by the St. Lawrence Transmission Company of Potsdam for permission to construct a power plant at Russell.

WATERTOWN, N. Y.—F. W. Woolworth, 233 Broadway, New York, has awarded contract to C. T. Wills, 286 Fifth Avenue, for the erection of a store and office building to cost about $800,000. Jardine, Hill & Murdock, 50 East Forty-second Street, are engineers.

BAYONNE, N. J.—The City Commission has voted to install a "white way" street-lighting system on Broadway from Fifth to Eighteenth Street and from Twenty-fourth to Forty-second Street.

CAMDEN, N. J.—Contract has been awarded to the Raymond Concrete Pile Company, Thirtieth and Schuylkill Streets, Philadelphia, Pa., by the Victor Talking Machine Company for the erection of an addition to the power house at its local plant.

CLAYTON, N. J.—The local lighting company has been ordered by the Borough Council to replace all parts of the distribution system operating with defective wires.

NEWARK, N. J.—Application has been made to the State Board of Public Utility Commissioners by the Public Service Company for permission to issue additional capital stock of $3,000,000, part of the proceeds to be used for additions to equipment and for distribution and transmission lines.

PATERSON, N. J.—Royal Hasco, Inc., Peel Street, will erect a power house at its local textile mill, to cost about $25,000.

PEQUANNOCK, N. J.—The Tri-County Electric Company has been granted permission by the Board of Public Utility Commissioners to issue $17,800 in securities for extensions to its distribution system in Pequannock Township. Energy will be furnished by the municipal plant at Pompton Lakes.

ALLENTOWN, PA.—The Allentown Rapid Service Company will erect an engine, boiler and power house in connection with its new ice-manufacturing plant now under construction at Seventeenth Street and Summer Avenue. The cost, including machinery, will be about $130,000.

ALTOONA, PA.—The erection of a transmission line in the vicinity of Twin Rocks is being planned for by the Penn Central Power Company. Day & Zimmerman, 611 Chestnut Street, Philadelphia, are engineers.

EALLS, PA.—The Boys' Industrial Home contemplates the construction of a dairy at White's Ferry, to cost about $100,000, including the installation of electric light and power equipment.

HARRISBURG, PA.—Applications have been received by the Public Service Commission from the following companies for permission to issue stock for proposed extensions and improvements to electric power plants and systems: Conemaugh Power

Company, Johnstown, $500,000; Palmerton Lighting Company, Palmerton, $17,000; West Penn Power Company, Pittsburgh, $75,000; Beaver County Light Company, Pittsburgh, $33,500.

PHILADELPHIA, PA.—John Friedrich contemplates the erection of a power house at his factory on North Lawrence Street.

PHILADELPHIA, PA.—The Robinson Dairies contemplate the erection of a power house, 95 ft. x 48 ft., and an office building, on Kensington and Hunting Park Avenues.

PITTSBURGH, PA.—Permission has been received by the Duquesne Light Company to erect two high-tension electric transmission lines over the Allegheny River to a point near Colfax, extending to Plum Township. The lines will connect the company's plant at Colfax with the substation at Woodville.

ST. MARY'S, PA. Bids will be received by F. Arthur Rianhard, architect, Masonic Temple, Williamsport, until July 26, for the reconstruction of a monastery into a hospital building and the erection of a power house, to cost about $100,000.

SOUTH BETHLEHEM, PA. A proposition has been made to reconstruct and extend the fire alarm and police signal systems in the city, at a cost of about $200,000.

UNIONTOWN, PA.—Bids have been received by the Aaron Furniture Company for the erection of a nine-story mercantile building. Electric light equipment and electric elevators will be installed. Albert Kahn, Marquette Building, Detroit, Mich., is architect.

LEWES, DEL. The Navy Department, Washington, D. C., has had plans prepared for the erection of a new radio compass station on the old artillery grounds in the vicinity of Lewes Beach.

BALTIMORE, MD. The Consolidated Gas, Electric Light & Power Company will erect a substation on Philadelphia Road, to cost about $42,000.

CUMBERLAND, MD. The Baltimore & Ohio Railroad, it is understood, is planning for the electrification of about 17 miles of line, from Piedmont to Altamount, Garrett County. J. H. Davis is chief electrical engineer.

LAUREL, MD.—C. L. Reeder, engineer, Park Avenue and Saratoga Street, Baltimore, has been commissioned to prepare plans and specifications for the erection of a municipal electric distributing plant, to cost about $25,000.

OAKLAND, MD.—Plans are under consideration by the Borough Council for the installation of a new electric light and power system, to cost about $50,000.

PETERSBURG, VA. Contract has been awarded to the Ambursen Construction Company, 186 Fifth Avenue, New York, N. Y., by the Chesterfield Manufacturing Company for the erection of a hydro-electric plant on Swift Creek.

GREAT CACAPON, W. VA. The Morgan Power Company has been recently incorporated and a charter has been granted for the development of water power in Morgan and Hampshire Counties.

RIDGELEY, W. VA. A local electric distribution system will be installed at a cost of about $12,000. The Edison Electric Illuminating Company of Cumberland will furnish the energy.

North Central States

DETROIT, MICH. Bids will be received by the Public Lighting Commission, 56 East Atwater Street, until July 20 for electric lighting equipment to include conduits, lamp-post foundations for various streets, etc.

DURAND, MICH.—Improvements to the municipal electric light and water plant to cost about $100,000 are contemplated.

JACKSON, MICH.—New construction and improvements involving an expenditure of $6,000,000 are under consideration by the Consumers' Power Company. Plans include the installation of new equipment at Battle Creek station increasing the capacity by 25,000 kw., and the 40,000-volt transmission lines from Owosso and Argenta to Battle Creek and from Battle Creek to Jackson will be raised to 140,000 volts. Also a new type outdoor substation will be erected at Grand Rapids Monteith, Argenta, Kalamazoo, Jackson, Muskegon, Flint, Saginaw and Junction Dam.

AKRON, OHIO.—The proposal to issue $1,000,000 in bonds for the erection of a new municipal electric light and power plant was rejected by the City Council.

CLEVELAND, OHIO. A proposition to issue bonds will be submitted to the voters on Aug. 10 for the purpose of replacing all street and park gas lamps with electric lights.

DELAWARE, OHIO.—A committee appointed by the City Council is considering the erection of an electric light and power plant.

LITCHFIELD, ILL. The installation of a "white way" street lighting system in the business section is contemplated.

NEWTON, ILL. A proposition to issue bonds to the amount of $20,000 for extensions and improvements to the municipal electric light and power plant will soon be submitted to the voters. Fuller & Beard, Chemical Building, St. Louis, Mo., are engineers.

PALMYRA, ILL.—Petition has been filed with the Illinois Public Utilities Commission by the Palmyra Light, Heat & Power Company for permission to extend its lines to Rohrer station and for authority to furnish power to residents along the proposed route.

BIRON, WIS. A company is being organized for the purpose of erecting an electric transmission line from Biron to Auburndale. A question is under consideration as to the advisability of extending a line to Marshfield.

MILWAUKEE, WIS.—Bids will soon be received by the American Metal Products Company, 671 Kinnickinnic Avenue, for the erection of a machine shop and foundry, 80 ft. x 200 ft. Electric motors will be required.

TWO RIVERS, WIS.—Plans are under way for the construction of a high school to cost about $400,000. John D. Chubb, Dearborn Street, Chicago, Ill., is architect.

MINNEAPOLIS, MINN.—Bids will be received by the Flour State Baking Company until July 15 for electric light and power equipment, freight elevators, etc., to be installed, at a cost of about $40,000, in a new bakery now under construction. Terry-Schulte Engineering Company, Endicott Building, St. Paul, Minn., is engineer.

ST. JOSEPH, MO.—The St. Joseph Heat, Light & Railway Company plans the enlargement of its electric power plant and the installation of new equipment.

ST. LOUIS, MO.—The erection of a power house and morgue building at the Robert Koch Hospital, to cost about $23,000 is contemplated.

CAMPBELL, NEB.—At an election to be held soon the proposition to issue $10,000 in bonds for improvement to the electric lighting system will be submitted to the voters.

Southern States

CAMILLA, GA. The Baker County Power Company, located at Barnett Shoals on the Notchaway River, is making progress in the erection of a dam as the first step in developing a power plant to supply 250,000 hp. The company also contemplates the construction of a plant of equal capacity at Lurks Shoals near Hoggards Mills.

ST. PETERSBURG, FLA. Bonds to the amount of $28,000 have been voted for extensions to the street-lighting system.

BIRMINGHAM, ALA.—The erection of a power plant to cost about $2,500,000 is contemplated by the Tennessee Coal, Iron & Railroad Company.

FLORENCE, ALA.—A committee has been appointed by the Florence chamber of commerce to investigate the cost of the installation of a hydro-electric plant on Cypress Creek for the purpose of supplying light and power to Florence.

GADSDEN, ALA. The Lehigh Portland Cement Company plans the erection of an electric transmission line from the plant of the Alabama Power Company to the Cement Company's quarries in eastern Etowah County.

DURANT, MISS.—Bonds to the amount of $81,000 have been voted for the purchase of a new generating unit to be installed at the municipal electric light plant.

LITTLE ROCK, ARK.—Application has been made by the Little Rock Railway & Electric Company for permission to issue $313,000 in bonds, of which $263,000 will be used for improvements to the water plant and $50,000 for the purchase of transformers, meters and other electrical equipment.

TALLULAH, LA.—The Tallulah Light & Power Company contemplates the construction of additions to its plant to cost about $10,000.

ANSON, TEX.—The Anson Light & Power Company contemplates rebuilding its plant recently destroyed by fire.

FLORESVILLE, TEX.—The plant of the Floresville Light & Power Company has been purchased by J. D. Spruce & Sons of Waco, who plan to install an additional plant.

FORT WORTH, TEX.—The Colton Belt Railway Company has awarded contract to the W. C. Hedrick Construction Company, South Western Life Building, Dallas, for the erection of a roundhouse and a number of other buildings, to cost about $185,000. Electric light equipment will be required.

HOUSTON, TEX. Plans are under consideration by the City Council for the erection of a power plant to cost about $60,000.

KILGORE, TEX.—The installation of an electric light plant in Kilgore to cost about $8,000, is under consideration by the city commissioners.

MERCEDES, TEX.—The Llano Grande Plantation Company, Scanlon Building, Houston, contemplates the construction of a local power house and the erection of a 2,300-volt transmission line in Mercedes.

PORT ARTHUR, TEX.—The Eastern Texas Electric Company plans to erect an addition to its generating station, to cost about $600,000, including the installation of a 4,000-kw. turbo-generator, two 665-hp. boilers with auxiliary equipment and pumps. Stone & Webster, Inc., 147 Milk Street, Boston, Mass., are engineers.

Pacific and Mountain States

HOLLYWOOD, CAL.—A proposition to issue $30,000 in bonds will soon be submitted to the voters for the installation of a proposed ornamental street-lighting system.

STOCKTON, CAL.—The National Paper Products Company contemplates the installation of considerable electrical and mechanical machinery in an addition to be erected at its plant and to cost about $1,000,000.

BRIGHAM CITY, UTAH.—The city officials have decided to replace the present municipal electric light plant with a new and modern generating plant in order to develop the maximum electrical energy on Box Elder Creek.

BONNERS FERRY, IDAHO.—The installation of an electric light plant to cost about $50,000 is under consideration by the City Council.

Canada

CALGARY, ALTA.—Bids will soon be received for the construction of 2,500 miles of rural and toll telephone lines in Alberta.

CALGARY, ALTA.—Plans are under way for the construction of a service building, nurses' home and a power house for the General Hospital. J. B. Richards is city architect.

FORT SASKATCHEWAN, ALTA.—A by-law has been passed authorizing the installation of an electric lighting system. H. F. Greenwood is town clerk.

VANCOUVER, B. C.—The Bridge River Power Company is having plans prepared by W. R. Bonnycastle, architect, 1950 Haro Street, for the construction of a power house. Plans include six units to cost about $5,000,000 each and the development of 400,000 hp.

DESERONTO, ONT. Bids will be received by R. C. Desrochers, secretary Department of Public Works, Ottawa, until July 13 for the construction of electric wiring to be installed in the Public Building at Deseronto. Plans and specifications may be obtained at the offices of the chief architect, Department of Public Works, Ottawa, the caretaker, Public Building, Deseronto, and the Superintendent of Dominion Buildings, Postal Station "F," Toronto.

NEWMARKET, ONT.—The municipal electric light and water plant was recently destroyed by fire, causing a loss of about $10,000.

TORONTO, ONT.—The United Hotels, King Edward Hotel, has awarded contract to P. H. Secord & Sons, 133 Nelson Street, for the construction of an extension to the King Edward Hotel to cost about $2,000,000. Electric light equipment and electric elevators will be installed.

MONTREAL, QUE.—Bids have been received for the construction of a power house for the Berliner Gram-o-phone Company, St. Antoine Street.

(Issued June 15, 1920)

1,343,208. ELECTRIC ARC-WELDING SYSTEM; Hans Fahnoe, Pittsburgh, Pa. App. filed Sept. 8, 1919. Transformer automatically regulates voltage.

1,343,211. SYSTEM OF CONTROL; Rudolf E. Hellmund, Swissvale, Pa. App. filed Oct. 24, 1916. Regenerative control for electric railway.

1,343,212. STARTING DEVICE FOR ELECTRIC MOTORS; George W. Huey, Wilkinsburg, Pa. App. filed March 8, 1917. Fluid starter.

1,343,221. DYNAMO-ELECTRIC MACHINE; Chester B. Mills, East McKeesport, Pa. App. filed Jan. 5, 1918. Durable field terminals.

1,343,222. STARTING SYSTEM FOR AUTOMOBILES; Chester B. Mills, East McKeesport, Pa. App. filed June 30, 1915. Shifts motor longitudinally.

1,343,242. WELDING TOOL; Richard E. B. Wakefield, Wilkinsburg, Pa. App. filed Nov. 6, 1919. For holding electrode.

1,343,251. CABLE SPLICE; James F. Dillon, Crown City, Ohio. App. filed April 20, 1918. Sleeve with diagonal ends.

1,343,256. SELECTIVELY OPERATED CIRCUIT-CONTROLLING DEVICE; Joseph C. Field, Orange, N. J. App. filed May 18, 1916. Step-by-step telephone control.

1,342,306. DUPLEX TRANSLATING CIRCUITS; John R. Carson, Montclair, N. J. App. filed Sept. 5, 1916. Having pair of input and pair of output circuits.

1,343,307. DUPLEX TRANSLATING CIRCUITS; John R. Carson, Montclair, N. J. App. filed Sept. 5, 1916. Signaling circuits.

1,343,308. DUPLEX TRANSLATING CIRCUITS; John R. Carson, Montclair, N. J. App. filed Sept. 5, 1916. Telephone signaling circuits.



1,343,242. Welding Tool

1,343,345. ELECTRICAL SYSTEM; James M. Brown, Pittsburgh, Pa. App. filed Dec. 2, 1916. Motor control.

1,343,362. ELECTRICAL SIGNALING OR INDICATING APPARATUS ESPECIALLY APPLICABLE FOR SIGNALING ORDERS AND NUMERICAL DATA; Edward A. Graham, Brockley, London, England. App. filed May 16, 1919. Step-by-step telephone signal.

1,343,372. ATTACHMENT FOR SPARK PLUGS; William J. O'Gorman, New York, N. Y. App. filed May 11, 1918. Auxiliary spark gap.

1,343,380. HARD-RUBBER BATTERY JAR AND METHOD OF MAKING THE SAME; Harry Weida, Highland Park, N. J. App. filed Oct. 26, 1916. Devoid of joints.

1,343,393. METHOD OF AND APPARATUS FOR DETECTING AND OBSERVING OBJECTS IN THE DARK; Samuel O. Hoffman, San Francisco, Cal. App. filed April 8, 1919. Detects thermal radiation.

1,343,404. ALTERNATING-CURRENT ELECTROMAGNET; Granville E. Palmer, Boston, Mass. App. filed Dec. 10, 1918. No chatter nor residual effect.

1,343,409. ELECTRIC STARTING AND GENERATING SYSTEM; Elmer H. Schwartz, Glen Rock, N. J. App. filed May 16, 1916. For engine-cranking motor.

1,343,411. STARTING MECHANISM FOR ELECTRIC MOTORS; George E. Slocum, Cleveland, Ohio. App. filed March 9, 1917. Automatic starter.

1,343,451. METHOD AND APPARATUS FOR STARTING MOTORS; John H. Hertner, Cleveland, Ohio. App. filed Dec. 24, 1915. For motor-generator.

1,343,462. TELEPHONE-EXCHANGE AUTOMATIC SWITCHING SYSTEM; Edward A. Mellinger, Chicago, Ill. App. filed Sept. 4, 1908. Non-numerical trunking switch.

1,343,472. COMPRESSIBLE RHEOSTAT; Antonio Papini, Philadelphia, Pa. App. filed March 23, 1920. Reduces commercial voltages for bell ringing.

1,343,475. CUT-OUT SWITCH FOR MINE TROLLEYS; John Rakosky, Jerome, Pa. App. filed April 28, 1917. For sectionalizing trolley wire.

1,343,489. SYSTEM FOR INTERCONNECTING MANUAL AND AUTOMATIC TELEPHONE-EXCHANGES; George D. Wolf, Chicago, Ill. App. filed Sept. 14, 1914. For extending connections from manual to auto-

Record of Electrical Patents

Notes on United States Patents

1,343,512. APPARATUS FOR THE TREATMENT OF LOSS OF HAIR ON THE HEAD; Joseph Krauer, Heaton Chapel, near Manchester, Eng. App. filed May 1, 1916. Electric heater.

1,343,524. SAFETY-ZONE INDICATOR; Stanley H. Shackelford, Washington, D. C. App. filed June 1, 1917. Lowered into pavement when idle.

1,343,551. MEANS FOR SUPPORTING ELECTRODE IN IONIC TUBES; Oswald Durdle, London, Eng. App. filed Aug. 9, 1918. Cylindrical anode supported from both ends.

1,343,562. CONTROL MEANS FOR VACUUM-TUBE CIRCUITS; Raymond A. Heising, East Orange, N. J. App. filed Sept. 21, 1915. To change oscillatory conditions.

1,343,573. ELECTRIC LAMP HOLDER; Victorio Martinez, Habana, Cuba. App. filed June 4, 1917. Push-button socket.

1,343,592. TROLLEY; Henry J. Spoden and James B. Welsh, St. Cloud, Minn. App. filed June 30, 1919. Spring in trolley head.

1,343,597. SYSTEM OF ELECTRICAL DISTRIBUTION; William A. Turbayne, Niagara Falls, N. Y. App. filed Nov. 15, 1915. For car lighting.

1,343,599. X-RAY SYSTEM; Harry F. Waite, New York, N. Y. App. filed Oct. 6, 1917. Heating current and X-ray current generated in same transformer.

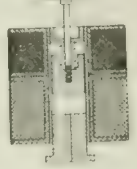
1,343,607. ELECTRIC ARC-WELDING MACHINE; James L. Adams, Jr., and Horace H. Welch, Milwaukee, Wis. App. filed Nov. 10, 1919. Automatic feed.

1,343,662. PROCESS FOR PRODUCING ANHYDROUS ALUMINUM CHLORIDE; Paul Danckwardt, Denver, Col. App. filed June 23, 1919. Electrolysis of molten metal chloride.

1,343,676. CONNECTING PLUG; Sidney J. La Montaine, Chicago, Ill. App. filed Feb. 1, 1919. For heating appliances.

1,343,689. LAMP-DIMMING SOCKET SWITCH; Raymond D. Smith, Arlington, Mass. App. filed Oct. 27, 1916. Varying degree of light through usual pull chain.

1,343,690. HEAT-DISSIPATING SOCKET SWITCH; Raymond D. Smith, Arlington, Mass. App. filed June 5, 1917. For lamp-dimming socket switches.



1,343,411. Starting Mechanism for Electric Motors

1,343,708. SEPARATOR FOR STORAGE BATTERIES; Rufus N. Chamberlain, Chicago, Ill. App. filed Oct. 21, 1918. Made of ribbed wood.

1,343,714. TELEPHONE SYSTEM; Georg Grabe, Nickolassee, near Berlin, Germany. App. filed Jan. 14, 1915. Selective connection of subscribers.

1,343,717. TELEPHONE APPARATUS FOR THE DEAF; Earl C. Hanson, Washington, D. C. App. filed June 11, 1919. Vacuum-tube amplifier.

1,343,719. RELAY; Clinton O. Harrington, Swissvale, Pa. App. filed April 17, 1918. Solenoid windings close to pole pieces.

1,343,751. ADJUSTABLE V-BLOCK AND THE LIKE FOR MAGNETIC CHUCKS; Frank L. Simmons, Woonsocket, R. I. App. filed March 19, 1919. Plurality of magnetizable members separated by non-magnetic material.

1,343,754. APPARATUS FOR TEACHING CODES AS USED IN TELEGRAPHY; Cecil R. Woodland and Reginald Woodland, Liverpool, Eng. App. filed July 5, 1919. For teaching signal codes.

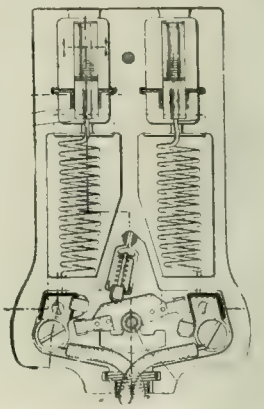
1,343,765. ELECTRIC SYSTEM; John L. Creveling, Tucson, Ariz. App. filed Feb. 9, 1920. Floating battery system.

1,343,848. COFFEE URN; Anson S. Rice, Brooklyn, N. Y. App. filed June 19, 1919. For hotel and restaurant.

(Issued June 22, 1920)

1,343,903. TELEPHONE SYSTEM; Henry P. Clausen, Mount Vernon, N. Y. App. filed Sept. 14, 1917. For automatic connection.

1,343,905. ELECTRIC REGULATION; John L. Creveling, White Plains, N. Y. App. filed Aug. 17, 1916. For battery charging.



1,343,676. Connecting Plug

1,343,948. PROCESS FOR PRODUCING CEMENT OF LIQUID SLAGS IN ELECTRIC FURNACES; Karl G. Wennerstrom, Bartange, Sweden. App. filed March 29, 1920. By direct melting without previous mixing.

1,343,957. BATTERY GRID; Franklin R. Bickhart, Philadelphia, Pa. App. filed Dec. 1, 1919. For vehicles.

1,343,989. AUTOMATIC TELEPHONE SYSTEM; Franklin J. Truby, Chicago, Ill. App. filed April 15, 1918. Automatically connects with an idle trunk line.

1,343,996. ELECTRIC HEATING APPARATUS; Edgar F. Collins, Schenectady, N. Y. App. filed Sept. 23, 1919. For electrically heating rivets.

1,344,002. ELECTRIC TREATING AND EXERCISING MACHINE; John B. Kibler, Girard, Pa. App. filed April 30, 1919. Current administered while exercising.

1,344,030. METALLURGICAL PROCESS; William E. Greenawalt, Denver, Col. App. filed Aug. 11, 1917. Extraction of metals from ores with chloride solutions.

1,344,031. PROCESS FOR TREATING LIQUIDS WITH GASES; William E. Greenawalt, Denver, Col. App. filed Jan. 5, 1917. Electrolytic precipitation process.

1,344,052. RADIO-TELEGRAPHY; Roland G. Marx, Palo Alto, Cal. App. filed Aug. 13, 1917. Arc radio transmitters.

1,344,125. PROCESS AND PRODUCT OF ELECTRIC WELDING; Edward Fulda, New York, N. Y. App. filed Nov. 23, 1918. Spot welding.

1,344,127. METALLURGICAL PROCESS; William E. Greenawalt, Denver, Col. App. filed Nov. 28, 1917. Treatment of mixed sulphide and oxide ores.

1,344,153. PRODUCTION OF ALUMINUM NITRIDE AND THE LIKE; Mark Shoeld, Chicago, Ill. App. filed July 10, 1919. From alumina, carbon and nitrogen-containing gas.

1,344,195. TELEPHONE SYSTEM; George A. Yanochowski, Chicago, Ill. App. filed March 25, 1916. Subscriber disconnected on hanging up receiver.

1,344,206. EMERGENCY LAMP; William J. Koenig, Brooklyn, N. Y. App. filed Dec. 3, 1918. For automobile.

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Taking the Public Into Partnership

MOST men are willing enough to subscribe to the truth when expressed as a generality. Fewer are willing to act on it, especially when it requires the doing of something new or different from the usual. Public utilities are all willing enough to recognize that the public should be told in detail the truth about their problems and their needs. Many of them have been too timid in making their actions in this regard conform to their beliefs. One of the large central stations lately faced the necessity of increasing its rates. It did not remain satisfied with presenting its case to the state commission. It presented a report to the council of the city in which it operates, giving a complete account ot what it proposed to do and invited examination of its affairs. In other words, the company put before the public that it served through the accredited officials the facts that made the change of rate necessary and asked that full consideration be given to them—that they be studied and understood. Such a policy must result in closer co-operation and better understanding between the server and the served. It should stimulate similar action by other central stations.

American Manufacture of Apparatus

AMERICAN skill can produce anything that can be produced elsewhere, but in pushing quantity production it cannot be depended upon to reach the highest standard. In this fact lies the usefulness of permitting free importation by license until this standard shall be reached and then giving the American manufacturer full advantage of a tariff high enough adequately to protect him. This, we believe, is a better project than forbidding importations of technical apparatus entirely and will be equally effective in jealously guarding American manufacture while holding it up to its best ideals. At present there is little indication of a dumping policy on the part of foreign competitors. As a rule their prices are quoted with very heavy increases to cover exchange, frequently reaching 200 per cent. Thus prices figure out at a large increase over pre-war figures for articles which are by no means certain to be of pre-war quality, as the experience of some importers has already shown. If American makers will but keep up the standards they are capable of reaching and have reached, they have, under a reasonable duty, little to fear from competition. As to things not made here of kind or quality obtainable abroad, there seems no reason for applying any duty at all pending the provision of a suitable American supply. The proposed English scheme of importing by license in such cases strikes us as a good one, being effective and flexible. This country ought to produce everything that it can require in the line of technical apparatus. As a mere matter of convenience the American-made article is to be preferred, and the only important requirement is that it shall be made available; but, as the British manufacturers themselves point out, a tariff alone will not insure meeting this desirable end. Either a tariff or complete prohibition with suitable provision for importing by license will tend to hasten American independence in research.

Research in Pure Science

THE recent announcement of the resignation of Dr. Ernest Fox Nichols, an eminent physicist, from the faculty of Yale University is of more than passing interest. Professor Nichols has accepted the post of director of pure science in the Nela Research Laboratories in Cleveland. In his letter of resignation from Yale he made the following statement: "The position offers complete freedom in the choice of research problems and places at my unhampered disposal such human and material resources as no university I know of can at present afford." This is but another indication of the changing trend in the advancement of science. Our institutions of learning are more and more hampered in the promotion of pure research by the lack of high-grade men and material resources, while large industrial organizations find it to be more and more to their advantage to broaden the scope of knowledge in certain directions vigorously and systematically. They are doing this by drawing into their organizations the best available men and by offering them almost unlimited resources. There can hardly be any regret over this irresistible development, provided that the change is not too rapid and that the scientific achievements which are thereby made possible will in the course of time become the common property of all humanity. In this way only can the new method accelerate progress in research in the pure sciences.

Interest During Construction

IN ANY engineering project occupying considerable time in its execution the interest charges during a period of construction may become somewhat serious. Delays after the capital required is out and bearing interest are particularly unfortunate, and the necessity of getting earning operations under way is obvious. A rather striking series of graphical demonstrations showing the bearing of this interest factor on the enterprise under various conditions are given in this issue by Page Golsan. He shows that on a million-dollar project the cost of delay at present rates will run to about $200 a day, so that slow shipments, unfortunate halting in construction and failure to get the works into operating condition promptly entail loss that may really make a serious difference in the early showing of the enterprise.

The secret of success is to shorten the whole construc-

tion period, to start the various portions of the work so that the completion of each part just when needed will neatly interlock with the progress of the structure as a whole, to arrange payments so as to incur the smallest possible additional interest charges, and finally to get earning operation at the earliest possible moment. The first requirement shows that there must be keen balancing between the cost of hurrying the work and the cost of delay. The engineer at this point is between the devil and the deep sea. If he tries to get ahead too fast, money will be wasted through the increases of cost entailed in rushing the work. If he moves too slowly, the interest charges will run on. Co-ordination of the various portions of the work is evidently a paying proposition, for when the work completed and on which payments are due is held from usefulness while another portion of the work is going on the interest charges count heavily. To obtain the necessary capital as needed is part of the fine art of the financier. Every dollar not borrowed too far ahead of time means a saving of interest, yet the funds must be always in sight and ready for prompt payment.

Distribution Under Difficulties

A RATHER striking illustration of the ingenuity that has to be exercised in dealing with novel conditions of distribution is given this week by Messrs. Gray and Hagenlocher in their account of the distribution problems involved in the construction of the government nitrate plant No. 1 at Sheffield, Ala. This great nitrate plant, more or less experimental in its character, required an electrical distribution of a decidedly unusual nature. In the first place, a very large proportion of the electrical output had to be used in form of direct current for variable-speed units acutely needed for the experimental work in hand. Since turbine-driven direct-current generators of the necessary size were out of the question, the alternators were wound six-phase and for the voltage required for the rotary converters.

The main operating plant had to be divided into three independent units so that the chemical process could go on with little interruption even in the case of a breakdown in one portion. The switchboards were massed together in a steel and glass room to protect them from moisture and fumes, and each motor could be operated from a push-button station alongside or from the switchboard, as the occasion required. The whole wiring system for the major part of the plant had to be planned with reference to resisting acid fumes, and the main busbars were run outside the building. In the portions of the building most exposed to fumes were alternating-current motors with acid-proof insulation and a distributing system consisting of flexible armored wire, acid-proofed before and after installation. Even the lighting fixtures in some instances had to be vapor-proof. The general direct-current system from building to building was put under ground with permanent provision for draining the manholes. In addition to the working buildings a whole town had to be built for the working force, lighted and provided with telephones, and systematic floodlighting was applied to the boundary fences, leaving no part of the outside unilluminated. Finally, as an additional unusual feature in the general wiring scheme of the plant, the temperature had to be known at about two hundred different points, and a central office in the switchboard room provided indicator boards for all of these points. This is a mere outline of some of the features of what in its entirety furnishes an instructive account of an intricate distribution system of most unusual character, skillfully carried out during a war-time rush.

Power Transmission and Industrial Congestion

THE fourteenth census of the federal government, now being taken, is likely to lead to startling developments. Decade by decade the census has shown an increasing agglomeration of the population into the larger cities, and the present reckoning will emphasize this tendency in a way to give good ground for alarm. It is already evident that the sudden and enormous industrial development due to the war has been stripping the country of available labor and concentrating it in the cities to a menacing degree. The result has been a great diminution in the necessary agricultural products, a congestion of traffic, an unprecedented rise in the general cost of living and huge increases in rentals. As a result of these conditions labor, despite rapidly rising wages, finds itself worse off at the finish than at the start. What is most needful now is centrifugal action instead of the centripetal force which has lately been the main feature of industrial dynamics.

It is just here that electrical power transmission may find its really most vital field for usefulness by enabling industrial operations to be conveniently and profitably carried on wherever the power networks may reach. The best labor market under present conditions is not the sinister old ideal of a line of unemployed standing before the factory doors, but a condition in which labor has a better opportunity outside the cities than in them, and where power and transportation are available there is no reason why industries should not gradually become distributed. Electric roads now struggling vainly for passenger traffic in a territory stripped of population would find both freight and passengers and afford the necessary connections for shipping. Water powers, big and little, can be pressed into service for power supply to recoup industry for the rising price of fuel. There are already many examples of highly successful manufacturing plants, established under favorable conditions in small towns, taking advantage of these opportunities and prospering to an extent which would hardly be possible with a change of location. Fuel will cost steadily more and more, and its mere transportation is a burden of which the country as far as possible should be relieved. To make the most of the advantages of transmission a distributed load is highly desirable as against long lines with but a single market. To be sure, the mountain may electrically be made to come to Mahomet, but it is far better for the national prosperity that he should at least make an effort to go to the mountain. We published not long ago an account of the Spanish and Japanese projects for the general distribution of power, thus equalizing in great measure economic conditions over a widespread territory. That the spell is working there is abundant evidence. Only recently there was advertised in a London paper a water power in the Pyrenees suitable for industrial utilization. Have we less imagination or enter-

prise that we should be content to see the country grow up to underbrush and the towns dwindle, while manufacture crowds cityward and contends with industrial discontent? It is high time for manufacturers to consider what may be done to improve conditions which are rapidly growing intolerable. No country can long remain prosperous unless effort is made to utilize its full resources, and this cannot be done when the population is herded in limited areas making vain endeavor to live without production. It would be exceedingly interesting to know how large a proportion of the dwellers in any large center are actually engaged in productive labor, physical or mental, instead of living off each other, and to compare this proportion with the conditions in smaller communities. Distributed industry will afford the solution for many of our gravest economic problems.

Turbines for Low Heads

ONE of the standing difficulties in hydro-electric work is the suitable treatment of cases where the available head is unusually low. To begin with, one encounters the fundamental difficulty of obtaining proper speed without serious losses due to belting or gearing, and in the second place these low heads are extremely troublesome on account of the large proportional effect of moderate absolute variations in the head. A. Streiff's account of the hydraulic arrangement of a typical low-head plant recently installed will give our readers a very distinct notion of the improvements which relatively recent years have shown. The plant in question is on the Kalamazoo River and has a normal available head of only 12 feet (3.6 m.). Originally the equipment consisted of a single 750-kw. generator driven by seven old-fashioned wheels geared to a common jack-shaft. This plant was burned, one might almost say providentially, last year and has been replaced by the installation which Mr. Streiff describes.

The new plant contains three 72-in. (1.8-m.) vertical-shaft turbines giving 380 brake hp. each at 164 r.p.m. The turbines are of modified Jonval type, especially planned to give high speed. The buckets of the runner are but four in number and are drawn clear back to the hub instead of forming a ring carried by radial arms. Our readers will instantly recognize that with a wheel of this size under 12-foot head the output has extraordinary high speed compared with earlier turbine practice. The construction evidently is one difficult to design for the highest efficiency, but the figure reached under test for this type—a little better than 86 per cent—compares very well with the best wheels of the earlier days of hydro-electric development. The turbines have the so-called vacuum setting, in which they are placed high and the penstock is arranged so that it is under partial vacuum.

In the case before us the wheels are below ordinary headwater, but in operation the water rises to the under side of the concrete generator-room floor, from which it is excluded by a stuffing box, and entrained air is removed by a small water ejector. The actual vacuum obtained in this way amounts to 5¾ in. (14.4 cm.). Each machine is provided with an independent governor, and the generators of 400 kva. capacity each deliver power, three-phase, 60-cycle, at 2,500 volts, stepped up to 45,000 for transmission. The little plant is a singularly interesting example of modern low-head practice.

Measurement of Power Factor for Rate Purposes

MUCH attention has recently been given by central-station managers to the question of low power factors in their customers' installations. The cost of supplying electric power through a three-phase system to a consumer depends principally upon the following four things:

1. On the distance of the consumer from the generating station, or the distance over which the power has to be transmitted.

2. On the demand for the power consumed, both as to its amount and as to the time of day when the demand occurs. A given demand is much more expensive to meet at or near the peak of the daily load than at other hours.

3. On the power factor of the customer's load. The load created by a shop full of underworked induction motors is more costly to supply than that absorbing the same amount of energy from the system to supply incandescent lamps.

4. On the balance of the customer's load. A badly unbalanced load, such as may be developed by large single-phase devices, is more costly to supply than a balanced three-phase load taking the same amount of power.

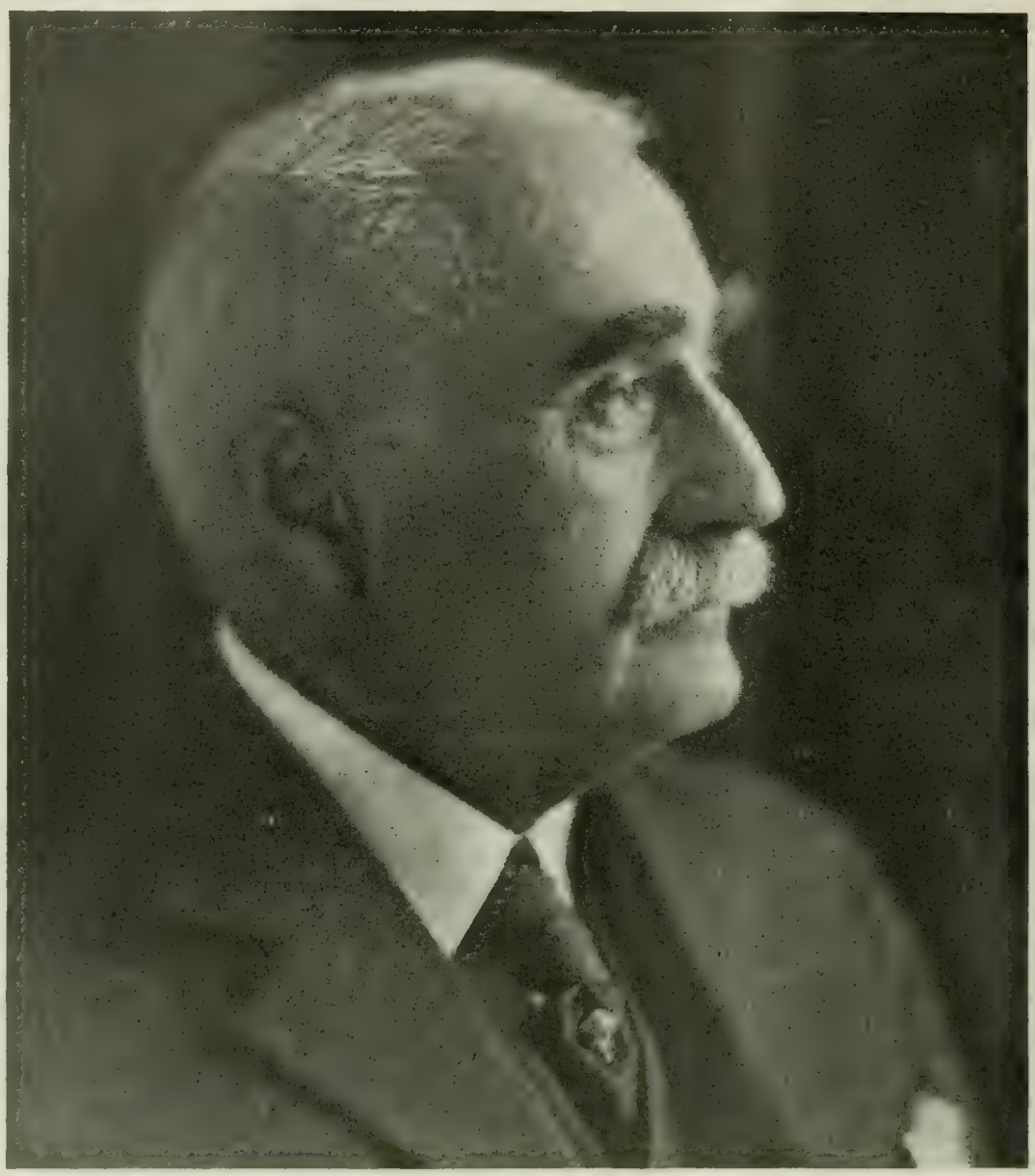
Experience over a number of years has enabled reasonable and generally accepted rates to be established covering the first two points—*i.e.*, the distance and the demand factors. There is, however, still a good deal of discussion as to the best methods of providing a fair overcharge in cases where the customer allows his load to develop a bad power factor or a bad lack of balance. The two errors are actually distinct, because a load may have a very low power factor and yet be balanced. On the other hand, it may have a very low balance factor and yet have a power factor which is quite close to 100 per cent.

This problem can be solved, as pointed out in a past issue, by using, in addition to the ordinary three-phase active watt-hour meter, a special three-phase reactive watt-hour meter which integrates the total number of reactive watt-hours applied to the customer's load.

The vector sum of the total active watt-hour reading and the total reactive watt-hours, the latter being treated as a j quantity, gives the total vector watt-hours absorbed by the load. The ratio of the number of active watt-hours to the number of total vector watt-hours is then the average power factor of the load during the entire time which is occupied by the registration.

This procedure is logically sound and mathematically correct for any three-phase system, balanced or unbalanced, provided that the two watt-hour meters are correctly calibrated and also that the voltages and currents of the system are sinusoidal. Except, however, in special cases, the discrepancy due to departure from sinusoidal wave form is not likely to be serious, and the procedure may properly be conventionalized for general use.

As soon as the meter makers are called upon to produce three-phase reactive wattmeters, they may be depended upon to supply an instrument with the proper constant and with a quadrature phase relation that shall not be dependent upon the maintenance of a balanced three-phase voltage.



Charles Francis Brush

To whose pioneer work in the field of arc lighting and generator design much of the later development of electrical apparatus can be attributed

ALTHOUGH a graduate mining engineer, Charles F. Brush at the age of twenty-eight returned to the field of his boyhood interest—electricity. The following year, 1878, he gave to the world the famous Brush system of arc lighting, which up to a few years ago was so widely used both in the United States and Europe for street lighting. It is noteworthy of the work of this pioneer that his various discoveries were of such widely practical value and have been so fundamental in the development of electrical apparatus. The Brush dynamo and arc lighting systems are perhaps the most widely known of his inventions, but it is doubtful if they will prove of such lasting value to the electrical art as his contributions to generator design. To Mr. Brush is attributed the discovery of the use of iron laminations for generators. This in itself would be enough to perpetuate his name. Working in the days prior to the discovery of the utilization of alternating current, it is doubtful if Mr. Brush had an inkling of what this was to mean to future generations. To him also is attributed copper-plated carbon brushes and the damper winding in which a copper band is used between the field magnets and the coils surrounding them and what is more important the compound winding now so widely used on industrial current motors. He did much to develop and perfect the lead storage battery and secured many patents by which improvements in the manufacture of lead plates were effected.

In 1881 his achievements in the field of electric lighting were recognized by the French government, which decorated him as a chevalier of the Legion of Honor; in 1899 he received from the American Academy of Arts and Sciences the Rumford medal, "for the practical development of electric arc lighting," and in 1913 the American Institute of Electrical Engineers recognized his accomplishments by awarding him the Edison medal.

Mr. Brush is a member of a great number of scientific and engineering associations both here and abroad. Of late years he has devoted his time largely to his numerous business interests, but he still maintains at his home in Cleveland, Ohio, a well-equipped laboratory where he delights in spending leisure moments. Mr. Brush was born in Ohio, March 17, 1849, and at the age of twenty was graduated from the University of Michigan as a mining engineer.

Electrical Distribution at Nitrate Plant

How Electrical Energy Was Used at United States Government Nitrate Plant in Various Processes—Difficult Problems Were Encountered by Exposure of Apparatus to Chemical Fumes

By C. D. GRAY and E. HAGENLOCHER
The J. G. White Engineering Corporation

BUILT under the stress of war conditions and in the face of a very difficult labor situation, the government Nitrate Plant No. 1, at Sheffield, Ala., still conforms to the same rigid specifications prevailing in normal times. The construction was necessarily such that the chance of interruption at any vital part of the plant was minimized and great care was exercised in installing the apparatus which would be exposed to chemical fumes. Even in laying out the residence community for officers and workmen an electrical distribution system of a high order was decided upon.

When the government took over the plant of the General Chemical Company for the construction of Nitrate Plant No. 1 some of the apparatus had already been purchased and delivered. The first plan called for only two buildings besides the power house, and a direct-current supply had therefore been arranged. Later, upon expansion of the plans and when it became necessary to build a permanent dwelling community, a 2,300-volt alternating-current system was added.

The greatest amount of power required in the system was used for motors to drive fans, blowers, compressors and pumps. The remainder was used for lighting. No electric power was used for arc furnaces or heating furnaces of any kind as in the case of nitrate plants using other processes. By referring to the table it will be seen that the station has a generating rating of 5,000 kw., of which a considerable proportion was used in the ammonium process building alone.

In a previous article in the ELECTRICAL WORLD of April 5, 1919, by E. R. Welles and C. T. Mitchell, covering both United States nitrate plants No. 1 and No. 2, the location of these plants with reference to the characteristics of the particular section of the country was discussed and a general idea was given of the difference between the two plants.

Since the electrical features of the power house were

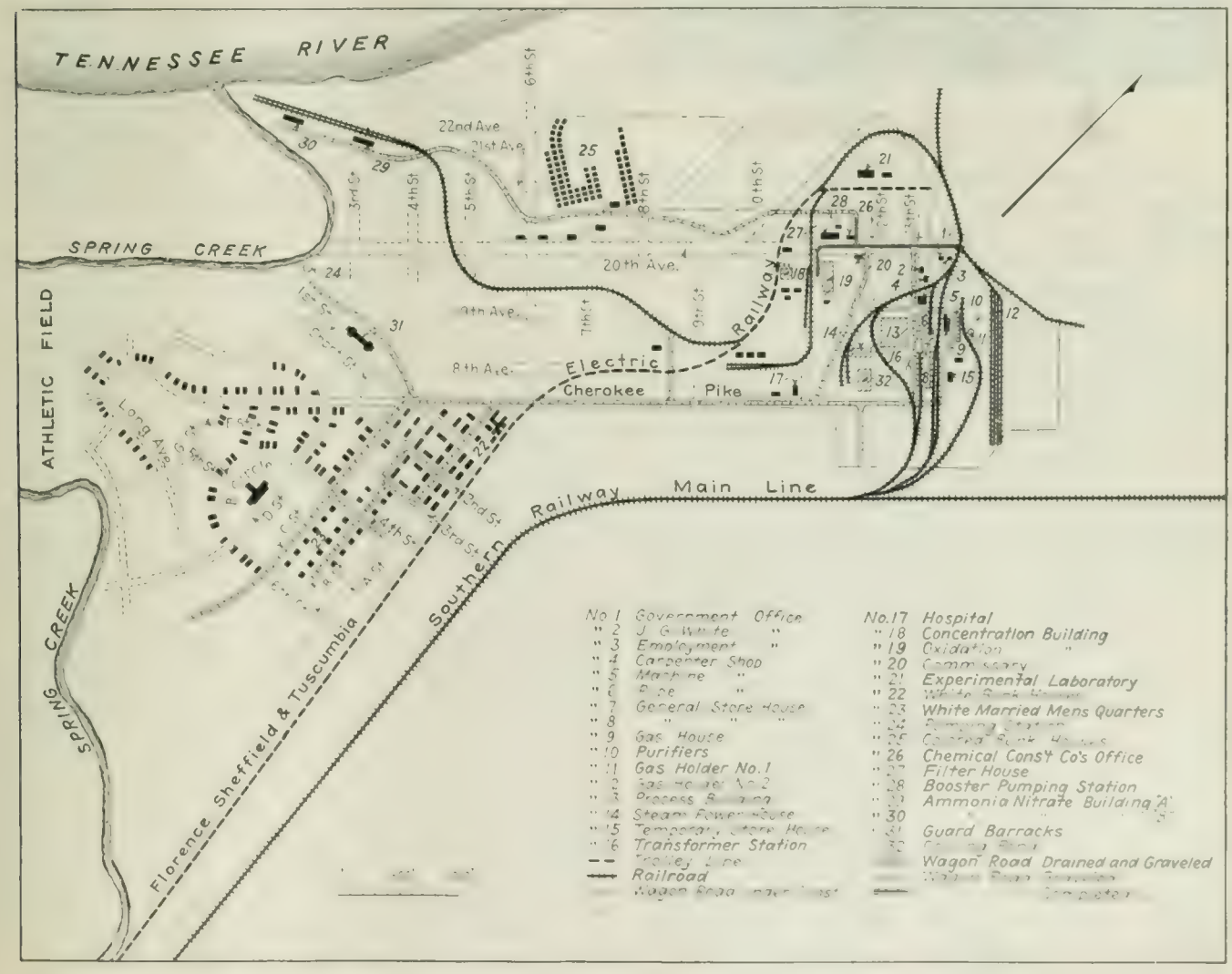


FIG. 1—LAYOUT OF UNITED STATES NITRATE PLANT NO. 1 AND DWELLING COMMUNITY

described in a paper by the present authors (ELECTRICAL WORLD, Dec. 13, 1919) they will be dealt with only briefly here. It will be noted from the table that the three rotary converters are of such size as to convert all of the alternating current into direct current. The direct current is required to supply variable-speed motors in the process building, and variable speed motors were necessary for the experimental work for which the process plant was built. The alternators were designed for 190-volt, six-phase supply in order to save the expense of transformers for the converters, also for the reason that turbine-driven direct-current generators could not be obtained of sufficient size for the requirements.

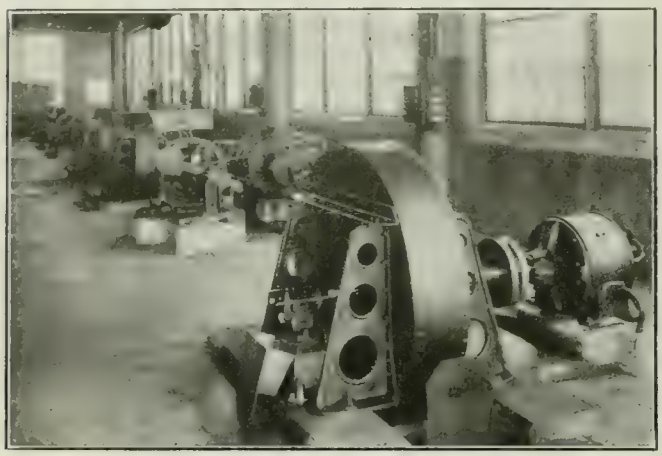


FIG. 2—BLOWER ROOM IN GAS PLANT
Six 40-hp. centrifugal and two 30-hp. positive blowers

A storage battery furnishes current for the solenoid-operated switches and a motor-generator set which supplies 220 volts, three-phase, at all times even with the main generating units shut down.

EQUIPMENT OF THE PROCESS BUILDING

The process building is divided into three units, two having a capacity of 15,000 lb. (6,800 kg.) of ammonia per twenty-four hours each and the third a capacity of 30,000 lb. (13,600 kg.). This plant, being a purely experimental one which had for its purpose the development of a process similar in some respects to the Haber process used in Germany, was so arranged that each unit could be operated independently of the other—a matter of particular importance, as there was a great element of danger in case one part of the system broke down or was unable to deliver its rated output. The general arrangement of the process building was such that the switchboards were all at one end of the building inclosed in a steel and glass room for the purpose of protecting the switchboard and cables from condensation or moisture. The switchboard was made up of incoming line and switch panels, together with the standard remote-control panels which are usually furnished with direct-current motors. Each motor was supplied with a push-button station at a point near the machine and one on the panel so that either the machine operator or the switchboard operator could have control of these motors. In general, all cables were run in fiber, iron and tile ducts under the floor and distributed from six manholes in the process building. These manholes were about 8 ft. high and 5 ft. x 5 ft. (2.4 m. x 1.5 m. x 1.5 m.) inside dimensions.

The nature of the process required that temperatures be accurately known at all times at more than 200 points, and for this purpose a central office of eight boards similar to a telephone switchboard was installed directly above the main switchboard. Cables had to be run from various points on the piping and apparatus to the switchboard room, and it was found best to install these in conduits hung from the roof trusses.

PROTECTION AGAINST FUMES IN ACID PLANT

The power in this building was used mainly for driving gas and air blowers and acid-gas fans. In laying out the electrical work inside the building it was realized that there would be a considerable amount of acid gas in the air and that this gas would be dissolved by the moisture, making a very destructive combination on such metals as iron, copper and zinc. It was decided, therefore, to run the main bus outside the building on steel cross-arms installed approximately 20 ft. (6.1 m.) above the ground and spaced 35 ft. (10.7 m.) apart, as shown in Fig. 3. At the corners of the buildings the cables were dead-ended on strain insulators attached to the middle of the arm and carried around the corner on pin insulators which are under no strain. This construction gave a good appearance and it kept all the wires at the same level except the jumper around the corner.

Each motor was tapped from the mains at the nearest point. A steel-inclosed fused knife switch was mounted on the building wall. Directly under it the compensator was mounted, and from this point to the motor the leads were run in iron conduit and steel. In this way only the shortest possible run of wire was exposed to the action of the acid, and in case of trouble temporary wires could be run overhead to the motor while the leads in the duct line were being repaired. All the motors that were exposed to acid fumes had coils with acid-proof insulation.

SUMMARY OF LOAD

	Installed Kva	Active Kva	Installed H.P.	Active H P	No of Units Inst.	No of Units Active	Current
POWER HOUSE:							
Generating	4,950	3,125			3	2	AC
Rotaries	4,550	2,850			3	2	DC
Auxiliaries	142	60	178	93	18	10	DC
Transformers	1,200	800			6	6	AC
PROCESS BUILDING							
Motors, unit No. 1			1,089	549	22	11	DC
Motors, unit No. 2			1,106	554	24	12	DC
Motors, unit No. 3			1,658	1,075	26	13	DC
Generators, unit No. 1	75	75			1	1	DC
Generators, unit No. 2	78	75			1	1	DC
Generators, unit No. 3	150	150			2	2	DC
Total motors			3,853	2,178	72	36	DC
Total generators	300	300			4	4	DC
GAS HOUSE							
Motors			345	170	10	6	DC
MACHINE SHOP							
Motors			44	44	3	3	DC
OXIDATION and ABSORPTION PLANT							
Motors			220	150	18	12	AC
NEUTRALIZATION							
Motors			15	7½	4	2	AC
CONCENTRATION							
Motors			21	14	6	4	AC
PUMPING STATIONS:							
Motors			720	530	12	9	AC
ICE PLANT							
Motors			109	56	6	4	AC
RESEARCH LABORATORIES							
Motors			5	5	1	1	AC
Distribution transformers	908	891			35	35	AC
Street lighting transformers	61	44			4	3	AC

The lighting for this building involved some unusually difficult features on account of the acid conditions, the arrangement of the apparatus and the great height of the building. In this case the height was 90 ft. (27 m.) with no floors or galleries intervening, and the problem was to determine upon a method of construction which should require as little labor as possible both from first-cost standpoint and because of later replacements due to deterioration by the acid fumes. It was decided that the best scheme would be to use a good grade of flexible armored wire and dip this in an acid-proofing compound similar to pitch before installing. After being installed all the armor and clips were treated with compound again, to close up any cracks or abrasions that occurred during erection. The use of flexible cable eliminated the labor usually required for cutting and threading conduits and making bends and also allowed the use of less rigid means of support. On the roof tresses and on the steel work and side walls a very convenient method of fastening was used which eliminated drilling, as shown in Fig. 4. The advantage of this when working 90 ft. (27 m.) above the ground on planks placed between the roof trusses can be appreciated.

In the portions of the building where acid conditions were particularly bad the junction boxes and fixtures were made of aluminum and ground wires were installed as mentioned above, the idea being that the aluminum fittings would not need to be replaced while the wires could be renewed in a very short time without disturbing the rest of the installation.

The fixtures used were of the standard industrial type, steel-enameled with a cast-iron hood over the socket.

Vapor-proof fixtures were used only where small units could be utilized and where the replacement difficulties would be great.

Circuit Breakers Instead of Fuses

In the gas house the switchboard is different from installations usually found in that carbon circuit breakers were used instead of fuses in the circuits of each motor. This represented quite a considerable saving in maintenance and very little if any additional initial expense.

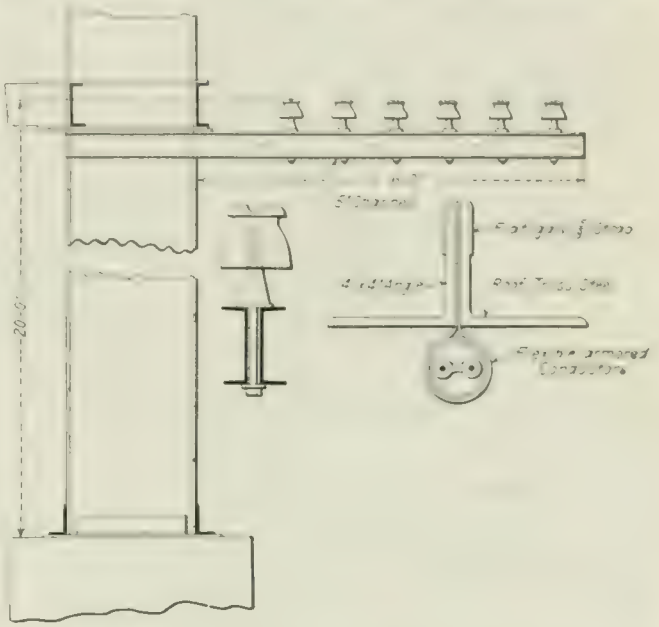
The pumping stations, acid plant, permanent community buildings and other outlying parts of the plant were at such a distance that it was not feasible to supply them with direct current. Therefore two banks of transformers, with a total rating of 1,200 kv., stepping up from the turbo alternators to 2,300 volts, were installed. This energy was distributed over wooden and steel poles. It was found that in some cases the structures carrying the overhead steam and ammonia pipes could easily be adapted to carry the electrical conductors. Telephone cables, signal wires and street-lighting circuits were also carried overhead. A ground wire was carried over the electrical wires in order to minimize disturbances from lightning, which is very severe in this section.

Direct-Current Cables Underground

An underground system was chosen to transmit power from the power house to the various buildings supplied with 250-volt direct-current power, telephone and signal cables. There are altogether twelve manholes, about 150 ft. to 200 ft. (45 m. to 60 m.) apart, and between these manholes tile ducts embedded in concrete are run. The manholes themselves are sufficiently large to allow a man to stand erect with plenty of room for making splices. These manholes are made of reinforced concrete, and standard type of frames and covers were installed at the proper level for the proposed finished street grades.

The duct lines were graded to three different points in the system so that any large quantities of water collecting could be drained out of these points. This is the minimum number of points to which water could be drained on account of the great distances and contours. In addition, it was necessary to keep the conduit runs at the proper level to avoid interference with air gas, water and sewer mains which were installed at a later date.

At the bottom of each of the manholes a sump pit or depression was made approximately 12 in. (30 cm.) square and 6 in. (15 cm.) deep, which collected the

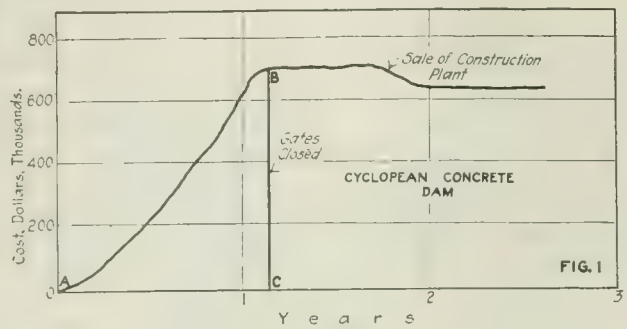


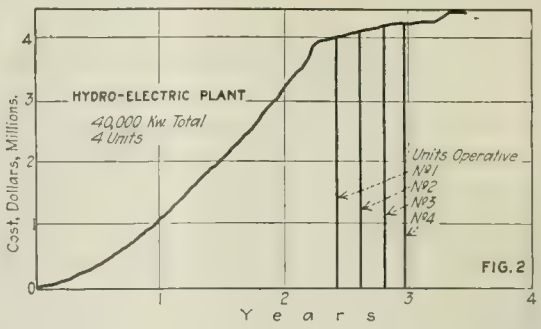
FIGS. 3 AND 4—SUPPORT OF BUSES OUTSIDE ACID PLANT AND SUSPENSION OF CABLE FROM ROOF TRUSS

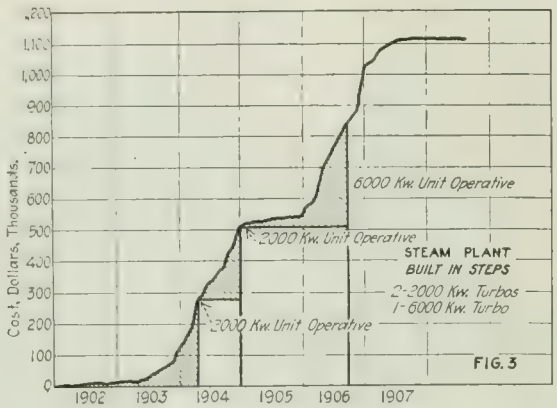
moisture and allowed the workman to stand on dry concrete. U-bolts were installed in the forms before the concrete was placed and were of considerable value in attaching the snatch blocks and other cable-pulling rigs.

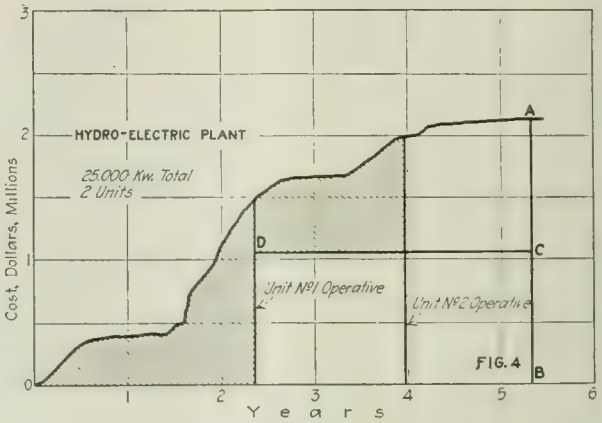
In the pumping station are installed three 150 hp. 2,300-volt motors driving centrifugal pumps and also a 10-hp. sump pump. On account of the shape and small size of the building there was not sufficient room to make a good open-wire layout of the 2,300-volt circuits inside the building, so triple-conductor cable in conduit was used in order to get a compact and safe arrangement. This was especially advantageous where the circuits had to cross each other. The circuit feeding the pump was carried down in 2½-in. (6.3-cm.) conduit and run as a header over the compensators. Disconnecting switches were installed so that each starting outfit or motor could be worked on without danger and without opening the main disconnecting switches.

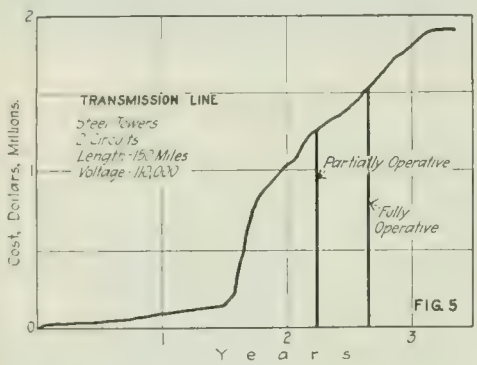
The construction work, except the nitric acid plant, which was designed and constructed by the Chemical Construction Company, was done by the J. G. White Engineering Corporation, and all designs (with the exceptions of the special ammonia and acid processes) were made in conjunction with the Nitrate Division, Ordnance Department, U. S. A., and the General Chemical Company.

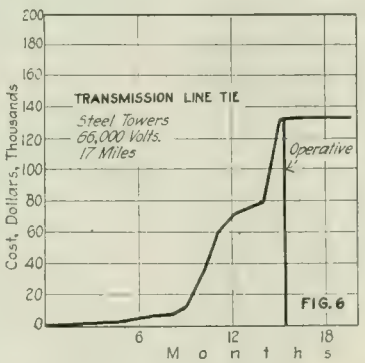


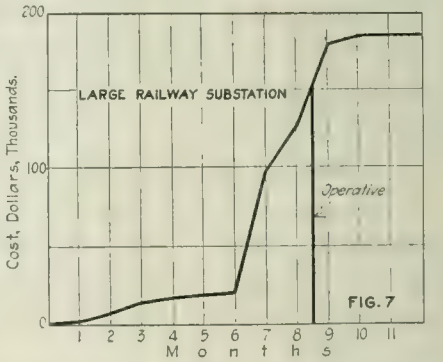


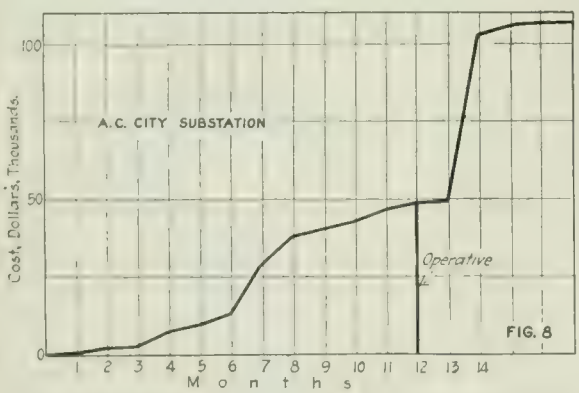


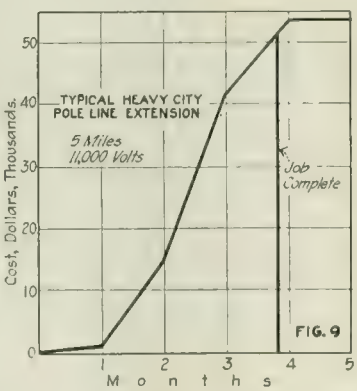












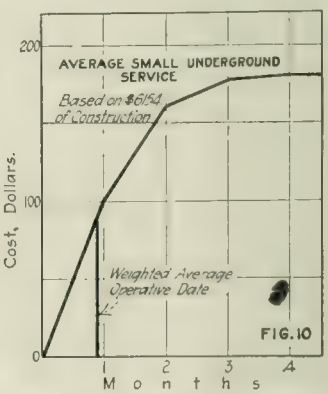


Fig. 1—Early sale of construction equipment after job is completed is economical, provided market conditions and other factors are equal.

Fig. 2—Showing economy of early completion of portions of a hydro-electric plant.

Fig. 3—Complete cost history of a three-unit steam plant. The shaded areas represent the interest during construction. It will be noted that final payments on the 6,000-kw. turbine were made after it had been placed in operation.

Fig. 4—Cost history of a two-unit hydro-electric plant. Work was stopped twice, as the curve shows, owing to a poor bond market. In the evaluation of this plant on the actual cost basis some question arose as to proper procedure. It was felt that an equitable solution was determined thus: Total cost of two units = AB. Apportion one-half of this cost, or AC, to second unit. Draw line DC as shown. Thus the shaded areas, as defined, were used as the "dollar years."

Fig. 5—Cost history of a transmission line, wherein the concreting of tower footings was carried out after the line was completed.

Fig. 6—Cost history of steel-tower transmission tie line.

Figs. 7 and 8—Showing payments for equipment after operation has commenced.

Figs. 9 and 10—Cost curves for heavy city pole line extension and for small underground service.

Interest Charges During Construction

Cost Curves for Hydro-Electric and Steam Plants and Transmission Lines Showing Factors Involved in an Economical Construction and Operating Program for Estimating and Valuation Purposes

By PAGE GOLSAN
Consulting Engineer, San Francisco, Cal.

IN THE estimation of the cost of new construction or in the valuation of a physical property "interest during construction," among other overhead charges, must always be added to the so-called "bare" structural costs. In small jobs quickly completed this cost, expressed as a percentage, is small, and for this reason its importance in long-drawn-out construction is often neglected. Many large jobs have incurred interest charges up to 25 per cent and over, and in these days of high interest rates and expensive construction programs the question has assumed greater importance. Owing to the lack of published data based on actual facts, the accompanying curves will be of interest. In determining a percentage for interest during construction the annual interest rate should, of course, be first determined. If an entirely new project is being reported on, the cost of money to similar going concerns in the same locality may be easily ascertained and due allowance must be made for the unseasoned character of the securities to be sold. If additions are to be made to an existing utility, interest costs can be closely approximated from the market prices of present issues. For valuation purposes, on a "cost" basis, the past rates of interest may be usually obtained from the records. Bond yield tables will quickly determine the desired percentage in any of these instances.

The interest costs in any problem are:

$$I = rdt,$$

when I = interest costs, r = rate per year, d = dollars, t = years; or more simply:

I = rate (dollar-years).

The total cost of a project during its construction can be plotted as in Fig. 1. The expenditure of money starts at A, and the totals are as represented from time to time. At BC the expenditures are complete and the project is placed in operation. Calculus easily proves that the area ABC is proportional to the "dollar-years" of investment during this construction period. Whence

Interest during construction = r × area × constant

As an example to determine this constant for Fig. 1, let 1 in. vertically = $600,000 and 1 in. horizontally = one year. Then if the area is obtained by a planimeter in square inches, the constant equals 600,000; that is, each square inch = $600,000 × one-half year = 600,000 dollar-years.

The aim of an engineer in designing construction work should be toward the reduction of the dollar-year area. This may be accomplished by (1) shortening the period in its entirety, (2) starting various portions so that all parts will be finished just when needed and not sooner, (3) deferring payments where possible (and ethical), without incurring additional interest, and (4) bringing into use as much of the plant as possible at an early date. The program, however, must not increase costs, through hasty work, beyond the saving of interest.

The accompanying curves are based on expenditures as paid, and in reference thereto, for either estimation or valuation purposes, it should be remembered that favorable financing nearly always requires the sale of securities considerably in advance of construction. A further point that is often overlooked is that overheads incur interest as well.

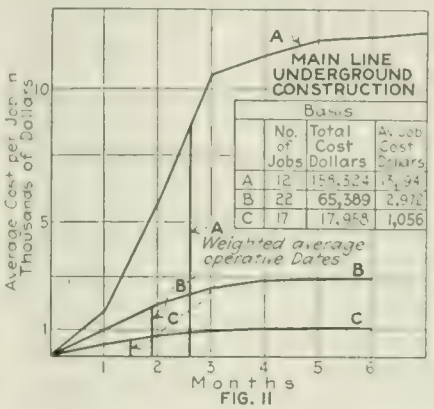


FIG. 11

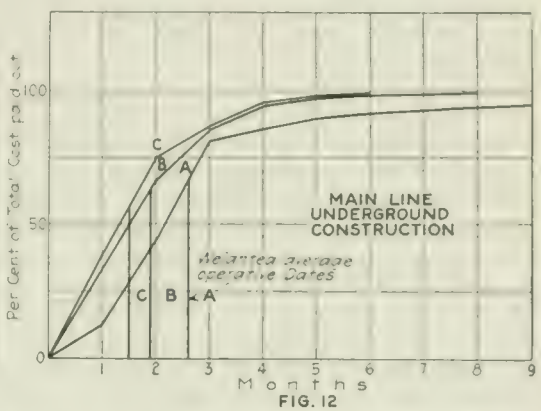


FIG. 12

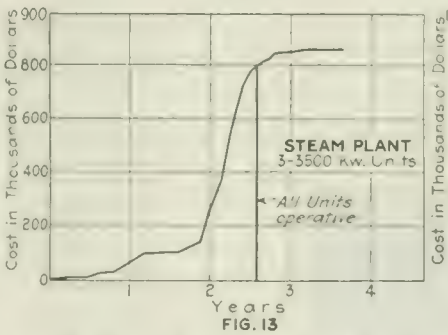


FIG. 13

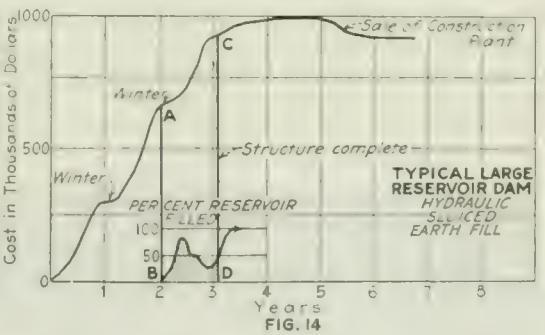


FIG. 14

Figs. 11 and 12—Identical data on underground work, the former being expressed in dollars of cost and the latter in percentage of cost. Fig. 11 would lead to the belief that a wide variation existed in interest during construction percentages between large and small underground jobs. Fig. 12, however, shows the divergency to be not so great as expected.

Fig. 13—A typical steam plant job. The first small expenditures are for engineering, the next series of payments being the purchase of the real estate and actual construction, undertaken about a year and one-half after first contemplation.

Fig. 14—Cost progress of a large hydraulic-sluiced earth-fill dam. The slacking up of work during the winter is clearly shown. The small inset, showing how this dam was used during its construction (as nearly all such dams may be if properly designed), presents certain difficulties to the valuation engineer in computing the interest during construction. From the inset of Fig. 14 it clearly cannot be held that all interest after the end of the second year is chargeable to operation, for the dam was incomplete. On the other hand, after a certain date all water was shut out of the temporary flume, and to all intents the structure was in full operation. The solution in this case was as follows: (1) Entire area up to AB-construction. (2) Determine the percentage that the shaded area of usage bears to the area of 100 per cent usage. Such percentage of the area $ABCD$ charged to operation, the balance to interest during construction.

Metal Deposition in Arc Welding—II

Mechanism of Metal Transfer from Electrode to Plate Is Explained by the Aid of Photography —Evidence Indicates that 85 Per Cent of Metal Is Carried Across Arc in Liquid Form by Molecular Forces

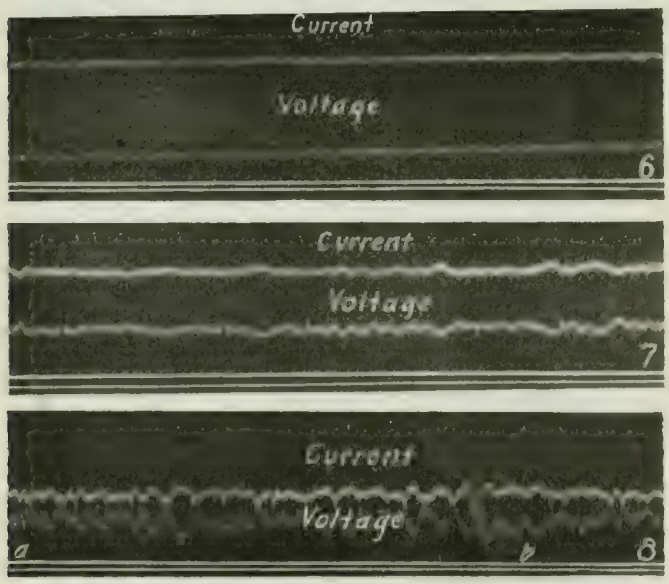
By O. H. ESCHHOLZ
Research Engineer Westinghouse Electric & Manufacturing Company

EVIDENCE that the passage of metal across the arc in metal-electrode arc welding results principally from simple molecular forces rather than from vaporization and condensation or from rapid gas expansion was offered in the first part of this paper, published in the ELECTRICAL WORLD of June 12. Further study of the problem is now presented, based upon oscillographic records of welding current and voltage, which corroborates the author's explanation of the mechanism of metal transfer, and the influence of this basic theory on the design of welding equipment and on welding operations is pointed out. Analogies are also offered to permit the ready visualization of metal transfer.

CIRCUIT CHARACTERISTICS OF METAL DEPOSITION

The variations produced in the circuit current and voltage by the mechanism of metal deposition may be observed readily upon inspecting oscillograms of arc characteristics when welding from a direct-current, 110-volt source, with a resistance ballast only in series with the arc. It is well known that a stable arc may be maintained with such a circuit. The resulting current and voltage reaction are therefore indicative of the stabilizing characteristics desired in circuits of special design.

When the rate of liquid metal deposition is low and the arc is sustained largely in an atmosphere of vaporized electrode material, arc voltage and arc current remain nearly constant in value, as shown in Figs. 6, 7 and 8 for, respectively, tungsten, carbon and iron (*a-b*) arcs. Upon increasing the energy concentration at the wire electrode terminal the end is liquefied,



FIGS. 6, 7 AND 8—CURRENT AND VOLTAGE FLUCTUATIONS FOR SHORT ARCS WITH ¼-IN. ELECTRODES

(6) Tungsten electrode (negative). Scale: Time, 0.33 sec.-in. Voltage, 71.8 volts-in. Current, 162 amp.-in. (7) Carbon electrode (negative). Scale same as Fig. 6, except that voltage scale is 71.8 volts-in. (8) Mild-steel electrode (negative). Scale same as in Fig. 7. No liquid metal was observed to have been deposited in period *a-b*. Rate of globule deposition 0.8 per second.

assumes a globular form, as discussed above, increasing in size and shortening the arc until, in long arc downward welding, its weight exceeds the retaining forces when the globule falls to the plate. Fig. 10 shows typical arc current and voltage fluctuations under this condition. A cycle of deposition appears to be as follows:

1. After forming the arc, appreciable time is required to liquefy the electrode end.

2. The liquefied end assumes a globular form, enlarges, decreasing arc length and arc voltage, while increasing arc current.

3. When the globule has enlarged sufficiently to bridge or short-circuit the arc stream, the arc voltage drops to practically zero and the arc current increases to short-circuit value.

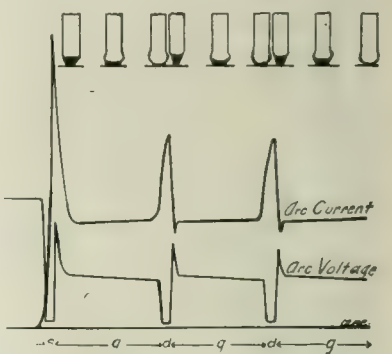


FIG. 9—CURRENT AND VOLTAGE VARIATION FOR CYCLE OF METAL DEPOSITION

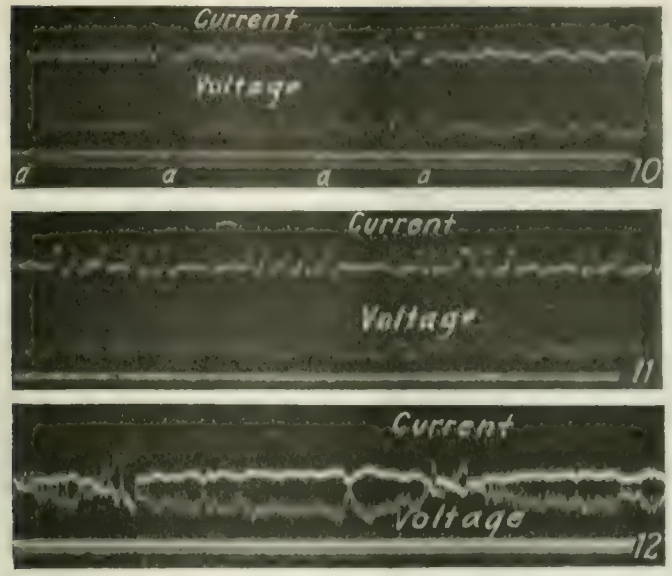
s, starting of arc; *g*, growth of liquid globule; *d*, deposition of globule.

4. The short-circuit condition exists until the globule is no longer in contact with the wire electrode.

5. At the instant of detachment the current decreases while the voltage rises sufficiently to re-establish the flow of the welding current in the partially deionized arc gases.

Fig. 9 shows this cycle graphically. Fig. 11 illustrates circuit characteristics upon holding a short arc with the same mild-steel electrode used in Fig. 10. The increased frequency of metal transfer is obvious, a smaller globule being required to bridge the arc gap. The contraction and expansion of arc gases due to this intermittent deposition produce a characteristic sputtering or "frying" noise; the frequency of the sound-wave impulses indicates the rate of metal deposition, arc current, arc length and electrode characteristics.

Upon welding overhead with a long arc very little metal is deposited. Figs. 5h (June 12) and 12 show the characteristic appearance of arc and the variation in arc current and voltage. Upon shortening the arc stream, however, Figs. 5g (June 12) and 13, molecular forces of attraction, discussed above, produce metal transfer. In Fig. 5g the globular electrode end may be observed in close proximity to the arc crater formed on the layer of deposited metal. The manipulative skill and metal deposition rate vary widely for different electrodes. A comparison of the downward and overhead deposition characteristics of a given mild-steel electrode may be obtained by a study of Figs. 14 and 15, while a comparison of the overhead deposition characteristics of two different mild-steel electrodes may be obtained on inspecting Figs. 13 and 15.



FIGS. 10 TO 12—CHARACTERISTIC OSCILLOGRAMS FOR VARIOUS ARC-WELDING PROCESSES

(10) Long-arc downward welding using mild-steel electrode. Scale same as Fig. 7. Deposition of liquid globules at *a* (rate about 2.4 per second). (11) Same as 10, except short arc length. Note increased frequency of deposition (rate about 25 per second). (12) Long-arc overhead welding, practically no metal deposition. Scale and electrode same as in Fig. 10. Appearance of arc shown in Fig. 5h. Rate of globule deposition, zero.

In view of these electrode characteristics, as well as others discussed in previous papers[1], the welding circuit should possess the following characteristics:

1. Ease of arc establishment when electrodes are cold.
2. Freedom from "sticking" or "freezing" of electrodes on short-circuiting arc stream.
3. Maintenance of a stable arc and approximate constant current value during growth of liquid globule.
4. Increase of welding current at instant and during the period in which the globule short-circuits arc stream. This is essential if adequate penetration is to be secured in short arc welding, the increased I^2R energy replacing to a considerable extent the arc terminal energy lost on short-circuiting the arc stream.
5. Rapid increase in arc voltage at instant of globule detachment for the purpose of facilitating the re-establishment of a stable arc.

The single operator set described in A. M. Candy's[2] paper incorporates these characteristics with the desired portability and efficiency, the complete unit occupying about half the space and having twice the efficiency of a constant-potential unit. Figs. 16, 17 and 18 show how this machine responds to the phenomena of metal transport, facilitating arc establishment, arc maintenance and deposit fusion.

ANALYSIS OF WELDING CHARACTERISTICS

The significance to the welding engineer of this analysis of metal transport is as follows:

A. An examination of the globular tips permits:
   1. Classification of electrode wires.
   2. Selection of electrodes which will produce a minimum oxide content, gas pockets and arc instability.
   3. A rough estimate of the arc length maintained by the welder.

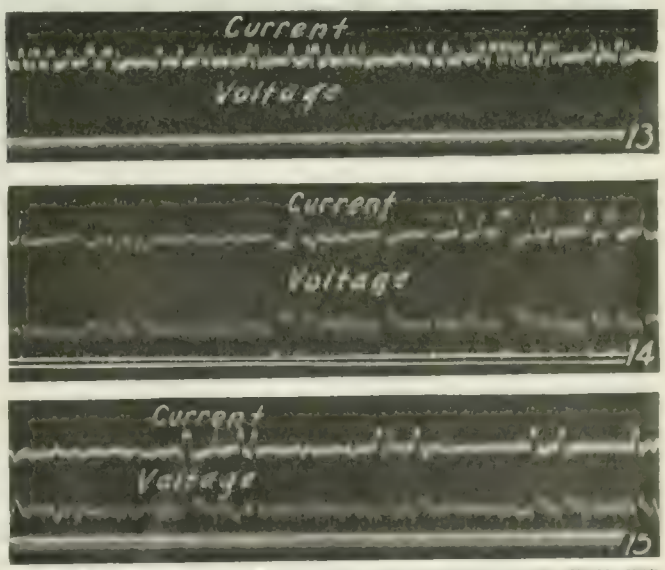
B. Use of a short arc length
   1. Retards the rate of oxygen penetration into the solid incandescent electrode metal beyond the arc stream.
   2. Increases the deposition rate. With some electrodes the increased force obtained on bringing globules in contact with the wetted plate surface after a short period of growth increases the deposition rate 35 per cent above that when maximum globular growth is permitted.

C. To facilitate overhead welding, electrodes must possess, apparently, the following characteristics:
   1. Small maximum globular formation.
   2. Stabilizing ingredients to facilitate re-establishment of arc after globular short circuit; freedom from occluded and generated gases.
   3. High-temperature gradient at junction of liquid globule and electrode, in order that the contact surface may be a minimum and the forces holding globule to electrode may therefore also be a minimum.

ANALOGIES SHOWING METAL TRANSPORT PROCESS

To convey an adequate conception of the magnitude of the forces producing metal transport, the author has developed a number of analogies employing the use of mercury and amalgamated surfaces:

Downward Welding.—A device for simulating metal deposition under this condition is shown in Fig. 19. Mercury is admitted into the upper end of a copper tube serving as the wire "electrode," flowing down slowly until it reaches the lower end. As this part of the "electrode" is amalgamated the force of surface tension causes a globule to form and enlarge until its weight exceeds the surface tension at the "electrode," when the globule drops to the plate and another proceeds to form. A constant stream of mercury may therefore be admitted at the upper "electrode" end and an intermittent globular deposition secured from the lower end.

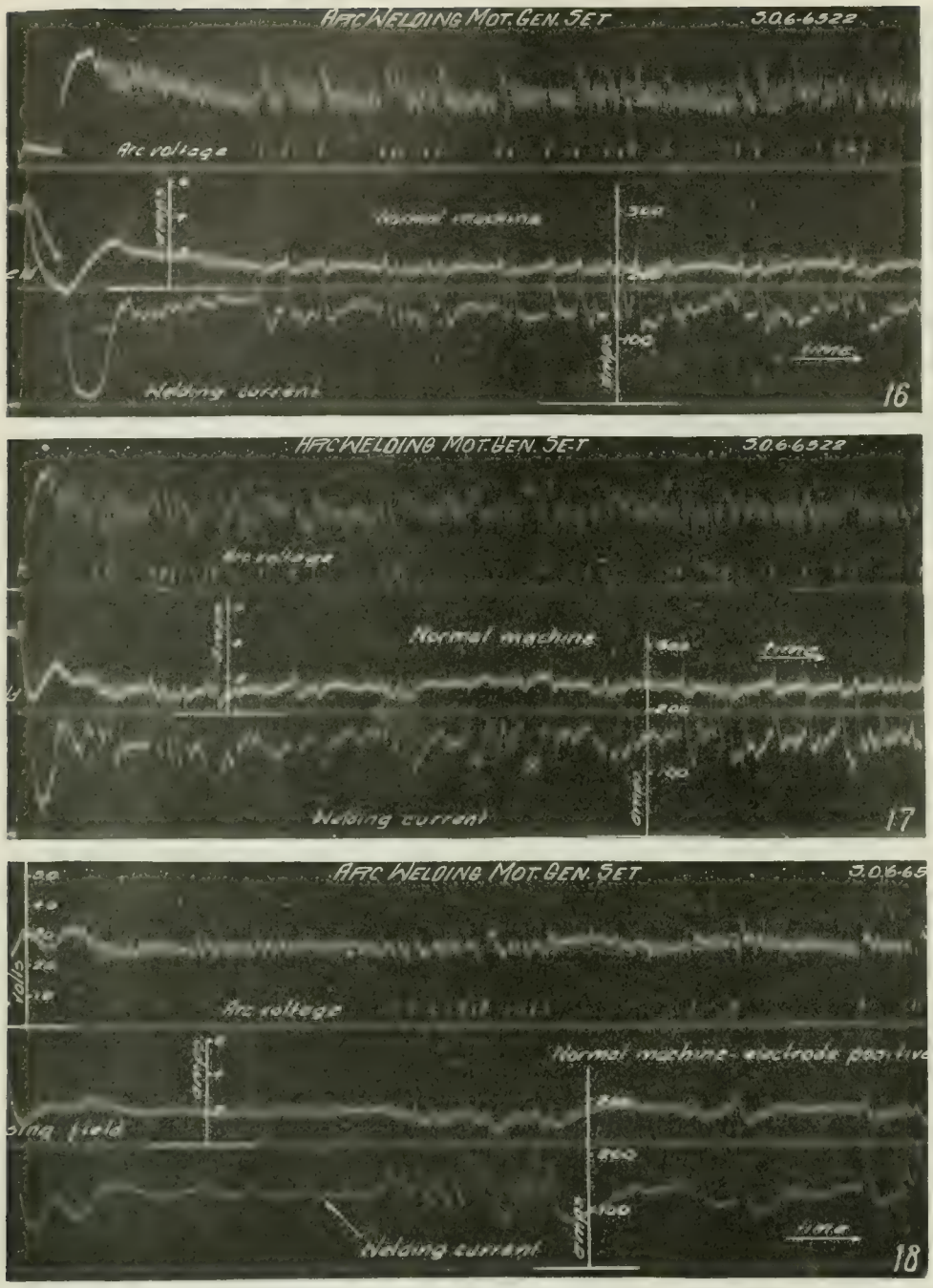


FIGS. 13, 14 AND 15—CURRENT AND VOLTAGE VARIATION FOR METAL ARC-WELDING PROCESSES

(13) Short-arc overhead welding, metal deposition as shown in Fig. 5*g*. Scale and electrode same as in Fig. 10. Rate of deposition approximately 28 per second. (14) Short-arc downward welding. Change in make of electrodes only. Compare with Fig. 11 and Fig. 15, globule rate, 13 per second. (15) Short-arc overhead welding, same electrode as in Fig. 14. Compare with Figs. 13 and 14. Rate of deposition, 6 per second.

[1] "Some Recent Investigations in Arc Welding," O. H. Eschholz, December, 1917, A.I. and S.E.E., pp. 714-717; "Training of Arc Welders," O. H. Eschholz, ELECTRICAL WORLD, Sept. 27, 1919, pp. 692-696.

[2] June convention 1920, A.I.E.E., "Characteristics and Performance of Arc-Welding Machines."



FIGS. 16, 17 AND 18—CHARACTERISTICS OF SPECIAL WELDING MACHINE DESIGNED TO FACILITATE STARTING OF ARC, DEPOSITION OF METAL AND ARC MAINTENANCE

(16) Arc current (lower) and arc voltage (upper). Electrodes, $\frac{1}{16}$ in. Bare mild-steel wire. Time, 0.37 second per inch. (17) Same as Fig. 16, excepting coated electrode used. Film speed, 0.65 seconds per inch. (18) Same as Fig. 16, excepting covered electrodes used. Speed. 0.33 seconds per inch.

Upon shortening the "arc" so that an inclined amalgamated plate is brought into contact with the surface of the enlarging globule, the forces of surface tension and adhesion at the contact area assist the force of gravity in detaching the globule. The increased rate of metal deposition by the use of a short arc may, therefore, be easily demonstrated. If a very short arc, $\frac{1}{16}$ in. (1.7 mm.), is held, the flow of mercury is continuous. This condition may also be obtained with welding electrodes, a very skilled operator having, to the author's knowledge, held for an appreciable time a 6-volt "arc" with a bare electrode. A similar condition may be obtained more readily, however, with heavily covered wire. The maintenance of such a continuous flow of metal on short-circuiting the arc stream greatly reduces energy concentration at the plate and therefore produces incomplete fusion of deposited metal to joint members.

Overhead Welding.—Metal deposition phenomena occurring on welding a vertical, inclined or overhead surface may be demonstrated with the device shown in Fig. 20. The end of the "electrode" tube in this case has a small opening and is not amalgamated. On admitting mercury into the connecting tube at a suitable height, a globule is formed on the end of the electrode. If a long arc is held or if the "electrode" end is amalgamated, globular growth will continue until the liquid surface ruptures, whereupon the metal flows down the electrode walls. The irregular or striated electrode contour shown in Fig. 5h was produced in this manner.

Upon shortening the "arc" to approximately $\frac{1}{16}$ in. (2.4 mm.), globule growth continues until contact is made with the wetted or amalgamated plate surface. (In practice this wetted condition is produced by the energy developed at the positive or plate arc terminal.) The globule then appears to leap upward. A similar phenomenon in overhead welding has led operators to conclude that the electrode metal "jumps" to the plate. This rapid transmission is caused mainly by the greater total surface tension exerted on the globule at the plate. The area of contact between globule and wire electrode is defined by the perimeter of the electrode. However, as the plate surface is relatively flat, liquid in contact with it may spread over a large area. Since the total surface tension is a function of the perimeter of the contact area, it is apparent that by a suitable selection of wire electrode size, current as well as arc length, the sum of the forces of surface tension, cohesion and gravity acting to hold the globule to the electrode end may be exceeded by the combined forces of surface tension and adhesion tending to lift the globule to the plate. In practice it is therefore found that overhead welding is facilitated by holding a short arc (small globule and low weight), reducing current from 150 amp. to 125 amp., with a $\frac{5}{32}$-in. (3.9-mm.) electrode (improved control in globular formation, decrease in wetted wire electrode surface and therefore total sur-

face tension and cohesion at electrode). A further reduction in attractive forces at the wire electrode is accomplished on decreasing the electrode diameter and current to respectively $\frac{1}{8}$ in. (3.4 mm.) and 100 amp.

The deposition characteristics obtained due to the expansion of occluded or generated gases may be demonstrated by trapping air in a $\frac{1}{16}$-in. (1.7-mm.) connecting tube. On varying the amount of confined gas and height of mercury column, either the pellet discharge or a slow globular enlargement, terminated by rupture, may be duplicated.

Although the knowledge concerning the behavior of the welding arc is still incomplete, the hypothesis that metal transport is chiefly caused by the forces of molecular attraction facilitates the interpretation of important arc phenomena and offers as well a basis for the ordered determination of electrode requirements, apparatus design and welding characteristics.

High-Speed Wheels for Low-Head Plants

Old Low-Head Plant with One 750-Kw. Generator Geared to Seven Wheels Through Jack Shaft Replaced by Three High-Speed Water Turbines Direct-Connected to Three 320-Kw. Generators

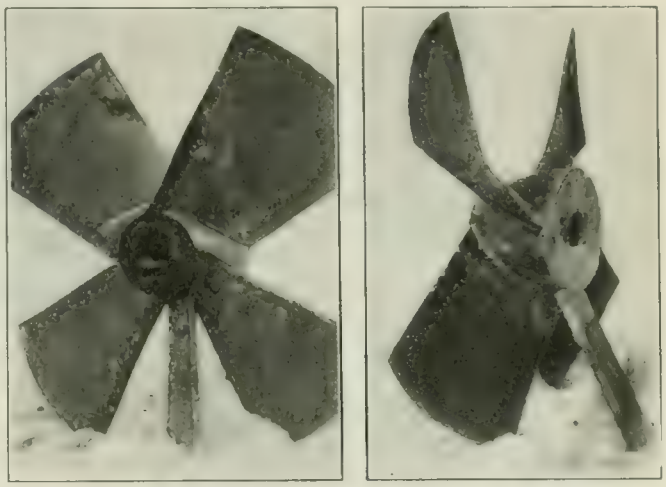
By A. STREIFF
Fargo Engineering Company

A HYDRO-ELECTRIC plant that is probably the first of its kind has been placed in operation by the Consumers' Power Company near Plainwell, Mich. This station contains three Allis-Chalmers high-speed runners of the latest type and has the further unique characteristic that the headwater over the turbines is raised and the turbines therefore may be classed among those installations which are known as "vacuum turbines."

Originally there had been a hydro-electric station on the same site, which is on the Kalamazoo River, 2 miles (3.2 km.) below Plainwell, Mich. It had consisted of a timber penstock, earth embankment and gate spillway. The head was 13.5 ft. (4 m.). Seven old-type wheels geared to a jackshaft were operated in the timber flume and were coupled to a single 750-kw. generator. This old plant was destroyed by fire on May 20, 1919, and the penstocks were then rebuilt in concrete. The new generating units delivered power for the first time on Jan. 28, 1920.

In the new plant there are three penstocks each of which contains a 72-in. (183-cm.) Allis-Chalmers type NX turbine, operating at 164 r.p.m. and delivering 380 b.-hp. under a head of 12 ft. (3.6 m.). This type NX turbine as developed by F. Nagler constitutes a very material advancement in turbine design. The tendency in this design has in the last decade more and more approached the Jonval type, showing a constancy of discharge at various speeds. The previous important stride in the design of high-speed runners was made by Professor Zowski, whose high-speed runners of a type characteristic around 100 are even now unsurpassed. These Zowski runners have all the characteristics of the Jonval turbine and even at high speeds approach the characteristics of Fourneyron turbines. The turbines of the Plainwell dam have been designed entirely along the lines of the Jonval turbines and show at increasing speeds the characteristics of the Fourneyron turbines. The result is that much higher speeds have been attained by this type NX turbine than is possible by any other type.

At full-gate opening the Plainwell turbines show a type characteristic of 143. The runner is an entire departure from the Francis, or the so-called mixed-flow, turbine and is of the Jonval type with important innovations. The arms of the old Jonval turbine to which the bucket ring was fastened are eliminated entirely and the buckets drawn back to the hub. The reduction of the number of buckets previously applied in high-speed runners is here carried to the limit. The number of buckets or blades has been reduced to four, and these four are spaced wide apart, so that the buckets and clearance between buckets each occupy about one-eighth of the total projected area of the runner. In this manner a very high-type characteristic has been obtained.



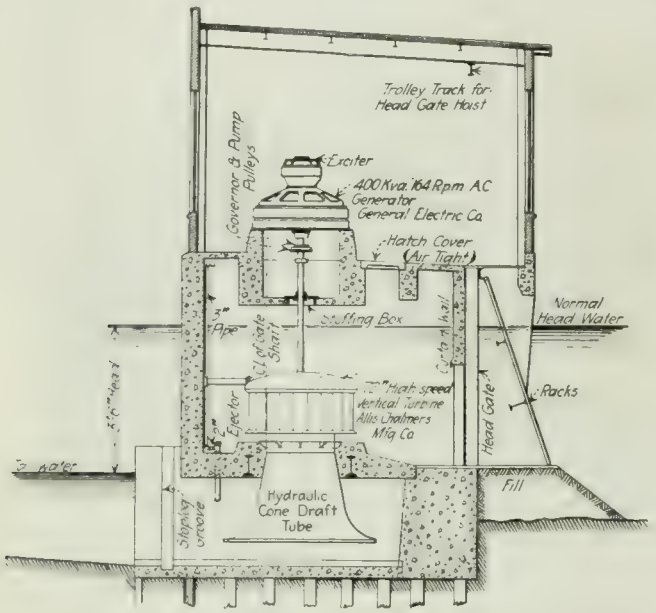
TWO VIEWS OF NEW TYPE OF RUNNER FOR HIGH-SPEED, LOW-HEAD TURBINES

As to the efficiencies that may be expected from such a high-type characteristic it is evident that the efficiency of high-speed runners of the Zowski design has not yet been fully attained. These Zowski-Leffel turbines, as finally developed by F. B. Fish, have given at Holyoke an efficiency of more than 92 per cent, whereas the type NX turbine at the present time shows a maximum Holyoke efficiency of 86 per cent to 87 per cent.

The accompanying illustration shows a view of the runner which has the general appearance of an ordinary propeller. It is made of cast iron. The wide openings between the buckets are of great advantage from an operating standpoint, as it is impossible for the wheel to become clogged by trash. The runners are placed in turbine cases of the ordinary design.

This type of turbine requires a draft tube of as great length as possible in order to attain the necessary efficiency. The draft tube made of steel plate is a flaring cone with vertical axis of the hydraucone type designed by William M. White. In this case the outline closely approaches the theoretical ideal draft-tube forms, the calculations of which were given by Professor Prasil. The characteristic of this draft tube is that the distance from the tailrace bottom to the draft-tube edge is comparatively small and the flare at the lower diameter is great.

On account of the large size of the turbine for the head and the high elevation of the center of the turbine case necessary through the required length of the draft tube, the wheel center in the Plainwell plant came too near the headwater to insure satisfactory operation in the ordinary way. It was therefore decided to use the so-called vacuum-turbine setting in order to provide



SECTION OF PLAINWELL (MICH.) PLANT USING NEW TYPE OF HIGH-SPEED TURBINES

The so-called vacuum-turbine setting is used, being sealed off by the curtain wall. Air is removed by the 2-in. ejector.

sufficient depth of water over the turbine. These vacuum turbines were introduced for the first time by the Escher-Wyss Company of Switzerland, and several installations have been made in which the turbines were installed in whole or in part above headwater and operate in a partial vacuum. The Plainwell turbines are still under the ordinary headwater, but the water level over the turbine when operating is raised about 6 ft. (1.8 m.) above headwater in the pond and rises to the underside of the generator-room floor, the entrance being sealed by a curtain wall. This concrete penstock, therefore, is entirely closed and operates under a partial vacuum. The air is constantly removed by means of a water ejector of small size. Its water consumption is insignificant compared with the discharge of the turbine.

After the plant was placed in operation the vacuum was tested and found to be 5¾ in. (13.3 cm.) at normal pond level, which showed that the penstock was full of water to the underside of the generator floor. The turbines have not yet been tested but are fulfilling power guarantees.

An interesting feature in the general appearance of the plant is the unusually small size of the generator as compared with the size of the turbine. Usually the generator for such a low-head plant is of quite large diameter. The small size of the Plainwell generators is due to the high speed of the turbines, and this permits the economical use of direct-connected exciters on top of the generators.

The generators are 400-kva., 320-kw., 0.8-power factor, 164-r.p.m., 2,500-volt, three-phase, 60-cycle machines. The thrust bearing is a General Electric Company combined spring-thrust and guide-bearing type. The machines are provided with alarm thermometers and oil gages to control the oil level in thrust bearings. The governors are Woodward governors of 6,700 ft.-lb. (924.6 kg.-m.) capacity and belted to the turbine shaft. At times of low water one or more of these machines may be used as a synchronous condenser to improve voltage conditions on the company's transmission lines. This is possible in this type of unit because no bearings depend on passage of water through the wheel for lubrication or cooling.

The oil switches are equipped with disconnecting switches for inspection purposes, in accordance with standard practice of the Consumers' Power Company.

There will be three type H 60-cycle, 400-kva., 45,000-volt primary, 2,500-volt secondary, oil-cooled, single-phase outdoor-type transformers. The 40,000-volt high-tension switch is also rated at 400 amp. This is mounted on a pipe framework, will be automatic and hand-operated, and will be provided with bushing type current transformers so as to operate the necessary relays. The entire plant is operated by one man on each shift.

At the Plainwell plant the hydraulic structures were designed by the Fargo Engineering Company of Jackson, Mich. J. B. Foote is chief engineer of Consumers' Power Company and W. W. Tefft is hydraulic engineer.

Electrical Development in China

ACCORDING to the *Transpacific*, there are only 168 electrical undertakings in China, forty-nine of which are under foreign management. The Japanese have invested over $100,000,000 in such enterprises through the South Manchurian Railway Company and $759,000 through other concerns, and the British have invested $25,000,000, of which about half is through Chinese concerns. In Canton there are twenty-two power and light companies in addition to the British Tramway Company. No water power is used, most of the power being derived from oil, except for two coal-burning plants. They are all small, only four having a capacity of over 1,000 kw. There are also twenty-two electrical enterprises in Kiangsu Province, centered around the city of Shanghai, which develop twice the power of the Canton plants. All of them use steam power.

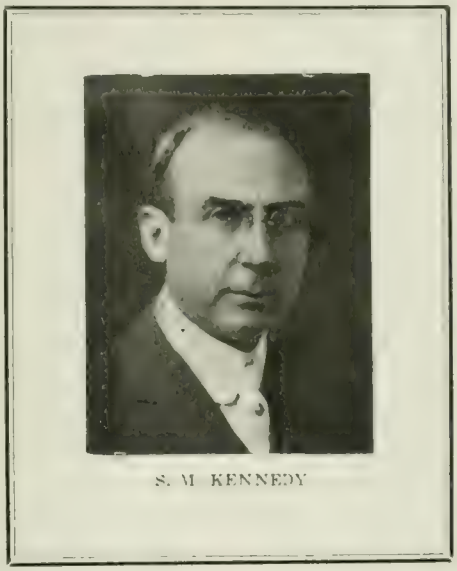
Of the fifteen electrical companies in Shengking Province, Manchuria, thirteen are managed and owned by the Japanese, and the 30,000 kw. of power generated is supplied to Chino-Japanese industrial or transportation enterprises. The largest single enterprise is a power house of the railway company, which generates 4,500 kw. by steam. Although Shantung Province is one of the most populous areas in China, there are but four Chinese and one Japanese plant, generating a total of but 5,000 kw. In the other provinces there are only the small native plants using gas power and operating on a very small scale. The possibilities for future development are therefore very great.

"I Thank You"

By S. M. KENNEDY
Vice-president Southern California Edison Company

THERE is a story told of a young man who was what might be termed a strenuous lover. On one occasion when embracing his sweetheart he fancied he heard something that sounded like a gasp. "Am I holding you too tight?" he queried. "No," was the young lady's reply; "all I ask is that you leave me breath enough to say, 'I thank you.'" Whatever else may be said, there is no doubt that this lady understood a fundamental principle, namely, that the best protection for present joys and the best assurance for the fulfillment of hopes for the future is a thankful appreciation for past favors.

Now, let us suppose you are an employee of a public service corporation, possibly just entering the business. You may have come to the company from the ranks of those influenced by prejudice and hostility toward corporations in general and all concerned with them. But, doubtless, you have personal ambitions—you desire to increase your usefulness to the company and you are striving to be recognized by the management of the corporation. If you are in this class, if you desire to reach the goal of your ambition in as little time as possible—in short, if you want to hold a trump card in playing the great game of success—then here is a message for you. Learn to retain breath enough at all fitting times to say "I thank you."



S. M. KENNEDY

Some man of a mercenary mind once said that the four sweetest words in the English language are "Inclosed please find check." Be that as it may, sweetness does not draw all the prizes in life, and other attributes may be considered with advantage. After all, the envied man is the man who possesses personal power—the power to disarm prejudice and to dispel opposition, the power to win friends and to draw business. Find such a man and he will tell you that the three most potential words in the English language are "I thank you." If it's checks a man wants, then the checks will come more frequently and their amounts will be greater if the "I thank you" is never overlooked. If it's ultimate promotion to a high position an employee seeks, then one of the surest ways to draw the attention of superiors and create a favorable impression is to understand thoroughly the potentiality of the words "I thank you."

Most men know there is a proper time for everything, and the proper time to commence saying "I thank you" is not next year or next week, but now and at once.

> "Look to this day;
> For yesterday is only a dream
> And tomorrow only a vision."

An editorial writer, in a recent issue of a daily paper, published an article under the caption "The Thank You Club," thereby indicating that he realized some men and women were daily missing great opportunities. He said in part: "It's great, the 'Thank You Club.' No initiation, no dues, no long-drawn-out meetings and no reports. Any one can join, and so small a number as two make a quorum to do business. No stated meetings and no stipulated place of meeting. Anybody can start a 'thank you club.' Beats 'overall clubs' all to pieces, lasts longer, does more good and spreads sunshine. One carries the bylaws around in his head. The password is 'Thank you.' And that's all there is to the whole book of rules. That's all it means—the 'Thank You Club'—just a 'Thank you' for the little services performed daily as well as the big ones. A 'Thank you' is more appreciated by many people than a tip, which by some may be considered an insult. Start a club some morning—watch your club grow—good ideas spread. Try the club for one day. It may make you a life member, and the 'Thank yous' will increase and radiate like ripples from a stone thrown into a millpond."

The modern public utility organization is much like a great machine, and its employees are the cogs in the wheels which grind out the daily round of usefulness. But there one must stop in the simile. A machine itself has no thinking power and no initiative. A man or woman should possess both judgment and discernment and be capable of independent thought and action. Upon the proper use of these qualities depends the degree of ultimate success obtained.

The prosperity of a utility company hinges upon the kind of men who handle the details of its business. Do these men work together harmoniously and efficiently? Does the company as an organization endeavor to please its patrons and satisfy the public? Let us assume it does. Then there will be in evidence a spirit of courtesy and consideration between man and man and between the company and its customers. The more respect and consideration fellow employees have for one another, the greater will be the amount of kindly courtesy exhibited in daily intercourse. And the more a utility company aims to please its consumers, the greater amount of public confidence and good-will it must enjoy. The outward and visible sign in all this intercourse of a pleasing character is the frequent and consistent use of the words "I thank you," when prompted by the right spirit.

It is quite possible that some may ask what the proper time and place to say "Thank you" is and to whom it shall be said. A little practice will soon clear up all doubts in this regard. Some people may be surprised at first to hear the words addressed to them, but they will not be shocked. The words become sweet music to the ears of him who gives and of him who takes.

The time? Any time—in personal intercourse, over the telephone or through correspondence. The place? Any place where an opportunity is given to recognize the existence and assistance of another. The one? Any one—whoever does you a small favor or a big one; any one who serves you, either in a special manner or

along the lines of regular routine. "Thank you" is rarely out of place and almost always welcome.

Many individuals say "I thank you" because the words express their feelings and they like to use them. Some people feel "I thank you," but leave the feeling to be understood. Others there are who do not know the "I thank you" feeling and rarely use the words. But the "I thank you" gospel may be spread if it is consistently promulgated. Ideas are like nails—the oftener you hit them, the deeper they sink. Those who believe in the "I thank you" policy need not be discouraged if success does not immediately crown their efforts to convince others of its value. The idea will eventually sink in through persuasion, conviction or self-interest, if the hammering is kept up.

There is another angle of the "I thank you" idea which is not along the lines of policy or self-interest. It is that each of us owes a debt of courtesy and politeness to the fellow-men with whom we come in contact. Shakespeare has said, "Thanks to men of noble mind is honorable meed." We have no more right to be discourteous or impolite to our neighbor at home, to our fellow employee, or to those with whom we daily come in contact, than we have the right to hold a gun at their heads and forcibly rob them. On the other hand, if one finds it necessary to commit robbery, the average man is liable to forgive the robber if he does his unpleasant task in a polite manner and says "I thank you" when he has finished.

The fixed star of ambition is the eternal guide which beckons men on to the goal of success. Its light flashes from the desired haven of ease, comfort and affluence. The lives of successful men illuminate the pathway for those who seek the guiding light of experience. All successful men have not reached the goal through the same attributes or by the same means. But all signs point to the quickening power of courtesy and politeness. History demonstrates that most men who have climbed highest learned, when their feet were yet on the lowest rounds of the ladder, of a marvelous compelling power the use of which had an irresistible effect. The marvel was its simplicity, for this mysterious power was tied up in the use of the three modest words "I thank you."

Linking Up the British Empire by Wireless

THE long-contemplated plan to connect all parts of the British Empire by wireless telegraph has received fresh impetus through the issue of the report of the committee appointed by the government to formulate such a scheme. The committee's report, which is unanimous, recommends that the empire shall be linked up wirelessly by stages of about 2,000 miles each and that the system employed shall be that of the generation of radio-telegraphic energy by thermionic valves.

The scheme contemplates two main chains of wireless, one receiving dispatches from Africa and the other from Asia and Australasia, both with Cairo as their first station. For the first link of the first chain a connection would be made on the Poulsen arc system between Oxford and Cairo, which the Post Office Department has nearly completed.

The cost of the scheme is estimated at £1,243,000 and it is figured that there would be a loss of about £100,000 annually in the working of the system during the opening years.

Columbia's Six-Year Course for Engineers

COLUMBIA UNIVERSITY, New York, is calling attention to its engineering courses, which since 1912 have followed the plan of a three-year professional course preceded by three years of college work, including specified and thorough training in mathematics, physics and chemistry. In this way six years elapse between the high school and graduation in an engineering course. Many eminent engineers and technical instructors are in favor of college preparation covering this length of time, and it will be remembered that the committee on development of the Institute of Electrical Engineers reported and the Institute itself adopted a resolution declaring for a six-year course in electrical engineering, two years of this to be given to the study of the humanities. Dean George B. Pegram of the School of Mines, Engineering and Chemistry of the university asserts that, with the exception of the mining engineering course at Leland Stanford Junior University, the courses at Columbia are the only ones to meet this desire. While in one sense the Columbia school is a graduate school, he says, in another sense it is not. That is, it is distinctly not a course which adds two more years to the ordinary course, but rather one in which more time has been devoted in the first three years to an education in the humanities and in the fundamental sciences, its organization being along the same lines as that of the law school and other professional schools.

The three years of preparatory college training include—in addition to English, history, modern languages, philosophy and economics—mathematics through differential and integral calculus and elementary differential equations, general chemistry and qualitative analysis and very thorough training in general physics. The three years in the technical school are entirely taken up with professional studies, the time devoted to the special branch chosen increasing with each year. For instance, in the electrical engineering course, physics, mathematics, chemical engineering and mechanical engineering each consume more of the student's time the first year than does his electrical course proper, but in the second year almost one-half and in the third year fully two-thirds of his time is devoted to electrical engineering pure and simple.

President Nicholas Murray Butler, in discussing the plan of engineering education pursued by Columbia University, has dwelt upon the fact that fewer than 50 per cent of the students who enter engineering schools remain to graduate. "The clear differentiation in our present program between the undergraduate work and the professional school work," he says, "together with the deterring influence of the longer course upon those whose resolve is not firmly established, operates to collect in our professional engineering school a group of men of sound and homogeneous preparation, each of whom is there for good reason. The interaction of the minds of these well-selected students on one another is by no means one of the least important features of this arrangement, and the possibility of a much higher standard of instruction is obvious. As for those other students who may have spent one or more years in college looking forward to an engineering course only to discover that their real interest lies elsewhere, they are when in college in the very best situation for directing their attention to preparation for other fields of labor."

Readers' Views and Comments

Welding Structural Steel Work

To the Editor of the ELECTRICAL WORLD:

SIR: The article by H. B. Payne in your issue for June 19, page 1421, entitled "Welding Structural Steel Work," has interested us very much, especially as the Quasi-Arc Company made a similar demonstration of welding on structural work about twelve months ago. In this case one-half of a 20-ft. roof span was welded, while the other half was riveted, and the structure was then loaded on the center line until it failed—*under a load of 3,360 lb.* The riveted section buckled and spread, while the welded portion was practically intact.

D. C. ALEXANDER, JR.,
President.

Quasi-Arc Weldtrode Company, Inc.,
Brooklyn, N. Y.

Advantages of 50-Deg. and 40-Deg. Motors

To the Editor of the ELECTRICAL WORLD:

SIR: A number of articles have appeared in your columns during the last year or two on the relative advantages of the "continuous-rated" or 50 deg. C. rise motor versus the older "double-rated" or 40 deg. C. rise motor.

One claim frequently put forward by the advocates of the 50 deg. rise motor is the price advantage. A higher efficiency is also claimed since the use of the 50-deg. motor lessens the chance of over-motoring. These arguments are based on the economic advantages, and the writer wishes to point out that these advantages are often apparent rather than real. This fact was recently brought to his attention in connection with investigations of certain motor-equipped industrial plants purchasing power from a public utility company.

A particular load required 11 hp. almost continually. Either a 10-hp., 40-deg. (old type) or a 15-hp., 50-deg. (new type) motor could carry the load. The motor manufacturer quoted $275 for the "old" 10-hp. and $274 for the "new" 15-hp. motor, an apparent advantage of $1 for the "new" type. However, the power companies usually have a "stand-by charge" or "maximum-demand charge" that is based on the installation, which in turn is taken from the name-plate ratings. In the case referred to the "stand-by charge" is $3.25 per month per kilowatt of installed load ($2.44 per horsepower). The excess annual charges on the 15-hp. motor amount to $146.40, and this sum far outbalances any possible price advantage of the motor. This condition will often arise, and care is required that an apparent saving shall not result in an actual net loss.

On the other hand, however, if the load approximated 13 hp. to 15 hp., then a 15-hp. motor of either type should be selected, and a price advantage of approximately $50 makes the "continuous-rated" motor the most economical application as there is no difference in the "stand-by charge" in this case.

The manufacturers of the "continuous-rated" motor state that, for purposes of comparison with the "old" 40-deg. motor, one must take 83⅓ per cent of the continuous rating. Accepting this figure (although the opponents of the new method of rating assert this to be too radical and unsafe), a 5-hp. "continuous" would rate as a 4.2-hp., 40-deg. rise motor. Similarly, a 7½-hp. motor would be 6¼ hp. on the old rating. It is apparent that on a common basis of comparison there is now available a larger line of motor sizes to select from. For example, 4.2, 5, 6.25, 7.5, 8.3, 10 hp., etc. Those opposing the new system of rating will probably insist on reducing the odd-size ratings (*e.g.*, 4.2 to 3.5, say; 6.25 to 5.5 or less, etc.), as they take the position that 83⅓ per cent of the continuous rating does not provide the same degree of security as do the older ratings.

From the above facts the following conclusions are drawn:

1. There are now approximately twice as many motor sizes to select from as formerly.
2. Further experience is apparently necessary to determine the correct listing, on a comparative basis, of the "odd" (new) sizes.
3. With proper data as regards the load, motors can now be selected closer in size to the exact requirements.
4. In arriving at the most economical selection, in the case of purchased power, it is evident that the power rates as well as the price of the motor must be taken into consideration.
5. At present, with the two systems of ratings and with various power rates, it seems that there is greater chance for mistakes in selection than in the past, unless expert advice is relied upon almost exclusively.

L. H. RITTENHOUSE,
Associate Professor of Engineering.

Haverford College, Haverford, Pa.

Fire from Electrical Causes

To the Editor of the ELECTRICAL WORLD:

SIR: Referring to an editorial article that appeared in the ELECTRICAL WORLD for May 22 in regard to accurate reports of so-called electric fires, the writer would like to say that, like many others closely connected with the electrical business, he has frequently known of cases where fires were reported incorrectly in the newspapers as due to defective wiring. It should be the duty of every electrician to combat such reports, accepting the blame, however, when fires are actually caused by electricity, and using every effort to suggest and carry out means for future prevention.

In our experience several fires have been reported as "caused by defective wiring" when this was not the case. In one instance the electric service wires had never been connected to the building. In another the service wires had been cut off two years previous to the fire. In a third instance a three-story department store, lighted by gas only, had electric elevator service. During a fire this elevator was operated for twenty minutes to carry the women employees to the lower floors. The proprietor of the store told me later that the fire started in a packing room from a lighted cigarette. In another case investigation brought to light the fact that a chemicalized mop was left on the west side of a house on a hot afternoon in close proximity to a telephone ground wire. The sun ignited the mop, setting fire to the side of the house.

Many similar cases are known. In this city every effort is made to induce the reporters to give us a fair chance to investigate fires before ascribing them to electrical causes.

ISRAEL LOVETT,
City Electrician.

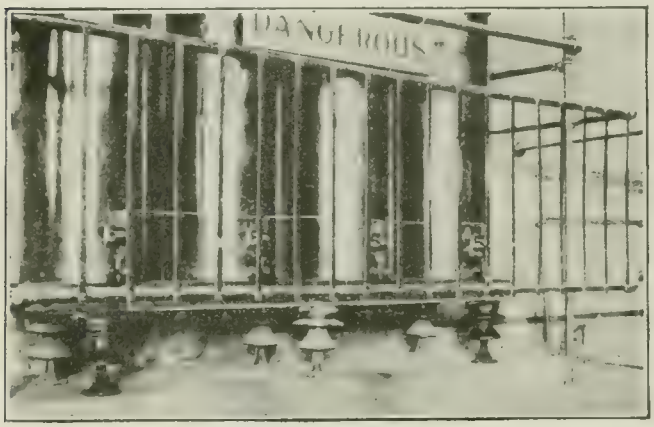
Omaha, Neb.

Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Pipe Frame Guards Lightning Arresters Against Trucks

TO PREVENT automobiles and trucks backing into a set of 33-kv. lightning arresters installed in an old boiler house now used as a central-station garage, a pipe guard was erected as illustrated. It consists of two 1¼-in. (3.2-cm.) pipe rails looped in front of the usual



PIPE AND STRAP-IRON GUARD PREVENTS TRUCKS BACKING INTO ARRESTERS

rail guard placed before the arresters, the former being connected by parallel iron straps ¾ in. (2 cm.) by 3⅛ in. (7.8 cm.) in section. The straps are spaced 6 in. (15 cm.) apart on centers and are 30 in. (76 cm.) long, being fastened to the rails by ¼-in. (6 cm.) stove bolts. The outer guard clears the inner one by about 15 in. (3.8 cm.) and has successfully resisted the impact of motor vehicles backing toward the arresters on more than one occasion.

Large Birds Are Found to Be Cause of Transmission Trouble

DURING the past year a number of short circuits on the 60,000-volt transmission line of the Southern California Edison Company from Kern River to Los Angeles were found to have been caused by large birds which roosted in the jumper loops. The bodies of the dead birds found underneath the towers gave an explanation of a number of line troubles which had been occurring for some unexplained reason. These birds, which were from 25 in. to 30 in. (60 cm. to 75 cm.) high, rested in the jumper loops of the dead-end towers where the clearance to steel arm was approximately 19 in. to 20 in. (47.5 cm. to 50 cm.).

In order to stop this trouble, and also another frequent trouble consisting in a flashover from the loop to the tower, it was decided to add another insulator to the string, bringing the total number on the dead-end strings to six and on the suspension strings to five. The trouble last referred to was caused by the formation of an arc between the main body of the tower and the jumper loop, which would rise until it spanned the insulator strings and caused the end units of the string to be broken by heat. As a general rule, service was immediately resumed over the line after the arc was broken, which was accomplished by lowering the voltage on the line. No definite conclusion has been reached as to the exact cause of this trouble, and it would appear that the clearance of 28 in. (70 cm.) should be entirely sufficient to insulate the line against any normal voltage.

Systematic Line Inspection Practiced by New York State Companies

IT WAS brought out very plainly in the discussions of line inspection methods at the recent Utica (N. Y.) meeting of the Empire State Gas & Electrical Association that practically all New York companies do have some system of inspection, unless there are special conditions involved. The period of inspection on poles averages about one year and high-tension lines are patrolled about once a week. Special inspectors are usually employed for the high-tension systems, but linemen are used for the distribution lines. In some cases distribution lines are being worked on so constantly that any troubles are caught without special inspection.

Inspections are made annually for the Schenectady Illuminating Company by an inspector who uses a blank form to fill in the conditions of the line as found. This type of man has been found very important, and an ordinary lineman has not given satisfactory service for this work, according to C. S. Van Dyke.

The Syracuse Lighting Company, S. A. Huntington said, has a system whereby one-half of its lines are inspected one year and the other half are inspected the next year. All butts of poles are carefully inspected in the spring after the frost is out of the ground. During the winter months the overhead-line condition is noted by the inspector. High-voltage lines are inspected very carefully each year by cutting the current off and making a thorough examination of the cross-arm, insulators, etc. The high-tension lines are patrolled every week.

C. H. Cross stated that the Solvay Lighting Company tested all pole butts, cross-arms and pins annually. It is the practice of the Utica Gas & Electric Company, according to W. J. Brady, to patrol the high-tension lines each week, but no regular inspection system is maintained for the distribution lines as they are continually being tested and inspected by the line gangs at work. The Empire Gas & Electric Company has no regular system of inspection at the present time on account of rebuilding its lines. On high-tension lines a patrolman is kept continuously busy on inspection work, P. Hoodman asserted. The Rochester Gas & Elec-

tric Corporation is another company that has no periodic inspection on account of joint ownership with the telephone company. With two different gangs working on the lines it is thought that the inspection work is automatically taken care of, although every six months the guys are gone over and tightened up, according to Sidney Alling.

While there is no regular systematic inspection, it is the endeavor of the Rome Gas, Electric Light & Power Company to go over the lines every year and to trim the trees each fall, stated A. B. Motor, in discussing his company's activities. The Elmira Water, Light & Railroad Company patrols the high-tension lines once each week, and linemen are used to inspect the distribution wires periodically, J. F. Creighton said.

The work of the Boston Edison Company is divided up into ten divisions, according to J. A. Vahey, who told of the work of this company. Each division has an inspector who is a lineman. While the lineman may occasionally err on the side of safety, that would seem to be a virtue rather than a fault. A card index of poles is kept, with a card for each pole, and the inspector's records are recorded on these cards. It is the policy of the company to change the oil in all switches and transformers once each year. High-tension lines are patrolled every day.

In discussing the practice of the Westchester Lighting Company, H. W. Watt said that the subject of maintaining the line system might be divided into two parts, the first being inspection to maintain the continuity of service and the second the record system. This company has 30,000 poles and an inspector is kept busy making the round in one year. Slips are made out by the inspector which really correspond to work orders. As these work orders collect, they are grouped into districts and the repairs are made at certain times. Each foreman of a district also keeps on the lookout for minor faults requiring repair. Poles are also thoroughly inspected by linemen before climbing them. The record system is kept up by the inspection department, and a check is made on all new work to see that it has been done in a thorough manner and to inventory the material that has been used. The Municipal Gas Company of Albany uses a lineman for regular inspection work, who enters his reports on cards. All poles, cross-arms, insulators, etc., are inspected, as well as the trimming of trees. This information is all entered in the pole-line book. The inspector, however, does not have the final word, but the foreman inspects the poles that are marked "bad" in the pole-line book and after his personal inspection marks the approximate date on which the pole should be changed. It is possible to cover the system twice each year with this method, stated A. Anderson.

The Adirondack Electric Power Corporation employs a regular patrolman who reports to the system operator. The system, however, is applicable more to the high-tension line than to the distribution line. There is no regular inspection on its distribution system, the line gang taking care of this work, L. R. Nichols asserted. W. J. Fox stated that the Fort Plain Gas, Light, Heat & Power Company had no regular form of inspection but considered that with three companies owning poles jointly the line work was well taken care of by the line gangs. The New York & Queens Light & Power Company has about 30,000 poles that are covered by an inspection system. At the time of erection the poles are dated for inspection at a certain time. When this time arrives the pole is inspected and the date is again set forward for the next inspection, which may be in two or three years. This method allows the inspection time to be shortened with the life of the pole and at the same time reduces the total inspection work to a minimum. In the opinion of W. C. Blackwood, who told of the work of this company, butt inspection tends to shorten the life of the pole. Linemen are not considered good inspectors by the company.

Chart Shows Turbines to Use for Different Loads on Plant

BY MEANS of a chart prepared by a large central station in the Middle West the power-house operator can tell precisely which of the different turbines in the station will develop a given load with a minimum steam consumption. In this chart, which is shown here, a curve is plotted for each size of turbine in the plant showing the steam consumption compared with the load. The following example illustrates the manner in which the curve is used:

Assuming a 60-cycle load of 18,000 kw. and a 25-cycle load of 19,000 kw., what is the most economical arrangement in machines to carry the load and how many

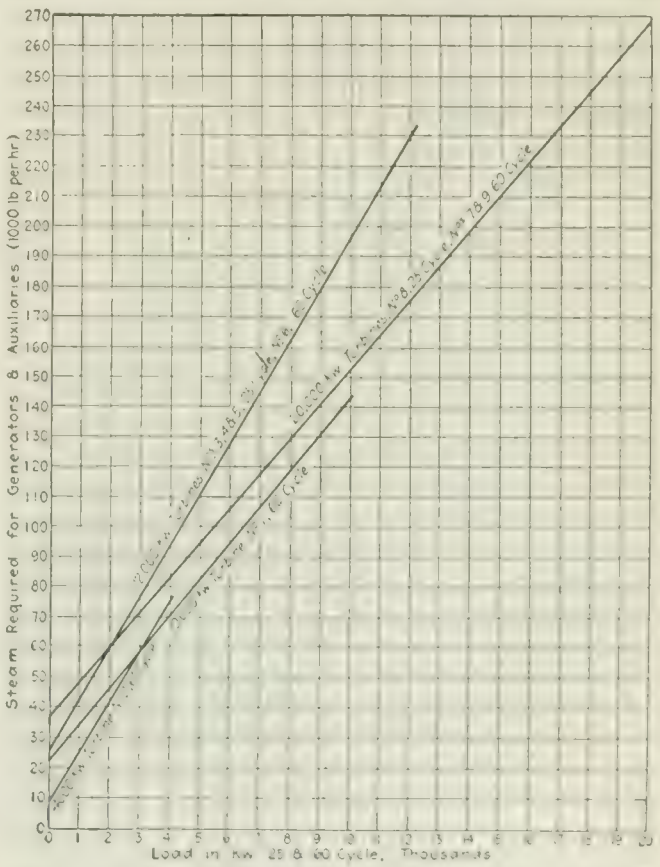


CHART SHOWS WHICH TURBINE IS MOST ECONOMICAL FOR ANY LOAD ON PLANT

Note that the 10,000-kw., 60-cycle machine consumes less steam than the 1,000-kw. unit on loads in excess of about 2,000 kw. A comparison between the 12,000-kw. and the 20,000-kw. turbines of both frequencies shows that the latter is the more economical for any load over about 2,000 kw.

pounds of steam per hour will be required? Taking the 60-cycle load of 18,000 kw., first find this load on the bottom of the chart and proceed vertically to the first intersecting line of a 60-cycle machine. This shows that a No. 7 or No. 9, 20,000-kw., 60-cycle turbine should carry the load, and by following a horizontal line to the left

side of the chart it will be found that 245,000 lb. (110,000 kg.) per hour is required by this machine under the load mentioned. By the same process it will be found that No. 8, a 20,000-kw., 25-cycle unit, should be used to carry the 19,000-kw., 25-cycle load and that the machine will require 256,000 lb. (116,000 kg.) per hour of boiler capacity. If for any reason the No. 8 25-cycle unit is not ready for operation, it is apparent that two units of the next size, 12,000-kw., must be used to carry the load. The load would preferably be divided equally between these two machines, and it will be noted that at 9,500-kw. load each machine would require 187,500 lb. (85,000 kg.) per hour. This means that the boiler room would have to supply 375,000 lb. (170,000 kg.) of steam instead of 256,000 lb. (116,000 kg.) as required for one 20,000-kw. unit.

In addition to the steam requirements of generators and auxiliaries, 15,000 lb. (6,800 kg.) is required for the fixed steam requirements of the station. The total steam requirements with two 20,000-kw. machines in

RATING OF LARGE MIDDLE WEST CENTRAL STATION

Unit No.	Voltage	Cycles	Date Built	Rating in Kw.
1	4,500	60	1911	10,000
2	4,500	60	1911	4,000
6	4,500	60	1910	12,000
7	4,500	60	1917	20,000
9	13,200	60	Not in service	20,000
Total rated capacity, 60-cycle machines....				66,000
3	6,600	25	1910	12,000
4	6,600	25	1909	12,000
5	6,600	25	1911	12,000
8	6,600	25	Not in service	20,000
Total rated capacity, 25-cycle machines....				56,000
Aggregate capacity, 60-cycle and 25-cycle				122,000

service, one supplying 19,000-kw., 25-cycle, and the other 18,000-kw., 60-cycle, would therefore amount to 250,000 lb. plus 245,000 lb. plus 15,000 lb., or 516,000 lb. (234,000 kg.). This information is transmitted to the boiler room a half hour before it is estimated that the load will be required, and from characteristic curves of the boilers the most efficient boiler combination is figured out in much the same manner as has been indicated for the generators. (See ELECTRICAL WORLD, June 26, 1920, page 1486.)

When machines now on order have been put in service the total rating of this station will be 122,000 kw., made up of the three-phase General Electric Company turbo-generators shown in the table.

The standard operating conditions in the boiler room of this plant are: Steam pressure, 210 lb. per sq. in. (14.7 kg. per sq. cm.), 130 deg. Fahr. (55 deg. C.) superheat; 28.5 in. (72.4 cm.) vacuum with 30-in. (76.2 cm.) barometer.

S. N. CLARK.

Chicago, Ill.

From 15 to 20 per Cent Reactance Desirable for Arc-Type Furnaces

TO LIMIT the voltage regulation on 13,200-volt lines of a Western company feeding arc-type furnaces, a reactance (including transformers) of 20 per cent has been found necessary with 200-volt arcs and of 15 per cent with 100-volt arcs.

This central station, which has many steel furnaces ranging from 1-ton (900-kg.) to 12-ton (10.8) capacity connected to its system, supplies all such loads from its 13,200-volt lines. The majority of the furnaces on the 25-cycle system are supplied through transformers designed with 12 per cent inherent reactance. However, 12 per cent reactance has been found low, and the most recent installation is equipped with a transformer having 20 per cent inherent reactance. The amount of reactance required is affected somewhat by the type of the furnace used. Those arc-type polyphase steel furnaces which operate with approximately 100 volts between electrodes do not produce surges on the line as great as those which result from the operation of furnaces with 200 or more volts between electrodes. The arc of lower voltage is better from the power company's standpoint, but the high voltage between electrodes seems to be much more desirable for the steel men because it permits of more rapid melting.

A 3-ton, three-phase arc type furnace having about 208 volts between electrodes was connected to the company's 60-cycle, 13,200-volt system through a transformer with 12 per cent inherent reactance. This reactance proved entirely inadequate, so external coils were added to bring the total reactance up to 20 per cent. Even then the regulation on the line is about 10 per cent.

Furnaces of the same size but with approximately 100 volts between electrodes are being operated satisfactorily on 60-cycle, 13,200-volt lines when supplied through transformers having about 15 per cent inherent reactance.

This particular company has no steel furnaces connected to its 4,000-volt lines with the exception of a very small one which requires only a maximum demand of 100 kva. The furnace is supplied from a 250,000-circ.mil (126.7-sq.mm.) line which is essentially a power feeder. The disturbance caused by this furnace is no greater than that caused by certain welding loads connected to the 4,000-volt system. It has not resulted in any undue fluctuations in the line voltage.

Chicago. G. G. POTTS.

Attractive Construction for Supporting Cable Across Stream

THE attractive concrete-filled steel girder shown herewith is employed to carry power cables of the Worcester (Mass.) Electric Light Company from the Webster Street station across a small stream. This



REINFORCED CONCRETE BETWEEN BRIDGE GIRDERS CARRIES POWER CABLE ACROSS STREAM

support crosses the stream beside a highway bridge and was designed to harmonize with the bridge. It is supported at each end by concrete walls.

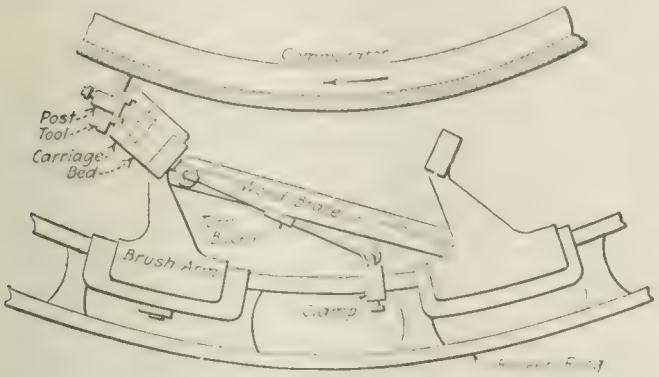
Boston, Mass. H. S. KNOWLES.

Industrial Applications

The Economical Utilization of Electrical Energy
in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

Turning a Commutator in Place

FOR turning down a commutator without removing the armature from its bearings the method described here has proved successful to the writer. The turning tool, as shown in the drawing, is simply a long tool carriage with lengthwise feed, which is mounted on a



METHOD OF MOUNTING TOOL TO TURN DOWN A COMMUTATOR IN PLACE

brush arm by two eyebolts and cap screws. The slide block has a screw-adjusted taper edge for making it fit tight in the slide and thus prevent chattering of the tool. On an engine-driven generator the tool is mounted on an arm near the bottom of the machine so the chips will fall away from the armature. If a bottom arm cannot be used, the top arm must be employed. Mounting on either side is bad because any shaft throw in the engine will cause the commutator to be not truly round. As there is no shaft throw in turbines or motor-generators, the tool can be mounted on a side arm if desired.

A fiber cardboard shield is hung so that chips cannot fly into the tails. A wooden brace is placed between the arm holding the tool and the next arm behind to take the pull of the turnbuckles. Slack is taken out of the rocker-ring adjusting screw and wedges of hard wood are placed between the ring and each top bracket to prevent any play.

The cutting tool must be of the best high-speed steel with a sharp diamond point and should slant toward the tails. The cutting speed on 500-volt or 250-volt machines with a good deal of mica should be from 200 ft. to 400 ft. (60 m. to 120 m.) per minute. Low-voltage machines with less mica can be cut at speeds up to 500 ft. (150 m.) per minute. Adjustment of the tool to take the next cut is made by hammering the butt end around, causing the cutting point to swing in toward the commutator.

Gas-engine generators can seldom be run slow enough to turn and usually must be ground. Sometimes they can be run slowly and steadily enough on the starting air. Motor-generator sets and turbine-driven machines cannot be run slow enough under their own power except under special conditions. Usually it is best to belt a motor to the machine to drive it at the proper speed for turning.

After turning, the tool marks are removed from the commutator by a grit stone or fine sandpaper, and it is burnished with a piece of oily canvas. Kerosene is undesirable as it penetrates the mica, dissolves the shellac and never dries entirely.

It is sometimes necessary to turn a machine while running it as a motor. In this case, before the tool is mounted, the arm is disconnected and insulated from the bus ring and the turnbuckle rods and braces are insulated. Full voltage is put on the field and an adjustable resistance is inserted in the armature circuit so the machine will run at a slow speed. In turning extra care must be observed to keep chips out of the armature. The tool will be alive and care must be used to avoid shorts. A fuse just large enough to carry the current should be put in the line so that if a short circuit occurs there will not be serious damage.

This method cannot be used on a machine which has undercut mica because the tool is certain to draw copper over the mica and short-circuit the bus.

Cleveland, Ohio. JAMES DIXON.

Stacking Elevator Mounted on Industrial Tractor

FOR stacking gunnybales at the port of Seattle two electrically operated stacking elevators have been built which when in use are mounted on standard electric industrial tractors. These elevators consist of a



MOTOR-DRIVEN ELEVATOR FOR STACKING BALES WHICH IS DETACHABLE FROM INDUSTRIAL TRACTOR

platform which is raised in channel-iron guides by means of cable wound by a motor on the tractor. This platform raises the 1,400-lb. to 2,000-lb. (560-kg. to 870-kg.) bales from the floor level to about twice the height of a bale.

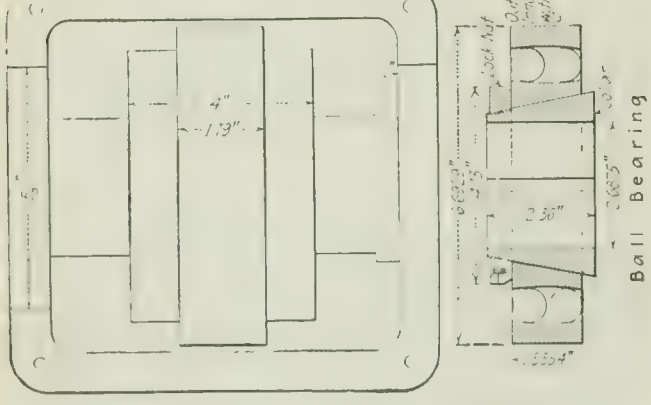
The channel-iron guides, as shown in the illustration, are mouted on wheels by which most of the weight of the lifted bales is supported. Diagonal braces *B* run from the guides to the horizontal channel members on which are mounted the motor *E*, the reduction gears and the drums *M* on which the cables are wound. To permit passage under low doorways the guides are pivoted at a point *L*, so that they may be laid backward after the rods *B* are unbolted. Two hoisting cables are employed to give a balanced pull on the gearing. For power an induction motor is used, fed through an extension cord connected to the nearest circuit. A direct-current motor supplied from the storage batteries of the truck might be used instead of this induction motor.

When it is desired to take the elevator off the truck, the steel attaching clamps are removed and the pivoted struts *C* are swung down, after which the truck is run out from under the elevator, which is left supported by the struts. In order to allow stacking in a narrow space, a pivoted table has been designed (not shown in photograph) which will permit the elevator to be swung around at right angles to the truck.

San Francisco, Cal. C. W. GEIGER.

Fitting Ball Bearings to a Sleeve-Bearing Machine

A METHOD of replacing worn sleeve bearings with ball bearings which was followed recently with an old alternator in an Eastern shop is described in the following paragraphs. The machine was a standard 50-kva., six-pole, 440-volt, 60-cycle, 1,200-r.p.m. alternator which had its bearings and shaft badly worn so



OLD SLEEVE BEARING CHANGED FOR BALL BEARINGS

that it was necessary to renew the bearings and take a light cut off the shaft. It was found that new sleeve bearings would have to be made up specially, which would require a long time, and as the machine was of a very old type their cost would be high and the problem of renewal would always be annoying. It was therefore decided to equip the machine with ball bearings.

Grooves were chipped in the oil wells of both shields and the shields were then filled with a hard babbitt metal, the grooves being cut to provide anchors for the babbitt metal. The shields were then turned out to dimensions as shown in the sketch. In turning the shield, ¼-in. (64-mm.) liners were put between the bearing cup and housing, which permitted just the right amount of metal to be turned out of the cap. Care had to be taken in machining the shields to have the work turn slowly in the lathe since the cap is of cast iron and the bearing seat of babbitt metal; otherwise when the tool strikes the cast-iron cap it would spring out of center.

The shaft was turned slightly smaller to remove its rough worn surface. The ball bearing used (type S.K.F. 1616) consists of three parts, namely, the outer and inner race with the balls, a split collar and a lock-nut. It will be noted that such bearings can be locked on any part of the shaft so that the end play can be adjusted to any amount desired. To complete the job the bearings were assembled on the shaft at the proper distance between centers and the whole machine was assembled. EUSTACE J. SOARES.

Ampere, N. J.

Motor Distribution and Consumption in Steel Plant Requiring 117,852 Hp.

POWER requirements at the Sparrow Point plant of the Bethlehem Steel Company reach a total of 117,852 hp., of which 64,000 hp. is alternating current and the rest direct current. The total number of motors in use is 2,169, 583 of these being alternating-current. The maximum demand is about 26,600 kw., of which the company supplies 12,000 kw. from three gas-engine-driven units and 14,000 kw. is purchased from the Consolidated Gas Company. Raw material is brought in by boat, and the ore-handling equipment requires a total of sixty motors, representing 3,618 hp. The average energy required to handle a ton of ore from steamer to stock pile and from there into the furnace stock bins is from 1½ kw.-hr. to 2 kw.-hr. The coal-handling plant for unloading and crushing requires a total of fifty-six motors, representing 4,100 hp. For the total coke-oven plant, including the coal unloading and crushing and by-product plant, there are a total of 474 motors, representing 8,035 hp. The power consumption of these motors per ton of coke averages 1.3 kw.-hr. It takes ninety-six motors totaling 10,087 hp. to handle the requirements of the blast-furnace department. Average power consumption per ton of pig iron, excluding casting plant and sintering plant, is 6.9 kw.-hr. There are 141 motors in the open-hearth department, totaling 7,947 hp., with an average power consumption in a No. 2 open hearth, with one furnace duplexing and two furnaces on cold charge, of 4.6 kw.-hr. per ton of ingots. Power requirements of the blooming billet and bar mill layout, including a roll shop, are taken care of by 181 motors, totaling 18,487 hp. The power consumption of the 24-in. (60-cm.) mill averages 9.55 kw.-hr. per ton of finished billets, while the 18-in. (45-cm.) mill consumes 26.8 kw.-hr. per ton of finished steel bar. In the 36-in. x 110-in. (90-cm. x 275-cm.) sheared-plate mill there are 122 motors, representing a connected load of 8,653 hp. Power consumption on the main motor averages 21.0 kw.-hr. per ton of slabs and for the entire mill 44 kw.-hr. per ton of slabs rolled. There are 126 motors in the 60-in. (150-cm.) plate mill, totaling 10,128 hp., and a 1,000-kw. motor-generator set. The entire tinplate plant, including coal-handling machinery, pumps, air compressors, etc., totals 5,441 hp. in 116 motors, of which twenty-one motors, totaling 590 hp., are on the cranes. The requirements of the sheet mill are met with twenty-six motors, totaling 6,070 hp.

For supplying salt-water service all over the plant there is a central pumping station, consisting of three

30,000,000-gal. pumps driven by three 1,200-hp., three-phase, 25-cycle, 6,600-volt wound-rotor induction motors. The iron and gas foundry requires 136 motors, totaling 2,351 hp.

These facts were brought out in a paper by R. B. Gerhardt on "The Modern Steel Plant," presented before the Philadelphia Section of the Association of Iron and Steel Electrical Engineers at the Feb. 7 meeting.

Portable Substation Mounted on Sled

IN ORDER to avoid repeatedly setting up a substation and tearing it down when operations moved from one locality to another, the complete substation was permanently mounted on a logging sled which is moved as the work of lumbering carried on by the Snoqualmie



MOUNTING TRANSFORMERS ON SLED SAVES LABOR AND TIME OF REPEATEDLY SETTING UP

Falls Lumber Company, Oregon, progresses from one place to the next.

In the use by this company of an electric yarding machine for lumbering it was found that the transportation of the transformer equipment from one setting to the next required considerable time and the efforts of at least four men for half a day. In the endeavor to better this record the transformers were mounted on the sled. This has done away with much of the trouble of hauling, and the reconnecting can now be handled by one lineman in about an hour.

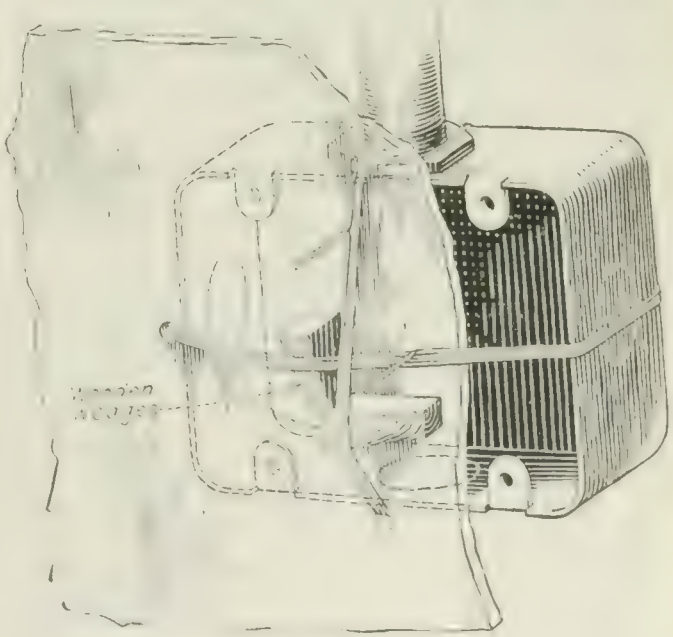
The transformer equipment consists of three 200-kva. single-phase transformers at the power house, which step the voltage up to 13,000 volts, and two 250-kva., three-phase transformers in the woods, which step the voltage down to 550 volts for operating the motor. These step-down transformers are set up about 300 ft. or 400 ft. (90 m. or 120 m.) from the spar tree and of course must be moved whenever operations are transferred to a new locality. This occurs about every twenty-five days, the distances varying from 1,000 ft. to a mile (300 m. to 1.6 km.).

The transformers were mounted on a sled, as shown in the illustration, a structure being built on the sled to support the incoming lines. The 13,000-volt transmission line terminates on cross-bars held by two poles at 8-ft. (2.5-m.) centers. A disconnecting switch is permanently mounted on this structure, making it possible to cut off the current at this point. The energy from the 550-volt side of the transformers is carried to the motor by means of a three-conductor armored submarine cable laid along the ground.

F. E. GRAY,
Electrical Engineer.
Snoqualmie Falls Lumber Company,
Oregon.

Setting Outlet Boxes in Reinforced Concrete Columns

IN ELECTRICAL WORLD of March 6, 1920, page 553, an article described a method of supporting conduit outlet boxes in steel forms before the reinforcing steel of the column has been located in position. The present writer uses another method for supporting the boxes in columns where there is a considerable amount of reinforced steel, as in 18-in. x 30-in. columns, which are used on all large concrete buildings. With columns of this size the reinforcing steel has to be placed before the steel forms are set up, and in this case the conduit with the outlet box attached is put in place before the forms for the concrete. To fasten the box to the form four holes are drilled in a sheet of the form so that one hole will be in each side of the box and about 1 in. (2.5 cm.) from the side of the box. After the box has been tightly filled with paper to prevent concrete from entering, four strands of wire are placed through one set of holes around the sides of the box and four strands are placed around the top and bottom of the box with two of these



OUTLET BOX TIED TO STEEL FORM

wires on each side of the pipe so as to hold the box straight and in place. The ends of the wire on the outside of the form are then twisted together and two small wooden wedges are driven between the wires and the steel form until the box is flush with the steel column.

Baldwin & Stewart, NICHOLAS F. CONDRON.
Meriden, Conn.

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

New England Electric Truck Business Growing

ABOUT 200 industrial electric trucks were added to New England plant service during the last eighteen months and about 150 electric road trucks, according to figures recently given before the New England Section of the National Electric Light Association. It is estimated that there are now no less than 1,400 industrial electric trucks in operation in these six states and 1,200 road trucks of the electric type. Industrial plants are showing much initiative in this field, and the value of the charging load to the central station is coming to be better appreciated. Figuring an average revenue of 60 cents per day for truck battery charging shows a possible central-station revenue of about $500,000 a year from this source, supposing that energy were supplied for this work by the utility companies. The revenue from a small industrial electric truck may easily equal that of fifteen to twenty-five flatirons.

Baltimore Company's Service Department Aids Public Relations

RECOGNIZING that its success would be measured by the manner in which it treated the public, the Consolidated Gas, Electric Light & Power Company of Baltimore has organized a general service department whose duty it is to handle intelligently all customers' business (except industrial) from the time of the signing of the application for service to the collecting of the final bill. In fact, its work does not end then, as there are a considerable number of inquiries and complaints from the general public which must be handled by the various departments.

The personnel of this department is composed of men and women especially fitted to deal with the public and who have become familiar with the company's policies through years of training. New employees meet daily for instructions, care being taken to point out the important part played in their work by conciliation, cheerfulness, courtesy and personality. Particular attention is given to telephone work, which is becoming more and more important each day in so far as number of customers handled is concerned.

"Dealing with the entire population of Baltimore and its immediate vicinity," said R. F. Bonsall, manager of the general service department, "we must necessarily treat with many phases of human nature. We expect a number of what might be termed unreasonable requests, but each of these requests means a necessity or convenience to the particular customer and should be handled on its own individual basis. Conditions often arise over which the customer has no control and which are against the rules, but rules are made only for guidance and should, wherever necessary, be broken.

"On March 31 we had 67,000 electric and 144,000 gas customers, which means that if you average to each customer four persons, we are in contact, as far as service is concerned, with 700,000 people each twenty-four hours in the day. To take applications from, read meters of, bill and collect from such a number of persons satisfactorily is the aim of the general service department. This does not include complaints, because through a campaign on complaint prevention we hope to see a decrease in this class of work; but this campaign can only be effective with the co-operation of the company as a whole, for complaints originate due to the action or non-action of employees of any department. The policies as laid down by the management are extremely liberal and fair. They insist on each customer receiving absolutely fair treatment, and while it is not always possible to meet all of a customer's demands, we do so as far as it is possible.

"It is necessary at times to make a definite promise to a customer which may place a hardship on the operating departments, but owing to the present real-estate situation a customer must sometimes move into premises before the steps are up or the windows in. He may not have known when he could secure possession of the house until the last minute. It is not right that he should be without service because we have arranged our work for the day. This is also true in the matter of complaints on service, where sickness or inability to prepare meals makes immediate attention by us necessary. True, it costs money to make these extra calls, but it is much better to go to this additional expense than leave the customer without service.

"We must realize that there is a very selfish interest behind the operation of our general service department. We are in a growing city and expect to remain, but our business is largely dependent on our fairness to the public as well as customers, and through whole-hearted effort on the part of us all we can improve on the present good feeling which the public has toward us.

"The importance of this work was demonstrated several months ago by four local magazines which came out about the same time, each of which had a more or less unfavorable statement regarding individual public utilities. Only one mentioned our company, and its closing paragraph was that while we were rated higher than any other public utility in Baltimore, it could give us only 95 per cent, and if we wanted to know why it did not give us 100 per cent, we should communicate with the editor. This we did and received the reply that he had forgotten why he could not rate us at 100 per cent.

"This effort toward service has been reflected in our relations with the city and the Public Service Commission—in fact, during 1919 we had only one case come up for a hearing before the commission, and the decision was rendered in our favor."

Merchandising as a Public Policy Asset

CENTRAL stations should seek contact with the public, and more advantageous relations can be obtained by the sale of electrical appliances than is generally possible through the contract or complaint department, according to E. C. Deal, general manager of the Springfield (Mo.) Gas & Electric Company, in discussing the subject before the convention of Missouri Association of Public Utilities. Too often central-station men overlook the possibilities of promoting a favorable public policy in the operation of a merchandising department, said Mr. Deal. The company's salesroom should be one of the most attractive stores in the town and conveniently situated for the public. The sales force should be made up of individuals capable of meeting the public in a pleasant, impressive manner and able to convey the policies of the general manager. Unless the merchandising sales department meets these requirements it is not being operated to the greatest advantage.

Life and Health Insurance for Chicago Company Employees

COMMENCING July 1, 1920, employees of the Commonwealth Edison Company were entitled to sickness and disability insurance running for two years and death benefits of from 50 to 150 per cent or more of their annual salary by paying dues which in most cases will amount to 2 per cent or less of the employee's salary. This plan will be handled through the newly organized employees' mutual benefit association.

Sickness, disability and death benefits all increase with the years of membership in the association, and for all employees who join before Sept. 1 the years of service in the company will count as years of membership in the association. The first thirty-six weeks' disability averages from 40 per cent of the salary of the employee who has been with the company six months up to an average of 80 per cent of the salary of the employee who has been with the company twelve years or more. For the next sixteen weeks the range of pay is from 20 per cent to 40 per cent of the salary, while the length of service ranges from a half year to sixteen years or more. These payments are for the first year's sickness or disability, and during the second year the employees receive an average of from 10 to 20 per cent of their salary. The six months' employees receive the lower figure, which is increased with the years of service, and the 20 per cent is given when the employee has been with the company twenty-nine years. These benefits are all for the monthly employees. Those who are paid at an hourly rate receive 75 per cent of these benefits.

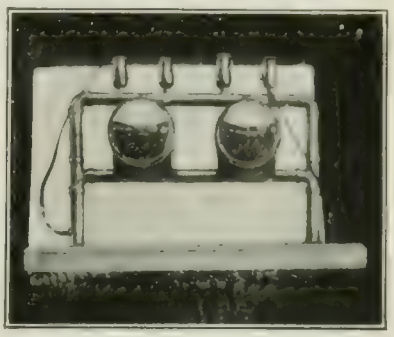
The death benefits, which are based on a maximum salary of $3,000 a year, vary from 50 per cent of the yearly salary for employees of six months' service up to 150 per cent of the yearly salary for employees who have been with the company for fifteen years. For every year in excess of fifteen that an employee is with the company the death benefits of 150 per cent are increased by 1 per cent.

The company pays all the overhead and operating expense for the association and approximately one-half of the benefits. Dues average $1.30 per month per $100 salary for employees of from twenty-four to thirty-four years of age. This increases every five years until the employee is from 65 to 69 years old, when he pays $7.26 per month. Dues increase as salaries increase.

Employees receiving a salary of more than $250 a month are not eligible for sickness and disability benefits. Such employees can join as associate members and have a reduction of 69 per cent in their dues in consequence. It is estimated that for every dollar paid in by the employees 69 cents will go for sickness and disability benefits and 31 cents for death benefits. The benefits of the association commence after one week's sickness or absence for disability, and for this week the company pays monthly employees their full salary.

Portable Meter Rack for Appliance Tests

INSTEAD of depending upon a fixed meter rack for showing the energy consumption of appliances to customers and visitors, the Lynn (Mass.) Gas & Electric Company has fitted up a portable rack, illustrated herewith, which is unusually attractive through the use of a marble base and polished brass framing to carry the wiring leads and instruments. Two meters are mounted on 1-in. (2.5-cm.) brass tubing, at the top of which are four pull-chain sockets to which various appliances are connected in demonstration. The uprights are 27 in. (69 cm.) apart on centers and 13 in. (32 cm.) high over all, the marble base being 10 in. x 28 in. x 2 in. (25 cm. x 70 cm. x 5 cm.) thick.



PORTABLE METER RACK FOR APPLIANCE TESTS

Outline of Day & Zimmerman's Cadet Course

IN ORDER to provide young men qualified to fill executive positions on their various properties, Day & Zimmerman decided in 1919 to inaugurate a "cadet" course. It is open to employees with proper qualifications and to engineering students in their freshman and sophomore years. The primary object is to develop executives, not specialists, and each cadet is being taken through a course of actual work in all departments.

This training not only determines a man's mettle and gives the thorough familiarity with all phases of the work which should be possessed by an executive, but also develops in him the ability to co-operate with other executives and with men who may eventually be under his direction.

The men for the cadet course who are not already employees of one of the properties are carefully selected from various colleges, the requirement being that they be freshmen or sophomores in electrical or mechanical engineering. The cadets selected from college are required to work three months each summer during the college course and complete the thirty-six months' work on full time after graduation from college. Cadets selected from among the employees work on full time and complete the course in three years. The course is

not one of technique, but one of practical application of technical training, and is arranged as follows:

Three months in the power house as an oiler.
Three months in the service department.
Three months in the boiler room as a fireman.
Three months in the meter department—test and installation of meters and instruments.
Three months as a patrolman.
Three months as substation attendant.

At this point the cadet selects either the production section or the transmission and distribution section. The decision is delayed until this time to permit him to make a wise selection.

PRODUCTION SECTION

Three months—Switchboard and power-plant attendant.
Three months—Load dispatcher.
Three months—Maintenance crew.

TRANSMISSION AND DISTRIBUTION SECTION

Three months—Construction and maintenance.
Three months—Load dispatcher.
Three months—Engineering department.

Then cadets in both sections take:

NEW BUSINESS

Three months—Power.
Two months—Light.

COMMERCIAL

Two months—Supply department.
Two months—Statistical department, analysis of reports.

Results of Twelve Months' Operation of Electric Ranges

DATA covering the operation of nineteen electric ranges for a period of twelve months have been received from a New England central station. This company's rate for domestic heating and cooking purposes is based on a demand charge of $2 per month for installations up to 5 kw., $3 per month for from 5 kw. to 7 kw. and $1 additional for each kilowatt of demand over 7 kw. plus a charge of 1.5 cents per kilowatt-hour consumed.

The accompanying table shows, first, the connected load of each range; second, the total amount of energy used during the entire year; third, average monthly consumption; fourth, total amount of bills for twelve months; fifth, average monthly bill; sixth, rate per kilowatt-hour. It will be noted that the average amount of energy used per month was 236 kw.-hr. at an average rate of 2.5 cents.

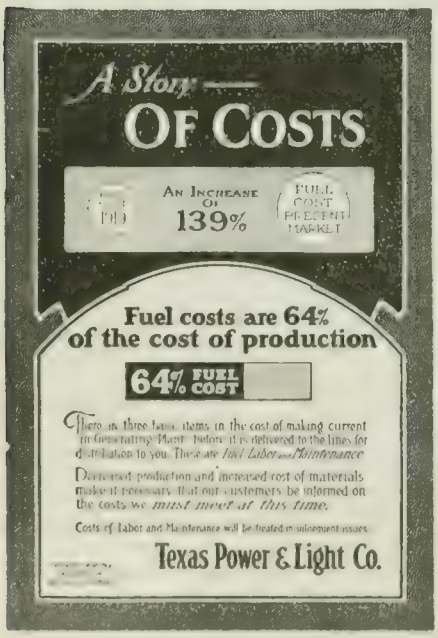
TWELVE MONTHS' OPERATION OF ELECTRIC RANGES

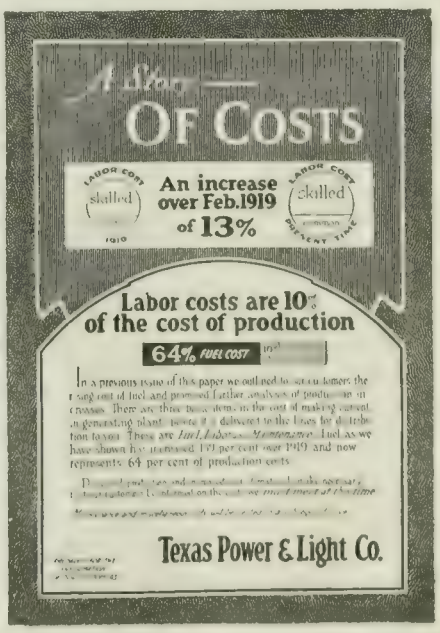
Maximum Demand, Kw.	Kw.-Hr Used During Year	Average Monthly Consumption, Kw.-Hr.	Total Amount of Bills	Average Monthly Bill	Average Rate per Kw.-Hr.
6	3,504	292	$88.58	$7.38	$0.025
5	1,123	93	40 86	3 41	.036
7	4,299	358	100 49	8.37	.023
7	5,067	422	112 00	9 33	.022
6	2,930	244	79.95	6.66	.028
7	1,069	89	52 04	4 33	.947
7	2,280	190	69 13	5.76	.030
7	1,972	147	65.59	5 46	.037
10	3,908	325	109.65	9 13	.028
7	9,615	801	180 25	15.02	.018
6	616	51	45.25	3 77	.070
3	2,340	195	59 11	4.93	.025
7	4,427	369	102 42	8.54	.023
7	2,818	235	86 68	7.22	.031
7	1,954	171	68.32	5.69	.033
7	2,087	174	67 33	5.61	.030
5	582	48	33 19	2 77	.058
7	937	78	50 06	4.12	.053
6	2,268	189	70.03	5.83	.030
Total and average:					
124	53,796	236	$1,480.93	$5 96	$0.025

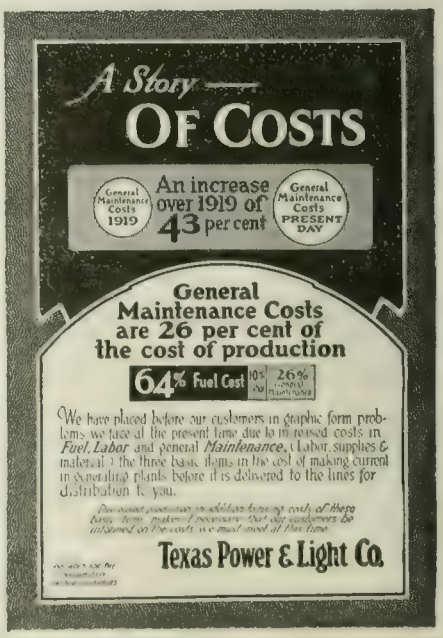
Texas Utility Conducts Successful Publicity Campaign

TO INFORM the public of the necessity for increases in its light and power rates the Texas Power & Light Company, with headquarters at Dallas, is conducting a successful publicity campaign through newspaper advertising in the thirty cities and towns where it operates. In a series of three advertisements shown herewith the increases in the cost of producing energy are explained. The basic item of each advertisement is a production block which was completed by three steps showing percentages of fuel, labor and maintenance costs and their respective increased costs.

The campaign is being handled through the publicity office of the company at Dallas and the advertising has received much favorable comment from the public and the daily newspapers.







TYPE OF PUBLICITY ADVERTISING BY THE TEXAS POWER & LIGHT COMPANY

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Coil-End Leakage Resistance.—L. DREYFUS.—The author attempts, in some introductory notes, to show how the magnetic lines of force will distribute themselves around those parts of the coils in an electric machine which are not directly surrounded by iron. Mathematical expressions are then derived for the fluxes around one single coil end, under certain simplifying conditions, due regard, however, being had to the effect of the neighboring iron surfaces in distorting the field. An actual example is considered in detail, the results of computations on the basis of the author's theory being compared to the values of leakage reactance for the same case as computed by means of the Arnold-Sumec and the Kloss methods. The author explains the deviations and states his reasons for assuming that the new formulas will give a more accurate result. He then takes up the problem of determining the interlinkages between adjacent coil ends of one phase and also between coil ends belonging to different phases in a polyphase machine. Numerical examples are worked out in detail in order to show the physical significance of each step in the theoretical evolutions.—*Elektrotechnische Zeitschrift*, Feb. 5 and 12, 1920.

Core and Incremental Losses in Rotating Machinery.—LAURENCE H. A. CARR.—The consideration of core-loss curves of 300 or 400 different machines has led the author to conclude that it is possible to lay down a general type of equation and to state the approximate values of the numerical constants for different cases, together with the effect of the various disturbing factors on the magnitude of the losses. He then proposes relations covering core losses and load losses which increase load.—London *Electrician*, May 21, 1920.

Lamps and Lighting

Coefficients of Utilization.—WARD HARRISON and EARL A. ANDERSON.—A method is presented for the direct determination of coefficients of utilization applying to installations of all ordinary types of lighting units in rooms of varied proportions and different ceiling and wall colors. As a basis for the method, coefficient of utilization data are tabulated from a series of several hundred illumination tests made in an experimental room with reflectors having three fundamental forms of light distribution. Illustrating the application of the data presented, typical coefficient of utilization tables, as determined for a number of reflector types in common use, are included.—*Transactions I. E. S.*, March 20, 1920.

Effect of Color of Walls and Ceilings on Resultant Illumination.—A. L. POWELL.—An abstract under this heading appears on page 1206 of the issue of May 22. The credit was erroneously given to the *Transactions I. E. S.* It should have been given to the *General Electric Review* for March, 1920.

Developments in Street-Lighting Units.—A. D. CAMERON and C. A. B. HALVORSON.—The writers draw attention to the growing tendency to use lamps giving intensities which are totally insufficient for street lighting. This is due to the desire of municipalities to keep down their street-lighting expense. At the same time lamps are being neglected, there being insufficient renewals, and dust is permitted to accumulate to such an extent that it seriously reduces the light flux and ruins the appearance of the installation.—*Transactions I. E. S.*, April 30, 1920.

Generation, Transmission and Distribution

Pulverized Coal.—The writer states that early attempts to use pulverized coal in England were not very promising, but that experience in America has now proved that the method may be used successfully. He deals with the changes necessary in water-tube boilers for the application of powdered fuel, indicating that the front of a furnace may be extended and converted into a combustion chamber. The required space for combustion is decided by the maximum demand likely to be made on the boiler and a ratio of 40 cu.ft. per lb. (0.5 cu.m. per kg.) of coal burned per minute is said to be a fairly safe minimum combustion space for large stationary boilers.—*Electrical Times*, May 20, 1920.

The Protection of Alternating-Current Circuits and Apparatus.—E. T. NORRIS.—A comprehensive discussion of the theory of protective systems, including reverse power relays, Merz-Price, split conductor, protective sheath and other systems.—*Beama*, May and June, 1920.

Oil-Burning as an Industrial Proposition.—F. SCHOUMANNE.—The coal shortage in Europe, which shows decided tendencies toward permanency, has emphasized the necessity of giving a careful study to the economical possibilities of naphtha and low-grade oil as industrial fuels. After some introductory remarks regarding the fuel value of Russian oils, the author describes a number of different oil burners, giving particular attention to those devices which are most commonly used for oil-burning plants in the Baku region. The article ends with a discussion of the relative advantages of the more important oil-burning systems.—*Revue Générale d'Electricité*, April 10 and 17, 1920.

Traction

Electrification of the Swedish Railroad System.—The Swedish government, which owns and operates the greater part of the railroads of Sweden, is planning an immediate electrification of certain trunk lines, first of all the important cross-country road from Stockholm to Gothenburg. Very good results have already been obtained with single-phase, 15-cycle supply in the remarkable Kiruna-Riksgränsen electrification in the north of Sweden, and much attention therefore has been given this system of supply, the recent large direct-cur-

rent electrifications in America having emphasized its possibilities and economy. A most comprehensive comparative study therefore has been made of both these systems, although no definite conclusions were reached, since the estimated yearly cost came out very nearly equal for both systems. However, the single-phase system seems to have been most favorably reported. Several technical reports on the question, submitted by the various administrative and engineering bureaus, were reprinted in the *Teknisk Tidskrift, Elektroteknik*, March 3, April 7 and May 5, 1920.

Installations, Systems and Appliances

The Electric Propulsion of Ships.—Eskil Berg.—The writer outlines some of the advantages of electric drive for ships as evidenced by the experience already obtained on ships of the United States Navy. From the point of view of economy he also points to the possibility of electrical drive for merchant vessels.—*Journal Engineers' Club of Philadelphia*, May, 1920.

Electric Purification of Air.—D'Arsonval, Bordas and Touplain.—The authors have experimented with a simple apparatus consisting of a brass tube 1 m. long with an axial wire, air being passed through the tube at the rate of 127 cu.m. (4,500 cu.ft.) an hour. The air was purposely polluted with a fine sterile mineral powder and also with dried cultures of a certain microbe. After passing through the tube, the central wire being maintained at a negative potential of 50,000 volts, the air was found to be absolutely sterile, while 95 to 97 per cent of the powder was removed. Before passing the tube samples of air gave 150 cultures of the microbe per cubic meter. It is suggested that the ozonization may have aided in destroying the microbes. —*Comptes Rendus*, March 15, 1920, reprinted in *Revue Générale d'Electricité*, April 10, 1920.

Telegraphy, Telephony and Signals

Method for Measuring the Received Current in a Radio Antenna.—H. de Bellescize.—The extreme smallness of the electromotive forces induced in a receiving antenna makes it impossible to measure the amplitude of the received current directly. The author instead suggests an indirect method, based upon a comparison, by means of telephones and, if necessary, amplifiers, of the intensity of sound obtained when receiving from a given distant station with the intensity when the receiving antenna is excited from a small auxiliary transmitter adjusted by heterodyning to exactly the same wave length as the transmitting station. The auxiliary oscillator is coupled to the antenna by means of a variable coupling coil of known constants. The transmitting station must be controlled by a chronograph so that it transmits during alternate periods of, say, ten seconds, the auxiliary oscillator being similarly controlled to excite the receiving antenna during the silent ten-second intervals. The auxiliary oscillator coupling and oscillation amplitude are adjusted till an unbroken sound of constant strength is heard in the telephones. The electromotive force induced by the incoming waves then is just equal to the electromotive force induced in the coupling coil, which may be determined from the oscillator calibration.—*Revue Générale d'Electricité*, March 6, 1920.

Submarine Signaling.—During the war mechanisms and systems were developed not only for communicating between two ships similarly equipped and between a ship and a power station by means of under-water signals, but also for sending messages to and from a separate submarine. The suitability of the Fessenden oscillator and other devices used in submarine service is discussed.—London *Engineer*, May 14, 1920.

Electric Transmission of Danger Signals to Moving Locomotives.—Several more or less successive systems have come into use for automatic repetition of semaphore signals on moving locomotives. In an interesting system suggested by Angereau and now being tested by the French state railroads a wireless transmission is used, although of somewhat primitive nature. Along the track is an antenna, excited by induction coil and spark gap, and the engine is provided with a similar little antenna, connected to a coherer. Track contacts close the transmitting circuit when the train passes the signal, and if the semaphore is in danger position, Herzian waves are sent out, which upon being received act on the coherer and by means of relays start the engine steam whistle blowing.—*Revue Générale d'Electricité*, April 10, 1920.

Miscellaneous

Use of Electric Surplus Power for Heating Purposes. —H. Theorell.—Particularly in case of water-power stations with adequate hydraulic reservoirs it is a direct waste of power ever to let the load go down below its maximum value. Off-peak power then may be very economically utilized for heating purposes, not only for electrothermal processes, but for plain heating of industrial and other localities. An electric heating plant of remarkable size has been in operation since 1914 at the Husquarna factories in Sweden. The factories obtain electric power from a hydraulic station, which, owing to topographical conditions, is practically void of all water-storage facilities. During all the night, therefore, the power (maximum 1,300 kw.) is used to heat the water in a large subterranean tank of 200 cu.m. (44,000-gal.) capacity, the water being circulated during daytime in the heating system of the factory. On a twelve-hour day basis the surplus power is sufficient for the heating of all the shops, except when the outside temperature is lower than 5 deg. C. (13 deg. Fahr.). In very cold weather it becomes necessary to use part of the original coal firing plant, which has been maintained in a stand-by capacity. The electric heating plant has utilized about 2,000,000 kw.-hr. a year, corresponding to a direct saving of about 400 tons of coke a year, while the first cost was only 24,000 kronen (about $6,000). The author also describes at length an electric hot-water plant of remarkable dimensions which is being planned for the Norwegian city of Bergen.—*Teknish Tidskrift, Mekanik*, April 14, 1920.

Porosity and Volume Changes of Clay Firebricks at Furnace Temperatures.—George A. Loomis.—This investigation is a study of some of the physical properties of clay firebricks by a comparison of their changes in porosity and volume, on heating to different temperatures, with the amount of contraction of the bricks under load at furnace temperatures and with the so-called "melting points" of the bricks. It is found that the porosity and volume changes serve as an indication of the ability of a clay firebrick to resist deformation under load at furnace temperatures much more reliable than the "melting point." It is also shown that these porosity and volume changes serve in explaining the failure of firebricks in use from such causes as insufficient burning in manufacture.—*Technical Paper No. 159, U. S. Bureau of Standards*, April 26, 1920.

Scientific and Industrial Research

(PRINTED IN THE THIRD ISSUE OF EACH MONTH)

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available, and Suggestions for Co-operative Work.

Conducted by PROF. VLADIMIR KARAPETOFF
Cornell University, Ithaca, N. Y.

Research in Progress or Completed

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department, "Digest of Electrical Literature," for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

CABLE DIELECTRICS, APPROPRIATION FOR

Authority was granted to the Technical Section of the N. E. L. A. to take up research and investigation on cable dielectrics, an initial appropriation of $3,000 being made for the purpose.

LAMP, CADMIUM VAPOR ARC.

A successful cadmium-vapor lamp is a stable source of monochromatic red light of high intensity. But when pure cadmium is distilled into the quartz lamp and freezes, the metal adheres to the silica with such tenacity as either to crack the lamp or to peel strips of the silica from the walls. It was discovered that the metal gallium is readily alloyed with cadmium, and that a very small quantity, less than 1 per cent, is sufficient to change radically the character of the cadmium and greatly to reduce its tensile strength. All breakage of the lamp was eliminated. In using this alloy in a quartz-vapor lamp, the cadmium spectrum is obtained of great brilliancy and purity. The spectrum of gallium is practically absent. A lamp of this type, using lead seals to render the electrodes proof against leakage, can be operated continuously with no variation in the high intensity of the cadmium lines, and appears to have an indefinite life.—*Frederick Bates, Bureau of Standards, Washington, D. C.*

PORCELAIN, SOLUBILITY OF, IN WATER.

Some interesting developments have recently been brought out by the use of very high pressures on the solubility of porcelain in water under certain conditions, and it is probable that considerable light will soon be thrown upon certain types of insulator depreciation as a result of these developments.—*W. D. A. Peaslee, Huntington, W. Va.*

RADIO, RESONANCE WAVE COIL.

A resonance wave coil has been developed. The coil is in the form of a long helix wound with a large number of turns on which stationary waves are produced by the incoming radio signals. An electron tube is used as the detector, the grid being connected to the point of maximum potential on the coil. The wave coil may be used either as a part of the usual antenna system or a part of a line wire, or it may act itself as the antenna for picking up the energy of the signals. In the latter case the coil may be either free at both ends or grounded at one end. Good results have been obtained in either case. It has been also found that the open coil has directional properties and can be used as a goniometer not only for horizontal measurements but for vertical measurements as well. This form of radio goniometer has the great advantage that it permits the determination not only of the plane where the signals are strongest but also of the direction from which such signals proceed.—*G. O. Squier, War Department, Washington, D. C.*

VACUUM TUBE GENERATOR, OUTPUT CHARACTERISTICS OF.

An extensive theoretical and experimental investigation of the three-electrode vacuum tube used for generating oscillations has been made and fundamental formulas have been established for power output, grid voltage and efficiency. It is shown that the principal constituents of the electron currents which will be supplied by a given tube under action of sinusoidal plate and grid voltages can be computed as functions of these voltages from a group of "static characteristics" of the tube which are obtained by varying these voltages step by step and measuring the resulting steady values of current.—*L. M. Hull, Bureau of Standards, Washington, D. C.*

WAVES, ELECTROMAGNETIC, VARIATION IN DIRECTION OF.

The observed direction of radio waves as obtained with a direction finder varies with time when long waves are used as those from very high power stations. The variations of direction are of the order of 90 deg. for very long waves. No such long variations are found for short damped waves produced by spark apparatus. A method of increasing the sharpness or determination of direction has been worked out. A theoretical explanation of the variations of directions has been found, based on the existence of media in the earth's atmosphere capable of reflecting and refracting the waves.—*A. H. Taylor, U. S. Naval Aircraft Laboratory, Washington, D. C.*

Suggestions for Research

DUCTS, METALLIC, FOR CABLES.

An increase in the current-carrying capacity of under-ground cables is one of the most important questions that confront the electrical industry. The problem becomes more and more difficult as cables are being made for higher and higher voltages, necessitating thicker insulation. A method which has been attempted in various ways is to keep down the temperature of the ducts themselves. A suggestion comes from a cable specialist to try metal conduits, so as to reduce the temperature gradient between them and the ground. Cast-iron pipes have remained intact in the ground for many years, and with proper precautions rusting may be minimized. He further suggests that in such metal conduits all the ducts be kept in one or two rows only, so as to avoid hot inner ducts. Preliminary experiments are desired and an estimate of the increase in the cost of the conduits as against a saving in the cables themselves.—*Editorial Suggestion.*

FURNACE, ELECTRIC, FOR BRASS.

While the electric furnace for melting steel has reached a considerable degree of perfection, electric brass furnaces are said to be much less satisfactory and are much less used. At the same time, there is a great demand for such furnaces throughout the country, especially in sizes of between 500 lb. and 1,000 lb. (225 kg. to 450 kg.) for small brass foundries. The greater expense of operation of an electric brass furnace as compared to the ordinary pot charge, molten on coke fire, is not important when the other advantages of electric melting are considered. Additional research is required to develop the details of construction, temperature regulation, tilting, etc., and to standardize the most important parts in order that brass foundries may confidently expect satisfactory results without experimenting. The molten brass has to be continually stirred to prevent its separation into component metals, and this is done by shaking or turning the container by an electric motor. Some simplification in this operation is also desirable.

FUSE, RENEWABLE, INDICATOR FOR.

Many non-renewable inclosed fuses of cartridge type are provided with an indicator, which enables one to distinguish a blownout fuse from the outside. To provide such an indicator for a renewable fuse is a more difficult matter, because presumably the indicator would have to be renewed every time with the fusible link. The problem is well worth a solution, because the addition of an indicator would make renewable fuses much more desirable.—*Editorial Suggestion.*

LUBRICANT FOR HEAVY PRESSURES AND HIGH SPEEDS.

Difficulty has been experienced in the operation of bearings capable of withstanding the stresses brought into play by heavy masses revolving at from 10,000 to 20,000 r.p.m. The problem is probably not so much one of the actual bearing design as it is of obtaining a lubricant with sufficient viscosity to withstand the temperature changes of these speeds and pressures. A method is desired for measuring the viscosity and temperature variations of a lubricant while it is a contact film on the bearing. A determination of these variations in the character of the lubricant would enable considerable progress to be made in the design of heavy high-speed rotating machinery.—*K. H. Stark, New York City.*

MACHINERY, ELECTRICAL, HEATING ON ONE-HALF-HOUR RUNS.

I find that on one-half-hour runs the heating of electric motors of moderate size varies somewhat as the volume of copper and iron, divided by the watts lost. This does not take care of hot spots, and some other places of similar nature, but when the motor is inclosed it gives a general average near the teeth and windings. Further experiments and tests of this nature are desired.—*A. M. Holcomb, Cleveland, Ohio.*

METER, PREPAYMENT.

The ordinary watt-hour meter is too expensive for the small customer, requires monthly readings, billing, collection, calibration, etc. The prepayment meter of the present type is also expensive and requires a periodic collection of the coins. A simple and reliable prepayment meter is desired of the "consumed" type, that is, one that is consumed by the passage of electric energy through it. In the case of direct current it may be a sealed electrolytic plug the contents of which are consumed in proportion to the number of ampere-hours passing through it. After it has been used up the circuit is interrupted and a new plug has to be inserted. For alternating-current circuits such a plug may be based on a thermal principle, involving, say, a compound to be melted by the current. Such prepayment cartridges could be sold in drug stores and elsewhere, so that the electric operating companies would have to undergo no expense for collecting from individual consumers. The device must be so designed that no unauthorized plug could be used as a substitute.

PERMEAMETERS AT HIGH PERMEABILITIES.

For some years the Burrows permeameter has been the standard instrument in this country for measuring the permeability of bar and sheet samples of magnetic materials. It has been found that for samples having maximum permeabilities of from 10,000 to 40,000 this instrument is often subject to appreciable errors, especially in the determination of hysteresis loops. A study of this apparatus when used with this material of high permeability would be of value. Recently the Fahy permeameter has received considerable attention. For certain magnetic samples it has been found that this instrument gives values of H at moderate inductions which are more than 100 per cent greater than those obtained by the Burrows permeameter on the same samples. A critical study of the limits of this instrument would be of value.—*T. Spooner, East Pittsburgh, Pa.* [With new grades of iron, obtained by melting it in vacuo, such high values of permeability have been obtained that a more accurate measuring instrument becomes essential. —*Editorial Note.*]

TELEPHONE, AUTOMATIC, WIPER CONTACT.

The wiper contact, its resistance and mechanical wear in various conditions, offers an interesting subject for study. The investigator should first become thoroughly familiar with the structure of the wipers and banks of automatic switches and the customary maintenance of them.—*A. B. Smith, Chicago, Ill.*

News in Brief

Summary of Market Conditions and of Recent and Approaching Happenings of Importance to the Industry

TRADE slackness due to the summer season is affecting the electrical industry, with jobbers reporting lighter sales. The freight situation, however, is improving except in the Puget Sound district, where the lumber industry is suffering from a 50 per cent shortage in cars.

LABOR is reported in good supply East and South, with a stronger demand on the Pacific Coast. Building in the Middle West is still slack, but in other parts of the country it is proceeding in good volume, especially as regards large industrial projects. Collections are tightening in some sections, particularly in Southern and New England districts, but money on the Pacific Coast is reported plentiful.

AN APPEAL has been filed by the Independent Lamp & Wire Company against the decision of the federal court in New Jersey in the Coolidge lamp patent case sustaining the General Electric Company.

POWER cable orders are in good quantity and shipments are lengthening. A marked tendency toward standardization is noted. Transmission towers are in better demand for export than for domestic use, especially those of large dimensions. Buying prevails in the Far East, Australia, South America and Canada.

INDICATIONS are that the fan season will not come up to early anticipations. Lack of transportation facilities rather than lack of orders is given as the reason, together with low seasonal temperatures and delayed hot spells. Fans are in fair assortment in the New York district; buying by distributers is about over in Boston; stocks are in pretty good shape in the Middle West, depleted in the South and plentiful on the Pacific Coast.

DESPITE the talk of prices having passed their highest point, motor manufacturers are inclined to anticipate a further increase in the cost of their product. The need of standardization in fractional-horsepower motors is demanding recognition, and manufacturers are working in that direction.

SALES of flatirons and other heating devices are reported to be heavy in all sections of the country, and the trend of prices is upward.

FIGURES issued by the Geological Survey show that New York State leads the nation in hydro-electric output, its monthly total for April being 268,736,000 kw.-hr. California comes next, with 219,475,000 kw.-hr. The total electrical output of the nation for the first four months of the year, including both water-power and steam plants, is put at nearly 15,000,000,000 kw.-hr. This includes central stations, electric railways and some other plants.

AN INCREASE of 5 mills a kilowatt-hour in power rates and of 1 cent in lighting rates has been granted to the Indianapolis Light & Heat Company and the Merchants' Light & Heat Company by the Public Service Commission of Indiana.

AN INVESTIGATION into lead-covered-cable failures in St. Louis is being made by the Bureau of Standards.

CONSTRUCTION of a super-powered radio station on the north shore of Long Island near New York City by the Radio Corporation of America is about to begin. Five units will afford simultaneous operation with as many foreign nations from 420-ft. towers.

SUCCESSFUL telephone communication has been conducted over live high-tension lines by the American Gas & Electric Company, which looks for far-reaching results in the direction of cheaper telephony to be achieved through this means.

FORMATION of the projected North Jersey Power Company with capital of $25,000,000, to be supplied in part by prospective consumers, has been postponed.

A MILLION-DOLLAR power line is to be built around the city of Toledo, Ohio, by the Toledo Railways & Light Company.

ARGUING before the Interstate Commerce Commission for the assignment at the mines of cars for public utility use, J. W. Lieb, representing the N. E. L. A., painted a grave picture of the fuel situation as it affects public service companies.

AN ORDER continuing permission of the use of open-top cars for coal transportation and providing for priorities for public utilities was issued on Tuesday by the Interstate Commerce Commission. This order, it is thought, will solve the difficulties of the utilities temporarily, but will need liberal interpretation to allow them to provide for winter contingencies. No fuel administrator will be appointed by the President at this time.

THE FIRST meeting of the new executive committee of the N. E. L. A. was held this week in New York. President Insull has appointed the chairmen of the national committees, subject to their acceptance.

A REHEARING has been asked by the Idaho Power Company in the matter of its petition to the Public Service Commission of the state for an increase of 60 per cent in its irrigation rates, only 10 per cent having been allowed.

ORGANIZATION of the new Public Relations Section of the N. E. L. A. has been deferred to Aug. 1.

LIEUT.-COL. WILLIAM KELLY has been appointed engineer officer of the Federal Power Commission. Final organization of the body awaits the return to Washington of Secretary of Agriculture Meredith.

PROGRESS in the organization of a co-operative electrical campaign for the Pacific Northwestern States was expected to be made at a committee meeting on Thursday and Friday.

PUBLIC co-operation was advocated and unfair taxation decried at the annual meeting of the Ohio Electric Light Association at Cedar Point this week.

ON CERTAIN interconnected systems in the East much improvement in joint frequency regulation is resulting from longer experience with interoperation.

THE MINIMUM charge for both gas and electric meter service will shortly be investigated by the Massachusetts Department of Public Utilities in response to a legislative order.

A STRONG program is being made up for the fall convention of the New England Section, N. E. L. A., at Kineo, Me., Sept. 14-17.

SINCE last fall more than $900,000 in securities of the Central Maine Power Company have been placed in the territory of the company, which, if pending petitions are granted, will soon serve 106 municipalities.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Federal Power Commission Organization Awaits Return of Secretary Meredith

LIEUT.-COL. WILLIAM KELLY has been appointed engineer officer of the Federal Power Commission. He is at present stationed in San Francisco, serving on river and harbor work.

The return of Secretary of Agriculture Meredith to Washington has been delayed, and as a result the organization of the Federal Power Commission has not been perfected. No steps have been taken in addition to those reported last week. Mr. Meredith is expected to reach Washington next week. In the meantime it is possible that the Comptroller of the Treasury will have rendered a decision in the matter of the employment of personnel by the board. The matter of quarters also remains to be solved. It is probable that the commission will be housed in the Interior Department building, where it can have access to the water-power files of the Geological Survey and those of the Public Land Office.

Coal Priorities Established for Utilities

ON TUESDAY the Interstate Commerce Commission issued Order No. 9, continuing Order No. 7 relative to the use of open-top cars for coal transportation until Aug. 19 and amending it so that public utilities and public institutions will receive priority in the assignment of coal cars. The order was originally granted for thirty days from June 21.

The amendment to Order No. 7 whereby priorities for electric light and power plants are established reads as follows:

It is further ordered that until and including Aug. 19, 1920, all common carriers by railroads within said territory, to the extent necessary in order that public utilities, including street and interurban railways, electric power and lighting plants, gas plants, ice plants, water and sewer works, also hospitals, schools and other public institutions, may be kept supplied with coal for current use but not for storage, be and they are hereby authorized to place, furnish and assign cars to coal mines for the transportation of such coal, in addition to and without regard to the existing ratings and distributive shares for mines upon said railroads; provided no cars shall be so placed, furnished or supplied by any such carrier without written application therefor from the public utility, concurred in by the delivering railroad, showing that such coal is needed for current use, and not for storage, in order that the applicant may continue in daily operation, and provided further, that such coal shall not be subject to reconsignment except to public utilities or public institutions and that a written report of the cars placed hereunder shall be promptly made to the Interstate Commerce Commission by the railroad placing the cars.

In connection with this paragraph a question of meaning is already being raised by public utility men and will in all probability be presented to the Interstate Commerce Commission very shortly for a fuller definition. Some utilities have in storage coal more than sufficient to meet immediate requirements. Whether these utilities will be allowed assignment of coal transportation for their current requirements, or whether they must first use up their storage, is the question that utility operators are asking. If the latter is the case, then the utilities, all of them, must necessarily go into the winter, with all of its transportation tie-ups, with but a few days' supply of coal on hand.

Public Relations Section, N. E. L. A., Postpones Organization

BECAUSE all the geographic divisions were not represented, the newly formed Public Relations Section of the National Electric Light Association, of which J. E. Davidson is chairman, at its first meeting in Chicago on July, which was for the purpose of organizing, merely discussed in a general way the work to be covered and postponed organization until Aug. 1. At that time the work will be divided and sub-committees appointed to handle every possible phase of public relations work.

The following national standing committees are now to be a part of the Public Relations Section: "Co-operation within the industry," "sale of company securities," "establishment of state committees on public-utility information," and "investigation and standardization of regulation of utilities."

Public Co-operation and Need of Fair Taxation Discussed by Ohio Men

LABOR conditions, the dearth and high price of coal and the urgent need of new capital were among the important subjects discussed by the central-station men of Ohio at the twenty-sixth annual convention of the Ohio Electric Light Association at Cedar Point this week. The business sessions were given over to discussions of the reports of standing committees and to addresses of special interest to central-station engineers and managers. The entertainment features embodied the results of much thought.

The work of the central stations during the war overcame much blind prejudice and made the public realize the economic value of centralized generation and extensive distribution of electric energy for all purposes, said C. H. Howell in his presidential address. He pointed out that a wide distribution of utility securities among local customers is a form of co-partnership that has proved very helpful. The public, he held, should be frankly and fully informed about all difficulties that beset the company, especially when these troubles affect the cost or quality of service.

That American civilization is menaced because public utilities, the great agents of the country's material development, are unable to compete successfully for

the necessary capital and labor with which to maintain and extend their service was the opinion expressed by William McClelland, vice-president of the Cleveland Electric Illuminating Company.

The injustice of the present system of taxing Ohio public utilities was the subject of a paper by C. Dalton of Toledo. He said that central stations and other utilities are taxed on their full book value, while mercantile establishments pay on only a fraction of their true valuation because the latter's books are not subject to public inspection. The taxable value of Ohio central stations was shown to have increased over eleven times in ten years, and the companies were said to be paying from 6 to 11 per cent of their gross income in taxes.

A saving of at least 3,000 tons of coal per day could be effected if the loads on all the power plants in Cincinnati were supplied from generating stations having efficiencies equal to that of the West Side plant of the Union Gas & Electric Company of that city. This statement was made by F. D. Wiatt of Cincinnati in the course of his paper describing the large Cincinnati generating station.

The activities of the Society for Electrical Development were outlined by F. W. Loomis of New York City. W. W. Freeman of Cincinnati, president of the society, speaking as a central-station executive, pointed out some of the advantages of membership. D. L. Gaskill said that small utilities got as much out of the society as the large companies, if not more.

The officers elected for 1920-1921 were: President, Col. Dudley J. Bard, Wooster; vice-president, W. A. Wolls, Columbus; secretary, D. L. Gaskill, Greenville. These will compose the executive committee: C. H. Howell, Coshocton; E. L. Franklin, Warren; Robert Lindsay, Cleveland; O. H. Hutchins, Dayton; Frank Espey, Canton.

Co-operative Campaign Progress in Pacific Northwest

AT A MEETING of the advisory committee of the Northwest Electric Light and Power Association in Seattle on July 15 and 16 a plan was proposed for conducting a co-operative electrical campaign in Washington, Oregon, Utah, Idaho and Montana, along the lines of the California plan. This committee of fifteen members, representing central stations, jobbers and contractor-dealers, has been working for some months to enlist the co-operation of all electrical interests in the Pacific Northwest. It is made up as follows:

Representing central stations—R. W. Clark, chairman, Puget Sound Light & Power Company, Seattle; A. G. McMicken, Portland (Ore.) Railway, Light & Power Company; G. A. Lewis, Washington Water Power Company, Spokane; J. V. Strange, Pacific Power & Light Company, Portland; R. G. Bailey, Utah Power & Light Company, Salt Lake City; J. Ryan Gaul, Montana Power Company, Butte; W. R. Putnam, Idaho Power Company, Boise.

Representing jobbers—H. L. Bargion, Montana Electric Company, Butte; G. W. Hawley, Intermountain Electric Company, Salt Lake City; J. I. Colwell, Western Electric Company, Seattle; R. N. Averill, Fobes Supply Company, Portland.

Representing contractor-dealers—J. R. Tomlinson, Pierce-Tomlinson Electric Company, Portland; R. G. McKenney, Nepage-McKenney Company, Portland; J. F. Nepage, Nepage-McKenney Company, Seattle; W. M. Meacham, Meacham & Babcock, Seattle.

The report of the committee will be presented at the annual meeting of the Northwest Electric Light and Power Association in Spokane, Sept. 8 to 11, when definite action is expected to crystallize the movement into a permanent working influence.

Immediate Appointment of a Fuel Administrator Not Likely

RUMORS to the effect that the President might appoint a fuel administrator during the present coal crisis were stilled at the White House on Wednesday. It was explained, however, by White House officials that later conditions might make the appointment necessary.

There seems to be reason for doubting the possibility of an immediate appointment of a fuel administrator, because no appropriation is available. The previous fuel administration utilized all of the appropriation at its disposal.

Coal Priority Order of Temporary Benefit

WHILE the coal priority order of the Interstate Commerce Commission was not all that could be desired by public utilities, it did bring relief to the minds of many utility operators who have daily been watching their coal pile diminish. In commenting on the order to a representative of the ELECTRICAL WORLD, M. H. Aylesworth, executive manager of the N. E. L. A., said:

"This order should temporarily insure the continued operation of public utilities. Had this order not been issued at this time, many utilities, particularly the smaller ones, would face a more serious coal situation than ever before.

"The Bituminous Coal Commission recommended that the public utilities store coal at once. Of course this has been impossible, nor does the recent priority order of the Interstate Commerce Commission permit the utilities to carry out these recommendations. The order issued extends to public utility coal for current use only, and this requires an immediate definition of the term.

"This order was not issued solely in the interests of the utility corporations, but rather that the people might have a continued lighting service both in the home and in the street and that industry depending on electricity might continue to function.

"It is to be regretted that the public is not fully alive to the fact that public utilities cannot operate without coal and that the few days' supply of coal now in the hands of public utilities is simply a hand-to-mouth proposition.

"If the present order is construed to mean that the priority shall apply only to the daily needs of utilities, it will be very apparent that the first heavy snowstorm or blizzard, or a repetition of the recent railroad strikes, will find the utilities without sufficient coal to operate. In other words, while the two recent orders of the Interstate Commerce Commission will be of temporary benefit to the consuming public, in my opinion it will become necessary for the commission to take more drastic steps if the public is to have light, heat and power during the cold winter months."

Assigned Cars at Mines Only Solution of Utility Coal Supply

ASSIGNED cars at the mines for public utilities is the only solution of the present uncertain supply of coal for public utility plants, J. W. Lieb, representing the National Electric Light Association, told the Interstate Commerce Commission last week, when he appeared at the hearing at which the supply, exchange, interchange and return of open-top equipment was being considered. Mr. Lieb pointed out that costs are being pushed upward to such an extent by the uncertainty as to coal supply that the public utilities are in a very serious situation. He called the commission's attention to the fact that public utilities are receiving only 50 to 60 per cent of the coal for which they have contracts. The inference from his testimony was that the contracts are being violated in order that more free coal may be available for sale at the high prices which can be obtained for spot coal.

Every effort has been made to effect economies in the use of coal, Mr. Lieb told the commission. He related how customers have been rationed and how interconnections between companies have been effected where the interchange of current was to advantage.

Anticipating the charge that one of the objects in seeking priority is to reduce competition with isolated power plants, Mr. Lieb asserted that electric power plants are not being called upon for increased amounts of energy and that they are very anxious to hold to the minimum the use of their power by non-essential activities. He pointed out, however, that authority to disconnect consumers in such a case must come from competent officials. For the power company to undertake to discriminate between consumers would simply invite suits for breach of contract, he said. Mr. Lieb presented tabulations showing the amount of coal used by the public utilities. These, he stated, were taken from the ELECTRICAL WORLD and the *Electric Railway Journal*.

E. R. Burritt appeared for the American Electric Railway Association. His argument was along the same general line as that of Mr. Lieb.

The National Committee on Gas and Electric Service, which is representing the gas and electric interests in Washington in this coal situation, has reopened its offices in Washington, with headquarters at 1,015 and 1,016 Munsey Building.

Confidence of Public Necessary to Utilities, Says Insull

PUBLIC confidence in a utility is seen by Samuel Insull, president of the Commonwealth Edison Company, to be the measure of a public service corporation's success. In discussing the relation of utilities to the public with a representative of the ELECTRICAL WORLD, Mr. Insull said:

"Whether or not a public utility is successful depends on its ability to gain and keep the confidence of the people that it serves. In this its problem is like that of any merchant. Of two merchants doing business side by side, one will be successful because he is rendering service and has won the confidence of the public, while the other will fail because he has failed to give service and has not won the confidence of the public. Where suspicion is found there is always distrust of every move. The utility's problem is basically that of the merchant and must be solved by the winning of confidence that will avoid subjecting its every move to suspicion. With confidence secured it will have no difficulty in receiving a favorable answer to any reasonable demand it may make on the public."

Interplant Telephone Communication Established Over High-Tension Wires

AT LAST successful telephone communication has been conducted over live high-tension lines by the American Gas & Electric Company, which has been convinced thereby that the method employed will solve one of its most important problems, namely, insuring a reliable and less expensive mode of communication between its load dispatchers and interconnected stations. The test which proved the practicability of the method was conducted July 7 and 8 between the company's Atlantic City and Ocean City stations, over a live 11,000-volt, 60-cycle transmission line, 12 miles (19.2 km.) long. Between the transmitting and receiving sets were the windings of the power transformers at both ends of the line and an underground cable, making the equivalent length of transmission about 21 miles (33.6 km.). The demonstration was made in the presence of R. E. Breed, president of the American Gas & Electric Company; George N. Tidd, vice-president and general manager; M. L. Sindeband, electrical engineer, and J. W. Milner, research engineer.

The system employed works on the principle of the wired wireless or directed radio and involves the use of apparatus to tune out the power-circuit frequency. The carrier current for the communications had a frequency in excess of 5,000 cycles. The transmitting and receiving sets were connected with the 2,300-volt buses at each station, but they could have been attached to the 440-220-volt circuits with just as satisfactory results according to engineers who have developed the system. Owing to the fact that the invention is still in the patent stage, details of the apparatus and connections cannot be obtained at this time. The invention is the culmination of several years' investigation and was the conception of Mr. Tidd nearly twenty years ago, although the practical development was made by Messrs. Sindeband and Milner.

Among the chief advantages of the scheme, according to Mr. Tidd, are that the investment and maintenance expense connected with private telephone lines are eliminated, the necessity of paying high rental charges for leased telephone lines is avoided, no interference from power circuits or static is experienced, no disturbance to neighboring telephones is produced, the system can be used with any voltage transmission, the possibility of the power circuits breaking is remote, and even if they all fall to the ground communication can still be maintained provided there is not a dead ground on the lines. The investment for apparatus will be only about $500 a station, said Mr. Tidd, so that the scheme is more economical than an ordinary wired telephone system, and especially so the farther apart the stations are. According to the operators who communicated over the system the audibility is higher than with ordinary telephones.

As an indication of what the American Gas & Electric Company thinks of the system, it is planning to apply the communication scheme to all of its properties in various parts of the United States for system load dispatching.

Bureau of Standards Investigating Lead-Covered-Cable Failures

THE Bureau of Standards has been investigating a large number of lead-covered cable failures in St. Louis, where it was claimed that electrolysis was at least in part the cause of the trouble. One of the factors considered is the question whether more failures have resulted on these cables when in fiber conduit than would otherwise have been the case.

The bureau in following up this point has sent out inquiries to a number of railway and power companies asking whether in their experience lead-covered cables fail more frequently when installed in fiber conduits than when installed in other types of conduit. Particular reference is being made to cables carrying power at 2,200 volts or higher. Companies with experience having an important bearing on this matter are being urged to send any information available to the Bureau of Standards, Washington, D. C., at an early date.

Increased Rates Granted to Indianapolis Electric Companies

INCREASED rates for power and lighting have been granted by the Public Service Commission of Indiana to the Indianapolis Light & Heat Company and the Merchants' Light & Heat Company, also of Indianapolis. By these rates, which became effective on July 4, the charge for power has been advanced 5 mills per kilowatt-hour and the charge for lighting, which had not been changed since 1915, 1 cent per kilowatt-hour. A new primary rate of 7½ cents has been established and the minimum rate has been increased from 50 cents to $1. Standard rate B, for combination power and lighting service, has been increased 8 mills. Municipal lighting and all other rates not included above have been raised 5 mills.

This order of the commission, issued after hearings and investigation covering almost three months, was based on fuel conditions and the increased cost of labor. In the order the commission requests that a simplified, comprehensive rate schedule, embodying not more than six divisions, be filed not later than Sept. 1, instead of the present intricate schedules, which include about thirty divisions. Co-operation between the two companies is also urged by the commission.

Two surcharges had been previously authorized by the commission—one on Sept. 1, 1917, and one on Aug. 10, 1918—to meet increased costs, principally of fuel. The estimated cost of coal was then put at $3.45 a ton, as against the present estimate of $5. Labor costs for 1920, it is estimated, will show a percentage of increase over 1919 more than double the percentage of increase shown for 1919 over 1918.

New York State Leads Nation in Hydro-Electric Output

AMONG outstanding facts derived from figures just issued by the division of power resources of the Geological Survey covering the production of electric power and consumption of fuel by public utility power plants in the United States for the first four months of 1920 is that New York State leads in hydro-electric output, the monthly total for that state reaching 268,736,000 kw.-hr. for April, against 292,336,000 kw.-hr. produced by fuel. California ranks second in production by water power, with 219,475,000 kw.-hr. for April, figures which show a good recovery from the low total of 148,836,000 kw.-hr. in February, caused by conditions of drought; Montana comes third, with 100,008,000 kw.-hr., and Washington fourth, with 95,672,000 kw.-hr.

The total production for April for the nation is put at 3,590,071,000 kw.-hr., divided as follows: By water power, 1,488,948,000 kw.-hr.; by fuels, 2,101,123,000 kw.-hr. For the four months totals are: By water power, 5,351,103,000 kw.-hr.; by fuels, 9,316,135,000 kw.-hr.; total, 14,667,238,000 kw.-hr. These figures are based on returns received from about 2,800 power plants of 100 kw. rating or more engaged in public service, including central stations, electric railways and certain other plants. They check closely with the figures of the ELECTRICAL WORLD printed in the issue for July 3, always bearing in mind that the statistics of the ELECTRICAL WORLD do not include electric railways.

University of Illinois Conducts Short Course for Meter Men

A TWO weeks' "short course for meter men" was conducted by the University of Illinois from June 21 to July 3 at the suggestion of the Illinois Electric Association, which bore the full expense involved. The instructions, shown in detail in the accompanying schedule, consisted of lectures, demonstration and laboratory work and covered the fundamentals of electric circuits and the principles underlying the operation of meters. The work on watt-hour meters was under the supervision of experienced meter men. The first week of the course included work with single-phase meters, and the second week was devoted to a study of polyphase meters, special meter appliances, etc.

A number of manufacturers were invited to co-operate by sending meters and experts to give talks on meters. The detailed schedule of work follows:

MONDAY, JUNE 21

8-12—Registration.
1-2—Classroom—Units, Ohm's law for direct-current circuits.
2-5—Laboratory—Resistance determinations.
7-9—"Get-together" at College Hall.

TUESDAY, JUNE 22

8-9—Classroom—Alternators, Ohm's law for alternating-current circuits.
9-12—Laboratory—Alternating-current circuits.
1-2—Classroom—Principles of indicating instruments.
2-5—Laboratory—Study of indicating instruments.
7-9—Talk by meter company representative.

WEDNESDAY, JUNE 23

8-9—Classroom—Clock and disk constants and gear ratio of watt-hour meter.
9-12—Laboratory—Meter characteristic curves.
1-2—Classroom—Theory of direct-current watt-hour meters.
2-5—Laboratory—Calibration of direct-current watt-hour meters.
7-9—Talk by meter company representative.

THURSDAY, JUNE 24

8-9—Classroom—Principles of alternating-current watt-hour meters.
9-12—Laboratory—Calibration of alternating-current watt-hour meters.
1-2—Classroom—Principles of alternating-current meters, continued.
2-5—Laboratory—Calibration of alternating-current watt-hour meters.
7-9—Talk by meter company representative.

FRIDAY, JUNE 25

8-9—Classroom—Discussion of previous lectures.
9-12—Laboratory—Calibration of alternating-current watt-hour meters.
1-2—Classroom—Discussion of previous lectures.
2-5—Laboratory—Calibration of alternating-current watt-hour meters.
7-9—Discussion of meter records.

SATURDAY, JUNE 26

8-9—Classroom—Discussion of previous lectures.
9-12—Laboratory—Calibration of alternating-current watt-hour meters.
1-2—Classroom—Examination.
2-5—Laboratory—Calibration of rotating standards.

MONDAY, JUNE 28

8-9—Classroom—Polyphase alternators and circuits.
9-12—Laboratory—Three-phase current and voltage relations.
1-2—Classroom—General characteristics of transformers.
2-5—Laboratory—Transformer tests.
7-9—"Mixer."

TUESDAY, JUNE 29

8-9—Classroom—General study of polyphase meters.
9-12—Laboratory—Construction and connections of polyphase meters.
1-2—Classroom—Discussion of polyphase systems and meters.
2-5—Laboratory—Calibration of polyphase meters.
7-9—Talk by meter experts.

WEDNESDAY, JUNE 30

8-9—Classroom—Polyphase meters with transformers.
9-12—Laboratory—Calibration of polyphase meters.
1-2—Classroom—Discussion.
2-5—Laboratory—Calibration of polyphase meters with transformers.
7-9—Talk by meter expert.

THURSDAY, JULY 1

8-9—Classroom—Polyphase meters with transformers.
9-12—Laboratory—Calibration of polyphase meters.
1-2—Classroom—Discussion.
2-5—Laboratory—Calibration of polyphase meters.
7-9—Talk by meter expert.

FRIDAY, JULY 2

8-9—Classroom—Graphic recording meters.
9-12—Laboratory—Calibration of polyphase meters.
1-2—Classroom—Demand meters and power-factor meters.
2-5—Laboratory—Study of graphic meters.
7-9—Talk by meter expert.

SATURDAY, JULY 3

8-9—Classroom—Examination.
9-12—Laboratory—Special experiments and calibration of standards.

The course was attended by thirty-four students during the first week and forty-four students during the second week. Seven meter engineers and meter foremen from six of the largest utility companies of the state acted as laboratory instructors. The students represented twenty-three different electric service companies.

Before the close of the course those attending formed the Illinois Electrical Meter Men's Association for the advancement of metering practice in this state with the following officers: President, R. D. Hart, Peoria; vice-president, H. W. Berning, Matoon; secretary and treasurer, D. Carlson, Oak Park.

Formation of North Jersey Power Company Postponed

CONSTRUCTION of the 200,000-kw. power station, for which the formation of a twenty-five-million-dollar corporation, to be known as the North Jersey Power Company, had been planned by the Public Service Corporation of New Jersey, has been indefinitely postponed.

An account of the project, which was to have been partly financed by prospective customers through subscriptions to preferred stock, was given in the ELECTRICAL WORLD of May 1. In a recent letter to those who had thus far subscribed for stock in the new corporation, Thomas N. McCarter, president of the Public Service Corporation, informed them that, owing to general conditions at the present time, it was deemed inadvisable to carry out the project.

It was stated at the general offices of the Public Service Corporation that subscriptions to the stock of the new company had been sufficient to warrant going ahead, so far as financing was concerned. The deterrent factor was the present situation with respect to fuel, labor and cost of material. It was pointed out that the formation of the new company involved a capital expenditure of a large amount of money at a high rate of interest and that apparatus and material are higher than ever before. This caused the officials of the Public Service Corporation to defer action for the present.

Furthermore, this company, like all of the other utilities, it was stated, is having difficulty in obtaining sufficient coal for present requirements, which are approximately 4,800 tons daily. The operation of a power plant of the size contemplated would increase the amount of fuel consumed from 25 to 50 per cent. Under present conditions no coal reserve can be built up and it would be impossible to obtain the necessary additional amount. However, the company has by no means abandoned its plan, it was stated.

Largest Radio Station Will Operate Five Units Simultaneously

ON THE north shore of Long Island, near New York City, the Radio Corporation of America is about to begin construction of a super-powered radio station, to be known as the New York radio central station, that will simultaneously send to and receive messages from five great nations of other continents. The steel towers of the station will be erected on a 6,400-acre (2,585-hectare) tract lying east of Port Jefferson with a long frontage on Long Island Sound. Preliminary engineering studies have been completed, contracts for all construction material are being let, and a force of radio experts will immediately commence work.

There will be five duplex transmitters and receiving sets which can be operated simultaneously, according to Edward J. Nally, president of the Radio Corporation. As soon as the station is completed, Mr. Nally said, message service will be established with France and Germany to supplement the existing commercial circuits, and ultimately radio from this station will connect up Buenos Aires and other points in South America as well as Poland, Sweden, Denmark and other European countries.

The form of aërial construction to be used is somewhat unusual. From the central power house six spans of aërial wire will radiate in a star pattern to a distance of more than a mile from the center. The wires of this antenna will be supported on 400-ft. (120-m.) steel towers with the wires suspended at the top between 150-ft. (45-mm.) cross-arms. Each of the six antennas will have twelve towers. Five of the antennas will be used for regular service, while the sixth is reserved for emergency operation.

The generation of energy for each of the five units will be effected by Alexanderson alternators, the same as are now used at the New Brunswick (N. J.) station. There will be two 200-kw. machines for each transmitting station.

Another departure in radio engineering will be the utilization of what is termed a multiple-tuned antenna, which, Mr. Nally explained, materially reduces the electrical resistance of the long, low, flat-top aërials.

Receiving aërials are also of a new type and are designed for operation with the Weagant system of static elimination.

Lighting Data File

A FILE of lighting data is being compiled and distributed monthly in the form of bulletins by the Edison Lamp Works of the General Electric Company. Each of the bulletins covers a different phase of lighting. Lamp characteristics, the effect of different voltages, relation of lighting to merchandising and to production, lighting of factories of one kind and another and other places of works, etc., each forms the basis of a separate bulletin.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Growth of the Telephone in London.—London, which has never been in the front rank of the world's great cities as regards the general use of telephones, is catching up, sixty new exchanges and 250,000 new subscribers being expected in the next twenty years as a result of plans for extension of service now being made.

American Iron and Steel Institute Report.—The annual statistical report of the American Iron and Steel Institute for 1918 has just been issued. Besides complete figures on the production of iron and steel, tinplates, galvanized sheets, pipes and tubes, etc., it contains tabulated data on the production and shipments of coal and of coke, arranged by states, for the five years from 1914 to 1918 inclusive.

Water-Power Possibilities in Utah.—A survey by the United States government is in progress in the vicinity of Salt Lake City for the purpose of determining the water possibilities and possible power sites along a great portion of the Wesatch Mountains. This survey will eventually take in most of the canyons from Ogden to Nephi and will result in the gathering of valuable data that may be used by the city of Salt Lake now that the water-power bill has become law.

Rat Puts Plant Out of Commission.—Perhaps no source of electrical trouble is harder to guard against than the depredations of animals. A case in point is reported from a large British plant where on the chief electrician's switching in an explosion occurred, injuring him severely, smashing insulators and rendering the busbars and contacts useless for the time being. In the search that ensued it was discovered that the short circuit had been caused by a large rat which had got athwart the busbars and achieved a noisy and spectacular suicide.

Atlanta Company Favors Maximum Kva. Demand.—Application for an increase in electric lighting, heating and power rates, as well as in street-car fares and gas rates, has been made by the Georgia Railway & Power Company of Atlanta to the Georgia Railroad Commission. A noticeable feature of the proposed rates as applicable to wholesale power is the determination of the primary charge on a maximum kva. demand instead of a maximum kw. demand. The commission set July 20 as the limit date for filing briefs, and a decision on all features of the petition is expected shortly thereafter.

The Radio Compass in Seaplane Navigation.—Successful navigation of naval seaplanes by radio compass up to the distance of 200 miles is assured by a test completed recently at Hampton Roads. The test was between seaplane F5L, Anacostia air station, and the U. S. S. Ohio. The F5L left Hampton Roads and flew direct to the U. S. S. Ohio, 94 miles distant. The position of the ship was unknown to the plane, which navigated by radio-compass signals. Communication was perfect throughout the flight, and the time indicates that the plane followed the most direct course. The plane returned to Hampton Roads without landing, navigating entirely by radio compass.

Toronto University to Have New Electrical Engineering Building.—A building for the departments of electrical engineering and applied mechanics is now in process of erection at the University of Toronto, Canada. It will be a brick and sandstone structure, four stories in height, measuring 225 ft. x 68 ft. On the ground floor will be two lecture rooms, a library and rooms for the teaching staff. The rest of the building will be devoted mainly to laboratories. Electrical engineering will be provided with three large laboratories for the study of alternating-current equipment, direct-current machinery and electrical measurements respectively. Another room will be arranged to study safely problems of high tension. Questions of insulation, conductivity and magnetic properties of materials will be dealt with in separate rooms. Several small rooms will be used for research, and communication engineering, including radio-telegraphy, will be provided with space on the upper floors.

Electrical Progress in Holland.—Dutch manufacturers are clamoring for cheaper electrical power, and a project to spend $4,000,000 or more in this direction is taking shape. Since 1913 the consumption of electrical energy in Holland has more than doubled, and it now reaches between 35 kw.-hr. and 40 kw.-hr. annually for each inhabitant. The scheme for extension was at first broached along the lines of private enterprise, with the government prepared to take a large interest in the operating company; but this plan has been rejected in favor of state action, co-operation with existing undertakings to be had on a profit-sharing basis and the construction of an extensive system of transmission lines to be begun at once. For the high-tension network three-phase, 50-cycle energy is to be adopted, the minimum voltage being 50,000. The capacity recommended for the power stations supplying the system is from 30,000 kw. to 75,000 kw. Each station will be equipped with generators developing 15,000 kw. A yearly output of 100 kw.-hr. per capita is aimed at, or an output of 1,000,000,000 kw.-hr., on the assumption that in the thirty years required to complete the project the population will have grown to 10,000,000.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Electric Club of Chicago.—The twelfth annual outing of this club is scheduled for Thursday, July 29.

New York Electrical Society.—This society has issued a sixty-four-page booklet containing the constitution, by-laws, list of officers and past-presidents and a roster of membership.

American Institute of Mining and Metallurgical Engineers.—This society will hold its fall meeting from Aug. 20 to Sept. 3, leaving Buffalo, N. Y., by steamer and cruising through the lakes.

Association of Iron and Steel Electrical Engineers.—Sept. 20 to Sept. 24 inclusive have been selected as the dates for the fourteenth annual convention of this association, which will be held at the Hotel Pennsylvania, New York City. The program under preparation will deal with the whole range of plant electrification. Seventy-one representative electrical and allied manufacturing companies will take part in a display of products of particular interest to steel-mill engineers.

Meetings of Summer and Early Fall.—Among meetings of electrical bodies to be held before the end of September are the following: Michigan Section, N. E. L. A., Ottawa Beach, Mich., Aug. 24-26; Pennsylvania Electric Association, Bedford Springs, Pa., Sept. 8-11; New England Geographic Division, N. E. L. A., Kineo, Me., Sept. 14-16; Indiana Electric Light Association, French Lick, Ind., Sept. 15-17; Illuminating Engineering Society, Cleveland, Ohio, Sept. 27-30. The Electric Furnace Association will meet in New York City in September and the Colorado Electric Light, Power and Railway Association in Glenwood Springs, Col., in the same month.

A. I. and S. E. E., Chicago Section.—At the final meeting of the Chicago Section of the Association of Iron and Steel Electrical Engineers for the 1919-1920 season Thomas O. Organ, consulting engineer for the Keystone Lubricating Company, delivered an illustrated address in which he explained the relative merits of oil and grease for different lubricating requirements. The election of the officers to serve next season resulted as follows: Chairman, Gordon Fox, electrical engineer Steel & Tube Company of America, Indiana Harbor, Ind.; vice-chairman, Elbert Lewis, Illinois Steel Company, South Chicago, Ill.; executive committee, R. R. Shepard, electrical superintendent Steel & Tube Company of America, and James Mills, electrical engineer Illinois Steel Company.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Contract Approved Subject to Subsequent Valuation.—The Idaho Public Utilities Commission has approved a contract for street lighting between an electric company and a municipality which contains a provision for making retroactive to the date of beginning service the rates subsequently to be fixed by the commission, it appearing desirable to install a new system of street lighting at once without awaiting completion of detailed inventory and valuation.

Allocating Property of Joint Gas and Electric Company.—In apportioning the property of a company furnishing both gas and electric service the items of property which were of a composite character and used in both departments of the business were correctly allocated as between the departments upon the same ratio as the property which could be directly assigned to the respective departments, according to a recent decision of the New York Public Service Commission, Second District. The income from the electric department, the commission also held, had no bearing on rate fixing for the gas department.

Maryland Commission Will Protect Utilities Against Undue Competition.—The Maryland Public Service Commission announces its adoption of the policy that when a public utility is rendering to the public a service reasonably adequate and is intelligently and economically operated, that utility will be permitted to earn a fair return on the property dedicated to the public service after the payment of operating expenses, taxes and a reasonable allowance for depreciation, provided that such return can be obtained through rates not above the value of the service, and the utility will be protected against unnecessary, undue and indiscriminate competition.

Contracts Must Not Be Voided Without Authority from Commission.—The Washington Public Service Commission has ordered the North Coast Power Company to repay to the city of Centralia the full amount of rate increase collected by the company from the city between Dec. 20, 1919, and July 1, 1920. The company had, in the absence of a formal protest from the city, put the new rates into effect on the former date and rescinded the old contract without authority from the commission. The latter body had authorized the increase but not its immediate enforcement or the cancellation of the existing agreement. The new rates therefore are held to have been invalid prior to July 1.

Maintenance Reduction False Economy.—In granting to the Pacific Gas & Electric Company and the Great Western Power Company permission to add an emergency surtax of 15 per cent to all bills rendered between July 10, 1920, and April 10, 1921, and add to the standard rates the surcharges previously allowed, the Railroad Commission of California declared that shortage of water power and increase in wages justified the increase in rates until the installation of additional hydro-electric equipment shall make it possible to reduce the consumption of fuel oil. "The company's property," the commission said, "should be maintained in first-class condition. It would be false economy to reduce maintenance at this time. It would result only in decreasing the quality of service in the future."

Flat Rates to Agricultural Consumers Unfair.—In refusing to alter the rates fixed by it for the San Joaquin Light & Power Corporation on the complaint of the Kern County Farm Bureau that they were excessive and that because of increased rainfall and an alleged surplus of natural gas no power shortage need exist, the Railroad Commission of California said: "The evidence shows that the average increase in rates for the remainder of the year for agricultural service will be slightly in excess of 15 per cent; that the increased cost of service has been in the form of increased operating expense, depending upon the use of energy rather than upon the size of the installation; that the flat rates formerly in effect were unfair to the consumer using power less than the average, and that consumers using motors continuously were not paying their just proportion of the cost. Under the proposed rates consumers who can conserve in the use of water will receive the benefit of the reduced cost of service, a condition not possible under the former flat rates."

Power Sales in Washington State.—In a recent ruling by the Washington Public Service Commission (see ELECTRICAL WORLD, July 3, page 39) the earnings of the Puget Sound International Railway & Power Company on its Everett business, which had been 43.60 per cent upon power sales and 11.61 per cent upon lighting sales, were reduced to 8 per cent upon the property valuation. In issuing this order the commission accepts the company's challenge of its jurisdiction for regulatory purposes over electrical energy sold for power and undertakes to evaluate the lighting and the power systems separately for rate-making purposes. It is considered certain that this ruling will be contested in the Supreme Court, a former Supreme Court decision having held in effect that sale of surplus or "dump" power should not be considered a public use, subject to commission regulation, but as subject to the company's own control. The commission maintains that at Everett the sale of power is an established business and not affected by the court ruling.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Eighteen Years' Silence Does Not Outlaw Suit for Damages from Overflow.—That a defendant had not previously protested against a dam, although eighteen years had passed since it was built, was no bar to recovery of damages for flooding of land, the Supreme Court of New York has held in a suit brought against a pulp and paper company. (181 N. Y. S. 714.)

Safety Factor in Construction of Dams.—In an action for damages because of the breaking of a dam, the Supreme Court of Ohio has laid down the general principle that one constructing a dam across a natural watercourse must construct the dam with reference to the ordinary conditions of nature, but it is not necessary to make the dam so strong as to withstand an extraordinary convulsion of nature or an extraordinary flood—one which ordinary prudence would not have foreseen. (127 N. E. 408.)

Contributory Negligence Despite Warning Prevents Recovery of Damages.—In a suit against the Metropolitan Edison Company to recover damages because of the death of a painter who swung a scaffold on a tower in such a way that his head was only six inches under high-tension wires attached to the tower and who in some unexplained manner came to grasp one of the conductors, it was established that he had been warned about the wires and told to keep away from their neighborhood until the current was turned off. The painter failed to observe this order, and the Supreme Court of Pennsylvania has found that because of his negligence the lower court rightly found for the defendant. (110 A. 92.)

Massachusetts Department Without Power to Prevent Modification of Contract in Accordance with Approved Provisions.—Where the Department of Public Utilities has approved a contract which provides precisely how any modification of price necessitated by changed conditions shall be made, the department cannot prohibit such modification, under such specified conditions, the statute not conferring on it the right to fix a price nor giving it more than a limited function to ascertain whether the conditions calling for increase in price as specified by the contract have come about. This is the purport of the decision of the Supreme Judicial Court of Massachusetts in an action brought by the Boston Consolidated Gas Company against the Department of Public Utilities of the state. (127 N. E. 417.)

James E. Davidson, vice-president of the Nebraska Power Company, who was chosen to head the new Public Relations Section of the N. E. L. A., the executive committee of which met last week for the first time, has long been recognized for his activity in developing and strengthening association work. He has been president of the Vermont Electric Association (1909), chairman New England Section, N. E. L. A. (1910-1911), president Northwest Electric Association (1911-12) and chairman of its executive committee (1915-17), and president Nebraska Electric Association (1918). In 1915 he was elected a member of the N. E. L. A. executive committee. Mr. Davidson went from the Port Huron (Mich.) utilities to Montpelier, Vt., where he was president and manager of the Consolidated Lighting Company. In 1910 he left New England for the Northwest, to assist in the development of the Pacific Power & Light Company. Two years later he became vice-president and general manager of that company. He came East for the Electric Bond & Share Company in 1917, and toward the middle of the year he was appointed vice-president and general manager of the Nebraska Power Company at Omaha.



J. E. DAVIDSON

E. A. Baily has been appointed treasurer of the Brooklyn Edison Company to succeed the late Henry P. Erwin. Mr. Baily was formerly secretary.

E. W. Kells has been appointed secretary of the Brooklyn Edison Company, succeeding E. A. Baily, who has been appointed treasurer.

F. A. White, manager at Sweetwater, Tex., for the Texas Power & Light Company, has resigned.

D. W. Jardine, for the past seven years assistant manager, has been chosen to succeed F. H. Parker as manager of the Burlington (Vt.) Light & Power Company. Mr. Jardine since his graduation in 1907 from Lehigh University has been in the employ of the parent company, the American Gas Company.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

Irving E. Moultrop, assistant superintendent of the construction bureau of the Edison Electric Illuminating Company of Boston, has been elected a trustee of the American Society of Mechanical Engineers and a member of the Engineering Foundation Board to fill the vacancy caused by the death of E. Gybbon Spilsbury on May 28 last. Mr. Moultrop is also chairman of the Technical Section of the National Electric Light Association.

A. C. Miller has been promoted from foreman of the Pacific Gas & Electric Company's electric shop at Redding, Cal., where he has been for seven years, to manager for the company in Shasta and Trinity Counties, Cal.

M. E. Todd, who has been an instructor in electrical engineering in the Dunwoody Industrial Institute, will next fall take up general work in the electrical engineering department of the University of Minnesota.

J. H. Kullman, formerly a designer with the Electric Machinery Company, will become an instructor in electrical design at the University of Minnesota this fall.

F. H. Parker, after forty-four years of service with the Burlington (Vt.) Gas Light Company, which later was merged with the Burlington Light & Power Company, of which he was manager, has resigned. Mr. Parker's connection with the Burlington properties began two years after his graduation from the University of Vermont in 1874. In 1886 the gas company began furnishing electric light under the title of the Brush-Swan Electric Light Company. In 1892 that company absorbed its competitor, the Citizens' Electric Company, and in 1902 the Burlington Light & Power Company was formed for the purpose of operating the plants of the Burlington Gas Light Company, the Consolidated Electric Company, which furnished electric light only, and the Vermont Electric Company, which furnished electric power only. Throughout this enlargement of service in Burlington Mr. Parker continued as manager. In 1908 he was elected president of the Vermont Electrical Association.

G. R. Stahl, engineer for the People's Light Company, Davenport, Iowa, has been named assistant general manager of the company, with which he has been connected for a number of years.

L. J. Greer, formerly manager for the Texas Power & Light Company at Gainesville, Tex., has succeeded F. A. White as manager at Sweetwater.

Capt. Richard H. Ranger, after three years of service with the army, has resigned from the Signal Corps to take up work with the Radio Corporation of America under E. F. R. Alexanderson, chief engineer. During his service he came into close touch with the French radio service. This included a period at the station at Lyons, which is the most important radio center of that country. The training of cadet officers in signaling became an important part of the army work in France, and Captain Ranger was a member of the instruction staff of the First Corps signal school at Goudrecourt. Later he was put in charge of the department of military signaling at the Saumer artillery school, where at the signing of the armistice there were 2,200 cadet students. After the armistice a thorough course in radio at Sorbonne University was organized by the French specialists, and Captain Ranger handled the translations of these lectures. Research work on eliminating interference in radio receiving was conducted that led to a new type of apparatus which was further developed on returning to this country. For the last year Captain Ranger has been in charge of the Signal Corps radio laboratories at Little Silver, N. J., where it has been the endeavor to put into substantial, usable form the instruments which the war demonstrated to be necessary for the equipment of the army. Captain Ranger was graduated in 1911 from the Massachusetts Institute of Technology.



R. H. RANGER

Obituary

Axel Carl Ekstrom, consulting electrical engineer, Delaware & Hudson Company, died July 1 at his home in Ballston Spa, N. Y. Mr. Ekstrom was born in Stockholm, Sweden, fifty-eight years ago. He came to the United States in 1890.

Trade and Market Conditions

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

Electric Heating Appliances Increasingly Popular

WITH the approach of hot weather heating appliances have been coming more and more into popularity with housewives who appreciate the advantages of a quick initial supply of heat and great concentration. In the item of flatirons, for instance, sales are extremely heavy because of numerous campaigns run by the power companies. Percentage increases in sales are not so high as on other items because the market has been nearer saturation.

A recent report of the California Electrical Co-operative Campaign covering sales of such material on the Pacific Coast shows that users of electric percolators increased 104 per cent in 1919 over 1918, toasters 100 per cent, ironers 137 per cent, and 6-lb. irons 33 per cent. In New England territory recently some jobbers were so hard pressed to meet clamoring customers that they sold goods ordered early in the year and reserved for the 1920 Christmas season. Nor did general price increases about the middle of June appear to have any deterrent effect upon a demand in the Middle West which had been steadily increasing.

Distribution of heating appliances in the South is on the allotment basis, and dealers are urged to place their orders with jobbers at the earliest possible moment, as the latter have been unable to accumulate any stocks for fall trade. Jobbers' shelves in the metropolitan section are absolutely bare, and there seems to be no let-up in the demand.

The price trend in this line seems to be steadily upward. Manufacturers are faced with transportation troubles and an inability to obtain sufficient raw material. One producer of appliances made general price increases on July 1 amounting to from 6 to 15 per cent. Another is expected to follow his example within a week.

Here and there are heard reports of slackening demand, but in most cases this evidence seems to emanate from scattered jobbers throughout the country, and as likely as not the contrary view will appear to be the case the following week.

Foreign Demand for Steel Towers Good

STEEL transmission towers are reported in better demand for foreign work than for domestic. This is especially true of the large units. At the same time there is a fair demand for smaller towers, both tubular and fabricated, and in amounts for use over relatively short distances.

Although European exchange is rather unfavorable, there is some demand at this time from that source, while inquiries are good. Buying prevails in the Far East, Australia, South America and Canada.

Poor condition of power companies and high rate of borrowing money are the reasons advanced for a rather light domestic tower market. The power and light companies are interested to the extent of inquiries, and are keeping their plans rather forward for new extensions, but at the last moment the signature is lacking on the dotted line.

There is a shortage of material available for poles, but more particularly for tubular poles. The pipe demand in the oil regions is tremendous, with a consequent reaction on the amount of stock that can be turned into poles. Some fair street-lighting business is reported, however, for this class of pole. For fabricated poles supply in some quarters is a little short because of transportation hold-ups.

A rather new use for steel poles and towers is that in the radio field. Since the armistice, and later with the withdrawal of restrictions on certain classes of radio work, the demand in this field has increased, and it is in good condition at this time. It is understood that a recent order embraced twenty-four towers of 400-ft. length.

Deliveries on this material are lengthening and in some cases are running up to six months. At the same time prices quoted are holding rather steady.

Appeal Filed in Coolidge Lamp Patent Case

WORD has just been received from Dr. Liebmann of the Independent Lamp & Wire Company that that company has filed an appeal from the decision in the Coolidge lamp patent case, handed down on June 29 by Judge Morris of the United States District Court in New Jersey, wherein all the claims brought by the General Electric Company were declared valid and to have been infringed.

Hot Weather Would Leave Short Fan Stocks

IT IS probable that the fan season will not come up to the expectations expressed some months ago when the volume of initial orders was so heavy. The reason assigned for this apprehension is more a lack of transportation than a lack of orders. Mills have been up against the slow movement of raw materials into the plant as well as delays in getting the fans away from their doors. Jobbers have in many instances received only parts of their shipments, so that they have been compelled to buy from the trade to satisfy the orders for fans from their dealers.

At the same time, the fan season has been late in opening all over the country because of protracted cool weather. This was a fortunate occurrence, because had the season opened early jobbers would have been unable to come close to satisfying the demand. It must be remembered, however, that the products of some manufacturers were in their distributers' hands before the worst traffic jam resulted, but in many other instances this was not the case. Some distributers, therefore, opened the season with good supplies of fans.

At the present time there is a fair assortment to be found in the New York district because warm spells have been spasmodic. The call had hardly started when it was as quickly stopped. Before it has been resumed, a new shipment has appeared and stocks are built up a little; but it is generally recognized that a normally long-protracted spell of hot weather would soon clear these stocks to the point where they would be of little value except as substitutions.

In the business districts of New York City there hasn't been enough hot weather to move the direct-current oscillating fans in great quantities. Good stocks of these are

available. On the contrary, alternating-current oscillating fans are in low supply, and it is not expected that they will last out the season. Ceiling fans have moved in volumes surpassing all expectations, and there are few of the alternating-current type left. As usual, the 16-in. alternating-current oscillator is the favorite, although the 9-in. and 12-in. sizes are receiving a good call. Demand for the small sizes is good for apartment-house and home use. These are receiving more consideration because of the price feature, as in many quarters this item is of more importance than when fans are considered for business use.

New England Not Up to Expectations

Continued cool weather has held back the sale of fans in New England this summer, to say nothing of existing prices. It is a common saying in the wholesale trade that after July 4 the fan business amounts to little except in retail circles, and so far this year's business does not show much more than a normal demand. Some jobbers report sales from 25 to 50 per cent in excess of last year's, but others have done no better to date than was the case under the cool conditions which prevailed during much of the summer of 1919. Stocks are not large, however, and the total number of fans in the hands of seventeen leading jobbers in this district on June 30 was about 7,000 to 7,500, individual stocks ranging from 25 to 1,200. It appears likely that two or three hot waves will exhaust these reserves, and as few fans are likely to be purchased after this for 1920 delivery, the chances of any material carry-over into next year are small.

The oscillating type of fan is selling best this year. Fans of the larger sizes are moving better than residential fans, a leading jobber reports. The former are going into factory service, where initial cost carries less weight. Comparatively few fans were carried over from last year by New England jobbers. Not much complaint has been heard as to deliveries this spring, orders having been placed far enough ahead of requirements to yield very fair shipments even in the face of the unusually slow railroad service, which has been such a handicap to manufacturers and distributers in all parts of the country.

It is estimated that the New England market absorbs from 100,000 to 150,000 fans a year, according to weather conditions. Retail stocks are still pretty well filled. The feeling is widespread that prices cannot go much higher on desk fans without a decided reduction in the total volume of sales. Some cut-price sales are being conducted at present, but by and large the price level is being maintained at record-breaking figures. There is a general disposition to hold back on commitments to next year's fan program, many distributers preferring to play a waiting game in the hope that prices next winter for 1921 fan delivery will be materially lower than they were last time the seasonal orders were placed.

Few jobbers are ready as yet to say how many fans they will purchase for next year. They may have particular totals in mind, but feel that nothing will be lost by letting matters rest for a few months. In case stocks are cleaned out by hot weather, still largely deferred, the market will be vigorously canvassed for any 1920 "left-overs" that may be in sight. One large Boston house would be glad to get 200 more fans this summer, but most of the distributers with whom the ELECTRICAL WORLD has been in touch are practically through with fan buying for the present, barring protracted torrid weather.

During the last week, however, sales showed a decided spurt because of the warm weather, but jobbers' stocks are still meeting current requirements.

Mid-West Has Fair Stocks

During the greater part of June the demand in the Mid-West was very good. While this period of mid-summer heat was on, jobbers' stocks were in a fairly good condition to meet requirements because the call had come late. They were having difficulty, though, in replenishing these stocks, as shipments were coming in slowly from the factories.

By the end of the month cooler weather set in again and stocks began to pick up. At the present time continued unpleasant weather has further reacted on sales through dealer and jobber, while receipts have been better, and it is felt that unless more heavy hot weather comes on soon stocks can be maintained through the season. They are now in fair shape, but below the average.

Demand in general is reported lighter, in line with lessened demand for other socket appliances. As usual, the 16-in. oscillating fan is the best seller.

Southern Stocks Depleted

Exceedingly warm weather since the middle of June has played havoc with jobbers' stocks. These stocks in the first place were small enough because of embargoes in the East, but there are still some shipments reported in transit for a long time. Some jobbers have almost nothing left in stock, and the call for direct-current non-oscillating fans and for 12-in. and 16-in. oscillating fans has been insistent. At the same time, there are not enough ceiling fans to go around. In this region, too, jobbers expect that future receipts which may come in will not to any degree supply the demand which they feel will develop before the end of the season.

Northwest Season Light

In Seattle and the Puget Sound district, as a whole, there is no season which can be specifically designated as a "fan season." During June, July and August, as a rule, there are a few days when fan sales are good, but this movement is spasmodic. It is not unusual for an entire summer to pass with only a few really warm days. However, jobbers do carry a fair assortment of stock, which is amply sufficient for a trade necessarily light. Stocks for this year's trade were ordered six months in advance, and at the present time jobbers are well supplied. Up to date the present summer has shown no need whatever for electric fans.

Need of Standards in Fractional Horsepower Motors

THE fractional-horsepower-motor business has grown so rapidly that standards seem to have been overlooked or ignored by both manufacturers and buyers. The need of greater production from the motor manufacturers impelled the American Washing Machine Association to confer with the motor manufacturers for the purpose of establishing standards which would make the motors mechanically interchangeable. The Power Club has standardized shaft sizes, and a committee of that organization is grappling with some of the electrical problems of standardization.

Most of the purchasers of very small motors are not electrical engineers, and they are confused by the great variation in the performances of motors from the same or different factories. However, when certain motors are rated all the way from $\frac{1}{8}$-hp. to $\frac{1}{2}$-hp., depending on the duty cycle, there will naturally be a wide spread in their full-load performances at the different ratings.

Buyers want the fractional-horsepower motors to standardize their machines and reduce the numbers of ratings so that motors with the same nameplate reading will be electrically and mechanical interchangeable. The great non-technical buying public seems to think that it has a right to this service, which, it is claimed, would also benefit jobbers, dealers and the manufacturers themselves. There are manufacturers, however, who feel that such mechanical uniformity would hamper progress in the improvement and development of new ideas and who do not take agreeably to the idea of uniform design.

To a limited extent, practically all manufacturers are working toward standardization, as, for instance, the diameter of the shaft extension, size of keyways, size of pulley, etc., but it seems to be mechanical rather than electrical standardization which up to the present time is being considered.

Power Companies Ordering Cable Well

POWER cable orders are being received by the mills in good quantities. Shipments are being quoted in increasingly longer terms, running from three to eight months for paper and lead cable and from six weeks to four months for varnished-cambric and lead cable. A tendency is noted for the orders to run into larger sizes of cable, which forms some check on reports that fiber-conduit orders are also running to larger sizes.

The Middle West is providing the best market, but fair-sized orders are coming from New England, the Atlantic States and the South. Some good orders are coming from electric railroads and street-railway companies.

In at least one case paper-cable producing capacity is sold throughout the best part of the present year, and no orders will be booked beyond Jan. 1, 1920. At the same time, many utilities are unwilling to book orders for shipment as long as six months. Utilities of regular standing at the mill, however, are generally able to squeeze in an order, if necessity warrants, where an outside customer would have to wait his turn.

An interesting trend toward standardization is found in the orders from utilities. Former habits of specifications all their own are being changed, and the engineers are coming to see that they can use cable built on A. I. E. E. specifications as well as that built on their own. The mills are refusing to accept special orders in many instances, and this is helping in the standardization.

Metal Market Situation

FIRMNESS continues as the prevailing tone in the copper market, and a growing volume of both foreign and domestic inquiries is reported. Producers continue to hold at 19 cents for third-quarter delivery but seem shy about accepting orders for later than September. Smaller dealers are being forced from the outside market, which is now unwilling to sell for much less than 19 cents. London spot closed £3 15s. higher than a week ago under the influence of improved business conditions. Although buying is rather light, steadiness rules in the market for zinc, which advanced a fraction of a cent. Tin also closed higher with an increase of 2 cents, while minor price changes of not more than a quarter of a cent occurred among the old metals.

The Interstate Commerce Commission has extended its order confining the use of open-top cars to coal for thirty days from July 21. This is against protests of the iron and steel producers, who said that shutdowns of their mills would be inevitable if this extension were put into effect. All flat-bottom gondola cars or cars which on June 19 had been definitely withdrawn from coal-carrying service have been exempted from this order, as was requested by iron and steel interests, thereby affording a certain amount of relief.

NEW YORK METAL MARKET PRICES

	July 6			July 13		
Copper	£	s	d	£	s	d
London, standard spot	87	0	0	90	15	0
	Cents per Pound			Cents per Pound		
Prime Lake	18 75			19 00		
Electrolytic	19 00			19 00		
Casting	18 00			18 25		
Wire bars	22.50	23	00	22 50	23	00
Lead, trust price	8 00			8 00		
Antimony	7 50			7 50		
Nickel, ingot	43.00			43 00		
Sheet zinc, f.o.b. smelter	12 50			12.50		
Zinc, spot	8.15			8 25		
Tin	48.25			50.25		
Aluminum, 98 to 99 per cent	33.00			33.00		

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	15 00 to 15 25	15 00 to 15 75
Brass, heavy	9 00 to 10 00	9 00 to 9 75
Brass, light	7 00 to 7 25	7 00 to 7 50
Lead, heavy	7 00 to 7 25	7 00 to 7 25
Zinc, old scrap	5 00 to 5 25	5 00 to 5 25

THE WEEK
IN TRADE

VACATION season trade slackness is beginning to affect the electrical industry, with jobbers throughout the country reporting lighter sales than for some weeks past. A favorable feature, however, is the freight situation, which seems to be easing up considerably in all parts of the country, with one exception; in the Puget Sound district a 50 per cent normal supply of cars is tying up the lumber industry.

Labor in the East and South is in good supply, with a somewhat stronger demand on the West Coast, where a slight shortage of farm labor is expected to be relieved by an exodus of hands from the closed lumber camps.

Building construction in Middle Western territory is still off, but in other localities a good volume of this work is being undertaken, especially in the nature of large industrial projects.

In some sections, notably in Southern and New England districts, creditors are a bit panicky over the financial outlook, with the result that collections are tightening up. In other localities collections are fairly easy, as on the Pacific Coast where money is said to be plentiful.

NEW YORK

The summer vacation exodus is having its effect in a general easing off of business that begins to make itself felt. Jobbers report the market as a bit quiet the past week, and contractor-dealers are slowed up through the paucity of residence construction. Building work for industrial and business purposes, however, continues at a great pace, though many of these projects are still in the preliminary stages and have not made themselves felt on the electrical industry as yet.

Reports on the shipping situation are for the first time in many months in a measure favorable, for an increasing volume of freight is arriving on back orders, although anything in the nature of stocks has not yet had time to accumulate. Collections are fair and prices are generally steady.

The feature of the market is probably the relief in the acute situation as regards flexible armored conductor which several jobbers report during the week. No stocks are available, but receipts are better. Pipe is still out of the market, and sales of fans are poor, indications pointing to an off-season in that line. Lamp stocks are building up in good shape against anticipated heavy demand in the fall.

Metal Molding.—No material is being received from the steel mills, and consequently some shortage is met, with stocks spotty in face of a demand that is only "fair."

Fans.—Good stocks are generally reported. Jobbers agree that demand has been light this season, with a poor fan season in prospect unless prolonged hot weather saves the situation. Shipments are fairly regular.

Flexible Armored Conductor.—Some easing up of the previous shortage is reported by jobbers during the week. Shipments are arriving more regularly, but back orders will prevent any semblance of stocks for several weeks to come. From $115 to $117.50 is quoted on No. 14, 2-wire.

Rigid Conduit.—With not a foot in stock, and irregular shipments that at once melt in the face of back orders, many jobbers have ceased to quote prices. Demand holds up as strongly as ever.

Flashlights.—No difficulty is experienced in this line, which has a very rapid turnover. Shipments are good and stocks in such shape as to handle the brisk call which exists.

Wire.—Good supplies in general are the rule, with a

reasonable demand existing. Bare copper wire seems easy, with weatherproof slightly harder to obtain. No. 14 rubber-covered is quoted at $11 and upward per 1,000 ft.

Safety Switches.—Poor local trade has enabled good stocks to accumulate. Shipments range from six weeks to two months. Although one manufacturer announces a reduction of 13 per cent on his three-pole, 30-amp., 250-volt switch, no other price change is reported.

Lamps.—Better deliveries have enabled jobbers to build up stocks which have been spotty, in anticipation of a large demand this fall. Sales are normal for this time of year.

Heating Appliances.—A demand that far outstrips supply has left shelves practically bare. Deliveries are extremely slow, and one manufacturer has raised the price of irons and toasters 6½ per cent and that of percolators 10 to 15 per cent. Other increases are in sight.

Schedule Material.—In spite of good average stocks, with here and there a short item, jobbers look for a shortage in this line as a result of labor troubles closing New England factories and the general dearth of brass and porcelain material. Shipments at present are satisfactory.

Electric Ranges.—Local territory offers a poor market because of the high energy rate. Distributers report good business in outlying districts, however. Jobbers' stocks are in such shape as to handle the demand. One manufacturer advanced his price from 15 to 25 per cent on July 1; another made an increase of 8 per cent on July 15.

CHICAGO

All stocks, particularly schedule material and wire, show an improvement, as sales continue on a lower scale than during the spring. Inbound shipments are being handled by the railroads with greater regularity so that jobbers are enabled to build up stocks. These stocks are necessarily very broken, and on many items the increased supply is not yet sufficient to cover the accumulation of back orders. The improvement of freight conditions may be only temporary as the movement of fruit and produce, which is increasing every day, threatens the handling of non-perishable goods.

Construction remains at a minimum, the current week's permits for Chicago totaling only $635,000. This makes business light for contractor-dealers. Retail sales of household appliances in Chicago are also slack, with washing machines and vacuum cleaners holding up better than the rest of the line. Unseasonable weather, which continues quite cool, undoubtedly affects this class of business materially. Manufacturers report sales campaigns in smaller cities in surrounding territory as having unvarying success.

Wire.—With the single exception of magnet wire, all kinds and sizes are much easier to obtain and stocks are accumulating in fair shape. Demand has fallen off considerably and prices are unchanged.

Motors.—Large jobbing interests report the receipt of several cars of motors of 5-hp. size and larger and a material relief in delivery conditions. Fractional sizes are still unobtainable, as orders exceed visible supply for some time to come.

Poles.—No change is apparent from the last report. Production barely keeps pace with demand and shipping is uncertain, particularly since the advent of the fruit season. Stocks are badly broken, frequent substitution being necessary to fill requirements.

Cross-Arms.—General relief in transportation does not seem to have extended to carload shipments from the Pacific Coast, as cross-arms, plentiful in the producing yards, are still hard to get here; $123.90 is being quoted on 6-ft., six-pin, 3¼-in. x 4¼-in., Washington fir, when obtainable.

Wood Pins.—Locust pins are quoted at $59.94 per 1,000 in large lots and are in better supply than when last reported, although still not plentiful enough to fill requirements. Improved freight conditions should relieve this situation speedily.

Glass Insulators.—Insulators are hard to get, all jobbers reporting orders far in excess of supply. An advance of approximately 10 per cent is announced to be effective July 20.

Line Hardware.—Following recent sharp advances in price, demand is noticeably lighter. Receipts by jobbers show some improvements, but delivery is very uncertain.

Fans.—Cool weather has reduced retail sales materially. Exhaust fans, for which demand continues heavy, require from thirty to sixty days for delivery.

Heating Appliances.—Long-deferred shipments from factory are beginning to be received by jobbers and passed along to the retailer. With public demand below normal it appears that the threatened famine in percolators and toasters will not occur. Jobbers still have great quantities on order.

BOSTON

Business in jobbing circles holds up well, but in some localities a slight falling off is noted as compared with the past three or four weeks. Collections are tightening up a bit. Stocks are showing considerable improvement except as regards rigid conduit and motors. Deliveries on these are both long and irregular. Prices are holding fairly firm, although some cuts are noted in appliance sales. On close competition, wire is being moved at lower figures than last week. Labor in the textile field is beginning to be less dictatorial, as layoffs increase, and in the electrical industry conditions are somewhat more stable. Considerable non-employment is noted in the textile mills, and dullness also affects the leather industry. Building operations are still retarded by high prices, although imposing totals are accumulating on contracts let compared with previous years. As a rule, considerable improvement is reported in regard to deliveries after orders leave the factories.

Motors.—Deliveries of about thirty-eight weeks are being quoted on motors ranging from 1 hp. to 10 hp., with firm prices and bare stocks. The demand shows some recession, except in textile motors, the call for these being well sustained, with requirements well handled.

Rigid Conduit.—The demand far outstrips supply at present. A leading jobber reports a shortage in all sizes, but as a rule the smaller diameters are harder to obtain. Fittings are scarce and stocks are being quickly depleted.

Non-Metallic Flexible Conduit.—No complaint is heard as to short supply. Fair trade is moving stocks, with the ⅜-in. size bringing $33.50 per 1,000 ft. in 5,000-ft. lots, and the ½-in. size $38.50 per 1,000 ft. in 1,000-ft. lots.

Flexible Armored Conductor.—Prices are steady, with a current quotation of $110 per 1,000 ft. on No. 14, single-strip, in 1,000-ft. lots. A reasonably good supply is on hand in this territory.

Wire.—No. 14 rubber-covered wire sold last week at $11 per 1,000 ft. in 5,000-ft. lots, under sharp competition between Boston and outside jobbers. Bare copper wire is quoted on a 24-cent base and weatherproof, which is still short, notwithstanding brighter prospects for increased production, is on a 29-cent base.

Sockets.—Excellent stocks are reported, without serious differences among types. Slower building work, especially in residences, means slow sales compared with the potential absorbing power of the construction market.

Wooden Molding.—Some of this material is moving, and one jobber sold nearly his entire stock on a single order recently. Some local shortages were reported last week.

Ranges.—Buying continues at a healthy rate, notwithstanding the fact that few if any range campaigns are on at present. New development work continues, and increased manufacturing facilities are soon to be realized.

Lamps.—Present demands are being well handled. Production is being pushed against the fall trade, and so far the indication is that the demand will be covered satisfactorily, but without a large surplus.

Vacuum Cleaners.—Stocks are very good, despite active sales.

ATLANTA

The Sixth Federal Reserve district reports a new high-water mark for building permits for the month of May. The principal Southern cities show a total of 2,210 permits, valued at $6,600,000, an increase in value of $2,000,000 over those for the preceding month. It is freely predicted that building permits for June will overtop those of May by a large margin.

Labor conditions throughout the territory are reported as somewhat easier, with the exception of a number of strikes in New Orleans, the situation there having been complicated by a walkout of the street-railway employees last week. The local strike of the plumbers, tinners and painters, though still technically in effect, is not interfering with building activities in Atlanta.

Manufacturers report a slackening in the receipt of orders from jobbers, due probably to the placing of heavy orders in the early spring and the great difficulty that is experienced in making any promises for future shipments. The jobbing trade itself reports business brisk, little or no slackening in orders being reported, with the exception of the southernmost section of the state, where the crop outlook, because of the boll weevil, is very poor. The freight congestion caused by the railway clerks' strike is greatly lessened, and outgoing shipments are moving fairly satisfactorily. No price increases of moment were reported last week.

All lines of trade report collections tightening up considerably, and credit is being extended with a great deal more caution than has heretofore been the case.

Rigid Conduit.—Several large shipments of pipe have just been received in the territory, some of them being made in open gondola cars because of the shortage in the standard box cars. These shipments have served materially to ease the situation. Prices, galvanized, lots less than 2,500 lb., ½-in., $9.40; 1-in., $18.46; 1½-in. $29.87; 2-in., $40.18, per 100 ft.

Wire.—A large shipment of rubber-covered wire is expected daily and its receipt will serve to ease the stringency in No. 12 and No. 14. Weatherproof is still hard to obtain, stocks being badly broken and the demand continuing so brisk as to prevent the accumulation of any noticeable supplies.

Electrical Toys.—Jobbing salesmen are beginning to push this specialty and are urging dealers to place orders for Christmas trade in anticipation of the difficulty in supplying the demand.

Rectifiers.—The large number of automobiles throughout the rural districts has created a heavy demand, and jobbers report that good stocks and fair shipments are assisting in a brisk movement of this article. An increasing popularity is predicted in all the small centers where alternating current is available.

Washing Machines.—Jobbers report that washing machines continue to come through in good volume and that the demand not only continues to hold up well, but in many instances shows a healthy increase, due to the difficulty with the servant problem.

Pole-Line Hardware.—Stocks of pole-line hardware are badly depleted and shipments are not coming through so satisfactorily as could be wished. The demand continues very brisk and no stocks can be accumulated. Prices are: Cross-arm braces, lots of less than 100, $15.35 to $22.06 per 100, according to size; through bolts, ⅝ in. x 14 in., $29.63 per 100; guy clamps, two-bolt, 3-in., $21.55 per 100; anchor rods, ⅝ ft. x 8 ft., $107 per 100.

SEATTLE—PORTLAND

From week to week business conditions in the electrical industry show but little change in the Puget Sound district. Sales volumes from the jobbers' standpoint are light, but retailers are doing a fair counter business. It is believed no definite change in conditions either way will be noted before fall. Stocks are in the same condition as before and the freight situation has not changed materially. Prices, while fluctuating slightly, show no marked change.

Through the action of Secretary John B. Payne, of the Department of the Interior, Seattle will receive tonnage needed to bring fuel oil from California to avert the threatened shutdown of the Lake Union steam auxiliary to the municipal lighting plant. The car supply continues to be the big problem before lumber manufacturers of the Pacific Northwest, as at present the car supply is less than 50 per cent of requirements. A slight scarcity of farm labor is being felt, particularly in eastern Washington and Oregon. However, any shortage will very likely be averted by the surplus made available by the closing of lumber mills and logging camps during the summer shutdown.

Portland jobbers report business in general as rather slow, although reports from dealers in smaller cities over the state seem to indicate a reasonably good volume of sales at the present time. The recent increased price on all lines of household heating appliances is certain to have a downward effect on sales.

Electrical contractors report that business has been dull but that during the past two or three weeks it has been improving materially. Collections are poor and the credit situation is still tightening.

Pole-Line Material.—Demand for all classes of line material has decreased during the past several weeks. Apparently most of the maintenance work has been completed. With the exception of porcelain insulators, local stocks are in fair shape. Stocks of glass insulators are also fair. Cross-arms are obtainable, but demand is very heavy.

Lamps.—The exception to the stock situation in Seattle is the supply of lamps. Deliveries are good and available stocks far in excess of demand. Sales are light on account of the season. Residence lamps are moving well but industrials are slow.

SAN FRANCISCO

The number of big construction projects in all the Coast cities, and principally in San Francisco, is larger than it has been for some time, but smaller building is lessening, and there is no doubt that the usual summer lull is at hand. Money, however, is plentiful; labor is in demand and deliveries are better, so that any slight signs of pessimism are not justified by actual conditions. The town of Willows in the Sacramento Valley has been practically wiped out by a $2,000,000 fire, and this on top of a poor rice crop will deal the Sacramento Valley a heavy blow.

Automobile Accessories.—The former tendency of electrical dealers to stock heavily on automobile accessories has been reversed, until now virtually only one jobber carries a complete line of electrical and other automobile accessories in connection with his legitimate electrical jobbing business. Even such lines as spark plugs and spotlights have been cut out.

Ranges.—The recent advance of approximately 15 per cent, which brings the average cabinet style range to about $225 retail, will have comparatively little effect on whatever business is done. The price seems to be an altogether secondary consideration. A few scattered stocks are carried, but the cabinet type range is practically nonexistent on the Coast. A three months' delivery would be almost a rush order.

Wireless Apparatus.—Dealers who carry this line report heavy sales. Stocks are all good, except on wireless receivers.

Telephones.—The call for telephones is scattering, and no considerable efforts are being made to increase it because of the difficulty in factory deliveries. Large central-station jobs require more than a year for their completion. Cable is very scarce and is holding up stations in many districts. There is some call for interphones, but the competition comes among architects and not among dealers. Several inquiries from the United States transpacific possessions are reported, notably from the Philippines.

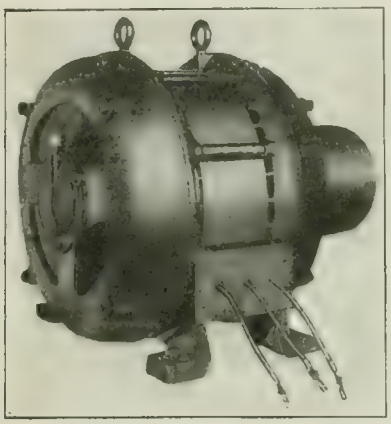
Sewing Machines.—After two months of dull business dealers and jobbers report that sales are again approaching normal.

NEW APPARATUS & APPLIANCES

A Record of Latest Developments
and Improvements in Manufacturers' Products
Used in the Electrical Field

Ball-Bearing Type Motor

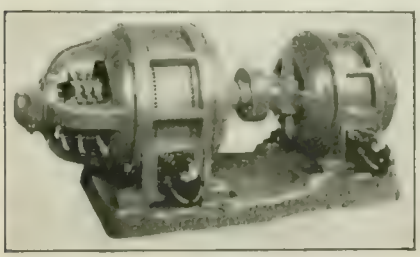
The Cleveland Electric Motor Company, Cleveland, Ohio, is marketing a type of riveted frame, ball-bearing, constant-speed, 25-cycle and 60-cycle, polyphase, squirrel-cage induction motor. Rotor bars are connected mechanically and electrically by a patented process in which the short-circuiting rings are welded around their ends. Ventilating fans are provided on the rotor. Standard ball bearings are used.



END RINGS ARE WELDED TO ROTOR BARS

Frequency Changer for High-Speed Induction Motors

A new application of the high-speed induction motor to certain classes of machine drive, especially in the woodworking and metal-trades industries, has been made possible by the development of an induction frequency changer by the General Electric Company. This device generates power at frequencies which will produce speeds of 18,000 r.p.m. or higher, says the manufacturer, and as a result high-speed induction motors can be directly applied to various types of machines.



SPEEDS UP TO 18,000 R.P.M. MAY BE OBTAINED

The frequency changer consists of a slip ring induction motor, which may be driven either by a belt or directly, the stator being connected to an alternating-current source of power. By rotating the machine in a direction opposite to that in which it would run as a motor frequencies are generated in the rotor equal to that of the exciting circuit plus that due to the reversed rotation of the rotor.

Virtually all the energy taken from the commercial circuit is transformed into high-frequency energy to drive the machine motors, it is claimed, the over-all efficiency being approximately 90 per cent. Where direct-current power only is available, an inverted rotary converter can be used both as a motor to drive the frequency changer and to supply the excitation for the stator. The high frequency supplied by this device being always three-phase insures uniformity as well as economy and simplifies both the motors and the frequency changers.

The standard motors are two-pole and wound in two series, the first rated normally at 120 cycles, 220 volts, the second at 200 cycles, 110 volts, to operate at a range of from 200 cycles to 300 cycles. The operating voltage of the motors must vary in proportion to the speed and frequency, but this change is accomplished automatically by the frequency changer. The normal slip is from 5 to 7 per cent, but where the load is such that the starting torque is the factor in determining the size of the motor it can be increased by increasing the slip to 8 or 10 per cent, although such changes are objectionable if the motor must carry full load.

Notes on Recent Appliances

Storage Battery

The Dixie Storage Battery Company, 1418 West Lafayette Avenue, Baltimore, Md., is manufacturing a storage battery designed especially for automobile starting and lighting service.

Time Switch

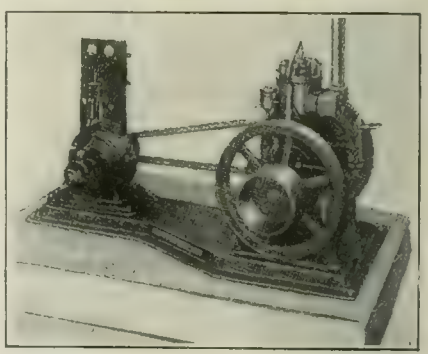
A low-voltage electrically wound time switch, type S, is being marketed by the Albert & J. M. Anderson Manufacturing Company, Boston, Mass.

Electric Furnace

The Greene Electric Furnace Company, 1602 Hoge Building, Seattle, Wash., has placed on the market a cylindrical electric furnace for making iron and steel.

Belt-Driven Electric Farm-Lighting Plant

Both electrical and mechanical energy may be obtained from the belt-driven farm-lighting plant now being marketed by the Chambers Manufacturing Company of Butler, Pa. The 4-hp. engine has two pulleys—one for driving the electric generator and the other for furnishing mechanical power. The engine may be operated with gasoline, kerosene, crude oil or natural gas. The generator is a 40-volt, 1-kw. shunt-wound Westinghouse machine, and the unit is controlled by a Westinghouse panel, on which are mounted a voltmeter, an ammeter, a rheostat, fused line switch, series field switch, ignition switch and a reverse current relay. A 16-cell, 107-amp.-hr. battery is used.



MECHANICAL AND ELECTRICAL POWER BOTH ARE DELIVERED

Twenty-Ampere Heavy-Duty Receptacle

A plug and receptacle has been developed by the Benjamin Electric Manufacturing Company, Chicago, for use with portable electrical devices requiring approximately 20 amp. on 125-volt circuits, though primarily designed for use in connection with 32-volt farm-lighting plants. The receptacle is so designed that it will take either the 20-amp. heavy-duty plug or the standard 10-amp. parallel blade cap. The receptacle contains double-spring contacts, so that electrical contact is made on both sides of the cap blades. The cap can be easily disconnected from the receptacle even when pulled at an angle. The receptacles are made for both flush and surface mounting.



RECEPTACLE TAKES BOTH 10-AMP. AND 20-AMP. PLUG

MANUFACTURERS' ACTIVITIES

Record of Changes Affecting Sales and Distribution Together with Trade Personals and Notes on Foreign Trade, Jobbers' News and New Trade Literature

R. T. ROTH, of Philadelphia, Pa., has recently become associated with Schweitzer & Conrad, Inc., as sales manager, with headquarters in Chicago. Mr. Roth was for a number of years connected with the Western Electric Company at the Philadelphia office. In 1910 he left the company to organize the Lewis & Roth Corporation, Philadelphia, construction engineers and manufacturers of high-tension equipment, with which he has been actively connected for the last ten years. He recently disposed of his interests in the Lewis & Roth Corporation. Mr. Roth's experience in the purchase and sale of electrical equipment has covered a period of twenty years.

J. A. WIDMER, formerly experimental engineer with the Sperry Gyroscope Company, has accepted a position with the Square D Company, Detroit, Mich., as development engineer.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., has awarded contract for construction of a one and two-story machine shop, 230 ft. x 900 ft., at Erie, Pa. The total cost is estimated at about $1,000,000.

THE MIDSTATES ENGINEERING COMPANY, Westminster Building, Chicago, has recently been incorporated as consultants, specializing in industrial power and plant engineering. The equipment and commercial division activities will be directed by J. H. Milliken, who is known in this field as an industrial sales manager. The engineering work will be in charge of R. J. Gaudy, president, who is known through activities with the Sessions Engineering Company and his connection with many engineering projects.

HAROLD L. HAZELTINE, formerly instructor of physics and electricity at the Trenton (N. J.) School of Industrial Arts, has become Eastern representative of the Sterling Varnish Company. He will make his headquarters in the New York district after Sept. 15.

THE COVINGTON MACHINE COMPANY, Inc., Covington, Va., has taken over the business of the Covington Machine Company and will continue the manufacture of punches, coke drawing and conveying machinery, etc., as well as making brass and iron castings. The officers of the new company are: F. U. Humbert, president and general manager; F. W. King, vice-president, and G. W. Lipscomb, treasurer.

THE NATIONAL ELECTRICAL CREDIT ASSOCIATION at its twenty-first annual convention in New York City, June 17 and 18, considered the advisability of raising and spending $25,000 to promote the sale and installation of the standard accounting system sold by the National Association of Electrical Contractors and Dealers. A committee has been appointed to confer with a similar committee of the contractors and dealers' association.

THE KINGSBURY SAMUEL ELECTRIC COMPANY, 213 North Calvert Street, Baltimore, Md., has acquired a three-story building 26 ft. x 110 ft. at 530-532 North Calvert Street, which it will equip for the manufacture of electrical products.

THE GIANT BATTERY COMPANY, Commercial Bank Building, Houston, Tex., recently incorporated, will establish a plant at once for the manufacture of electric storage batteries, separators and other parts. C. C. Rouse is president.

THE NEW ENGLAND WELDING COMPANY, Boston, Mass., recently incorporated as a subsidiary to the Thomson Electric Welding Company, Lynn, Mass., will locate in Worcester, Mass., and specialize in heavy steel and cast-iron sections.

NORTH CENTRAL ELECTRIC ASSOCIATION, at its first convention held recently at Minneapolis, Minn., elected the following officers for the coming year: C. D. Crocker, president; O. A. Rofelty, vice-president; H. E. Young, secretary, and Fred C. Hoffman, treasurer.

CLYDE L. CORBIN, district manager for the National Metal Molding Company in Pittsburgh territory, was seriously injured on June 15, sustaining a fractured skull and other injuries. He is now convalescing at the Mercy Hospital in Pittsburgh.

THE GREGORY ELECTRIC COMPANY, Chicago, at a meeting of its stockholders on July 1, authorized an increase in capital stock to $1,000,000. The present capital stock is $241,600.

THE WESTERN ELECTRIC COMPANY has recently added a large wing to its factory in Emeryville, Cal., in order to take care of the increasing business that has been built up on the West Coast. This branch will be devoted almost exclusively to the handling of automatic telephones, sales of which are increasing in that section of the country.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia, announces the appointment of George D. Luther as soliciting agent in Seattle, Wash., with offices at 811 White Building. Mr. Luther joined the sales force of the Boston office of the company in 1907, and in 1910 he was made soliciting agent in Denver, in which capacity he served until his recent appointment.

G. V. NIGHTINGALE, formerly Western sales manager for the Wilson-Maeulen Company, manufacturers of electric pyrometers, and F. C. Baker, formerly district manager of the same company, in Chicago, have formed a partnership under the name Nightingale & Baker, with offices at 163 West Washington Street, Chicago. They will represent the Wilson-Maeulen Company as general agents in all territory west and southwest of Ohio and Michigan.

THE COXE STOKER SALES COMPANY announces the appointment of Christian Schillinger, formerly engineer of steam equipment for the Delaware, Lackawanna & Western Railroad Company, as sales engineer, effective June 1.

THE APEX ELECTRICAL DISTRIBUTING COMPANY, Cleveland, Ohio, has established a new office in the Candler Annex Building, Atlanta, Ga., in charge of F. W. Price, Southern district manager. The company handles the Apex electric suction cleaners.

THE HIGHLAND MANUFACTURING COMPANY, Muncie, Ind., manufacturer of electric and gas fixtures and electric novelties, will rebuild its plant, which was destroyed by fire on June 29. The loss is estimated at about $200,000. Thomas L. Ryan is president and manager.

THE VESTA STORAGE BATTERY COMPANY, 1696 Broadway, New York City, manufacturer of storage batteries, has leased two buildings at 47-49 West Sixty-third Street for its proposed new works.

THE WADDELL ELECTRIC COMPANY, Atlanta, Ga., state distributer of farm-lighting plants manufactured by the Western Electric Company, held a convention on May 17 and 18, at the Piedmont Hotel, which was attended by its entire sales organization, comprising about forty men.

L. G. WHITE has severed his connection as manager and buyer of the electrical department of G. Sommers & Company, St. Paul, Minn., to accept a position with the Modern Laundry Machine Company, Kansas City, Mo.

J. H. WILLIAMS & COMPANY, Brooklyn, N. Y., announce that the drop-forge business and plants of the Whitman & Barnes Company at Chicago, Ill., and St. Catharines, Ontario, Can., have been combined with and are operated by that company. The organization includes the individuals heretofore identified with both concerns.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., has purchased a site (approximately 400 ft. square) at Humphries Street and Glenn Avenue, Atlanta, Ga., on which it proposes to erect a storehouse.

THE WAGNER ELECTRIC MANUFACTURING COMPANY, St. Louis, announces the opening of a sales office and service station at No. 2007 South Ervay Street, Dallas, Tex., in charge of Charles O. Rauschkolb, branch manager.

Supply Jobbers' Notes

THE WESTERN ELECTRIC COMPANY, 195 Broadway, New York City, held its annual sales conferences of the Atlanta (Ga.) district on Tybee Island on June 29. An attendance of between 75 and 100 employees is reported, including salesmen from the Atlanta territory, factory representatives and representatives from the home office.

THE COMMERCIAL ELECTRICAL SUPPLY COMPANY, Broadway and Spruce Street, St. Louis, Mo., has recently opened a specialty department and has employed several additional salesmen.



CREDIT ASSOCIATION CONSIDERS SPENDING $25,000 TO PROMOTE BETTER ACCOUNTING

Foreign Trade Notes

THE ETERNAL BATTERY COMPANY OF CANADA, LTD., recently organized to take over the property and business of the Eternal Battery Company, Winnipeg, Manitoba, Can., has acquired a site of about two acres at the corner of Main Street and Toronto Avenue, Kildonan, on which it proposes to erect a plant. Charles W. Jenner is president.

W. R. HAMILTON is manager and engineer of the Dominion Messenger Signal Company, Ltd., 302 St. James Street, Montreal, Quebec, Can., which recently absorbed the Dominion Gresham Guaranty & Casualty Company's electrical department.

THE WESTINGHOUSE ELECTRIC INTERNATIONAL COMPANY has made the following appointments: At East Pittsburgh H. F. Griffith is assistant to general manager, R. W. Everson is manager of merchandising department, and H. C. Soule is manager of apparatus department. In New York G. H. Bucher is assistant to general manager, J. H. Payne is supervisor of agencies, and F. M. Sammis is manager of incandescent-lamp department.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Tenders will be received at the office of the power commissioner of a city in Canada (No. 33,244) for fuel-oil engines and generators with switching equipment for an electric plant.

A merchant in France (No. 33,216) desires to purchase electrical goods and electrical specialties of all kinds.

A manufacturer's agent in Australia (No. 33,198) desires to secure an agency for the sale of all kinds of supplies and wire for electric household and office appliances, also mica and general electrical supply lines.

An agency is desired by a merchant in Switzerland (No. 33,203) for the sale of telephone equipment, electrical specialties, etc.

A commercial agent in Switzerland (No. 33,206) desires to secure the representation of firms for the sale of electrical supplies, etc.

Consulting engineers in Java (No. 33,225) desire to purchase water-power installations and machinery; one installation of 100,000 hp. and several others of 2,000 hp., cableways, etc.

A company in Venezuela (No. 33,231) desires to purchase machinery and equipment, excepting poles, for the installation of an electric light plant to maintain from 800 to 900 incandescent lamps of 25 cp. each, to be installed in two towns in that country.

Trade Publications

IGNITION.—The Remy Electric Company, Chicago, has issued four booklets covering its ignition systems for motor cars, tractors, etc.

GRINDERS.—Charles H. Besly & Company, 118-124 North Clinton Street, Chicago, is circulating a large catalog covering the "Besley" grinders and accessories.

ELECTRIC HAMMERS.—Bulletin No. 4 issued by the American Electric Tool Company, Petersburg, Va., describes and illustrates the Paulero electric hammer, type A, form 1, and generating outfits for use in monument and stone-cutting industries.

ELECTRIC HOISTS.—The Northern Engineering Works, Detroit, Mich., have issued catalog No. 43, covering their type D electric hoists.

INTER-PLANT TRANSPORTATION.—The Automatic Transportation Company, Buffalo, N. Y., has issued a fifty-four-page illustrated booklet covering its automatic electric industrial trucks, tractors and engines for inter-plant transportation.

HIGH-TENSION MAGNETO SYSTEMS.—The Simms Magneto Company, East Orange, N. J., is circulating catalogs Nos. 15 and 22, describing its high-tension magneto systems, and catalog No. 24, covering Simms-Huff starting and lighting systems.

New Incorporations

HILDRETH, CASEY & COMPANY, New York City, has been incorporated by J. C. Hildreth, H. H. Casey and W. Steinauer, 573 East 136th Street, New York, to manufacture machinery, electrical equipment, etc.

THE PROTECTO BATTERY FILLER COMPANY, 3 South Walnut Street, East Orange, N. J., has been incorporated by Louis M. Sanders and Louis M. Sanders, Jr. The company is capitalized at $600,000 and proposes to manufacture battery equipment, automobile parts, etc.

THE AMSTERDAM LIGHTING FIXTURE & NOVELTY COMPANY, New York City, has been incorporated by S. L. Klein and H. Litwin, 2346 Eighty-fifth Street, Brooklyn, N. Y. The company is capitalized at $50,000 and and proposes to manufacture metallic lighting fixtures and kindred products.

THE BRILLIANT CHANDELIER MANUFACTURING COMPANY, New York City, has been incorporated with a capital stock of $50,000 to manufacture gas and electric fixtures. The incorporators are M. Brilliant, A. Drutman and M. Propp, 122 West 114th Street, New York City.

THE OLNEYVILLE WELDING COMPANY, Webster Avenue and Plainfield Street, Providence, R. I., has been organized by Rudolph Csizmesia, 82 Dorchester Avenue, Providence, and others, to manufacture welding equipment.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

CLINTON, MASS.—Authority has been granted to the New England Power Company to erect wire on Lawrence Street for the transmission of electricity.

DANVERS, MASS.—The erection of a new power plant at the State Hospital to cost about $250,000 is contemplated. The R. G. Kimball Company, 6 Beacon Street, Boston, are engineers.

FALL RIVER, MASS.—The committee on street lights has approved an order for improvements and extensions to the street-lighting system.

QUINCY, MASS.—The Bethlehem Shipbuilding Corporation will require considerable electrical equipment to be used in a combination shop to be constructed at its Fore River yard at a cost of about $150,000.

HARTFORD, CONN.—The installation of a Gamewell fire alarm system is planned for the new plant of the Hartford Rubber Company now under construction.

HARTFORD, CONN.—The Hartford Fire Insurance Company has had plans prepared for the construction of a power plant on Asylum Avenue, to cost about $150,000.

Middle Atlantic States

BUFFALO, N. Y.—Contract has been awarded to J. W. Cowper Company, Fidelity Building, by the Standard Oil Company for the erection of a new power plant at its Atlas works on Elk Street, to cost about $250,000.

CARMEL, N. Y.—A franchise has been granted by the borough officials of Carmel and Kent, Putnam County, to Ellsworth Fowler, who will head a new company to be organized for the purpose of erecting an electric power plant.

ENDICOTT, N. Y.—Work is under way on the construction of three additional factory buildings, Nos. 17, 18, and 19, for the International Time Recording Company. An extension to the power plant will be erected. The cost is estimated at about $150,000.

FREEPORT, N. Y.—At a special election it was voted to raise $63,000 for improvements to the village lighting system, including the purchase and installation of engine and generator equipment, increasing the capacity of the electric light plant by 250 kw.

LONG ISLAND CITY, N. Y.—Electrical equipment, including telephone system, electric time clock service, motors, electrical controlling devices, etc., will be installed in the new printing plant to be constructed for the Metropolitan Insurance Company, New York City.

OLEAN, N. Y.—The construction of a new power and boiler plant at the local high school to cost about $50,000 has been planned for by the Board of Education.

SARANAC LAKE, N. Y.—Petition has been made to the Public Service Commission by the Paul Smith's Electric Light, Power & Railroad Company for permission to issue $100,000 to provide part payment for proposed construction to cost about $200,000.

SYRACUSE, N. Y.—The proposed $20,000,000 merger of electric power companies includes the Adirondack Power Company, Mohawk Electric Company, Utica Gas & Electric Company, Schenectady Power Company and the East Creek Light & Power Company. Plans, it is understood, will include the erection of a large modern steam generating electric power plant, rebuilding the East Creek plant and the erection of a power line from Spiers Falls.

UNION, N. Y.—The village officials contemplate the erection of a new electric distribution station on a recently acquired site. The old plant will be dismantled and the building and machinery will be sold.

WALLKILL, N. Y.—The Public Service Commission has granted permission to the Wallkill Valley Electric Company for the construction of additions to its power plants at Wallkill and Montgomery.

ESSEX FELLS, N. J.—Ordinances have been adopted by the Borough Council providing for the purchase of the local waterworks system, including electrically operated pumping plants, etc., for $175,000. It is understood that improvements and extensions will be made.

MAYS LANDING, N. J.—Notice of increase in its capital stock from $250,000 to $750,000 has been filed by the Mays Landing Water Power Company for proposed extensions.

NEWARK, N. J.—Bids will be received at the office of William J. Brennan, director of Public Safety, City Hall, until July 22, for furnishing the Police Division of the Department of Public Safety with the following cable for the police signal system: 2,000 ft., more or less, No. 18 gage ten-pair twisted-copper rubber-insulated lead-sheath underground cable and 1,000 ft., more or less, No. 18 gage five-pair twisted-copper rubber-insulated lead-sheath underground cable.

NEWARK, N. J.—Contract has been awarded to the United Fireproofing Company, 8 West Fortieth Street, New York, N. Y., for the erection of a factory and power house for the Peerless Baking Company, 713 South Fourteenth Street, Newark. Power house equipment will be required.

NEWARK, N. J.—Bids will soon be received by the Osborne Company, 759 Summer Avenue, for the erection of a power house to cost about $50,000. Equipment includes two 150-hp. boilers, engine and generator.

POMPTON LAKES, N. J.—The installation of an electrically operated fire alarm system has been approved by the Borough Council.

SUMMIT, N. J.—Bids will be received by Frederick C. Kentz, city clerk, until July 20 for furnishing two 2,000,000-gal centrifugal sewage pumps with motors and one 1,000,000-gal. centrifugal sewage pump with motor. Specifications and blank proposals may be obtained on application to the city engineer.

ALTOONA, PA. — Enlargement of its plant to cost about $1,000,000 is being planned by the Standard Power Company.

DONORA, PA. — The American Steel & Wire Company contemplates the erection of an ore dock and an unloading dock for coal. Electrically operated hoisting, conveying and material-handling machinery will be installed.

EASTON, PA.—Plans are under way for the construction of an addition, 30 ft. x 85 ft., to the power plant of the Pennsylvania Utilities Company at Second and Ferry Streets. The Public Service Commission has granted the company permission to issue $49,500 in bonds.

PHILADELPHIA, PA. — Application has been made to the State Public Service Commission by the Philadelphia Suburban Gas & Electric Company to issue $827,000 in stocks and bonds for proposed extensions and betterments.

PHILADELPHIA, PA. — Plans have been filed for extensions and improvements to the power house at the dye works of D. F. Waters, 53 Wister Street, to cost about $25,000.

PHILADELPHIA, PA. — Extensions and improvements to its power plant is contemplated by Foss-Hughes Company, Twenty-first and Market Streets.

PITTSBURGH, PA.—Arrangements have been made by the Penn Public Service Company, operating in Johnstown, Somerset, Phillipsburg and vicinity, for a bond issue of $850,000 for proposed extensions and improvements.

BALTIMORE, MD.—The Steinmetz Electric Motor Car Company, Inc., has acquired the newly erected plant of the Reus Brothers Company, Western Maryland Railroad and Kate Avenue. The present building, 100 ft. x 240 ft. will be enlarged and other buildings of similar construction will be added.

FREDERICK, MD.—The Board of Aldermen is planning for the establishment of a municipal electric power plant with improved distribution service. C. L. Reeder, 200 West Saratoga Street, Baltimore, is electrical engineer.

FREDERICK, MD.—The installation of a power and heating plant to cost about $25,000 at the Maryland School for the Deaf is contemplated.

MT. AIRY, MD.—The Hagerstown & Frederick Railway contemplates the erection of a local substation and a 16-mile, 33,000-volt electric transmission line.

UPPER MARLBORO, MD.—The installation of a local electric system for street lighting and commercial service is under consideration by the borough officials.

WASHINGTON, D. C.—Bids will soon be received by the District Commissioners for the construction of the psychopathic ward of the proposed new Gallinger Hospital to cost about $1,500,000, including a central power plant to be installed later.

North Central States

HAMTRAMCK, MICH.—The construction of a power house, 80 ft. x 83 ft., is contemplated by the Briggs Manufacturing Company.

LANSING, MICH.—On July 23 a special election will be held for the purpose of submitting to the voters a proposition to issue $145,000 in bonds for improvements to the electric light and power plant.

MOUNT PLEASANT, MICH. — A sum of $30,000 has been appropriated for the installation of a new power and heating plant in the Indian School at Mount Pleasant.

ST. CLAIR, MICH. —Plans are under way for improvements to the waterworks system, to include furnishing and installing one 300-hp. engine, one 200-kva. direct-connected generator, etc.

CANTON, OHIO.—Plans are under way for the construction of a power plant for the Hoover Suction Sweeper Company of North Canton.

CLEVELAND, OHIO.—Plans are under way by Walker & Weeks, architects, 1900 Euclid Avenue, for the construction of a bank and office building to cost about $500,000 for the Citizens' Savings & Trust Company, Alvord Smith vice-president, East Ninth Street and Euclid Avenue. Electric light equipment and electric elevators will be installed.

INDIANAPOLIS, IND. — Authority has been granted to the Linn Grove Light & Power Company to sell $25,000 in bonds for improvements.

BLUE ISLAND, ILL. —Plans have been outlined by the Chamber of Commerce for the installation of a modern boulevard lighting system.

CENTRALIA, ILL.—Contract has been awarded to Joseph E. Nelson & Sons, 231 South Michigan Boulevard, Chicago, by the Illinois Central Railroad Company for the construction of a passenger station, freight house, power house, etc., at Centralia, to cost about $400,000.

MADISON, WIS.—The construction of a hydro-electric plant, 46 ft. x 50 ft., is contemplated by the Peninsular Power Company.

OCONTO, WIS.—The Holt Lumber Company is planning for the construction of a power plant to cost about $75,000.

NORCROSS, MINN. — Bonds to the amount of $6,000 have been voted for furnishing better electric light facilities.

KANSAS CITY, MO.—The Kansas City Light & Power Company will spend approximately $500,000 during the next two years on the installation of five new substations in the down-town district between Oak and Wyandotte Streets and Seventh and Fifteenth Streets. The big substation at Fifteenth and Walnut Streets is to be abandoned as facilities under the new substation scheme develop. The stations will be equipped with automatic generator sets for converting alternating current to direct current. The first substation will be located in the R. A. Long Building on Tenth and Grand Avenues, and equipment will include one standard 1,500-kw. rotary. The company has purchased a 2,500-kw. rotary.

ROLETTE, N. D.—The Rolette Mill & Light Company plans the erection of a flour mill and lighting plant to cost about $15,000.

DUPREE, S. D.—The installation of electric lights throughout the city is contemplated by the Dupree Light & Power Company. Hugh Walkup is secretary.

TYNDALL, S. D.—A proposition to issue $50,000 in bonds will be submitted to the voters for the purpose of repairing the local electric light plant.

DE WITT, NEB.—John Zwonechek and Joseph Aksamit have purchased the property of the De Witt Milling Company on the Blue River and plan to erect a hydro-electric plant at a cost of about $100,000. It is understood that the owners will furnish energy for the milling company and may also extend a line from De Witt to Western, Catonia and other points.

LAWRENCE, KAN. — Improvements to the power and heating plant at the Indian School, Haskell Institute, to cost about $20,000, are contemplated.

Southern States

LAKE WORTH, FLA.—The city officials plan extensions and improvements to the light and water plants at a cost of about $15,000.

SMITHVILLE, TENN. — Bonds to the amount of $30,000 have been voted for the erection of an electric transmission line from the Great Falls Power Company's plant at Rock Island to Smithville.

FLORENCE, ALA.—The Burcham Valley Telephone Company, recently organized, contemplates installing a system in various parts of Lauderdale County.

MONROEVILLE, ALA.—A movement to establish a municipal electric light and power plant is being promoted by the Chamber of Commerce.

PRATTVILLE, ALA. — The installation of electrical equipment is contemplated by the Autauga Cotton Mills.

JONESVILLE, LA.—The construction of an electric light and water plant is contemplated. Xavier A. Kramer, Magnolia, Miss., is consulting engineer.

CLAREMORE, OKLA.—An issue of $75,000 in bonds was approved for extension to the electric light system in Claremore.

DALLAS, TEX. — The Dallas Light & Power Company has been requested to place its wire under ground.

KOUNTZE, TEX. — J. R. Bevil and others plan to construct an electric light plant, waterworks and ice factory.

WACO, TEX.—The Central Texas Electric Railway Company has made preliminary investigation of the proposition to erect a line from Waco via Mexia to Palestine, a distance of about 105 miles.

Pacific and Mountain States

SEATTLE, WASH. — Contract has been awarded to the Hurley-Mason Company for the completion of the third unit to the Lake Union steam plant, to cost about $200,000.

KLAMATH FALLS, ORE.—The Oregon-California Power Company contemplates immediately disposal of $1,842,000 for improvements.

BRAWLEY, CAL. — Earl S. Casey of Brawley is negotiating with the City Council for the construction of a hydro-electric power plant on the Alamo River, to cost about $200,000. Three turbine and generating units, with auxiliary operating machinery, will be installed.

SAN FRANCISCO, CAL. — An expenditure of about $22,500,000 will be made by the Southern Pacific Railway for equipping steam and electric railroads.

SIERRA CITY, CAL.—Surveys are being made for a series of large storage dams in the North Yuba River between Sierra City and Indian Valley, to be used for power purposes by the Yuba Development Company.

WIDSTOE, UTAH — Reconstruction of the Hatchtown Dam to impound 6,000 acre-ft. of water and the construction of canals to bring the water to the present holdings of the Johns Valley Irrigation Company is contemplated, at a cost of about $120,000. Elmer Jorgensen is president.

GLENDALE, ARIZ.—A. A. Carrick and Frank Mongham have been authorized to erect a power plant and pumps for irrigation purposes in Avondale-Buckeye district.

ROOSEVELT, ARIZ. — According to terms of contract the Gila Cotton Company will furnish the Salt River Valley Water Users' Association with $500,000 for the construction and complete equipment of a 5,000-kw. auxiliary electric generating plant at Roosevelt Dam, and the Water Users' Association will furnish power at a stipulated price for the operation of pumping plants to be erected by the Cotton Company on the Gila Indian Reservation for irrigation purposes. Also the Auxiliary Eastern Canal Land Owners' Association has been authorized to divert waste water of the Salt River Valley project to be pumped into the Eastern Canal from Granite Reef and then into the canals of the Auxiliary Association.

POLSON, MONT. — Application for preliminary power permit has been filed by the Rocky Mountain Power Company of Butte, in the office of the federal register of lands. Plans include the construction of five dams in Flathead River between the northeast corner of Bison Range and the point where the river leaves the lake near Polson.

ROMAN, MONT. — Permission has been granted by the town officials for the development of electricity for light, heat and power purposes in Crow Creek Canyon.

OSAGE, WYO.—The Osage Light Company has been recently incorporated for the purpose of erecting an electric light plant in Osage to cost about $12,500.

Canada

ALICE ARM, B. C.—W. V. Hunt, 1652 Eighth Avenue West has been awarded general contract by the Dolly Varden Mining Company for the erection of a hydro-electric plant to cost about $65,000.

CHATHAM, ONT.—Plans are under way for alterations to pumphouse including the installation of mechanical filters and electrically driven centrifugal pumps, to cost about $50,000. E. A. James Company, 36 Toronto Street, Toronto, are engineers.

HAMILTON, ONT.—Bonds to the amount of $15,000 have been voted for the construction of an electric light plant in Hamilton.

OTTAWA, ONT.—Bids will soon be received by Stevens & Lee, architects, 62 Charles Street, East Toronto, for the construction of a hospital to cost about $1,500,000. Electric elevators and electrical equipment will be installed.

SPRING BANK, ONT.—Bids will soon be received by the Utilities Commissioners of London for the construction of a dam at Spring Bank for power purposes. The cost of the project is estimated at about $300,000, including $100,000 for equipment. E. V. Buchanan is general manager.

MONTREAL, QUE. — General contract has been awarded to John McGregor, 511 St. Catherine Street, by the Canadian Steel Foundries, 120 St. James Street, for the erection of a power house.

MOOSE JAW, SASK.—T. W. Graham has been awarded general contract by the Canadian Pacific Railway Company for the erection of a power house to cost about $35,000.

(Issued June 22, 1920.)

14,888 (reissue). Insulator; Walter T. Goddard, Hamilton, Ont., Can. App. filed July 22, 1919. Exterior meeting faces of sections form unobstructed surface without acute change in direction.

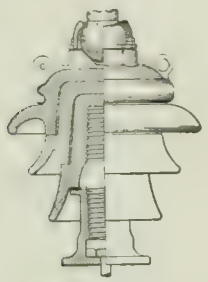
14,891 (reissue). High-Voltage Transformer; Svend E. Johannesen, Pittsfield, Mass. App. filed April 20, 1920. Efficacious manner of constructing, mounting and ventilating.

14,896 (reissue). High-Tension Discharge Apparatus; George D. Rogers, Cleveland, Ohio. App. filed April 7, 1914. For therapeutic use on lamp socket.

1,344,042. Spark-Gap Indicator; Tomlinson F. Johnson, Jr., Atlanta, Ga. App. filed Aug. 16, 1919. Detects incipient defect of insulator in service.

1,344,210. Automatic Telephone Repeater; Rodney G. Richardson, Chicago, Ill. App. filed Aug. 23, 1916. For multi-office automatic system.

1,344,220. Electrolytic Apparatus; Edward O. Benjamin, Newark, N. J. App. filed Aug. 1, 1917. For producing pure oxygen gas and hydrogen.



14,888 (Reissue). Insulator

1,344,222. Electric Regulator; John L. Creveling, White Plains, N. Y. App. filed Nov. 1, 1916. For battery charging.

1,344,260. Method and Means for Controlling Electric Circuits; Harry R. Canfield, Cleveland, Ohio. App. filed Sept. 21, 1910. For starting motors.

1,344,275. Method of and Apparatus for Electrical Communication; David G. McCaa, Elizabeth, N. J. App. filed Dec. 19, 1918. Eliminates interference on high-frequency system.

1,344,282. Electric Heating Element; Clifford R. Wassell, Chicago, Ill. App. filed May 5, 1916. Carrying member of refractory insulating material.

1,344,303. Electric Vapor Heater for Internal-Combustion Engines; William F. Little, St. Louis, Mo. App. filed Jan. 23, 1919. Located between manifold and carburetor.

1,344,387. Internal-Combustion-Engine-Testing Device; Roy G. Edgerton, Suffolk, Va. App. filed May 26, 1916. Tests spark of cylinder.

1,344,388. Combination Magnetic and Electric Polarity Indicator; Carl W. Eisenmann, Nebraska City, Neb. App. filed Aug. 16, 1919. Auxiliary compass pointer shows current direction.

1,344,406. Electrical Resistance Wire; Albert H. Johnson, Washington, D. C. App. filed Dec. 19, 1919. Wire flattened to prevent misalignment.

1,344,415. Electric Welding Apparatus; Frederick V. D. Longacre, Yonkers, N. Y. App. filed July 25, 1918. For lap-welding plates.

1,344,429. Electric Lamp; George E. Ricker, Fitzgerald, Ga. App. filed Jan. 14, 1918. Reflector within bulb.

1,344,452. Electrolier; Louis Roth, New York, N. Y. App. filed June 27, 1919. Globe easily detached.

1,344,463. Electrical System; Richard Varley, Englewood, N. J. App. filed April 26, 1919. For internal-combustion engine.

1,344,528. Intensifier; Harry R. Walker, Galatia, Ill. App. filed Aug. 23, 1919. For increasing strength of spark.

1,344,581. Thermo-Electric Arch Support; Albert H. Cooper, Findlay, Ohio. App. filed Aug. 22, 1919. Heated arch supporter.

(Issued June 29, 1920)

1,344,641. Inspection Indicator for Vehicles; William E. Rotermund, Seattle, Wash. App. filed Jan. 31, 1918. Resiliently mounted indicating head.

Record of Electrical Patents

Notes on United States Patents

1,344,681. Process of Extracting Metals; Charles J. A. Dalziel, London, England. App. filed Jan. 17, 1920. Metal precipitated from ore in single operation.

1,344,699. Relay; Richard C. Leake, Rochester, N. Y. App. filed April 25, 1918. Railway signaling.

1,344,701. Automatic Fire Alarm; William J. Luse, New York, N. Y. App. filed Nov. 20, 1918. By disruption of fusible link.

1,344,713. Reactance Coil; John F. Peters, Edgewood Park, Pa. App. filed Dec. 2, 1915. Power-limiting device.

1,344,723. Magneto; Wolfgang E. Schwarzmann, Springfield, Mass. App. filed Oct. 12, 1918. Sleeve type.

1,344,730. Relay; Benjamin H. Smith, Turtle Creek, Pa. App. filed Jan. 29, 1917. Reverse-phase relay.

1,344,741. Electric Sadiron; Frank Thornton, Jr., Pittsburgh, Pa. App. filed Oct. 3, 1914. Heat insulating heel.

1,344,742. Electrical Compensator; Allen A. Tirrill, Pittsburgh, Pa. App. filed May Aug. 9, 1916. Voltage regulator.

1,344,743. Electrical Compensator; Allen A. Tirril, Pittsburgh, Pa. App. filed May 28, 1919. Voltage regulator.

1,344,752. Electrolytic Cell; Lewis W. Chubb, Edgewood Park, Pa. App. filed Feb. 3, 1917. Titanium arrester.

1,344,753. Electrolytic Cell; Lewis W. Chubb, Pittsburgh, Pa. App. filed Feb. 3, 1917. Titanium oxide arrester.

1,344,757. Arc Lamp; William A. Darrah, Wilkinsburg, Pa. App. filed June 11, 1915. Incandescent vapor lamp.

1,344,759. Electrical Protective Device; Charles Le G. Fortescue, Pittsburgh, Pa. App. filed April 4, 1918. Dissipates electromagnetic energy of field-magnet winding.

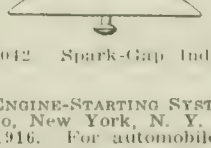
1,344,762. System of Control; Rudolf E. Hellmund, Swissvale, Pa. App. filed Sept. 10, 1914. Electric railway.

1,344,812. Means for Charging Storage Batteries; Clarence E. Ogden, Cincinnati, Ohio. App. filed Nov. 14, 1918. Used on commercial trucks, locomotives, etc.

1,344,814. Power Plant; Raymond H. Olley, Syracuse, N. Y. App. filed July 25, 1917. Wide range of speed without gear shifting.

1,344,822. Selective Switching Mechanism; Rodney G. Richardson, Chicago, Ill. App. filed May 10, 1916. Automatic telephone.

1,344,869. Electrolyzing Cobalt Solutions; Elisha B. Cutten, Kokomo, Ind. App. filed Oct. 20, 1919. Neutral solution employed as electrolyte.



1,344,042 Spark-Gap Indicator

1,344,870. Engine-Starting System; James K. Delano, New York, N. Y. App. filed Dec. 9, 1916. For automobiles.

1,344,918. Combined Telephone and Phonograph; John F. Malthaner, Atlanta, Ga. App. filed July 12, 1917. To record telephonic conversations on dictaphone.

1,344,938. Arc-Lamp Casing; Iredell Eachus, Philadelphia, Pa. App. filed April 28, 1916. Draft draws dust from operating mechanism.

1,344,970. Relay for Storage-Battery-Charging Systems; James M. Wilson, Newark, N. J. App. filed Oct. 4, 1918. For automobiles.

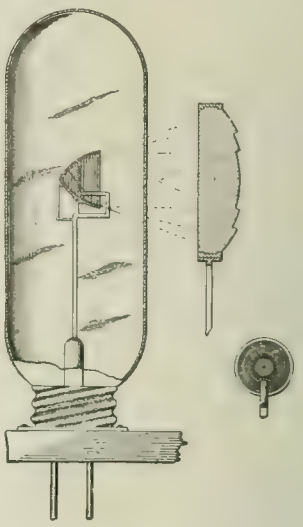
1,345,004. Electric Broiler; William S. Hadaway, Jr., New Rochelle, N. Y. App. filed March 4, 1916. For broiling meats.

1,345,007. Wave Changer for Radio Signaling Apparatus; Guy Hill, Washington, D. C. App. filed Oct. 7, 1918. For both transmitting and receiving.

1,345,015. Compression Rheostat; Otto A. Knopp, Oakland, Cal. App. filed Oct. 16, 1916. Submerged in oil.

1,345,016. Telephone System; Alben E. Lundell, New York, N. Y. App. filed July 22, 1918. For automatic and semi-automatic exchanges.

1,345,049. Telephonic Apparatus; Maximilian Weil, New York, N. Y. App. filed March 30, 1916. For use in noisy location.



1,344,429. Electric Lamp

1,345,054. Automatic Telephone System; Bernard D. Willis, Chicago, Ill. App. filed April 8, 1914. Controlling operation of automatic switches.

1,345,060. Telemotor; Melvin B. Benson Superior, Wis. App. filed Dec. 3, 1918 Steering gear for vessels.

1,345,066. Excess-Voltage Protective Device; Quincy A. Brackett, Pittsburgh, Pa. App. filed Aug. 8, 1919. Very delicate protection.

1,345,074. Automatic Mine-Door-Operating Mechanism; William Crooks, Aldrich, Ala. App. filed July 17, 1919. Mine car automatically open doors.

1,345,080. Foot-Controlled Electric Governor; Harrison D. Flegel, Racine, Wis. App. filed May 24, 1919. For sewing machines, dental lathes, etc.

1,345,091. Automatic Lockout for Lamp Sockets; Andrew J. Kellog, Acton, Cal. App. filed July 7, 1919. Prevents removal of lamp.

1,345,199. Direction Indicator for Automobiles or the Like; Clyde W. Landers, Portland, Ore. App. filed Feb. 24, 1919. Illuminated.

1,345,212. Electric Safety Lantern; James F. Monahan, Newark, N. J. App. filed Nov. 23, 1915. Safe in case of breakage.

1,345,222. Electrical Heating and Cooking Apparatus; Cornelius G. Nobbs and Walter W. Nobbs, London, England. App. filed Dec. 26, 1918. Immersion heater.

1,345,249. Electric Heater for Steering Wheels; Even J. Rohne, Minneapolis, Minn. App. filed Sept. 7, 1917. Hand warmer.

1,345,331. Magneto-Electric Machine; Henry W. Uhl, Freeport, N. Y. App. filed March 25, 1919. Removable distributer block.

(Issued July 6, 1920)

1,345,337. Tool for Testing Spark-Plugs; George H. Ainge, Springfield, Ohio. App. filed April 15, 1918. For testing plug on car.

1,345,348. Telephone-Exchange System; Henry P. Clausen, Mount Vernon, N. Y. App. filed June 25, 1917. Automatic ringing trunk.

1,345,349. Telephone-Exchange System; Henry P. Clausen, Mount Vernon, N. Y. App. filed June 25, 1917. Automatic trunk lines.

Electrical World

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Intelligent Salesmen for Industrial Equipment

ONE would hardly expect to find a salesman of electric lamps making sales in a territory where there is no electric service. That seems evident. What shall be said then of a salesman who sells a consumer a large single-phase motor which the central station won't serve because the load will unbalance the line, or of one who equips a factory with an electric furnace which the utility cannot supply with energy because of the character of the load? How shortsighted also it is to sell motors in a district where no power is available because the limit of capacity has been reached! We know what to dub such salesmanship, but it would not look well in print. Manufacturers of industrial electrical apparatus, and especially the smaller ones, in many cases are selling through agents possessing little or no knowledge of local service conditions. Faced with the necessity of keeping down selling expenses, they oftentimes use agents whose only recommendation is that they are successfully handling other accounts when what they really need is a salesman schooled in the power business. It ought to be a simple matter for half a dozen non-competing industrial electrical manufacturers to obtain in every industrial center a good power salesman as their agent—an engineer-salesman with a host of friends and a proper appreciation of the central-station point of view, one who can, above all, talk intelligently on load variations, demand, starting current, power factor and their effect upon rates. Such salesmen are assets and receive the cordial co-operation of every central-station manager. Therefore the selection of men of that type is a wise and profitable expedient.

The Young Giant

GRIMM'S tale of the boy who possessed the seven-league boots is fully exemplified in the phenomenal growth of the central-station industry, which has developed by leaps and bounds and become one of the fundamental elements of America's industrial fabric. In fact, the central station has grown so fast and we have been so intimately connected with the inner workings of that growth that few of us have ever taken the time to sit back and view the structure as a whole. Such a view is presented this week by our statistical department. The comparatively low percentage of power customers in the essentially industrial states is probably one of the outstanding facts to be deduced from the tabulations, although growth in number of power customers cannot be considered as indicative of the growth of the power load of the central stations. Differences in classification, low rates and inducements offered to small power users by the operating companies of the Pacific Coast account largely for the fact that 5 per cent of the total customers of that region are rated as power customers, while the Middle Atlantic States record only 3.3 per cent power customers. The increased activity in hydro-electric power development which it is believed will result under the new federal water-power act, as well as the erection and interconnection of steam super-power stations, should tend to increase greatly the number of power consumers, particularly in the eastern portions of the country. It is hardly to be expected that under the present conditions of high-priced fuel and labor any inducements can be made by central stations to increase the number of power consumers: nevertheless, reliability and continuity of service will be a decided factor in leading a large number of factories to seek central-station service, particularly in view of the difficulty they have in obtaining fuel.

The French Ambassador to Berlin

A SIGN of the times which has a special interest to electrical men is contained in the announcement that the French government has appointed as its first ambassador to Berlin since the war Charles Laurent, president of the French Thomson-Houston company and of the commercial body composed of manufacturers of heavy electrical machinery as well as a member of the governing board of the Union des Syndicats de l'Electricité. A graduate of the Ecole Polytechnique, M. Laurent has had a distinguished career as a financier and industrial organizer in public and private life, and last year the French government made him director of the Crédit National, in which is centered the restoration of the devastated region. That he, rather than a member of the diplomatic body, should have been selected to fill the delicate and difficult office to which he has now been appointed is an encouraging departure from European tradition.

Ohio and Affiliation

THE appearance of M. H. Aylesworth, executive manager of the National Electric Light Association, before the Ohio Electric Light Association last week and its executive committee this week is indicative of a change of attitude on the part of the latter organization. Although most of the central-station companies of Ohio are members of the National Electric Light Association, a separate state organization has been maintained which up to the present has had no affiliation with the national body. But the work which the national association has undertaken in connection with coal supply, finance, public relations, inductive interference, regulation, water-power development, interconnection, rural service, etc., has received the highest commendation from regulatory bodies, financiers and others not intimately connected with the industry, and naturally has also come to the attention of the Ohio Electric Light Association. Hence, the invitation of Mr. Aylesworth to explain the work of

the national body in greater detail. It is generally recognized throughout the industry that the Ohio Electric Light Association is one of the strongest in the country, and that under the efficient secretaryship of Mr. Gaskill it has rendered excellent service. It is also now fairly well appreciated that affiliation with the National Electric Light Association does not curtail the work of the state associations one iota, but rather increases the importance of the state association to its membership. There can be no doubt therefore that when the relative functions of the state association and of the national body are fully explained and comprehended, Ohio, like must of the other state associations of the country, will gladly affiliate with the national body and take its part in the larger program mapped out for the industry.

Motors in Automobile Works

WE ARE glad to be able to report some of the plans which have been worked out by the General Motors Corporation for motor drive in its recent factories. The specially interesting feature of this application is that it has been found wise to use individual motor drive throughout. The theoretical advantages of the plan are plain, and experience has shown that they develop into very practical economies in operation, into increased production and improvement of manufacturing conditions. Especially important in automobile manufacture is the great flexibility of the individual drive.

Every year or two competition forces some change in the model of cars which, slight in itself perhaps, still forces the rearrangement of manufacturing processes to an extent that is greatly facilitated if the machines are separately driven. The same consideration, and also that of time saving, where starting and stopping are frequent, has impelled the firm to go in for remote automatic control in a very large proportion of cases.

Electric Core Baking

CONSIDERING the price of energy only, electric heat is still expensive, but when it comes to judging by results the situation is suddenly altered. In another column A. D. Dauch gives a report on the use of electric heat for baking cores in foundry work, electric ovens being in actual competition with ovens fed by natural gas.

In results the electric installation showed, as might be expected, the greater cost of thermal energy, but also displayed very considerable practical advantages. In the first place, it was found that with electric heat obtained at a fairly moderate temperature it was practicable to run the ovens about 100 deg. Fahr. hotter than with gas without danger of cracking or burning the cores. The baking time is thus cut down from one to three hours and the completed cores are uniform in texture. Once the thermostat is set the performance of the oven becomes automatic, and it does not have to be opened for inspection, with readjustment of the heating burners, as is the case with gas. Incidentally the room temperature and general working conditions are greatly improved. Moreover, the production per oven has been increased 35 per cent, and in a year's run not a car of burned or cracked cores has been taken from the electric ovens.

Insuring Continuity of Service

COMPLETE reliability is important in every distribution system, but in none more so than in one which supplies a big industrial plant, failure of any part of which is liable to involve disorganization elsewhere. R. B. Gerhardt contributes to our columns this week a very useful account of the highly ingenious and efficient scheme of distribution used in the great plant of the Bethlehem Steel Company at Sparrows Point, Md. The fundamental feature of the distribution, and one particularly to be commended, is a complete double-ring three-phase bus feeding the four substations that take care of the great and widely spread plant. These buses are of 1,000,000 circ.mil cable carried on steel towers.

The general scheme of operation is to provide instantaneous overload relays as primary protection in the substation leads, and then by automatic time-limit relays and directional relays to provide for the isolation of any fault occurring between the generating station, with its tap from the Baltimore power circuit, and any of the substations. Current settings were worked out with the utmost care and put at a figure that would insure protection without forbidding the temporary carrying of a stiff overload. Finally, a low-voltage, three-phase circuit was connected through the relays and through suitable contactors exactly in the form and order of the main circuit, with which the time constants of the relays were set so that each would operate at its own proper time. With this precaution and a current setting on the circuit breaker just enough to take care of the maximum load on each substation circuit the danger of trouble spreading is practically eliminated.

Motor Inspection at a Shipbuilding Plant

EVEN with apparatus as reliable as the electric motor is today the systematic care and inspection of the equipment is vital to continuity of service. Where hundreds or thousands of motors are in regular use this is still more important. We are glad therefore to give a little sketch developed by the Bethlehem Shipbuilding Corporation. The fundamental point is to prevent trouble or, if it occur, to remedy it in the shortest possible time. To this end the plan is followed of giving considerable individual responsibility to inspectors, holding them responsible for results and leaving in large measure to each his independence and initiative in carrying out the work that is intrusted to him.

The chief points on which stress is laid are that motors must be inspected at least weekly and that every month the armature clearances must be checked up. In addition attention is given to cleaning, usually at weekly or shorter intervals according to the nature of the work. One place where a closer routine is carried out is in the care of cranes. The eighty-two crane operators report daily, inspecting the equipment carefully and setting down the condition of the apparatus and the loss of time, if any, from failures. The inspection of the cranes is very thorough and is followed up by a systematic record of each individual crane and its performance. For the motors in general, record is kept of the cleanings and inspections given and of the character of any failures. An interesting feature of the motor upkeep record is a master data card for each type, size and design of motor, giving at a glance all the necessary data for rewinding, dimensions and parts

and for immediate supply or manufacture of spares. Of late a graphic chart showing loss of time from failures has been put in use. This is so devised as to point instantly not only to the general performance but to any particular liability to trouble.

Incandescent Lamps for Projection

PROJECTION, whether of pictures on a small scale or of powerful beams for searchlight purposes, has been in the main the peculiar field of the arc lamp, a realm left to it in spite of the successful assault of the incandescent lamp all around its frontiers. Fairly good results for work on a modest scale have been attained with the gas-filled lamps having highly concentrated filaments. When it comes, however, to producing a brilliant, sharply defined and uniform field of light, even the best of the concentrated filament lamps leave much to be desired as compared with the performance of a well-regulated arc, and this moves us to inquire when we are going to have in commercial production in this country the very interesting and useful "Pointolite" lamp regularly produced in England. As our readers probably know, in this lamp the effective radiant is an intensely heated little ball of tungsten, in a 100-cp. lamp, a scant 2 mm. in diameter. The discharge in the lamp is started by a tiny ionizing coil thrown into circuit temporarily, and then the lamp comes up to full brilliancy, giving a beautifully sharp and well-defined source which furnishes an extremely steady and quite uniform field of light of ample power for all ordinary projection purposes and now being developed to sizes which promise brilliant results in the motion-picture field. A few specimens of this new rival of the arc have found their way into this country and have attracted a great deal of interest. The inconvenience of having to depend on foreign manufacture is, however, a serious drawback which we hope will soon be removed. It is rather interesting to speculate on how far this particular line of operation can be carried. The limit, of course, is the melting point of tungsten, so that one cannot fairly hope to rival the crater of the arc for large projection work or even approach the tremendous intrinsic brilliancy obtainable in searchlight arcs, rivaling even that of the sun. Every such step forward puts new facilities in the hands of research and industry for meeting specific though perhaps limited requirements not otherwise to be satisfied.

Courtesy

LITTLE things often count for much. A nod, a smile, a cheerful "good morning," a simple "thank you" make friends, and what a comfort friends are to a utility! There is a franchise perhaps to be extended, a right-of-way to be granted or a petition for increased rates. With the public in a friendly attitude these things aren't so hard to straighten out. Many ways there are of securing good will. They are touched on in these pages every week. A simple way was outlined last week by S. M. Kennedy of the Southern California Edison Company, in a plain talk to the public utility employees on the words "I thank you." Whether employees are meter readers or salesmen, linemen or cashiers, every one who comes in touch with the public, from the top of the organization down, should get the spirit of that article. Many a tramp has made it easier for the next hobo by saying, "Thanks, lady."

Power for Industrial Plants

THE economy of electric power generation in industrial plants has been often investigated both by itself and in connection with the concurrent generation of steam for heating purposes. In principle the utilization of the waste heat in exhaust steam is a rather attractive idea. In practice it often works out badly, increasing the cost of energy through low-efficiency engines to an extent quite sufficient to offset the gain from the use of the exhaust for heating.

The economy of the process in general depends on the particular heating and energy requirements of the individual plant and their thermodynamic balance. The same line of investigation applies to the supplying of energy by combined heating and power plants for public or private consumption, a subject which C. G. Weber discusses in our columns this week. Mr. Weber's examination of power generation under industrial conditions leads him to the conclusion that there is a very well-marked field for economy in the actual interchange of power between big industrial plants and general distribution systems, the former supplying surplus when the demand for their steam-heating purposes makes it economical so to do and receiving power from the central station when the reverse is the case.

A similar interchange of power is not very unusual on hydro-electric systems where industrial plants under some equitable form of contract receive power when water is plenty and generate it when water is scarce, turning over any available surplus into the general distribution system. In many instances the scheme works out extremely well. Mr. Weber's case is somewhat different as applied to the general central-station business. Its economy hinges on the relative cost of power from an industrial plant generating it in connection with steam for heating purposes and costs in a central station specialized for very highly efficient production of power alone.

In the former case neither electrical energy nor heat in the form of steam can be considered a by-product in any proper sense of the word. With a carefully planned combination plant material economies are feasible, but we are inclined to think that they are generally overestimated. Their real source lies chiefly in the gain that may be made in the load and diversity factors considering the nature of the combined demand in the plant.

As a rule a large central station can produce power as such more cheaply than the industrial plant itself. The latter could often cut out its power plant and use a specialized heating plant with positive gain. On the other hand, there are undoubtedly, as Mr. Weber shows, cases where the reverse is true and the industrial plant could at certain times furnish excess power to the general distribution at less cost than the same amount of added power could be turned in from the central station. It is rather a case for careful investigation of the conditions in specialized industrial plants and contiguous power distribution systems than for any broad generalization. It is easy to imagine special conditions under which association would be profitable, but this situation could be established only as a fact and not as a principle. The number of cases in which it has been found profitable for an industrial plant using a combined heat and power system to shut down the latter and take central-station supply indicates the highly specific nature of the problem.



Edward Goodrich Acheson

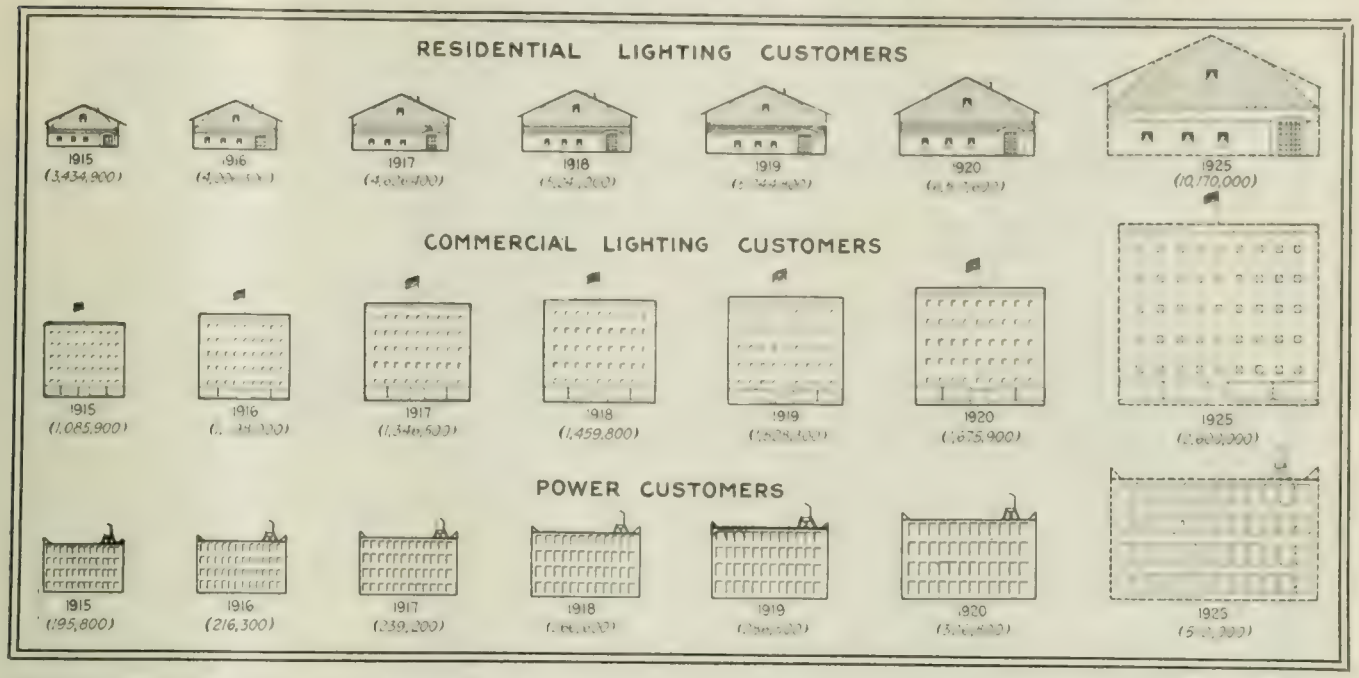
Scientist, inventor, discoverer of carborundum, creator of large electric furnace loads

TO A CHANCE remark made by a famous gem expert on the value of abrasives which made an impression on an imaginative young engineer of twenty-five the world owes its most widely used artificial abrasive—carborundum. This was in 1881. A few years later E. G. Acheson by mixing clay and a source of carbon together in a test tube at a high temperature got an inkling of what might happen at a still higher degree of heat. In 1891, with a simple solder melting pot for a furnace, the bottom of which was connected to one side of a generator, current being led in from the other side through a carbon rod, he first made carborundum, using sand and ground coke for the charge. In this experiment only one small crystal, for a long time unnoticed, was the reward. Now millions of pounds are being produced annually at the plant at Niagara Falls, where there is installed what is probably the largest electric furnace in the world. After overheating the charge one day Dr. Acheson discovered at the bottom a black substance with a greasy surface. This was graphite, produced for the first time from non-graphitic amorphous carbon. By this discovery a whole realm of scientific investigation was uncovered, resulting in a wider use of the electric furnace commercially. Dr. Acheson quickly was able to quadruple furnace electrode current carrying capacity by means of graphite rods. Because graphite electrodes can be threaded and machined other electric furnace economies have become possible. His researches on graphite soon led him into the field of chemistry, where his studies of late have been devoted to lubrication. He discovered the underlying principle of deflocculation, or dividing the particles of matter into a finer state, and from his experiments in this field a number of highly regarded commercial lubricants have resulted. One of them, a mixture of deflocculated graphite and pure water, has made possible the preciseness with which tungsten wire is drawn for incandescent lamps.

Like many another investigator, Dr. Acheson's early life was not free from financial handicaps, but in late years business success has been his in large measure. Far more to his liking, however, is the well-merited recognition that has come from his scientific contemporaries. He has received the highest American honor in the field of chemistry, the Perkin gold medal; from the American Academy of Arts and Sciences the Rumford medal, and twice from the Franklin Institute the John Scott medal. He was born March 9, 1856, at Washington, Pa. He was sixteen when he was taken from school to work at his father's blast furnace. From then until 1881, when he began to work for Thomas A. Edison as an assistant draftsman, he led an unsettled life, being successively chainman in a surveying party, railroad ticket clerk, engineer, bookkeeper and iron miner.

Growth in Central-Station Customers

Analysis of Reports from 65 per Cent of Installed Capacity of Industry Indicates that Electrical Customers Have Increased from 4,716,600 in 1914 to 8,520,400 in 1920, 81 per Cent Power Customers Show Increase of 67.2



DEGREE of healthy growth is an excellent indication of the economic condition of any industry. Continued prosperity is obtained only by broadening out and by the envelopment of new and fertile territory. The growth of the electric light and power industry has been phenomenal, especially during the last thirteen years. According to the census figures, the installed capacity of all central stations in 1907 was 2,709,000 kw. and the total output 5,862,277,000 kw.-hr. Returns received by the ELECTRICAL WORLD indicate that on Jan. 1, 1920, the total installed capacity of all central stations was 12,200,000 kw. and the total output for 1919 was 38,559,000,000 kw.-hr., representing an increase of about 340 per cent in installed capacity and about 560 per cent in output in the past twelve years. During this period the gross income for electric service has increased from $169,615,000 to $773,000,000, or about 360 per cent. It is probable that no other fundamental industry can show such a history of rapid development.

Growth in itself, however, may be of a mushroom nature and not such as to withstand the complex conditions of modern industrial life. This is not the nature of the growth of the central-station industry. It has impregnated every phase of the economic structure of the country and has become most intimately intertwined with American civilization. The home, upon which is based the future of America, has adopted electrical energy for lighting and labor-saving purposes with wide-open arms. Present-day commercial activity in all its various ramifications would be practically impossible without electric illumination, and the time is not far distant when energy will undoubtedly push steam out of its historic position as the world's chief motive power.

In an endeavor to ascertain the comparative growth of the three classes of central-station customers—residential lighting, commercial lighting and power—the ELECTRICAL WORLD has undertaken a survey of this phase of the industry extending back through the year 1914. Questionnaires were sent out to central-station operating companies representing about 80 per cent of the total installed capacity of the country, and satisfactory replies have been received to date from companies representing about 65 per cent of the total installed capacity. The 15 per cent not replying were mostly small local companies, a large proportion of which probably do not keep detailed records of customers. Table I gives an estimate of the various classes of customers by states, based upon the returns from the central stations and the assumption that companies not reporting experienced a growth similar to those reporting. Several of the large companies do an interstate business, and where this is known to be the case the customers have been proportioned to states involved in accordance with the estimated population served.

The total number of customers of all classes increased from 4,716,600 in 1914 to 8,520,400 in Jan. 1, 1920, a growth of 81 per cent in six years. The Middle Atlantic States, consisting of New York, New Jersey and Pennsylvania, show the largest percentage increase in this period, with 104 per cent, and the Mountain States show the lowest percentage increase, with 50 per cent.

Some slight differences will be found in the number of residential customers from that given in an article entitled "Electric Service in the American Home" which appeared in the ELECTRICAL WORLD for May 15, 1920. The most notable correction is for the State of Michigan. This is due to the unexpectedly large growth in the population of Detroit and surrounding towns, the number of residential customers in which was estimated in the previous article. The slight increases in each state over the previous estimate are due in most cases to the existence of more than one customer per house, especially in the large cities.

Table I—Residential Lighting, Commercial Lighting, and Power Customers of Central Stations

State	Total Central Station Electrical Customers (In Thousands)						Residential Lighting Customers (In Thousands)						Commercial Lighting Customers (In Thousands)						Power Customers (In Thousands)					
	1915	1916	1917	1918	1919	1920	1915	1916	1917	1918	1919	1920	1915	1916	1917	1918	1919	1920	1915	1916	1917	1918	1919	1920
Alabama	43 3	45 7	51 5	54 2	57 6	64 2	36 5	38 4	43 3	45 4	48 5	54 0	5 0	5 3	6 3	6 6	7 1	7 9	1 86	2 04	1 97	2 16	2 06	2 37
Arizona	7 7	9 6	11 6	12 7	13 5	14 0	6 7	8 4	10 0	11 0	11 8	12 1	1 0	1 2	1 5	1 6	1 7	1 9	0 03	0 05	0 06	0 08	0 09	0 11
Arkansas	33 4	38 2	44 1	49 6	54 1	61 4	26 0	29 9	34 7	39 0	42 6	48 3	6 0	6 9	8 1	9 1	9 9	11 2	1 33	1 48	1 35	1 58	1 63	1 90
California	490 6	546 6	596 3	632 4	674 0	746 8	382 5	426 0	465 0	488 0	518 0	570 0	84 6	95 4	104 2	112 8	121 4	134 6	23 46	25 15	27 05	31 58	34 60	42 20
Colorado	85 3	90 9	99 6	111 9	118 0	121 1	70 4	75 8	83 0	94 0	100 0	103 0	11 3	11 3	12 5	13 6	13 5	13 6	3 55	3 80	4 07	4 27	4 48	4 52
Connecticut	78 3	92 5	112 2	129 6	142 3	161 8	54 8	67 2	84 8	100 0	111 3	123 0	18 8	20 2	21 8	23 5	24 7	31 4	4 72	5 10	5 58	6 06	6 28	7 40
Delaware	5 7	7 0	7 8	10 6	10 7	12 4	4 3	5 3	6 1	7 8	7 9	9 3	1 1	1 3	1 4	2 3	2 4	2 7	0 24	0 30	0 31	0 42	0 42	0 44
District of Columbia	24 8	27 8	31 5	33 2	38 3	41 6	18 4	20 6	23 4	24 7	28 4	30 8	6 3	7 0	7 9	8 3	9 7	10 5	0 17	0 19	0 21	0 22	0 26	0 28
Florida	58 5	62 5	67 1	74 2	79 1	83 1	46 0	50 0	54 4	60 4	64 4	68 0	11 9	11 9	11 9	13 0	13 9	14 2	0 63	0 68	0 79	0 79	0 85	0 90
Georgia	78 6	81 5	91 7	92 9	97 6	107 8	61 8	63 3	71 7	72 6	76 3	84 0	12 9	13 9	15 0	15 3	15 0	17 5	2 09	2 28	2 66	2 66	2 83	3 39
Idaho	32 6	37 5	40 8	44 0	46 6	51 4	22 9	26 7	29 5	32 1	34 6	38 5	9 1	10 1	10 6	11 0	11 1	11 8	0 58	0 66	0 74	0 85	0 93	1 12
Illinois	468 3	520 2	620 3	693 7	749 0	836 1	341 3	387 0	462 4	526 5	572 5	640 0	106 0	111 0	132 8	139 6	146 6	160 5	21 02	22 24	25 07	27 60	29 93	35 60
Indiana	153 4	161 3	181 1	200 8	215 8	243 8	119 5	124 7	141 0	156 4	169 7	191 8	26 1	28 0	30 6	34 2	35 3	39 9	7 77	8 60	9 53	10 18	10 74	12 10
Iowa	85 9	97 2	109 4	119 2	125 6	140 1	59 4	70 0	81 3	90 2	96 0	110 0	20 6	21 3	21 7	22 2	22 7	22 8	5 87	5 97	6 46	6 88	6 93	7 30
Kansas	63 6	85 4	112 2	142 3	161 8	179 0	49 3	69 3	91 3	118 0	135 3	150 0	11 8	13 2	17 7	20 7	22 6	24 3	2 57	2 90	3 27	3 68	4 08	4 71
Kentucky	72 8	79 6	88 5	98 3	104 3	114 8	55 2	60 6	68 4	76 7	82 2	91 0	15 8	17 1	17 9	19 2	19 6	20 7	1 82	1 93	2 16	2 38	2 52	3 06
Louisiana	30 5	35 1	40 4	45 5	49 7	56 4	24 4	28 1	32 6	36 7	40 1	45 5	5 0	5 7	6 7	7 5	8 2	9 3	1 14	1 26	1 15	1 34	1 38	1 62
Maine	56 9	67 9	74 7	90 4	99 5	106 2	38 8	47 7	53 3	66 3	74 5	78 5	13 8	15 2	16 1	17 7	18 3	20 3	3 76	4 29	4 60	5 25	5 52	6 08
Maryland	41 0	46 0	52 4	58 5	62 1	71 4	29 9	33 5	38 1	41 8	45 1	53 2	9 3	10 4	11 9	14 0	14 3	15 6	1 67	2 00	2 39	2 71	2 71	2 61
Massachusetts	206 6	245 9	294 6	337 3	354 3	406 2	160 8	197 0	241 3	279 5	292 7	338 9	37 3	39 4	42 8	46 4	48 0	52 0	8 50	9 49	10 52	11 38	13 61	15 30
Michigan	213 9	249 0	307 3	352 5	378 7	428 6	139 0	172 7	214 8	251 0	275 8	320 0	66 0	66 7	82 2	90 4	91 5	96 0	8 92	9 67	10 34	11 13	11 40	12 58
Minnesota	115 0	146 8	175 7	201 1	216 5	248 5	86 2	105 8	126 3	149 0	163 5	192 0	24 5	35 9	43 2	45 2	45 9	48 8	4 16	5 15	6 24	6 87	7 06	7 66
Mississippi	33 3	35 5	37 9	41 9	44 7	46 9	24 2	26 3	28 6	31 8	33 9	35 8	8 7	8 7	8 7	9 5	10 2	10 4	0 46	0 50	0 58	0 58	0 62	0 66
Missouri	190 8	227 1	248 0	268 2	287 3	317 0	132 0	161 0	172 4	180 2	191 3	212 0	52 1	58 5	67 0	78 3	85 3	92 7	6 73	7 62	8 57	9 65	10 71	12 34
Montana	44 0	46 4	52 6	55 1	64 9	65 4	34 8	36 3	41 7	42 8	50 9	52 0	7 8	8 8	9 4	10 9	12 2	11 8	1 25	1 33	1 42	1 44	1 87	1 56
Nebraska	76 2	87 6	95 3	104 1	110 2	121 5	52 8	61 5	67 9	75 2	81 0	90 0	21 4	23 8	24 8	25 9	25 9	27 5	2 09	2 36	2 63	3 04	3 31	3 98
Nevada	18 9	20 3	19 8	18 9	15 0	16 2	16 9	18 1	17 6	16 9	13 4	14 5	2 0	1 9	1 8	1 8	1 4	1 5	0 14	0 33	0 31	0 29	0 23	0 25
New Hampshire	21 8	24 2	28 5	30 9	32 9	38 6	16 6	18 5	22 2	23 9	25 4	30 0	4 0	4 5	5 0	5 4	5 7	6 8	1 18	1 22	1 38	1 61	1 72	1 90
New Jersey	156 4	178 4	203 7	231 6	247 5	284 8	120 0	136 7	156 4	177 0	190 2	220 0	31 7	35 9	41 1	46 5	48 8	55 3	4 70	5 72	6 20	8 16	8 50	9 50
New Mexico	12 4	12 7	13 3	14 8	14 4	15 6	10 4	10 7	11 3	12 5	12 4	13 3	1 7	1 7	1 8	2 0	1 7	2 1	0 29	0 29	0 27	0 33	0 27	0 25
New York	319 8	379 7	448 7	524 8	591 8	708 9	181 8	222 3	272 6	336 0	392 0	480 0	126 0	144 3	162 2	173 5	183 4	209 5	12 01	13 14	13 92	15 34	16 38	19 35
North Carolina	44 2	49 4	53 1	55 1	62 2	70 1	31 1	35 4	38 0	39 5	44 4	50 0	11 1	11 8	12 7	13 2	14 8	16 7	2 05	2 14	2 39	2 49	2 94	3 41
North Dakota	30 8	38 8	45 0	52 4	52 9	54 9	23 7	29 9	34 6	40 3	40 7	42 3	6 5	8 1	9 4	11 0	11 1	11 5	0 65	0 82	0 95	1 11	1 12	1 12
Ohio	231 9	266 2	319 4	376 3	419 3	495 3	161 4	188 2	233 3	281 2	322 8	385 0	55 4	61 4	68 2	75 2	76 4	86 9	15 10	16 56	17 93	19 85	20 13	23 40
Oklahoma	47 8	50 5	55 0	60 0	65 6	74 0	39 5	41 7	45 4	49 6	54 2	61 0	7 1	7 6	8 3	9 1	9 9	11 2	1 14	1 23	1 33	1 39	1 52	1 84
Oregon	66 9	74 1	76 0	81 9	90 1	97 9	55 8	61 3	63 8	66 8	75 3	82 0	8 8	9 6	10 4	10 9	10 4	11 2	2 41	3 23	3 84	4 25	4 38	4 72
Pennsylvania	289 6	368 1	393 3	443 0	488 1	566 3	172 2	237 5	245 8	283 8	320 7	385 0	107 5	119 3	133 5	143 0	147 3	159 2	9 90	11 29	13 95	16 23	20 05	22 10
Rhode Island	27 3	33 2	40 1	45 3	47 4	54 8	19 6	24 1	30 1	34 5	36 1	42 5	6 1	7 3	7 9	8 5	8 8	9 5	1 67	1 89	2 11	2 31	2 55	2 79
South Carolina	40 1	42 4	45 7	47 2	53 8	61 7	32 9	35 0	37 6	39 0	44 5	51 0	6 3	6 5	7 0	7 1	8 1	9 3	0 88	0 96	1 10	1 09	1 15	1 38
South Dakota	33 5	38 2	41 1	43 1	44 3	51 4	23 9	28 6	30 8	32 1	33 1	39 3	8 3	8 3	8 9	9 6	9 7	10 7	1 32	1 32	1 40	1 41	1 44	1 44
Tennessee	43 1	48 1	54 9	58 9	63 3	72 1	32 1	34 9	40 7	44 1	47 7	57 0	8 8	10 7	11 5	11 8	12 5	11 6	2 21	2 49	2 74	2 91	3 09	3 49
Texas	88 4	118 9	157 2	205 2	236 6	263 0	68 8	96 5	129 8	171 2	198 6	220 0	17 3	19 2	23 4	28 9	32 1	35 6	2 31	3 21	4 09	5 11	5 93	7 44
Utah	42 1	48 3	70 5	80 9	80 0	80 5	36 2	41 2	60 8	69 2	68 7	69 0	4 8	5 4	8 0	9 1	9 1	9 1	1 19	1 64	1 64	2 53	2 22	2 35
Vermont	35 3	38 6	40 5	41 9	43 0	47 5	27 4	29 7	31 1	32 1	32 8	36 5	6 4	7 5	7 8	8 1	8 3	9 2	1 53	1 45	1 64	1 82	1 89	1 83
Virginia	75 1	82 4	93 3	100 8	105 2	118 1	55 8	62 0	71 3	77 1	81 4	92 0	16 6	17 2	18 5	19 3	19 4	21 0	2 78	3 16	3 50	4 37	4 41	5 10
Washington	154 5	171 9	180 0	198 4	222 1	239 6	127 3	140 4	148 0	165 7	187 4	204 0	21 9	25 3	24 8	25 7	27 4	27 9	5 27	6 24	7 18	7 00	7 30	7 68
West Virginia	17 6	21 7	26 2	31 2	40 9	48 0	12 4	15 7	19 5	23 8	32 2	38 0	4 5	5 2	5 9	6 2	7 4	8 3	0 67	0 76	0 82	1 15	1 32	1 70
Wisconsin	119 2	133 5	149 1	158 3	174 4	199 5	83 5	95 8	108 5	116 4	130 4	150 0	25 9	27 7	30 1	31 2	33 3	38 0	9 82	9 93	10 46	10 69	10 69	11 50
Wyoming	11 5	13 2	14 3	15 6	16 6	18 3	8 0	9 3	10 2	11 3	12 2	13 6	3 2	3 6	3 7	3 9	3 9	4 2	0 28	0 32	0 36	0 41	0 45	0 54
Section																								
New England	425 7	501 6	592 9	674 2	718 1	813 8	317 9	384 2	462 4	536 3	572 7	649 4	86 4	94 0	101 4	109 6	113 7	129 1	21 36	23 44	25 83	28 42	31 57	35 30
Middle Atlantic	765 8	926 2	1,045 7	1,199 5	1,327 3	1,560 0	474 0	596 5	674 8	796 8	902 9	1,085 0	265 2	299 5	336 8	363 0	379 5	424 0	26 61	30 15	34 07	39 73	44 93	50 95
South Atlantic	383 7	421 6	466 6	501 3	547 4	611 2	292 5	320 9	360 0	386 6	424 5	476 3	80 1	85 2	92 4	98 8	106 0	115 8	11 18	12 46	14 17	15 89	16 88	19 20
North Central	1,782 3	2,051 3	2,403 9	2,712 1	2,935 7	3,315 6	1,271 9	1,494 4	1,764 5	2,016 5	2,212 1	2,522 4	424 4	463 7	536 6	583 5	606 1	659 5	86 01	93 13	102 85	112 09	117 54	133 73
South Central	392 6	451 7	529 5	613 7	675 9	752 8	306 7	356 3	423 4	494 6	547 8	612 6	73 8	81 2	90 7	101 6	109 4	117 8	12 17	14 13	15 38	17 44	18 76	22 37
Mountain	254 4	278 9	322 4	353 9	369 1	382 6	206 3	226 4	264 2	289 8	304 1	316 0	40 8	44 0	49 3	54 0	54 5	56 0	7 31	8 45	8 86	10 20	10 54	10 69
Pacific	712 0	792 6	852 2	912 6	986 2	1,084 4	565 6	627 7	676 8	720 5	780 7	856 0	115 2	130 3	139 4	149 3	159 2	173 8	31 14	34 60	38 07	42 83	46 28	54 60
United States	4,716 6	5,420 7	6,210 1	6,967 4	7,559 6	8,520 4	3,434 9	4,006 3	4,626 4	5,241 0	5,744 8	6,517 6	1,085 9	1,198 0	1,346 5	1,459 8	1,528 3	1,675 9	195 78	216 32	239 23	266 61	286 50	326 84

The commercial lighting customers include stores, offices, churches, halls, amusement parks, etc., and in some cases manufacturing plants. Commercial lighting customers have increased from 3,434,900 in 1914 to 6,517,600 in 1920, a growth of 89 per cent. The Middle Atlantic States show the largest percentage increase with 129 per cent, followed by New England with an increase of 105 per cent. The Mountain States show an increase in this class of customers of only 40 per cent.

The number of customers does not give a correct indication of the amount of electrical energy sold by the central stations to each class of customers. This is particularly true with power customers. One power customer may use 20,000,000 kw.-hr. per year, while another power customer may use only 10,000 kw.-hr. per year, depending on the type of plant in which the energy is used. Again, one industrial customer may, and often does, buy energy in bulk from a central station, the purchased energy being used in many of the company's factories, mines, etc., and also used for lighting.

The increase in number of power customers, therefore, cannot be considered as a true indication of the growth in the power load of the central station. It does, however, give an index to the extent to which the central station has become the source of power for the industrial world in so far as number of consumers is concerned. The ELECTRICAL WORLD has under way at the present time an investigation to determine the actual amount of electrical energy supplied by the central station for power purposes.

The power customers have increased from 195,700 in 1914 to 326,800 in 1920, an increase of 67.2 per cent.

Fig. 1 shows graphically the growth of the three classes of electrical customers by years and also gives an estimate of the probable number of customers in 1925 in each class. The latter figure was obtained by extending the growth curves of each class of customers, as shown in Fig. 3. Fig. 2 shows graphically the growth in lighting customers, both residential and commercial, for the various sections of the country, and also includes an estimate of the number of customers in 1925.

The sections of the country where large inducements are made to small power users, both in low rates and special considerations, show the highest percentage of power customers. In the Pacific States about 5 per cent of the total customers are rated as power customers. This fact is more remarkable in that these states cannot be considered primarily as industrial states. The Middle Atlantic States, which are primarily industrial states, record only about 3.3 per cent power customers.

Probably one of the most important results to be gained from this investigation is the possibility of using the figures as a basis for future operations which involve in any manner the number of electrical customers in any section of the country. With these data at hand manufacturers of electrical goods should be able properly to base quotas for distributers and dealers for several years to come, as well as to plan in a more scientific manner the improvements and extensions which will be necessary to accommodate the trade of the future. With the exception of 1918, the rate of increase in all classes of electrical customers has been fairly uniform, being slightly larger during the past year. There is no reason for supposing that these rates of growth will decrease during the next few years. On the contrary, with renewed building activity it is probable that the rates will increase above any year in the past. The estimates made for 1925 are, therefore, believed to be conservative.

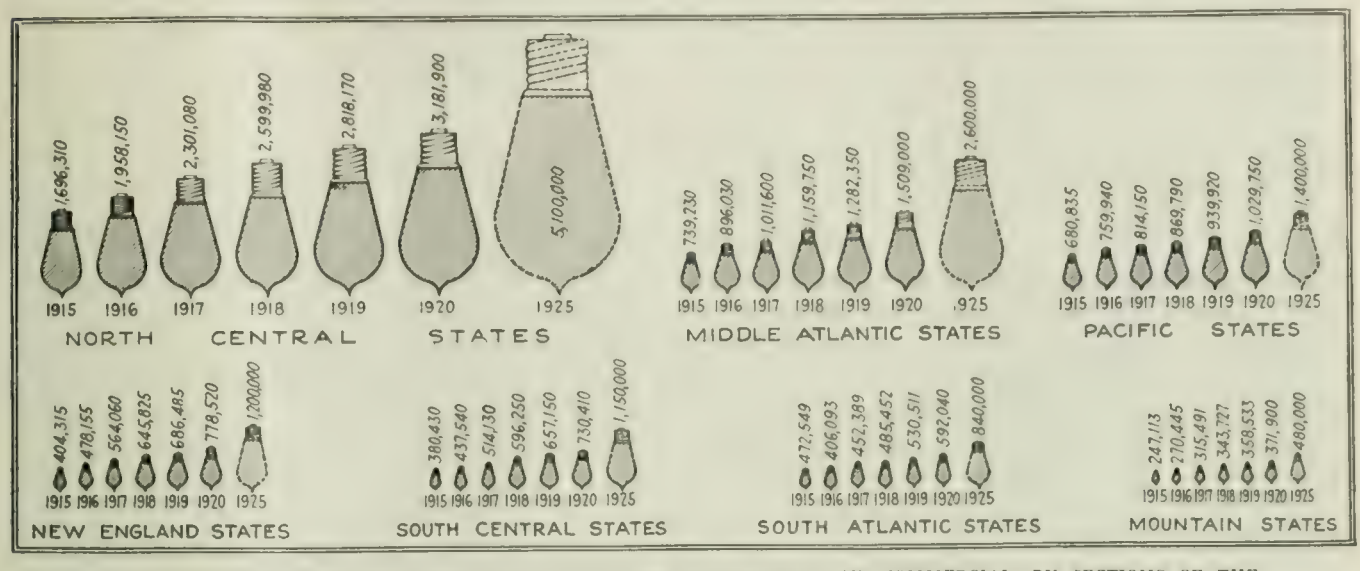


FIG. 2—GROWTH OF LIGHTING CUSTOMERS, INCLUDING RESIDENTIAL AND COMMERCIAL, BY SECTIONS OF THE COUNTRY FROM 1914 TO 1920

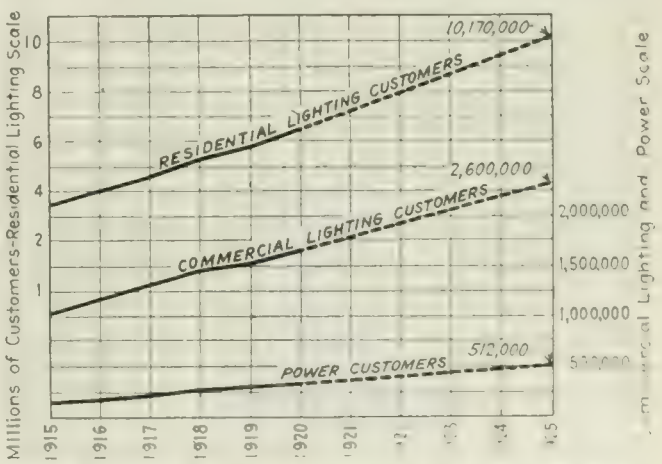


FIG. 3—CURVES SHOWING INCREASE OF CENTRAL-STATION CUSTOMERS BY CLASSES

Cost of Reinsulating Induction Motor Windings

Study of Methods and Materials and Installation of New System of Reinsulating Induction Motor Windings Results in Considerable Saving

By J. A. Knutsen
Milwaukee, Wis.

BY MAKING a careful study of methods and materials a large industry in the Middle West has reduced the cost of motor repairs to a minimum. This article is a record of present costs and practices in rewinding the stators of 220-volt, three-phase, 60-cycle, squirrel-cage induction motors.

One of the methods which had been used by repairmen was to throw the stator into a fire to burn off the insulation. This practice is not a desirable one as the intense heat is injurious to the stator laminations. A better method, especially with partially closed slots, is to cut off the entire winding on one side of the stator with a hack saw or chisel. After this much of the winding has been removed, the stator is fastened rigidly to the floor, cut side down, and the coils are pulled out of the slots from the opposite end with a small chain tackle. This method considerably reduces the time required to strip stators having semi-closed slots.

ther on for dipping and baking the winding of stators having semi-closed slots. No varnish is applied to these coils after they have been placed in position in the slots.

In both open and partially closed slot motors the end connections necessary to group the coils into poles and phases are taped with one thickness of 0.007-in. (0.178 mm.) varnished cambric tape and one thickness of friction tape. Joints between coils and between coils and end connections are insulated with one layer of friction tape.

Meeting Severe Operating Conditions by Care in Reinsulating Windings

The motors in this particular plant are subject to considerable moisture and to acid fumes and therefore special care is exercised in impregnating the windings. All stators of the semi-closed type are dipped twice in General Electric Company baking japan No. 175, and the stators are preheated for about four hours before each dipping. Then follows one dipping in General Electric Company varnish No. 166, which is proof against alkali and acid. The machines are allowed to soak in the varnish and japan for thirty minutes at each dipping, and after each dipping they are baked for fifteen hours at a temperature of 90 deg. C.

The cost of rewinding stators of different-size motors by the methods outlined is given in detail in the appended tabulation. No comparative costs are given for rewinding open and partially closed slot motors. However, in some instances the material cost has proved to be about the same and the labor to rewind an open-slot stator about 15 per cent less than that required to rewind a similar machine which has partially closed slots.

COST OF REWINDING 220-VOLT, 60-CYCLE, THREE-PHASE, SQUIRREL-CAGE MOTORS

No	Make	Type	Form	Amp.	Synchronous R.P.M.	H.P.	No. Slots	Size Wire	Lb. Wire	Connections	Stripping Hours	Stripping Amount	Winding Hours	Winding Amount	Material Cost	Total Cost
2	G. E.	KT	C	3 18	1,800	1	24	20	10	2 cir. star	1	$0 66	33	$25 41	$6.53	$32.60
1	Bissel			6	1,200	2	36	18	14	2 cir. star	3	1 98	23	17 71	8 68	28 37
1	Mech. appl	KH		5.5	1,800	2	36	16	9	1 cir. star	2	1.32	40	26.40	6.68	34 40
2	G. E.	KT	C	8 35	1,800	3	36	17	18	2 cir. star	3½	2.31	27½	21 18	10 75	34 24
15	G. E.	KT	C	14 2	1,200	5	48	16	23	2 cir. delta	6½	4 29	40	30 80	10 05	51 14
1	G. E.	KTE	C	47 2	1,200	56 ft. lb.	48	18	16	2 cir. delta	7	4 62	30	23 10	13 25	40 97
1	G. E.	KT	C	12 3	1,800	5	48	15	15	2 cir. star	5	3 30	50	33 00	12 85	49 15
2	G. E.	KT	B	25	1,200	10	54	17	30	2 cir. delta	4½	2.97	41	31 57	21.56	56 10
1	G. E.	KT	B	27	900	10	72	14	34	2 cir. delta	4	2.64	53	40 81	29.40	72 85
1	Allis-Chal.	3K		25	1,200	10	72	*	*	2 cir. star	4	2 64	15	11.55	54.00	68 19
1	Ideal	AT		33	900	10	72	12	40	2 cir. star	6	3 96	53	40 81	31 80	76 57
1	Allis-Chal.	3K		38	1,200	15	72	*	*	2 cir. star	5	3 30	30	23 10	56 16	82 56
1	G.E.	KT	B	49	1,200	20	72	*	*	2 cir. star	8	5 25	30	23 10	44 20	72 58
1	G.E.	KT	B	61	1,200	25	72	*	*	2 cir. delta	5	3 30	28	21 56	45 34	70 20
1	G.E.	KT	B	120	1,200	50	72	*	*	2 cir. delta	10	6 60	32	24 64	107 28	138 52

* Complete set of coils purchased from motor manufacturer

Having stripped the winding out of the frame, the insulation for the new winding must be considered. In selecting the slot insulation for partially closed slots the thickness as well as the dielectric strength must be taken into account. Cells made up of two thicknesses of 0.10-in. (0.25-mm.) horn fiber and one thickness of 0.007-in. (0.178 mm.) varnished cambric have proved a very satisfactory combination for slot insulation when the cambric cells are placed between the fiber cells. The portions of the coils outside the slots are insulated with one overlapping layer of linen tape 1 in. wide and 0.10 in. thick (25 mm. x 0.25 mm.). The weakest place on a winding from an insulation standpoint is where the coils enter the slots. Most breakdowns occur at those points, so they should be especially safeguarded when taping the coils.

Coils for open-slot stators are taped with three thicknesses of 0.007-in. (0.178-mm.) varnished cambric tape and one thickness of white linen tape 1 in. wide and 0.010 in. thick (25 mm. x 0.25 mm.). No other slot insulation is used. The coils are impregnated before being placed in the slots, using the formula given further on for dipping and baking the winding of stators having semi-closed slots. No varnish is applied to these coils after they have been placed in position in the slots.

In both open and partially closed slot motors the end connections necessary to group the coils into poles and phases are taped with one thickness of 0.007-in. (0.178 mm.) varnished cambric tape and one thickness of friction tape. Joints between coils and between coils and end connections are insulated with one layer of friction tape.

Meeting Severe Operating Conditions by Care in Reinsulating Windings

The motors in this particular plant are subject to considerable moisture and to acid fumes and therefore special care is exercised in impregnating the windings. All stators of the semi-closed type are dipped twice in General Electric Company baking japan No. 175, and the stators are preheated for about four hours before each dipping. Then follows one dipping in General Electric Company varnish No. 166, which is proof against alkali and acid. The machines are allowed to soak in the varnish and japan for thirty minutes at each dipping, and after each dipping they are baked for fifteen hours at a temperature of 90 deg. C.

The cost of rewinding stators of different-size motors by the methods outlined is given in detail in the appended tabulation. No comparative costs are given for rewinding open and partially closed slot motors. However, in some instances the material cost has proved to be about the same and the labor to rewind an open-slot stator about 15 per cent less than that required to rewind a similar machine which has partially closed slots.

The costs in the tabulation are the average of the number of motors shown in the first column. Material costs should be understood to be approximate. Coils mentioned in the table as made by the manufacturer were purchased in 1918 and the prices are those in effect at that time. Other materials are based on current prices in the latter part of 1919 and so more nearly compare to present prices.

Under the head of "Windings" is included the labor for cleaning the stator, connecting coils and all work in connection with dipping, baking and assembling the motor ready for service. Labor was paid at the rate of 66 cents and 77 cents per hour on a day-work basis. Japan, varnish, wire, insulating materials, etc., are included in the cost of material.

Application of Power to Modern Industry

Increased Protection for Small Motors, Direct Connection and Remote Control Show the Trend of Electrical Application in the Industries—Conditions in Recently Constructed Automobile Plants



LATEST TYPE OF PLANT LAYOUT MADE POSSIBLE BY ELECTRICAL APPLICATION

Gear shop (Central Gear Company) showing lighting and power panels on each building column and the method of arrangement of Cooper Hewitt lamps. Note the opportunity for correct lighting afforded by the absence of shafting, pulleys and belts made possible by individual drive. Power and lighting panels are located on building columns.

ALL new plants which have been laid out and built by the General Motors Corporation in the last year or two have been provided with a separate motor for every machine, and the motors of 5-hp. and less are given overload and no-voltage protection similar to that provided for motors of larger capacity. The increased cost of energy, belting and shafting, the need of better factory lighting, the advantages of having better working conditions and the responsibility imposed on manufacturers by workmen's compensation laws are among the chief reasons which led to the almost universal adoption of individual drive by this company. The super-standard protection of the small motors is to provide additional safety to men and motors, which in the last analysis means increased production.

Practically no new advantages have been found for individual drive, but the old theoretical arguments have been changed into large tangible economies, increased production and the development of desirable manufacturing conditions that compel consideration at the hands of factory executives. Flexibility did not mean much when machines were left in the same position for years at a time, but such conditions do not hold in the automobile industry today. With the advance in the design of automobiles and the keen competition on points that attract the public, it has been found necessary every year or so vitally to change the model of the car, in some cases but a slight degree and in others very materially. Where the model of the car is changed materially, especially in engine design, transmission or axle equipment, it means the rearrangement of a large number of manufacturing processes that go to make up a complete car. With the rearrangement of machinery to get production, it has been found that an enormous amount of money is spent, and considerable delay is caused because of the non-flexibility of group drive. With this in view several plants have already been equipped with individual drive and remote or automatic control for the motor. The application of individual drive makes it necessary to install a very flexible system of power distribution, comparable to a general illuminating scheme, so that the load in any part of the building can be transferred to any other part without changing the power feeders. At the same time, the cost of electrical work necessary to change the location of motors must be kept to a minimum. An article describing such a system of industrial power distribution is to appear in a later issue; this article is confined to consideration affecting the general use of industrial motors and their remote or automatic control.

Installations that Save Floor Space

The value of floor space for manufacturing operations has been strongly brought out in factory design work. It has been found that considerable objection is felt by the management to the obstruction of aisles or passageways around columns by the installation of panel boxes of any description. Many schemes have been worked out for eliminating this objection. In some cases the panels have been placed 6 ft. (1.8 m.) above the floor, in others directly behind the machines where space



DETAILS OF ELECTRICAL EQUIPMENT IN CENTRAL GEAR COMPANY PLANT

A—This electric truck for trouble dispatching has speeded up small repair jobs. B—The transformer room is located conveniently for handling equipment and for ventilation. C—Lighting and power panels are mounted in the building on columns. D—Switchboard No. 2 over transformer room. E—Reed-Prentice lathe driven by 5-hp., 440-volt, 60-cycle, three-phase, 1,150-r.p.m., 50-deg. C. General Electric Form C induction motor, General Electric CR7006, Form A-1 inclosed magnetic starting switch with push-button control, no-voltage release and overload relay mounted on machine. F—18-in. Gleason spiral generator for cutting spiral gears. Driven by 3-hp., 440-volt, 60-cycle, three-phase, 1,710-r.p.m., 50-deg. C. General Electric induction motor geared to the machine. General Electric CR7006, Form A-1 inclosed magnetic starting switch with push-button control, no voltage and overload relay shown mounted on framework over motor. Palmer Electric Company clapper box mounted on over-starter switch. G—Hartness automatic lathe for chuck work driven by 15-hp., 440-volt, 60-cycle, three-phase, 1,800-r.p.m., 50-deg. C. General Electric induction motor. General Electric Type H starting compensator, hand-operated with General Electric FP15 non-automatic 50-amp. switch in main line. Convenience in mounting equipment has been looked after very carefully.

cannot be used for anything else, and in still other cases the panel box has been done away with and all motor leads have been taken from a junction box in the truss of the building. The last arrangement, however, can be applied only to a one-story sawtoothed-roof building. Where remote-control starting equipment is used it is also a very simple matter to put all starting equipment above the truss line. In the Canadian Products (motor and axle) plant at Walkerville, Ont., between 50 per cent and 75 per cent of the compensators are automatic and installed above the truss line, and for future additions it is planned to purchase exclusively remote-control or automatic-motor starters.

The methods here described of applying the power and controlling the motors are employed only because the company is convinced that what it is doing pays. The increased cost of line shaftings, hangers and belting, and in addition the high cost and scarcity of the millwrights necessary to install line-shaft drive, is responsible for reducing the difference between the cost of group drive and individual motor installations. Estimates made by the Detroit office of the DuPont Engineering Company show that in most instances individual drive costs about 15 per cent more than group drive when friction losses, roller bearings, leather belting and manually operated starting devices are used in making the comparison. However, some of the estimates show that the initial cost of the installation would be the same in either case.

Automatic remote control for the motors has been found to cost from 63 per cent to 66½ per cent more than for manually operated control equipment. In the plants where 80 per cent of the machines installed are subject to frequent starting and stopping it seems to be the consensus of opinion that the time saved, the increased production, the simple operation of starting and stopping and the general protection for the motor are well worth the additional investment.

Making Time Studies of Production Through Motor Operation

Time studies are being required to an increasing extent, and in one of the company's plants testing jacks are provided for this purpose. By their use a graphic instrument can be plugged in to test the motor and to check the operation of every machine to find out definitely whether blame should attach to the man or to the machine when the production falls below expectations. A different system is used in the Canadian Products plant, where special studs are provided on the power panelboards for testing purposes and all instruments are placed at the distributing panels. The machine under test may be on any of the circuits connected to the panel, and the operator is not aware that a test is being conducted. An additional advantage of this system is its low initial cost. For instance, in a plant now being laid out for about 1,000 motors it would cost $10,000 for equipment for testing motors at $10 per testing jack per motor, whereas the cost of equipping the power panels with terminals for testing 1,000 motors is said to be less than $100.

Competent maintenance men have been scarce for some time, so that the comparatively small amount of maintenance work required with individual motors is a very important factor in its favor. It has been found by experience that one electrician with individual motor drive can replace every five millwrights required to maintain a similar group-driven plant.

The increasing cost of power has made the saving of 25 per cent to 50 per cent in energy consumption with individual drive of considerable financial importance. The reduction in demand and energy consumption is also welcomed by most central stations, especially as so many are having difficulty in supplying all the requests for service. However, individual drive with alternating-current motors has in some cases resulted in a lower power factor than central stations like. This objection has been overcome in some of these plants by the installation of synchronous motors to drive large motors.

Protecting Small Motors

Records from different plants of the General Motors Corporation show that single-phase operation has resulted in the burning out of so many motors of 5 hp. or less that it was deemed necessary to provide the same no-voltage protection on the small motors that is standard with motors of 7½ hp. and larger. In the last few factories built by this company all the motors up to 5 hp. are equipped with a remote push-button control across the line switch, and the motor protection is supplied by overload and no-voltage relays. These switches actually cost 14 per cent more than manually operated switches, but the difference was not considered sufficient to offset the convenience and foolproof feature of push-button control. Furthermore, everything bulky connected with the remote-control devices can be mounted on the ceiling or wherever space is least valuable. The push-buttons can be placed where most convenient to the operator and at more than one place on the machine if necessary. Some of the push-buttons are so placed on the machines that the motor is automatically stopped when the machines get to a predetermined point.

When polyphase motors of from 7½ hp. to 20 hp. are started and stopped frequently, and in all cases where floor or column space is valuable, it is the practice to use automatic remote-control compensators. It does not make much difference how a man starts the motor if he does it only once or twice a day; but when the motor is started and stopped frequently, as is the case in 90 per cent of the machines in the plants under discussion, the cumulative effect of excessive starting currents is obtained, and the increased cost of the automatic compensator is considered to be good insurance. The advantage is not so apparent with squirrel-cage motors of 25 hp. and larger, and except where space is a factor manually operated compensators are generally the rule.

As the factory managers try to increase their output floor and column space becomes more valuable. When the output per square foot of factory floor space can be increased by changing or discarding a manually operated compensator or controller and installing a remotely controlled device which will perform the same function and save valuable space, as in the Canadian Products plant, that change is usually made regardless of the differential in price between the manually operated and remotely controlled devices.

Esselstyn, Murphy & Hanford, engineers and architects of Detroit, are responsible for the design of the Central Gear Company plant, while the factory of the Canadian Products Company was designed by the Detroit office of the DuPont Engineering Company of Wilmington, Del. Both of these organizations, together with the General Motors Corporation, contributed data and photographs for this article.

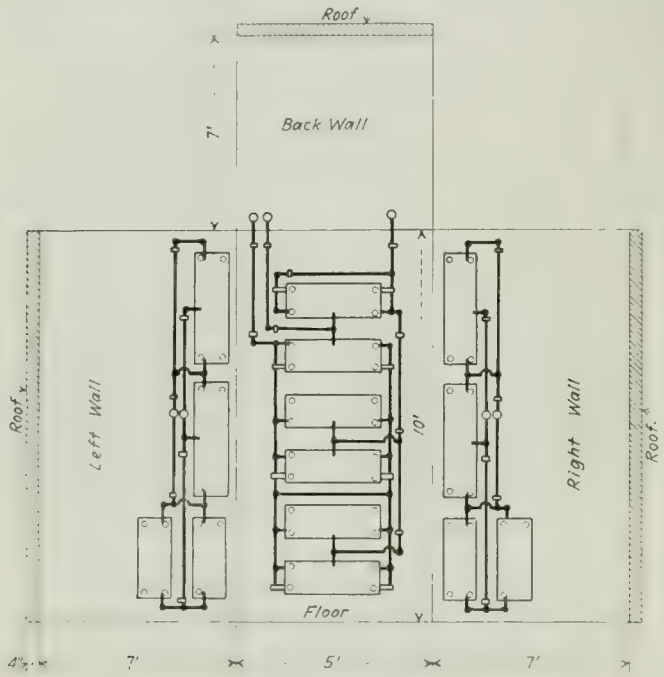
Experience with Electric Core Baking

Reduction of Baking Time, Greater Uniformity of Product, Improved Washing Conditions and Decreased Labor Cost Shown in Changing from Gas to Electric Ovens

By ALAN D. DAUCH
Industrial Heating Specialist General Electric Company

A CLOSE comparison of operating characteristics of electric ovens and gas-heating ovens for core baking at the plant of the Muncie (Ind.) Foundry & Machinery Company has shown excellent results for this application of heating. While the power bill is about 45 per cent higher than with gas, there are so many other economies effected that the superiority of the electric method is more than maintained. During the week in which the 108,730 lb. of cores were made, one kilowatt-hour of power was consumed for every 11.6 lb. of green cores baked.

The work at the plant of the Muncie Foundry & Machinery Company consists in the making of auto-



ARRANGEMENT OF HEATER UNITS IN OVEN

By doubling up the heaters near the door radiation losses at that point are taken care of.

mobile engine castings exclusively for a number of the higher-grade motor car manufacturers. The cores for these castings vary in weight from a small piston core weighing 1.67 lb. (0.75 kg.) to a large chunk core weighing 128 lb. (58 kg.). The average weight of the small cores is 5.5 lb. (2.48 kg.) each, while the average weight of the large cores runs as high as 72 lb. (32.6 kg.). All cores weighing 15 lb. (6.8 kg.) or less are considered small, and all those weighing over 15 lb. are considered large.

The mixture of binder—a very heavy linseed oil—and sand is standard throughout the entire plant for the reason that one section of the foundry is engaged exclusively in the mixing of molding sand. All of the material entering into the mixture is properly weighed and then placed in an electrically driven mixing machine with the proper quantity of core binder. This molding sand is then distributed to the various sections of the core room. From tests conducted it has been found that the moisture and volatile content of the large cores averages 16.07 per cent. The moisture and volatile content of the small cores averages 9.62 per cent. By moisture and volatile content is meant the difference in the weights of the green and the baked cores. This may be considered the total weight of the core binder and the moisture in the green core.

Electric ovens at this plant (four in number) are installed at one end of the core room. They are constructed of an 8-in. (20-cm.) wall of ordinary red brick lined inside on the three sides, top and bottom with a 4-in. (10-cm.) course of "nonpareil" brick. The inside dimensions of these ovens are 5 ft. wide, 10 ft. deep and 7 ft. high (1.5 m. x 3 m. x 2.1 m.). The doors are lined with 4 in. of insulation. These ovens are of the truck-type design. The cars employed are 4 ft. wide, 9 ft. deep and 6 ft. high (1.2 m. x 2.7 m. x 1.8 m.) and are of the regular rack type. Including the core plates, the average weight of a truck is 1,500 lb. (680 kg.).

Efficiency tests recently conducted show that these ovens operated at a minimum efficiency of 36 kw.-hr. and a maximum of 43 kw.-hr. By efficiency is meant the number of kilowatt-hours of power consumed per hour to maintain the charged oven at a constant temperature of 450 deg. Fahr. with a room temperature of 45 deg. Fahr.

The electrical apparatus per oven consists of four standard General Electric core-oven heaters mounted in a pit in the floor of the oven and four wall heaters mounted on each side wall. The total connected load is 72 kw. These heaters are connected three-phase delta to an automatic control panel also rated at 72 kw. The power service is 220 volts, three-phase, 60 cycles. A vapor-tension thermostat is employed as a control instrument. One 6-in. (15-cm.) vent, placed in the rear wall at the top of each oven and directly connected to a stack, carries off all the volatiles and moisture dur-

POWER CONSUMPTION FOR BAKING BOTH LARGE AND SMALL CORES

A record was kept of test runs, totaling 108,730 lb. The average was 11.6 lb. of green core baked per kilowatt-hour of power consumed

Baking Period Hours	Minutes	Energy Consumption, Kw.-Hr.	Weight of Cores, Lb.	No. of Cores	Lb. of Green Core Baked per Kw.-Hr.
		Large Cores			
5	5	208	2,786	41	13 4
4	15	224	2,635	43	11 8
5	10	220	2,379	41	10 8
4	20	180	2,134	45	11 8
4	50	208	2,044	39	9 8
4	45	208	2,431	43	11 7
4	50	212	2,346	38	11 0
		Small Cores			
3	35	120	1,476	350	12 3
3	47	120	1,914	442	15 8
2	45	168	2,389	659	14 2
3	5	116	1,899	719	16 4
3	25	124	1,781	551	14 3
Average number pounds of large core baked per kilowatt					11 4
Average number pounds of small core baked per kilowatt					14 6
Total average number pounds of green cores baked per kilowatt					13 0

ing the ripening period. This ripening period occurs at the time the charge of cores has reached the baking temperature.

Inasmuch as these four electric ovens are installed immediately alongside of six gas ovens, a very close comparison of the operations was easily obtained. To begin with, it was necessary to light the burners in the empty gas ovens Sunday night to have the ovens up to a temperature which the thermometer would indicate as satisfactory on Monday morning. This made it necessary for a man to keep fairly close watch on the ovens during the night to regulate the burners properly and to watch for fires or gas leakage. It has now been found necessary to close the control switch on the electric ovens only an hour before the time of the first bake. It was not found practicable to run the gas ovens at a temperature over 350 deg. Fahr. for the reason that the temperature around the gas burners would be so high as to cause hot spots in the oven, resulting in cracked and burned cores. The electric heaters being mounted in a pit in the floor and also on the two side walls of the oven, there is secured a continuous heat-radiating surface of one temperature extending the entire depth of the oven. By placing the heaters nearer to the door than to the rear of the oven the customary cold spot near the doors caused by excessive radiation losses is overcome. Another factor to be considered is that the temperature of the heating medium itself in the case of the electrically heated oven is nearer to the temperature of the work by several hundred degrees than the temperature of the gas flame. Temperature gradient is an important factor in any baking proposition, and more especially in the case of a composition of sand held in shape by a liquid core binder whose holding together qualities are disastrously affected by any intense heat.

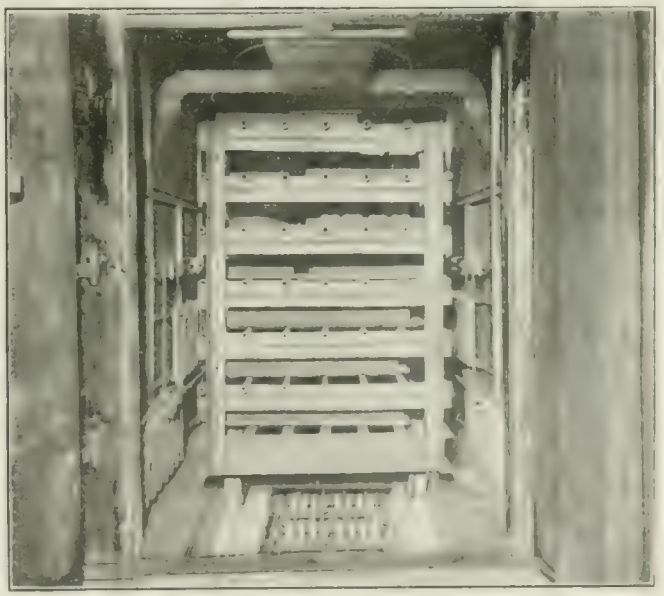


EXTERIOR VIEW OF ELECTRIC OVENS AT MUNCIE (IND.) FOUNDRY & MACHINERY COMPANY

With the electric oven the temperature has been increased to 450 deg. Fahr. with a reduction in baking time of from one to three hours. Moreover, it can be readily noticed when a car of baked cores is taken out of the gas oven that the colors of the cores vary from a light gray to a deep reddish brown. In the electric oven the individual cores are not only of the same color through their cross-section as well as on their entire outer surface but the entire car of cores is of a uniform color. This would indicate a very uniform heat distribution, as the varying colors of the cores are caused by the non-uniformity of the heat to which the linseed-oil binder is subjected. With the gas ovens it is necessary to open the doors of the ovens frequently to inspect the cores. Rearranging the caps over the gas burners so as to secure as even a heat distribution as is possible is also necessary. On the other hand, once the Tycos thermostat is set at 450 deg. Fahr., all that is necessary is to close the control switch, returning only at the end of the bake. Once this aging time is determined, this operation becomes automatic. In other words, the source and distribution of heat remain constant in the electric oven. In the gas oven the quality of the gas will vary (B.t.u. per cubic foot), as will also the gas and air pressure, as influenced by the weather conditions and outside demand.

Since sanitary working conditions are now receiving more than ordinary attention, the electric core oven presents another decided advantage in that it does away with poisonous gases, smoke and open flames. By intro-





INTERIOR DETAILS OF CORE-BAKING OVENS

Ventilation is taken care of by the ducts leading up to the roof. [illegible] loaded with cores for [illegible]

ducing a General Electric automatic door switch it is made impossible for a workman to subject himself to any danger on entering the oven. The opening of a door automatically cuts off the power. Since the resistor element of the heater is of a very small cross-section, its heat-holding qualities are negligible. On the other hand, to be continually extinguishing and lighting the gas flame necessitated by the close manual attention required in the gas oven presents an item involving a big time and labor element. Therefore the burners are lighted continuously, making the danger from burns, explosions and gas poisoning one ever present.

Owing to the fact that electricity as a heating medium is more expensive than natural gas, it has been found more practicable to build an oven of the very best heat-insulating qualities. This increased cost is offset by the fact that the temperature of the room in which these ovens operate is by far more inducive to good health and proper working conditions. Moreover, the radiation losses are decreased by approximately 75 per cent.

It was found from the tests that the four electric ovens in question worked at various efficiencies ranging from 8.2 lb. to 17 lb. (3.7 kg. to 7.7 kg.) of green cores baked per kilowatt-hour of power consumed. The total weight of cores baked in the four ovens for the entire week totaled 108,730 lb. (49,300 kg.). The power consumption was 9,389 kw.-hr., giving an average working efficiency of 11.6 lb. (5.2 kg.) of cores baked per kilowatt-hour. The higher efficiencies obtained in the small cores is readily explained by the fact that the cross-section of the large cores is of such dimensions as to require considerably more time to thoroughly bake, thereby increasing the power consumption.

On straight power costs the electric power bill will run as much as 45 per cent higher than the gas bill, but the following points must be considered in this connection: The production of the ovens has been increased 35 per cent. In more than a year's operations this foundry has not experienced a car of burned or cracked cores from the electric ovens. It is necessary for the men to watch the gas ovens constantly so as to avoid these losses as much as possible; the electric ovens require no watching and a greater uniformity of product has been shown.

Connecting Three-Phase Induction Motors

(With Supplement)

Tables and Winding Diagrams Give Information Necessary for Connecting Two-Pole to Twelve-Pole Motors—Complete Data on Connecting Coils in Unequal Groups

By A. C. ROE

New York Service Department Westinghouse Electric & Manufacturing Company

WITH the information given in the accompanying tables and winding diagrams (see supplement) any motor-repair man should be able to connect two-pole to twelve-pole three-phase induction motors for any speed or voltage. The data and charts have been based on years of practical experience and refer to the majority of problems encountered, not to the exceptional ones.

From the charts it can readily be determined for what voltages and speeds it is practicable to connect any motor containing from 12 to 240 coils. If coils cannot be evenly divided between groups, the charts indicate how the coils may be divided and still get satisfactory results.

The winding diagrams are grouped according to the number of poles in the winding and each group is further subclassified as to star or delta connection, series or parallel winding, etc. Both tables and diagrams apply to lap windings only.

There are one voltage table, one master grouping chart and six sub-charts. The voltage table indicates what changes should be made in connections to obtain certain voltage changes. This table is best explained by an example which has been taken as follows: Suppose it is desirable to raise the voltage of a four-parallel, Y-connected motor from 110 volts to 220 volts, what connection must be used? First the desired voltage must be expressed in percentage of the original voltage, and in this case it is 200 per cent. Then, starting at the four-parallel Y line in the left-hand column, this line is followed to the right until the figure 200 is reached. Directly above 200 is given the desired connection, which is two-parallel Y. The table is used similarly for lowering a motor voltage. Where a blank space occurs the change is impossible with two-pole to twelve-pole machines. Even if this table indicates that a winding is possible, the grouping charts may indicate otherwise and must consequently be the final guide. When reconnecting, the voltage of a motor should not be raised so high that there is danger of the insulation failing.

Changes of speed may be obtained in an induction motor only by changing the number of poles. The synchronous speed corresponding to the number of poles is shown at the extreme left of the master chart for 25-cycle and 60-cycle motors. The highest speed at which a rotor may be run is limited by the mechanical strength of the rotor. On the other hand a considerable reduction in speed results in decreased horsepower and power factor.

After the type of winding and the number of poles desired is known, the coils must be connected in groups (if not already properly connected) and the groups must be connected together according to the type of winding. The grouping charts and the winding diagrams will assist in doing this.

The master chart contains one vertical column indicating the number of poles in the winding, another vertical column indicating the type of winding (series, parallel, etc.) and a horizontal column at the top indicating the total number of coils in the winding. Where the total number of coils can be divided evenly among each group the main chart will show the proper number

of coils per group directly under the total number of coils and opposite the number of poles and type of winding used. When the total number of coils will not divide evenly, however—that is, where there are more coils in some groups than in others—a letter (A, B, etc.) will appear under the total number of coils and opposite the number of poles and type of winding to be used, indicating that the number of coils per group will have to be obtained from the supplementary table bearing the letter. If the connection desired cannot be efficiently made with the given number of poles and coils a blank space in the main chart will indicate this fact. Where a degree mark (°) appears in the master chart it is an indication that one coil will have to be left dead in each group indicated in the sub-chart by a degree sign (°).

The method of using the charts can better be explained by assuming some specific conditions. For instance, suppose that a six-parallel winding is desired on a six-pole motor having ninety coils. Looking under the vertical column marked 90 opposite a six-parallel winding, it can be seen that five coils per group will give the desired arrangement. On the other hand, suppose that a two-parallel connection is desired on an eight-pole motor having ninety coils. In the ninety-coil column opposite the eight-pole, two-parallel winding will be found the reference *D*, which indicates that the coil grouping is odd and that the sub-chart *D* must be consulted. By reference to the sub-chart opposite ninety coils it will be found that the following grouping is necessary: 3, 4, 4, 4, 3, 4, 4, 4, etc. Suppose again that with this same eight-pole, ninety-coil motor a four-parallel connection is desired. Inspection of the main table shows that sub-chart *D* gives the desired connection.

The connection will be the same as for a two-parallel winding, except that the degree marks would be observed because the master chart has indicated that coils must be killed. In cases where the coil always has to be killed it is indicated by a (—1) sign following the number of coils in the group. For instance, in a two-parallel winding, eight-pole, eighty-six-coil machine Table D indicates that the number of coils per group will be 4, 4—1, 4, 3, 4, etc.

Besides helping in rewinding or reconnecting motors these charts are useful in determining which is the best design for any machine. For instance, it can be seen that in a seventy-two-coil motor two, four, six, eight or twelve-pole connections are possible, and that ten-pole series or two-parallel connections are possible without killing any coils, although an odd grouping is necessary.

It will be noted that the number of coils is used throughout this article in preference to the number of slots. This makes the data apply to all cases irrespective of the number of coils per slot.

Connection Diagrams

In order to facilitate the use of the connecting diagrams on this supplement, they are numbered and lettered uniformly throughout. The numbers outside of the article indicate the number of the groups which they are opposite. The numbers inside indicate the two ends of each pole-phase group. Where one of these inside numbers is repeated this indicates that the two groups so numbered should be connected together at these points. The numbers are so arranged that when a machine is to be changed to a different connection with the same number of poles the change can be obtained by inspection of the two diagrams corresponding to the two connections. For instance, with a four-pole machine—suppose a change is to be made from a series-delta winding to a two-parallel-delta winding. Starting at the top of the first diagram showing the delta winding and proceeding counter-clockwise, the numbering on the coil groups is as follows: *C*-3, *A*-4, *A*-5, *B*-6, 1-7, *C*-11, etc. On the first diagram of the two-parallel-delta winding, preceding in the same direction, the lettering is the same until the lower end of group No. 8 is reached, where 7 has been changed to *A*. This means that the jumper which formerly connected around to the right to the other 7 has now been swung around to *A*, in order to make the two-parallel connection. Likewise the jumper from 12 in group No. 6 has been swung around to *B*, and 7 from group No. 5 has been swung around to *B*. Coil 2 from group No. 4 has been swung to *C* and 12 from group No. 3 has been swung to *C*, while 2 of group No. 1 has been swung around to *A*. By making these changes the motor is reconnected from a series to a two-parallel winding. In the star-connected windings the symbol (*) indicates a connection to the neutral of the motor.

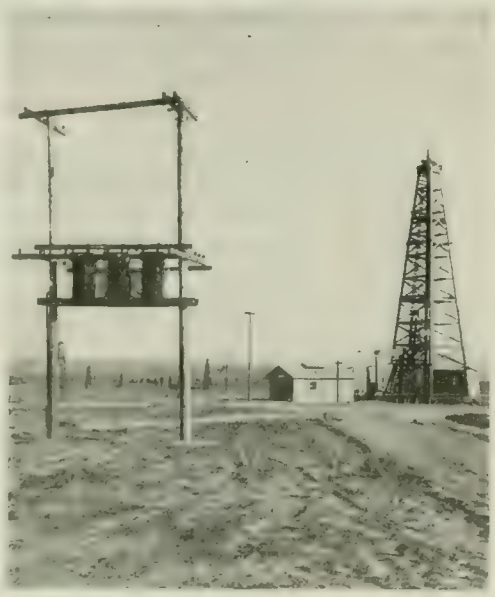
It will be noted that there are two drawings for some types of connections. For instance, there are two series-delta windings shown for the four-pole machine. The first of these drawings shows what is called a "top-to-bottom" connection and the second a "top-to-top and bottom-to-bottom" connection. These are indicated on the diagram by the letters *T-B* and *T-T*. In the top-to-bottom connection the jumpers connect all like poles, skipping alternate poles. In the top-to-top connection the jumpers pick up adjacent poles. The *top-to-top connection should be used for all odd coil groupings* which are given on the charts. In reconnecting for a different voltage a *T-B* diagram must be used in conjunction with a *T-B* diagram; likewise a *T-T* with a *T-T* diagram.

There are a number of special diagrams showing a two-speed motor, a wound-rotor and star-delta connections which give an idea of the method to be used, showing the principles which can be applied to all cases. The diagram of the rotor shows the method of bringing out leads for slip rings spaced 120 deg. apart.

The method of using these diagrams and charts as practiced by the writer is as follows: Instruction is given to the winder as to the number of coils in each group, and if the grouping is odd the instructions are written on paper in the order shown on the chart, as, for instance, 4 4 5 5 4 4 5 5. After the coils have been connected in groups or "stubbed" by the winder, all of the top leads of each group are bent out from the center of the machine and all of the bottom leads are bent in toward the center. The beginning and end of each coil are tagged according to the diagram with metal or fiber tags having numbers corresponding to the numbers indicated on the diagram at the ends of the coil groups. These tags are drilled so that they can be slipped on the leads. After the foreman or head winder has checked the tagging the winder connects the leads by putting a jumper from each number to the corresponding like numbers. If only two tags are removed at once, there is less chance for mistakes. When all the jumpers are on, the motor leads indicated in the diagram by *A*, *B*, *C*, can be put on, after which the winding may be soldered and the joints insulated, etc.

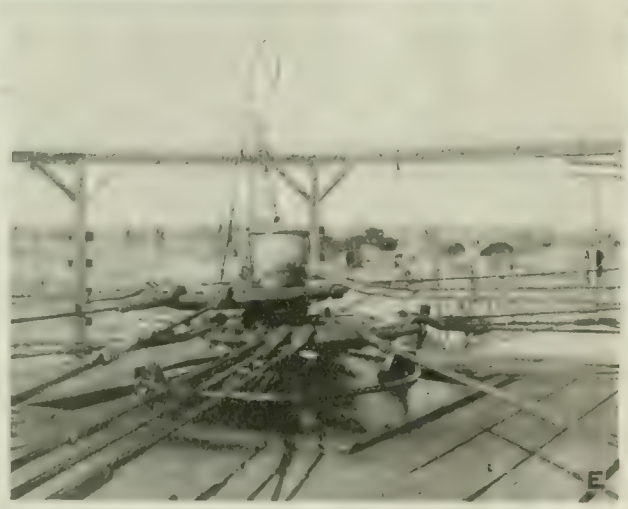






Drilling Pumping and Pulling of Oil Wells Is Now Being Done Very Economically with Electricity







A—Dehydrating plant showing method of handling and treating the oil which contains an emulsified water. After being treated by the electrical process, the clear oil flows into the tanks at the left.

B—Line pump for pumping oil into pipe line from earthen storage reservoirs shown in the background.

C—Oil well pumped by electricity, in Kern River Oilfields, Kern County, California, on system of San Joaquin Light & Power Corporation, showing standard construction of transformer installation and running of service to the oil well motor house. Energy is delivered at 11,000 volts, motors being operated at 440 volts.

D—Pumping two oil wells from one motor to effect a balance.

E—Eighteen wells are pumped by this eccentric, which is electrically driven by motor shown in Fig. F. Cables radiate from the eccentric to the various pumps.

F—Interior of electrically operated jack plant showing belt connections and countershafts controlling speed of jack operation.

Interchange of Industrial and Central Station Energy

Data in a Number of Individual Cases Give Indication of the Large Savings in Coal, Labor and Transportation that Would Be Possible from Electrical Interconnection Between Industrial and Central Station Plants

By CORNELIUS G. WEBER
With Vaughn & Meyers, Consulting Engineers

IF ALL industrial establishments were to purchase their electrical energy from large public utilities, a large amount of coal would be saved, so far as the generation of electricity is concerned; but the fact that many industries require heat in the form of low-pressure steam at once makes it more profitable for such industries to generate energy as a by-product. Usually such an industry will generate only as much energy as it requires for its own use and will operate an engine only as economical in fuel consumption as the case may require. No attention is given to the possibility of generating all the energy economically feasible to generate from the steam used and of disposing of the excess amount, for where could a market for the surplus be found?

In a study of this subject many industrial plants were inspected, and in the particular cases cited exhaustive tests and analyses, including the measurements of live and exhaust steam consumption of apparatus and processes, boiler tests, economic performance tests, heating load tests, etc., were made for the purpose of working out in each individual case a plan of rehabilitation that would reduce the fuel consumption of the specific establishment investigated. All such investigations resulted in the compilations of detailed reports based on actual facts and measurements, and since plants of widely varying character were encountered, it was thought that it might prove of interest to work out the over-all fuel economy that could be anticipated in the cases considered in the event that they were electrically interconnected and were generating electrical energy only in proportion to the fuel needed for heating and processes, disposing of excess energy to the central station at times when more energy was being generated than was needed and purchasing energy from the central station when a deficiency occurred.

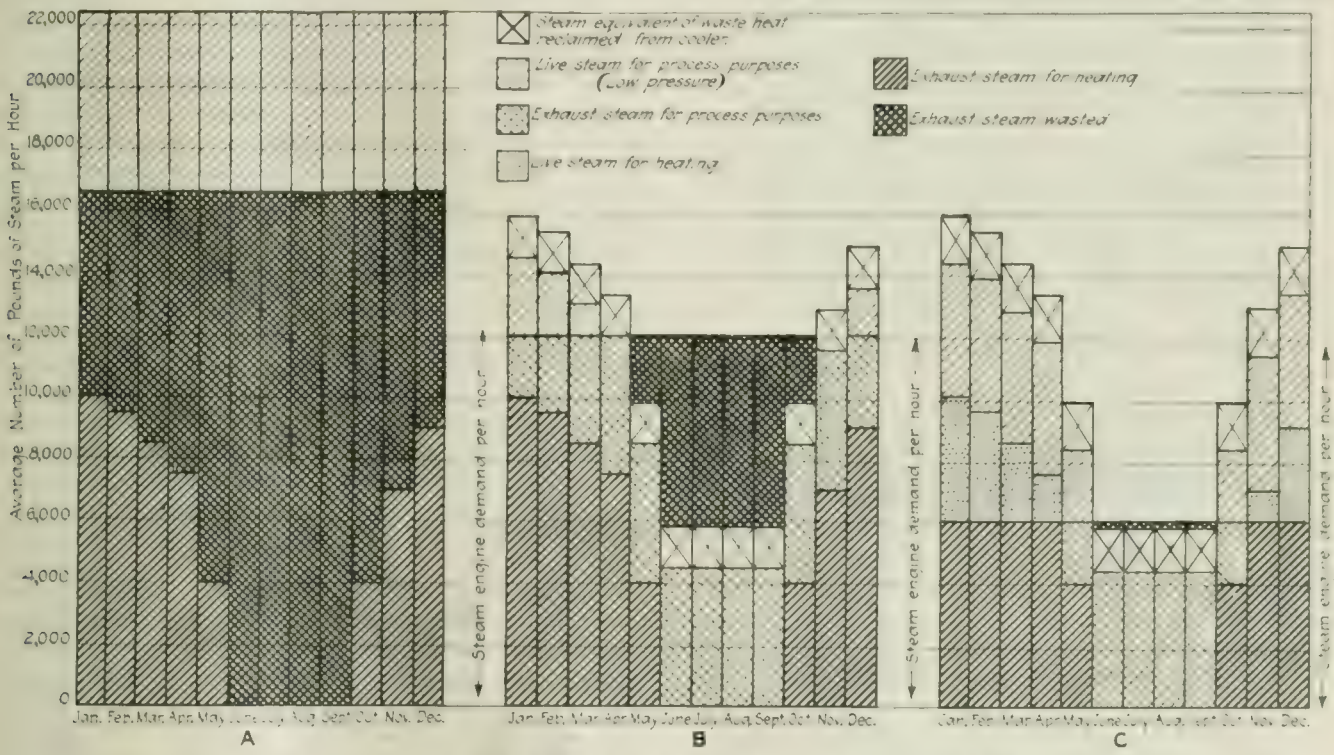


FIG. 1—ECONOMIES OF POWER EFFECTED IN TYPICAL INDUSTRIAL PLANT

Graph A represents the original conditions. In B is shown the result of replacement of live steam for process purposes by exhaust steam, the boiler being brought up to proper efficiency, waste heat reclaimed from a solution cooler and repairs made to Corliss engine. In C is shown the result of installing a new generator set, reduction of friction load through electrification and the use of superheated steam and shows a condition where practically no exhaust steam is wasted.

In addition to the fuel economies possible in the plants considered as independent units, the probable additional fuel savings that would result, were these plants provided with induction or other generators and connected to the public service company's distribution system, have also been worked out. The plants considered embrace industries of the following kinds: Automobile parts, machine manufacturing, food products, sheet-metal products, leather manufacturing, woodworking, structural steel fabricating, textile goods and dye works.

In each instance the fuel consumption was first determined, and from boiler and engine tests the economic performance was determined. The low-pressure steam requirements for heating and process work were then found, and the annual fuel consumption was computed on the basis of proper performance of the boilers, the installation of more economical prime movers and the utilization of exhaust steam to best advantage.

In Fig. 1, *A* represents the operating conditions as found by test. The diagram is self-explanatory in so far as it represents steam utilization. There is this to be added, however: the fuel consumption under the conditions revealed was 6,033 tons per annum. The processes utilized live steam at low pressure, the boilers were operating at an efficiency of only 63.2 per cent, and the Corliss engine was consuming on an average

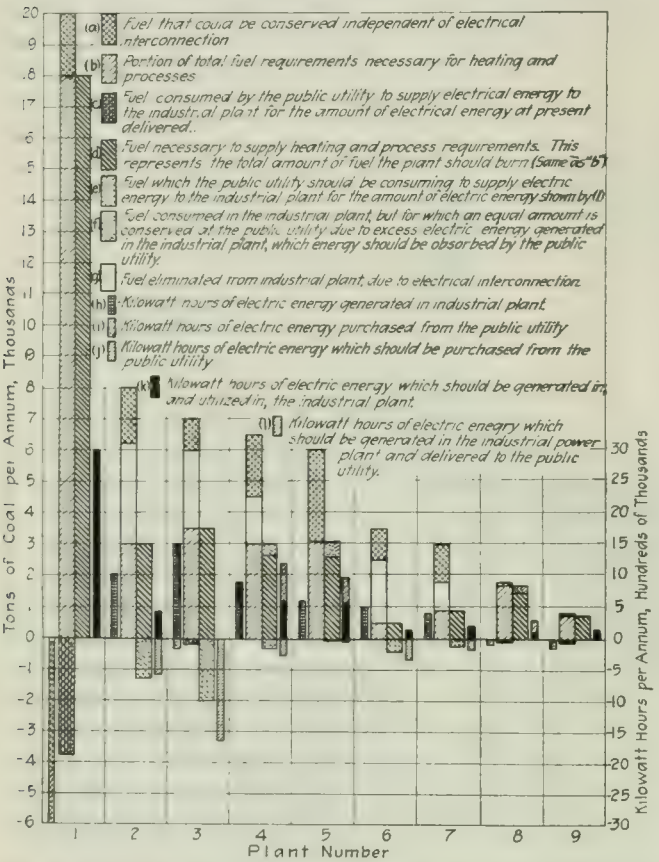


FIG. 2—RELATIONS BETWEEN A TYPICAL GROUP OF INDUSTRIAL PLANTS AND CENTRAL STATION

Above the line are represented the conditions in the industrial plant; below the zero line the public utility's operation considered in relation to the particular plant is shown. The two bands at the left represent conditions as they are, while at the right the possible improved condition is shown.

43 lb. (19.5 kg.) of steam per indicated horsepower per hour.

In *B* of Fig. 1 is shown the operation of the same plant under the conditions wherein the live steam for processes is replaced by exhaust steam, the boilers brought up to proper efficiency, waste heat reclaimed from a solution cooler and the Corliss engine carefully repaired to bring its steam consumption down to about 30 lb. (13.6 kg.) of steam per indicated horsepower per hour. The annual fuel consumption represented by *B* is 3,519 tons.

By the installation of a direct-connected poppet-valve-engine-driven generating unit, the use of superheated steam and the elimination of a considerable friction load by electrification 3,100 tons is the consumption.

It will be noticed that under the conditions shown in both *B* and *C* of Fig. 1 there is not a sufficiency of exhaust steam during the colder months to meet the requirements and that a considerable amount of live steam for building heating and process work is necessary. This steam, being all low-pressure, could first be drawn through a larger engine and additional electrical energy generated to be fed into the public utility company's distributing system.

The amount of additional energy that could be so generated under conditions shown in *C* of Fig. 1 would be 360,000 kw.-hr. per annum. During the months of June, July, August and September, when some exhaust steam would be going to waste, this plant could utilize about 50,000 kw.-hr. of central-station energy in order to keep from wasting exhaust steam. This procedure would eliminate about 100 tons of coal, which, if valued at $700, would mean that to break even financially the plant in question could not afford to pay more than 1.4 cents per kilowatt-hour. However, if the central station were purchasing the 360,000 kw.-hr. at, say, 1 cent and were charging for the 50,000 kw.-hr. 2.5 cents, the plant under consideration would still be ahead by an amount of ($3,600 + $700) — $1,250 = $3,050, against which latter figure only the additional fixed charges on the larger engine and generator would have to be figured.

As it happens, the plant discussed is not a consumer of central station energy, but it seems reasonable that under present conditions even a central station could afford to purchase energy at 1 cent per kilowatt-hour. In this special case the industrial-plant owner would be ahead $3,050 per year less the fixed charges on that portion alone of the prime-mover equipment cost which is larger than his own needs require. The central station would be ahead by the profit represented by $1,250 worth of new business, it being assumed that the fuel and labor charges in the central station amount to 1 cent per kilowatt-hour. Should it cost the central station more than 1 cent for these items of coal and labor, then the central station would make an additional profit.

It is apparent, of course, that the industrial-plant owner could generate the 50,000 kw.-hr. during the summer months at less than 2.5 cents per kilowatt-hour and that financially it would be to his advantage not to purchase such energy. This is true, but it must be borne in mind that he would no doubt be willing to pay the amount of $1,250, of which only $550 actually represents added cost, for the privilege and opportunity to dispose of excess energy which he would be generating as a by-product. It is evident that the above represents a profit to both parties concerned.

With such a co-operative arrangement the amount of fuel conserved for the nation at large would be about as follows: Assuming that the central station can generate energy at as low a rate as 2.5 lb. (1.12 kg.) of coal per kilowatt-hour, then the purchase of the 360,000 kw.-hr. cited previously would conserve 450 tons of fuel, since the central station would be buying 360,000 kw.-hr., for the generation of which it would otherwise have to burn 450 tons of coal. During the summer months, when the public service company would be selling 50,000 kw.-hr. of energy to the industrial plant, the central station would consume 62.5 tons of coal where the industrial plant would be consuming about 100 tons, thereby bringing about an additional saving of 37.5 tons, or a grand total of 487.5 tons.

In round numbers, the annual fuel saving in so far as the nation is concerned would be from 475 to 500 tons. At $7 per ton, this would represent about $3,500 per year, which latter figure must be reconciled with the industrial plant owner's $3,050 profit and the central station's profit on $1,250 worth of new business.

The summary of the above is shown as plant No. 5, in Fig. 2. By consulting the key the curve becomes self-explanatory. Representations above the line 0-0 show the industrial power plant operation and those below the line the public utility's operation in so far as it is, or would be, affected by the industrial power plant in relation to which it is considered. In Fig. 2 there are four sets of bands to each plant representation. The two to the left show actual conditions as found, and the two to the right as they would obtain under electrical interconnection conditions. By a similar process of analysis several other typical industrial power plants have been charted in a summary way, as further shown in Fig. 2. For convenience they have been arranged according to magnitude of coal consumption. Data on numerous other plants are in possession of the writer, and only typical cases have been selected.

There is this to be said specially about plant No. 1. This plant operates gas engines for generating electrical energy, but burns 20,000 tons of coal exclusive of the gas engines for high-pressure and low-pressure steam purposes, at the same time purchasing 3,000,000 kw.-hr. of electric energy. Only fuel burned for steam purposes has been considered, and that portion of the steam which is used at low pressure if first taken through an engine as a reducing valve would be just sufficient to generate the same amount of energy as is now purchased. As it happens, the power demand is practically uniform, and since low-pressure steam is used also at almost a uniform rate, this steam would generate energy in porportion to the amounts needed.

Fig. 3 is a summary of Fig. 2, showing total quantities of fuel to be saved. As found, the aggregate amount of fuel consumed per annum by the nine plants considered is 56,633 tons. As isolated independent plants under reasonable rehabilitation plans, these same plants would consume only 44,500 tons of fuel, or 12,083 tons less. Electrical interconnection and operation on a give-and-take basis would result in an additional saving of 11,400 tons of coal. The total saving due to rehabilitation and electrical interconnection would be 23,550 tons, as represented by the total areas of the bands shown in Fig. 3. This is 41.5 per cent of 56,633, or, in other words, a saving of 41.5 per cent in fuel would be possible in these cases. The solid black portions of the bands shown in Fig. 3 represent 11,400 tons. Electrical interconnection would result in a saving of 11,400 tons in 44,500 tons, or 25.5 per cent.

In these cases the public utility would lose 3,425,000 kw.-hr. of business, gain 3,125,000 kw.-hr., and in addition would have to absorb about 1,200,000 kw.-hr., bringing about a net loss of approximately 1,500,000 kw.-hr. to the public utilities. However, the business lost would represent a large consumer paying a low rate, whereas the new business would be numerous small customers paying a higher rate, and since the 1,200,000 kw.-hr. to be absorbed would be purchased at a low rate, it is quite probable that the public utility would be benefited. In any event, a plan on the order outlined, where plant No. 5 was discussed in detail, would have to be worked out since the co-operative plan would have to be of benefit to the public utility in order to be attractive and workable. From a national fuel-conservation standpoint the public utility should be interested in all industrial plants and every industrial plant should be a subscriber to the public utility, which should be operating in a bigger, broader and better field.

In one instance a plant consuming 45,000 tons of coal a year was burning 3,000 tons for heating buildings with live steam. This 3,000 tons could readily have been utilized for power purposes. As another example, in a town of 3,500 population the local public utility is being operated with uneconomical engines which exhaust the steam to atmosphere. The public utility's plant is situated on a large river, and the installation of a condenser would result in saving 20 per cent of the fuel. In this same municipality there is a large woodworking establishment consuming a combined amount of coal or its equivalent in wood refuse equal to 9,000 tons of coal per year. The plant operates twenty-four hours per day, and its exhaust steam requirements are such that virtually 9,000 tons of coal or its equivalent would have to be burned for steam-heating purposes regardless of any power requirements.

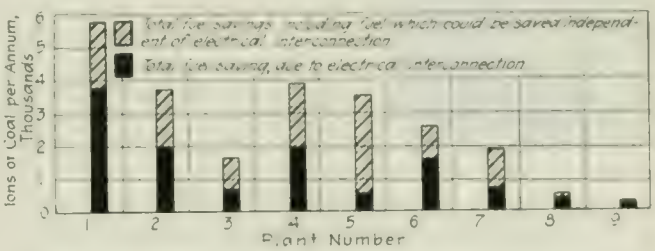


FIG. 3 -SUMMARY OF COAL SAVING POSSIBLE FOR NINE INDUSTRIES SHOWN IN FIG. 2

However, this plant was actually considering the purchase of electrical energy from a water-power concern, and had this been advised and done, an additional loss to the general public would have been added to an already aggravated situation.

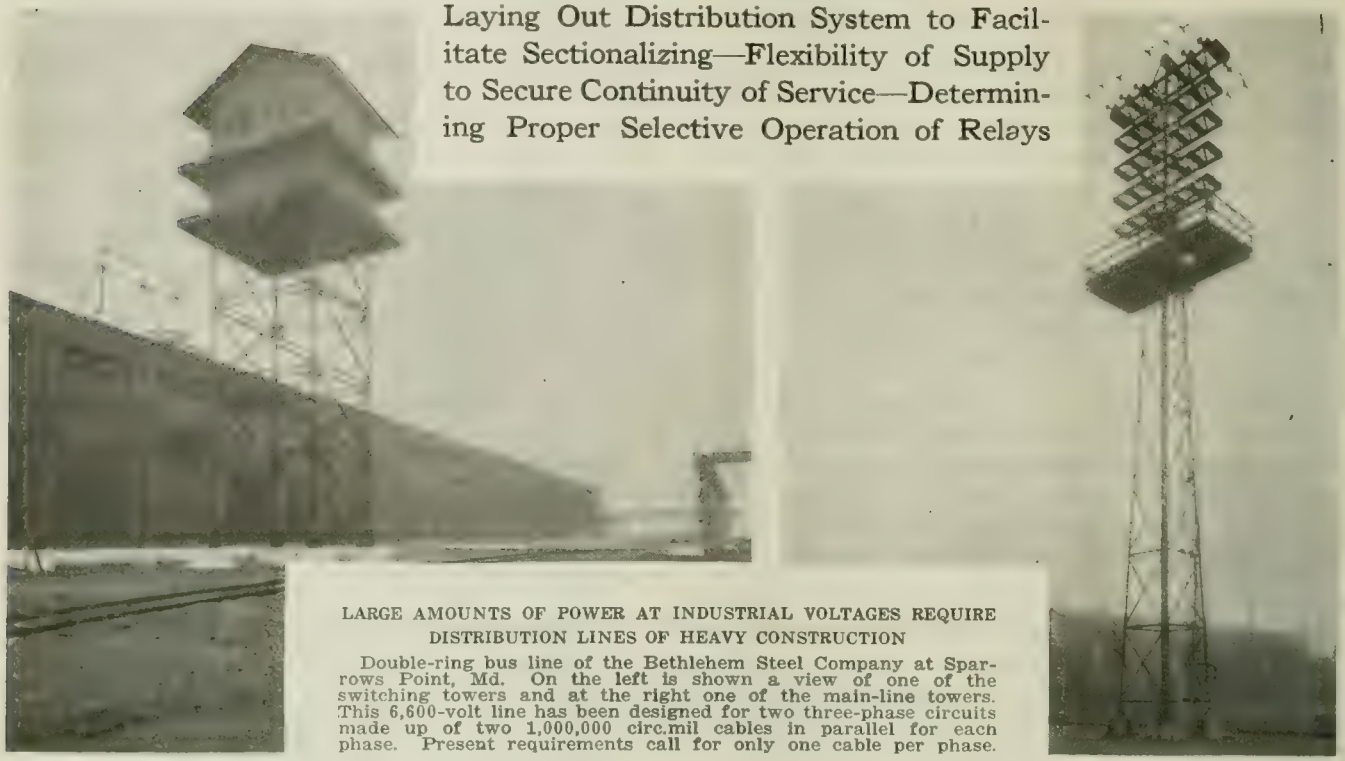
If equipped with high-efficiency engines, the woodworking establishment would have been in position to generate more than all of the electrical energy required by the municipality at night and could have generated more than enough to meet the daytime demands of the municipality as well as its own needs. In other words, instead of this establishment purchasing energy, it should take advantage of its position to sell energy to the local public utility, allowing the latter to shut down and conserve 2,000 tons of coal per year. If a transmission line should become available, the plant under consideration would be in a position to retail electrical energy to other consumers besides.

The annual bituminous coal production of this country is about 600,000,000 tons. About 90,000,000 tons is used for heating houses and other buildings, 135,000,000 tons for railroad operation, 375,000,000 tons for industrial purposes, including gas utilities, ore smelters and electric central stations. It seems reasonable to suppose that at least 200,000,000 tons is used per annum by industrial power plants. If only 25 per cent instead of the 41.5 per cent found in one typical case could be saved by electrical interconnection and other means, it would mean an annual saving of 50,000,000 tons, or 1,000,000 50-ton cars.

Protecting Industrial Distribution Lines

By R. B. GERHARDT
Electrical Engineer Bethlehem Steel Company

Laying Out Distribution System to Facilitate Sectionalizing—Flexibility of Supply to Secure Continuity of Service—Determining Proper Selective Operation of Relays



LARGE AMOUNTS OF POWER AT INDUSTRIAL VOLTAGES REQUIRE DISTRIBUTION LINES OF HEAVY CONSTRUCTION

Double-ring bus line of the Bethlehem Steel Company at Sparrows Point, Md. On the left is shown a view of one of the switching towers and at the right one of the main-line towers. This 6,600-volt line has been designed for two three-phase circuits made up of two 1,000,000 circ.mil cables in parallel for each phase. Present requirements call for only one cable per phase.

CONTINUITY of service is fully as dependent on the distribution system of the industry as it may be on the central station or the industrial plant supplying that service. If the weak link in the system is in the distribution of the power to the various sections of the plant, then greater thought should be given as to how this may be corrected. In the new plant design features may be incorporated that will adequately take care of the sectionalizing of troubles and prevent sections of the plant from being shut down by short-circuit conditions in the distribution system which should have been isolated automatically and without throwing any section of the plant out of operation. By rearranging switches and changing types of relay, together with a check of the selective action, it is often possible to improve the old system and eliminate possible interruptions of service.

At the plant of the Bethlehem Steel Company the original plans were laid out in such a way that only the most unusual and unforeseen conditions could throw any section of the plant out of service because of motor troubles, or anything else, producing short-circuit conditions on the distribution system.

The distributing system consists of a 6,600-volt, three-phase, double-ring bus, on which are installed four switching towers, with taps off to the principal substations. These substations are at the 40-in. blooming mill, the 60-in. universal plate mill, the rail mill and the coke oven. Other stations at the tin mills, sheet mills, sintering plant, shipyards, gas-pumping plant and central pumping station are fed from one of the principal substations. A portable substation, consisting of a 400-kw. rotary converter with necessary transformers and switching equipment mounted in a standard railway box car, is used anywhere around the plant where occasion requires.

As shown in Fig. 1, the loops originate and end at the gas-engine power stations, and energy from Baltimore is fed into the loops at No. 1 substation. All principal switching on the loops is designed with an ultimate capacity of 35,000 kva., and the line construction is about as heavy as is possible to install using present practice.

Steel towers, 85 ft. (25.9 m.) in height each, weighing 17,000 lb. (7,700 kg.) and supporting five crossarms and a working platform, carry the line around the plant. The lines consist of 1,000,000-circ.mil double-braid weatherproof wire, carried on special cable-top 33,000-volt insulators. At various strain points on the line special double-barreled strain insulators and clamps are used. The switching towers are the same height as the line towers and carry all the switching in a two-compartment, two-floor house at the top of the tower. The two compartments are provided so that the switching on one loop is entirely independent of that on the other loop. The substations connected to the ring bus are tied together by a three-phase, 550-volt and a 250-volt direct-current tie line. There are a complete system of relays and automatic switches for the full protection of all the lines and an independent telephone system connecting each substation with the load dispatcher. Weatherproof wire is used in all cases to protect from the corrosive action of the plant gases.

By reference to Fig. 1 it will be seen that each switching tower is protected by two oil switches, one on either side of the tap-off point, these switches being operated by relays of a directional type. The route around the ring in a counter-clockwise direction is known as

route No. 2, and that along the loop in a clockwise direction is known as route No. 1. If the fault occur between the power house and the 40-in. blooming mill, the switches should function to cut off this section of the line according to the tabulation in Case I, which

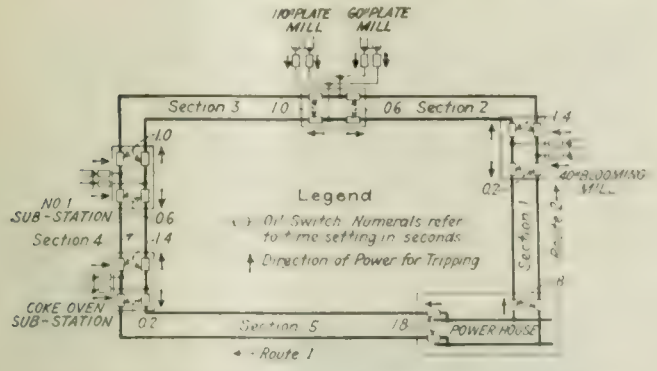


FIG. 1—SIMPLIFIED DIAGRAM OF DOUBLE-RING BUS SYSTEM, USING DIRECTIONAL RELAYS

The arrows in each case show the direction of power required to trip the relay. At each switch is given the time of operation required for the particular setting, which in this case is a little greater than full-load current for the line. Relays for the substation switches are instantaneous, reverse power relays.

gives the switches through which the current passes to reach the station at fault, an X mark indicating the switches which open.

CASE I—TIME FUNCTION OF SWITCHES TO FAULT WHERE FAULT IS IN FIRST SECTION OF THE LINE

Route No. 1, Seconds		Route No. 2, Seconds
1.8		X 1.8. Opens
0.2	(opposite direction)	
1.4		
0.6	(opposite direction)	
1.0		
1.0	(opposite direction)	
0.6		
1.4	(opposite direction)	
X 0.2	Opens	

It will be noted by reference to this table that should a fault be located in this section the power-house bus switch will open in 1.8 seconds, clearing the bus in the route No. 2 direction. By following around route No. 1 it will be seen that the first switch does not trip since its relay is operated only by power in an opposite direction. The next relay is set for one and four-tenths seconds; the one following that is set for the opposite direction, the next one for one second, the next for the opposite direction, and the next for six seconds. The relay following this is set for the opposite direction, and the next one for two seconds. The relay set for two seconds naturally goes out first on route No. 1, clearing the fault from that side.

Assuming that the next fault is between the 40-in. blooming mill and the 110-in. and 60-in. plate mills, Case II shows the selective operation of the relays:

CASE II—TIME FUNCTION OF SWITCHES TO FAULT WHERE FAULT IS IN SECOND SECTION OF LINE

Route No. 1, Seconds		Route No. 2, Seconds	
1.8		1.8	
0.2	(opposite direction)	0.2	(opposite direction)
0.4			
0.6	(opposite direction)	X 1.4.	Opens
1.0			
1.0	(opposite direction)		
X 0.6	Opens		

Each tap to a substation or mill from the switching station is protected by instantaneous reverse power relays, and to check a fault in the switching station the following conditions may be followed out as shown in Case III:

CASE III—TIME FUNCTION OF SWITCHES TO FAULT FAULT AT FIRST SWITCHING STATION

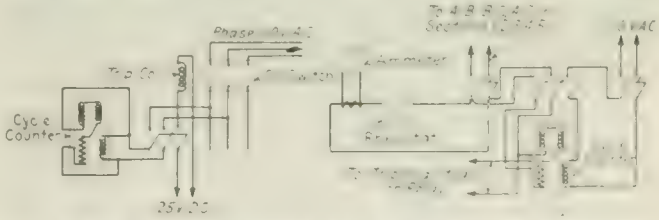
Route No. 1, Seconds		Route No. 2, Seconds
1.8		X 1.8. Opens
0.2	(opposite direction)	0.2 (opposite direction)
1.4		
0.6	(opposite direction)	
1.0		
1.0	(opposite direction)	
X 0.6	Opens	
1.4	(opposite direction)	

By choosing any possible location for a fault it will be found that the selective operation of the switches on either route works in general as illustrated. As each ring is entirely independent except for the connection at the substation buses, and protection here is instantaneous, there is hardly any possible condition that can throw a substation out of service.

TIME SETTING FOR PROTECTIVE OPERATION OF RELAYS

As a sectionalizing system is dependent on the operation of relays, the time interval of setting is most important. In the first place, the relays must be set for the greatest protective operation of the system, and in the second place, their operation must be accurate so that the proper relay will function.

The maximum relay operating current was determined in this case from the short-circuit conditions, which were calculated to be 10,950 amp. per phase, or for the relays 45.7 amp. per phase. The current setting of the relays, however, was determined by the normal load current, and the setting decided on was that which would trip the breakers at a line current of 1,920 amp. While this was a very heavy load for the line, it was not thought advisable to set the relays for a lighter load, as conditions might arise which would make it necessary to carry all the load possible for a short time. After setting the current screws at this value of current (8 amp.) all the relays were set for the proper time of tripping with a load of 50 amp., based on the 45.7 amp. short-circuit current, and the time interval was tested for several of the switches when this tripping current was applied, since the interval must not be less than this time lag of the switch, otherwise selective action could not be obtained. This test was made by connecting the oil switch to close a 25-cycle circuit of 100 volts on a cycle counter through two blades of a three-pole knife switch. As shown in Fig. 2, the third



FIGS. 2 AND 3—CONNECTIONS FOR STARTING CYCLE COUNTER AT THE SAME TIME TRIPPING CURRENT IS THROWN ON RELAY

Fig. 2 is a simplified scheme for checking [illegible] relays, and Fig. 3 is the set-up used in throwing the current on the particular section of the line to be tested, together with the relay which is supposed to trip.

blade of this switch was connected so as to throw 125-volt direct current tripping current on the coil of the breaker. By closing the knife switch the cycle counter and the tripping action were begun simultaneously, and

the opening of the oil switch stopped the cycle counter, showing the number of cycles required for the tripping action to take place. An average of numerous trials show this time interval of the breakers to be 2.4 cycles. To allow an ample safety factor and to take into account the time required to rupture a heavy arc in a switch tank, the interval between successive switch operations for proper selective action was taken as 10 cycles.

After determining the number of stations connected to the ring bus, the time setting of the relays can be figured out very easily, knowing the interval of setting determined above. Diagram No. 1 shows the simplified connections for this system, consisting of power house and four switching stations, with the sequence of operation as shown in the table.

Short-circuit conditions often set up surges that influence relays at a considerable distance from the source of trouble, causing switches to trip which according to the layout should have been entirely protected from interruption. To determine the accuracy with which these relays functioned an experimental layout was constructed which would approximate very closely the conditions to be found on the distribution system, as shown in Fig. 4. A three-phase, 110-volt circuit was connected through the relays and through contactors exactly as in the transmission lines, except that the relays were connected directly to the line instead of having current and potential transformers. Contactors were connected so that each contactor represented one pole of a circuit breaker and were held in by 125-volt direct current with a lamp in series with the coil. When the relay tripping circuit closed it short-circuited the coil of the corresponding contactor and allowed it to drop open, thus clearing the line exactly as the oil circuit breaker would do in actual operation. An overload of 50 amp. was put upon the relays at each section of both loops and all phases in turn to insure that the proper relays would operate first in each case. Power was fed to this circuit from both ends of the loop and from the center, representing the power from the generating plant and No. 1 substation respectively, to reproduce as nearly as possible actual operating conditions. By this system it was found the proper relay would operate as desired.

In order to minimize the amount of energy which could flow to a short circuit occurring in any section of one of the ring buses when both are tied together at each substation bus connected to switch towers, reverse-current relays are also provided on each circuit breaker feeding each substation, and these are set to open breakers almost instantaneously at a low current.

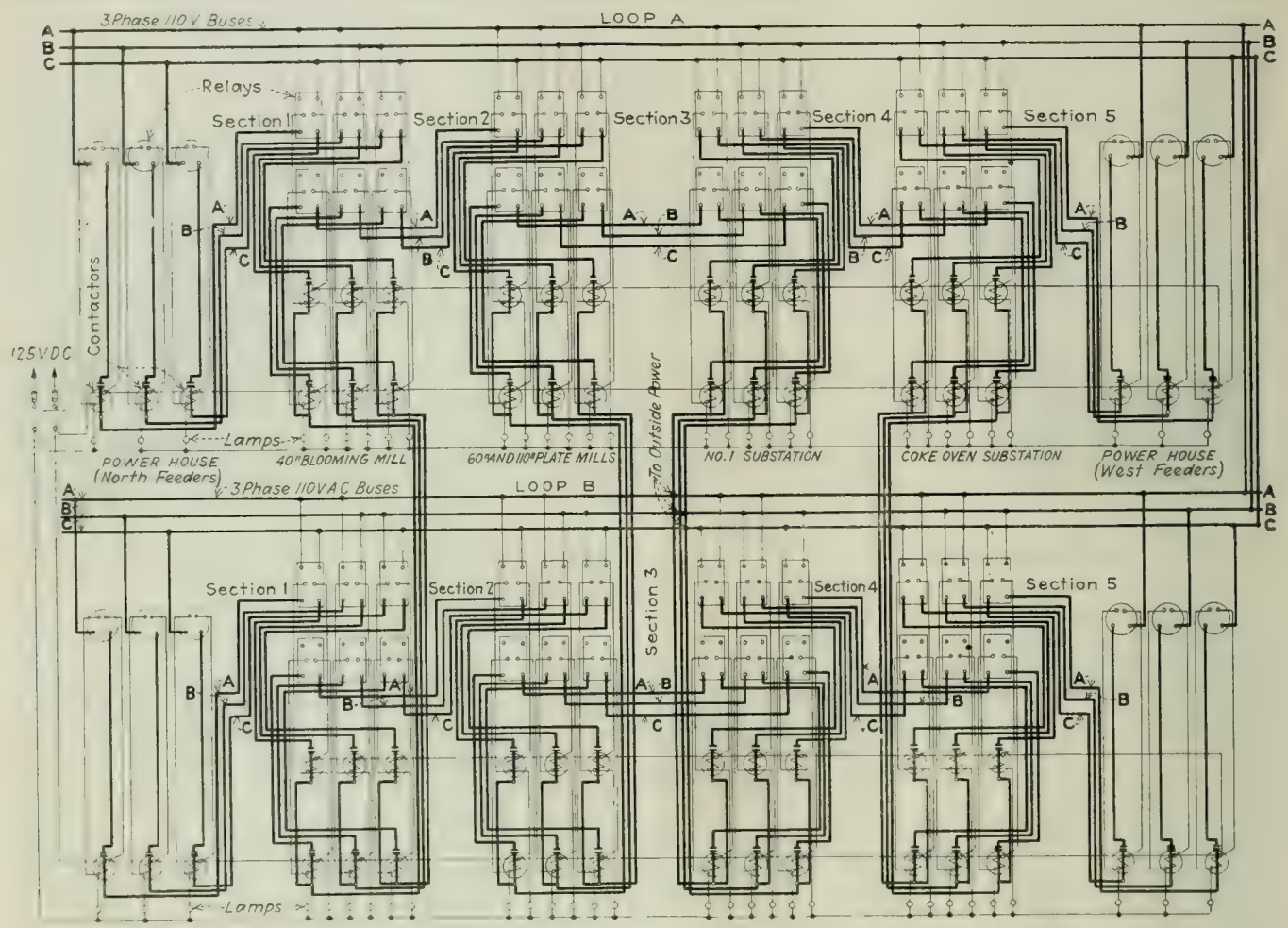


FIG. 4—MINIATURE LAYOUT USED TO DETERMINE THE ACCURACY OF RELAY OPERATION

In making the layout it is necessary to reproduce the conditions shown in the simplified diagram of Fig. 1. Single-pole contactors replace the oil switches, and when the corresponding relay trips it short-circuits the holding coil of the contactor, allowing the contactor to drop out. In this manner the section of the line is cleared in the same way as it would be with the oil switch. At each substation the two buses are tied together by the substation bus, and this condition is shown by the cross-tie lines from loop *A* to loop *B* in the diagram. The instantaneous relays used on the substation circuits and the switches themselves are not shown in this set-up as it was not considered necessary to make any test in this connection. By short-circuiting different sections of the line and at the same time noting the length of time for the circuit to be opened by using the cycle checking counter, an accurate check may be had on the relay operation of the entire system. Up to the present time only about two-thirds of the transmission system has been completed, but as soon as the remaining section is finished actual power tests will be made to check the accuracy of the selective operation.

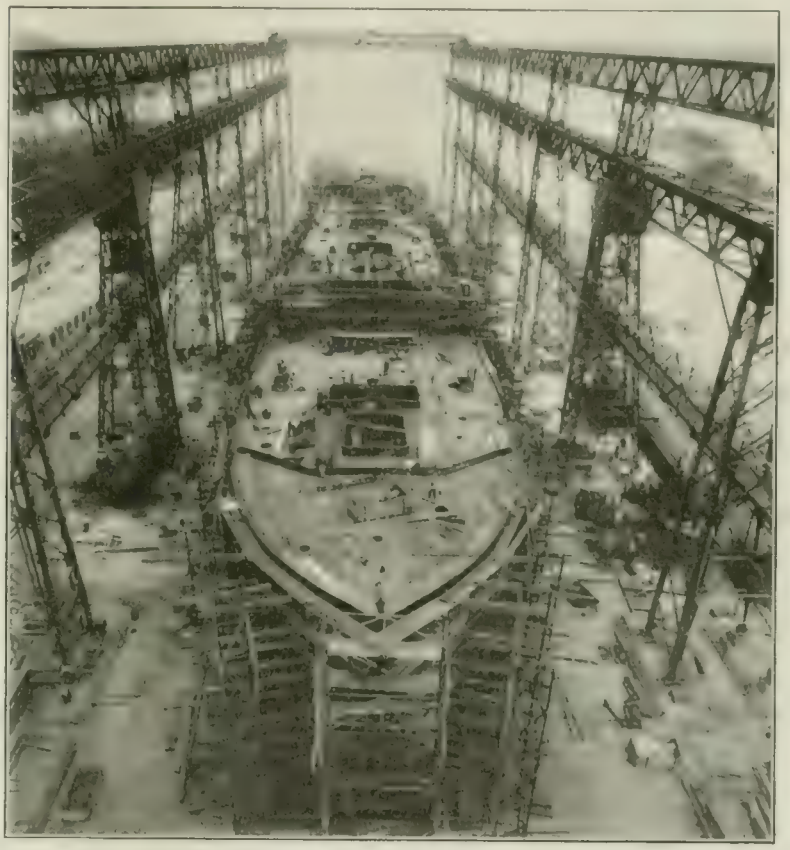
See Text-Illus Page 323

Systematic Inspection and Maintenance

Prevention of Production Delays by Careful Attention to Inspection of Electrical Apparatus Found Advantageous by the Bethlehem Shipbuilding Corporation

VIEWED from the standpoint of economic importance, uninterrupted production places a heavy responsibility upon the electrical inspection and maintenance organization of the industry. The problems of the shipyard in this regard are not peculiar or distinct from those of other industries, and the methods developed at the Fore River yards of the Bethlehem Shipbuilding Corporation are indicative of the attention now being paid to continuity of service by prevention, rather than cure, of electrical troubles.

Routine electrical construction, inspection and maintenance in the yard require a present staff of about 248 men; including crane operators. This total includes electrical-department forces engaged in ship installation work. The major portion of the inspection and maintenance of the electrical equipment in the yard proper, excluding vessels, is handled by about fifty men. At the head of the department is a foreman reporting to the assistant superintendent of the works, and under the former the force is subdivided into groups in charge of quartermen responsible for plant, merchant-boat and submarine electrical work. Other groups are in charge of so-called leading men who supervise the electrical inspection done by crane operators, of which eighty-two are employed, temporary lighting gangs and miscellaneous service.



INSPECTION OF MOTORS IN SHIPYARD WORKS PLAYS AN IMPORTANT PART IN REDUCING LOSS OF TIME

This particular view shows the craneway over merchant vessel under construction at the Fore River works of the Bethlehem Shipbuilding Corporation

Emphasis is laid at every point in the organization upon the prevention of trouble and upon the quickest possible restoration of service in case of equipment failure. The inspection and maintenance work is combined to this end. The inspectors are all electricians, and to each man considerable latitude in his work is allowed, though he is held strictly accountable for the performance of equipment in his assigned area. The more important apparatus receives frequent examinations, and regular records of inspection are a vital feature of the departmental service. No instruction books are used, and individual inspectors follow their own preference in regard to sequence of examinations, except that weekly oiling of motors and monthly checking of armature or rotor clearances are required, with cleaning intervals depending on class of service and running usually in very active departments upon a weekly or shorter basis.

The flexibility of the organization and the individual latitude allowed in detailed work do not, however, permit the overlooking of important routine. The crane service is the most important motor work in the yard, and for this reason crane operators are required to make a daily written report on crane conditions and are included in the inspection force. These reports, 4 in. x 5 in. (10 cm. x 12.5 cm.) in size, cover the mechanical and electrical status of the major parts of each crane, also giving the production hours lost in case of interruption and notes on repairs effected. They are filed daily at the office of the electrical department. One report per crane is prepared per shift.

From the daily reports of crane operators a 7-in. x 9-in. (17.5-cm. x 22.5-cm.) weekly report of breakdowns on cranes is prepared by the clerical staff of the departmental office, showing the crane number, date and period of outage, cause of breakdown and the repair man concerned in service restoration. It is not considered necessary to compile periodical summaries of the weekly reports. The regular inspection includes examination of commutators, brushes, observation of bearing conditions, vibration, heating, control and gearing condition.

A graphic chart of motor inspection is prepared for each department and kept on file in the electrical department office. This provides space for checking the condition of every motor on every day of the month, and shows at a glance the regularity of cleaning, oiling, the air-gap clearance, periods of idleness on account of repairs or lack of work for a particular tool and the date on which bearings were washed. On the original record colored symbols are used to report these condi-

tions, those requiring prompt attention being indicated in red. A typical record for the joiner shop during June, 1920, covers forty-four motors and shows that each motor was oiled six times and cleaned six times, with one air-gap examination. Six motors had their bearings washed out with kerosene. Any irregularity in inspection routine is immediately noted, and the work of field inspectors is frequently checked.

From time sheets turned into the office daily a weekly report of the maintenance work performed by electrical department employees is prepared and a copy sent to the department in which the work is done. This gives each department head, including the foreman of electrical inspection and maintenance, a continuous record of the cost of repairs on his equipment, and it affords a basis for budget estimates in connection with appropriations

MASTER MOTOR RECORD

MANUFACTURER				FILE NO.
ADDRESS				H.P.
WOUND	TYPE		FORM	STYLE
VOLTS	AMPERES		R. P. M	COMM / PULLY / END SHAFT
BRUSHES				
TH WC	SHUNT	COMM END BEV	HOLDER END BEV	GRADE / STOCK / NO. IN USE
BEARING				
NO.	INSIDE DIA	OUTSIDE DIA	LENGTH	METAL / OIL RINGS
COMMUTATOR		BRUSH HOLDERS		STUDS

	ARMATURE	SHUNT	SERIES	INTERPOLE	REMARKS
COILS					
FORM NO.					
MFGRS NO.					
SIZE WIRE					
NO TURNS					
LAYERS					
WEIGHT					

REMARKS

FIG. 1

INDIVIDUAL MOTOR RECORD

MANUFACTURER			SERIAL NO.
ADDRESS			H.P.
			FILE NO.
NAME PLATE DATA			
WOUND	TYPE	FORM	STYLE
VOLTS	AMPERES	R. P. M	

STARTER DATA

DATE	LOCATION	MACHINE NAME	DETH. NO.

REMARKS

FIG. 4

WEEKLY REPORT
LABOR

DEPARTMENT DATE

D151A AND D151H

DATE	NAME	NO.	RATE	HOURS	COST	REMARKS	O.K.

FIG. 2

PRODUCTIVE HOURS LOST IN BREAKDOWNS

TA-DEPT.

WEEK ENDING	CRANES, LOCO. & GANTRY		TRUCKS		REMARKS
	MECHANICAL	ELECTRICAL	MECHANICAL	ELECTRICAL	
Feb 14	0	0	0	10	
" 21	5	0	12	10	
" 28	9	0	8	28	
Mar 6	0	0	6	12	
" 13	0	0	9	0	
" 20	25	3	0	0	

FIG. 5

S 5025

BETHLEHEM SHIPBUILDING CORPORATION LTD
FORE RIVER PLANT

OPERATORS DAILY REPORT ON CRANE CONDITIONS

CRANE NO M 11 DATE 6/30/20
SHIFT 2nd

CONDITION Good Fair Poor ✓
LONG TRAV OK
BRAKES CROSS TRAV OK MOTORS Fair
HOIST Bad
CABLES Fair
WHEELS Bad LONG TRAVEL Good
CROSS TRAVEL Fair
CONTROLS Fair
NO PASS HAS LOST 2
FIRE EXTINGUISHERS Burns
REMARKS Held up 45 min. for Foreman
Bolt.

FIG. 6

PATTERN SHOP JUNE 1920

H.P.	TYPE	MACH. NAME	MACH. NUMBER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
			60971		O	X				O			X	O			X		O	△					X	O	X	X			O		X
			60960		O	X				O			X	O			X		O	△					X	O		X			O		X
			60976		O	X				O			X	O			X		O	△					X	O		X			O		X
			60915		O	X				O			X	O			X		O	△					X	O		X			O		X
			61902		O	X				O			X	O			X		O	△					X	O		X			O		X
			54708		O	X				O			X	O			X		O	△					X	O	X	X			O		X
			53905		O	X				O			X	O			X		O	△					X	O		X			O		X
			63906		O	X				O			X	O			X		O	△					X	O		X			O		X
			60707		O	X				O			X	O			X		O	△					X	O		X			O		X
			63907		O	X				O			X	O			X		O	△					X	O		X			O		X
			54703		O	X				O			X	O			X		O	△					X	O		X			O		X
			60705		O	X				O			X	O			X		O	△					X	O		X			O		X
			54307		O	X				O			X	O			X		O	△					X	O		X			O		X
			63904		O	X				O			X	O			X		O	△					X	O	X	X			O		X
			54709		O	X				O			X	O			X		O	△					X	O		X			O		X
			54311		O	X				O			X	O			X		O	△					X	O	X	X			O		X
			54702		O	X				O			X	O			X		O	△					X	O		X			O		X
			54710		O	X				O			X	O			X		O	△					X	O		X			O		X
			54711		O	X				O			X	O			X		O	△					X	O		X			O		X
			4461		O	X				O			X	O			X		O	△					X	O		X					
			64606		O	X				O			X	O			X		O	△					X	O		X					
			54704		O	X				O			X	O			X		O	△					X	O		X					

Graphic Motor Inspection Chart

— Idle for Mechanical repairs
△ Air gap clearance O.K
• Motor cleaned
✱ Motor cleaned and Babbitt Bearings washed
▲ Air gap clearance dangerous
---- Idle, Electrical repairs
Oiled
Idle, not working

FIG. 3

OUT OF ORDER

FIG. 7

BETHLEHEM SHIPBUILDING CORPORATION LTD.
FORE RIVER PLANT

				REPAIRMAN
			Man bully grounded	S. 468
			Bully wire grounded & burned off	S. 468
				S. 468

FIG. 8

MOTOR INSPECTION AND MAINTENANCE RECORDS USED AT THE FORE RIVER SHIPYARD

There are 1,500 motors totaling 8,000 hp. and motor records are carried on card shown in Figs. 1 and 4. The master motor card gives details of a type and saves duplicate entries on the individual card. Fig. 3 shows the graphic record of motor inspections and Fig. 5 a graphic record of productive hours lost. Crane operators report daily on form shown in Fig. 6 and the reports are summarized on form shown in Fig. 8. Apparatus out of order is tagged with tag shown in Fig. 7.

for future repair service. It is not considered necessary to prepare periodical summaries of these records, although they are available, as are the crane breakdown reports previously mentioned, in case executive analysis of equipment performance are demanded.

Whenever a motor-driven machine is taken out of service a 6¼-in. x 3⅛-in. (15.6-cm. x 7.8-cm.) red tag is attached to it by the electrical inspector, who tears off a red check strip and turns it over to the electrical department foreman pending completion of repairs. Each tag is provided with wire to facilitate its rapid attachment to the machine. The dates of suspension and of restoration are indicated, so that the hours and minutes' duration of service outage may be computed. The tag also shows who is responsible for removing the machine from service and other notes as required. When the machine is restored to service the foreman of the electrical department is notified and the section of the tag in his custody is filed.

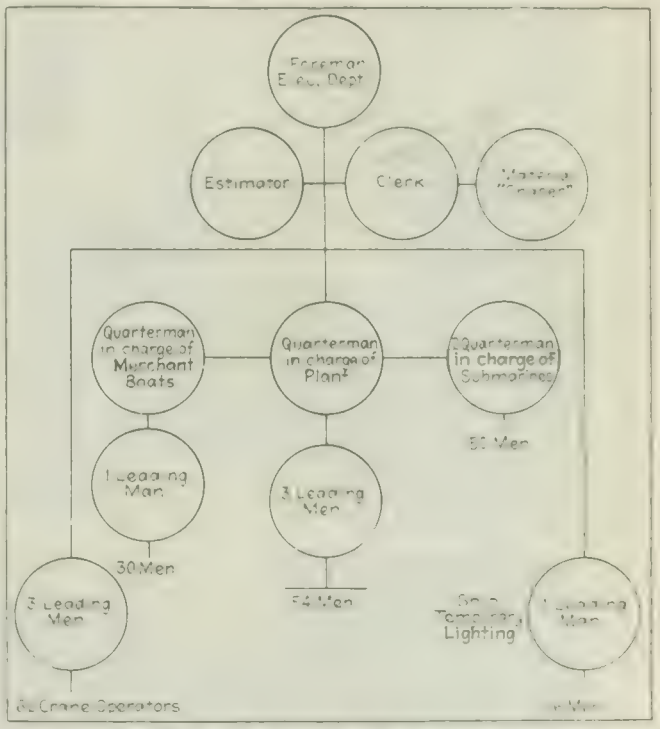
The great number of motors and other electrical equipment used at Fore River necessitates a complete record of each unit, so that repairs can be made in the minimum time. A new card system just going into effect consists of two types of cards, one known as an "individual motor record" and the other as a "master motor record." The "individual motor record" lists each motor by name-plate data, starter data, company number, manufacturer's name, rating and serial number. This card is designed merely to provide a proper record of each unit of motive power, regardless of how many times such a motor may be duplicated in the plant. The card is given a file number corresponding to the file number on the "master motor record" card and in this way the data on the latter may be quickly found and applied.

The "master motor card" gives the essential data for repairs on each type, size and design of motor, using one card for each change in specifications. All the necessary data for rewinding a 5-hp., 220-volt direct-current motor of a given make and speed, for instance, are recorded on a "master motor record" card, with particulars as to pulley, bearing, brush, armature, coil and commutator design sufficient to enable new parts to be ordered without delay or else manufactured in the electrical shop of the yard. This scheme saves a vast amount of labor, avoiding the necessity of recording over and over again the essential information for duplicated units on the backs of individual motor cards such as are ordinarily maintained in industrial plants. The record cards are 5 in. x 8 in. (12.5 cm. x 20 cm.) in size and thus offer much more space for data than the 3-in. x 5-in. (7.5-cm. x 12.5-cm.) cards so often found in factories.

Recently a graphic chart showing the productive hours lost as a result of breakdowns of equipment has been put in use at Fore River, one being prepared weekly for each department. The result of the inspection and maintenance work thus appear at a glance, expressed in the most significant units on a weekly basis. In a typical departmental chart covering the period from Feb. 7 to June 19 it appears that the time per week lost by mechanical troubles on cranes varied from zero to twenty-five hours, there being six weeks in which no service outage occurred from this cause. In only five weeks of this period were the total productive hours lost in excess of sixty minutes for any one week. Electrical troubles on cranes in this department caused a maximum loss of seventeen hours, and in nine weeks no productive hours were lost from electrical causes. The plotting of these outages enables the recurrence of any particular class of trouble to be "spotted" quickly, and the absence of rectangular areas indicating the hours lost contributes toward a "clean sheet."

In general, electrical repair work is performed on an "hourly bonus contract" system, which has reduced the cost of some jobs 50 per cent in comparison with a flat day rate. Such work as slotting commutators, rewinding armatures, making armature coils, stripping armatures, rewinding portable drilling and reaming machines, mechanical jobs in the electrical shop, making portable extension lights and stringers and rewinding alternating-current stators is scheduled in this way. From thorough studies of the time required to perform given jobs a base curve showing the hours allowed, either *in toto* or per unit, is prepared, so that the allowed time can be checked readily.

Including portable apparatus, about 1,500 electric motors are in service at Fore River. Of these, 792 are



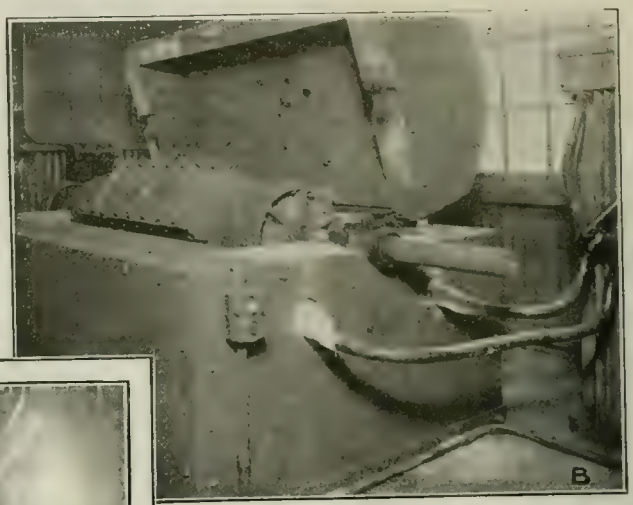
MOTORS FOR CRANE SERVICE ARE A VERY IMPORTANT APPLICATION IN THE SHIPBUILDING INDUSTRY

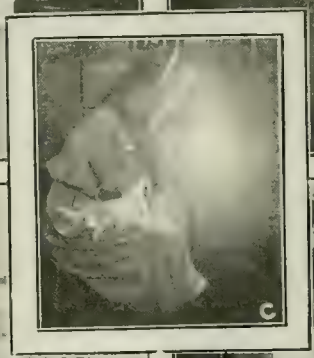
In the Fore River yard there are fifty-six cranes, ranging in capacity from 5 tons to 75 tons. Power service for these cranes is 220-volt direct current.

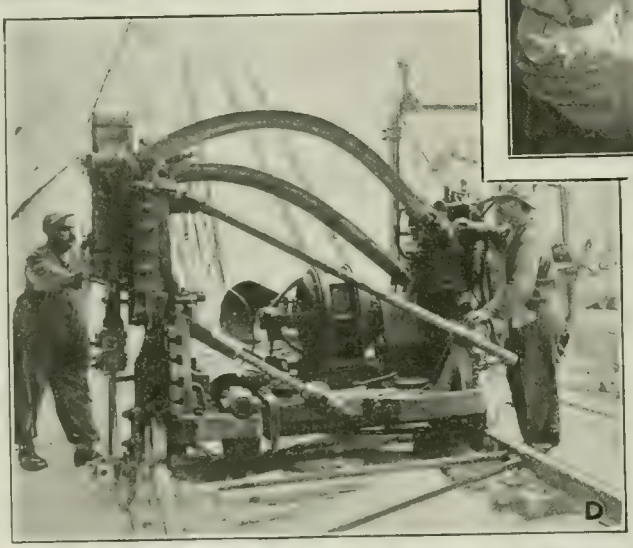
motors driving equipment of the heavier type. The total connected power load of the yard is about 8,000 hp. The motors range in size from fan motors up to 787-hp. air-compressor equipment, and the variety of service covers the operation of cranes, machine tools, trucks, elevators, drills, reamers, office devices, hoists, engraving and blueprinting machines, and electric riveting and welding apparatus, signaling systems, storage battery, testing and radio work. There are at present only a few alternating-current motors in the plant, most of the energy being transformed into direct current in a substation connected with outside sources of supply. The standard power service is at 220 volts. Fifty-six electric cranes are in use, ranging in capacity from 5 tons to 75 tons and in span from 50 ft. to 120 ft. (15 m. to 36.5 m.).

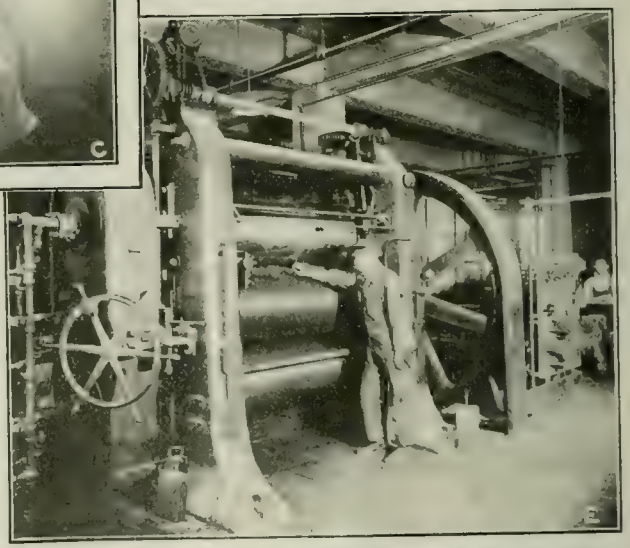
Electrical Development and Industrial Progress Have Become Almost Synonymous

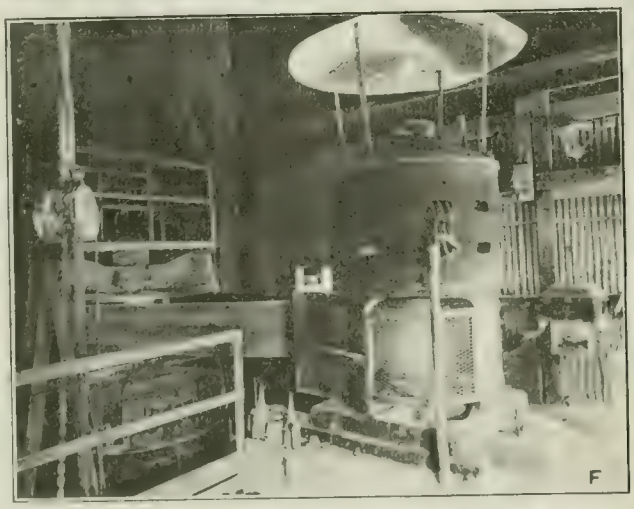


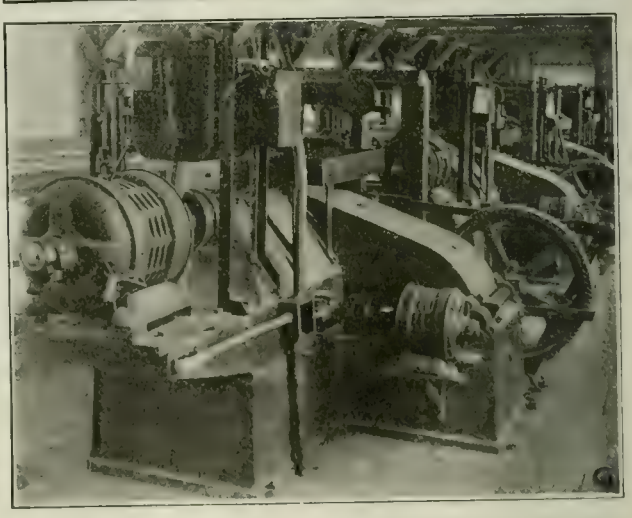












A—Electrical precipitation is saving thousands of dollars for smelting and refining companies. Twelve sets for this purpose are shown installed at the Murray plant of the Smelting & Refining Company.

B—Electric sherardizing furnaces are well established even though not familiar to many engineers. The furnace illustrated has its transformer conveniently situated.

C—Application of electric welding to ship building, chain making, structural steel repair and assembly has effected many economies. Oil circuit breaker tanks are being welded by operator shown in the inset.

D—Combined electric-air channeler used by Vermont Marble Company indicates just one entry of electricity into a field that was formerly considered exclusively pneumatic.

E—Rubber plants are firm advocates of first-class electrical equipment. A three-roll calendar driven by an automatic calendar motor is shown.

F—Cement-mill service is a severe duty for any machinery, but motors are measuring up to every phase of it. A 250-hp. 2,200-volt motor driving a vertical mill in the Siegfried (Pa.) plant of the Lawrence Portland Cement Company is illustrated.

G—Lumber mills are being electrified from head saws to shingle-mills with great satisfaction. The shingle-mills shown are driven by one 20-hp. and one 3-hp. squirrel-cage motor.

Burning Sawmill Refuse*

Comparison of Wood Refuse Fuel with Fuel Oil—How to Determine When Price for One Is More Economical Than the Other—Tests of Fuel Using Various Methods of Firing

By DARRAH CORBET
Engineer C. C. Moore & Company, San Francisco

THERE has not been a very extensive use of sawmill refuse fuel in power plants up to the present time owing to the fuel being so bulky and inconvenient for handling in large quantities and also because other fuels have been available at prices which make them more attractive. On account of the recent very rapid increase in the costs of coal and oil fuel there has been a strong tendency, particularly on the Pacific Coast, toward the use of sawmill refuse fuel.

Certainly one of the reasons why mill refuse fuel has not been more extensively used is the difficulty of transporting and storing it. The fuel is very bulky and on account of its characteristics is rather difficult to handle.

The methods which are in use at the present time to transport the fuel consist in the main of barges, railway cars with special bodies, and trucks. The difficulty is almost always in loading enough fuel into the transporting vehicle in order that it be given an economical load.

In the sawmills this class of material has in a great majority of cases been handled over chain conveyers. These are of various types, but the principle is to scrape

*Presented before Portland (Ore.) Section, A. I. E. E., this week.

RESULTS OF TEN TESTS CONDUCTED IN PLANT OF PORTLAND RAILWAY, LIGHT & POWER COMPANY TO DETERMINE EFFECT OF DIFFERENT FIRING CONDITIONS

	Test No. 1	Test No. 2	Test No. 5	Test No. 6	Test No. 7	Test No. 8	Test No. 9	Test No. 10	Test No. 12	Test No. 13
Boiler on test	No. 3	No. 3	No. 3		No. 3	No. 3	No. 3	No. 3	No. 6	No. 7
Kind of boiler	B. & W.	B. & W.	B. & W.	B. & W.	B. & W.	B. & W.	B. & W.	B. & W.	B. & W.	B. & W.
Kind of furnace	Extended Dutch oven	Extended Dutch oven	Extended Dutch oven	Riley stoker	Extended Dutch oven	Extended Dutch oven	Extended Dutch oven	Extended Dutch oven	Extended Dutch oven	Extended Dutch oven
Grate surface, sq ft	121.8	81.6	105.8	114.5	130.8	130.8	87.2	87.2	100	87.2
Water heating surface, sq ft	4,399	4,399	4,399	4,440	4,399	4,399	4,399	4,399	4,399	4,399
Ratio of water-heating surface to grate surface	36.1 to 1	53.9 to 1	41.6 to 1	38.8 to 1	33.6 to 1	33.6 to 1	50.5 to 1	50.5 to 1	44 to 1	50.5 to 1
Ratio of total heating surface to grate surface	36.1 to 1	53.9 to 1	41.6 to 1	46.2 to 1	33.6 to 1	33.6 to 1	50.5 to 1	50.5 to 1	44 to 1	50.5 to 1
Volume of combustion space between grate and heating surface, cu. ft.	1,150	1,150	1,150	916	1,150	1,150	1,150	1,150	1,200	1,150
Distance from center of grate to nearest heating surface, ft	9.5	10	9.5	8.0	9.5	9.5	10	10	10.5	11
Steam pressure by gage, lb	171	160	162	187	160	174.5	170	173	176	179
Temperature of steam, deg.	372	361	368	572	369	376	373	378	375	
Temperature of feed water entering boiler (economizer not working during tests), deg	84.4	77.5	86.5	74.3	65.8	68	84.9	84.9	72.5	84.70
Temperature of escaping gases leaving boiler, deg	610	600	560	670	520	570	520		460	609
Force of draft in inches of water:										
Draft in main flue near boiler, in.	0.444	0.27	0.43	0.71	0.48	0.48	0.50	0.40	0.36	0.51
Draft in first pass, in	0.259	0.14	0.29	0.37	0.36	0.31	0.32	0.21	0.19	0.21
Draft in ash pit, right, in	0.013	0.016	0.005		0.005	0.022	0.01	0.007	0.00	0.014
Draft in ash pit, left, in	0.0095	0.0065	0.004	...	0.004	0.024	0.007	0.018	0.005	0.010
Draft in bridge wall air duct, in	...	...			0.25					
Percentage of moisture in fuel as fired	50.1	49.8	41.6	35.2	35.7	44.06	46.6	34.6	47	56.8
Percentage of ash and refuse based on dry fuel	0.41	0.57	0.53	5.16	0.44	0.35	0.49	0.47	0.68	0.69
Total equivalent evaporation from and at 212 deg., lb	174,356	111,476	134,712	164,068	109,844	167,343	154,700	202,790	107,670	148,350
Dry fuel per sq.ft. of grate surface per hour, lb	49.3	23.2	49	48	42.5	42.5	57.9	81.0	37.6	58.8
Equivalent evaporation per hour from and at 212 deg. per sq. ft. of water heating surface, lb	39.6	3.2	38.3	6.16	4.16	3.43	5.02	6.14	4.1	4.82
Percentage of rated capacity developed	114	91.8	110	178	121	158	146	178	118	140
Water fed per pound of fuel as fired, lb	1.58	2.2	1.64	2.56	1.79	2.02	2.0	2.12	2.07	1.9
Equivalent evaporation from and at 212 deg. per pound of fuel as fired, lb.	1.81	2.5	1.9	3.29	2.12	2.40	2.34	2.5	2.43	2.2
Calorific value of 1 lb. of dry fuel by calorimeter, B.t.u.	9,170	8,375	8,740	8,700	8,620	8,750	9,220	8,450	9,140	8,710
Available calorific value of 1 lb. of fuel as fired (calculated), B.t.u.	3,920	3,734	4,561	5,178	5,069	4,315	4,315	5,076	4,231	4,310
Efficiency of boiler, furnace and grate, per cent	38.4	54.6	35.8	60.1	37.0	47.7	46.1	44.0	48.5	46.1
Kind of firing	Double chute	Hand fired	Single chute	Riley stoker	Single co. te	Four chutes	Two chutes	Le chutes	Two chutes	Two
Arrangement of furnace	Normal	Short grates, low bridge	Normal	Three overfeed chutes	Bridge curtain walls	Same as No. 9	Short grates same as No. 7	Same as No. 9	Low grates, high bridge	Grates raised, bridge

Test No. 1 was made with the boiler and furnace as found. Test No. 2 was made with the same boiler and furnace as test No. 1, but here hand firing was resorted to in an endeavor to show that by so doing better results could be secured from an economical standpoint than by firing through fuel holes, as was done in the first test. In test No. 5 the same general furnace arrangement was used as in the two previous tests, but a single fuel hole was used instead of two in parallel. Test No. 6 was made on a Babcock & Wilcox cross-drum boiler with a Riley stoker. Three feed chutes fed supplementary fuel through the front of the furnace. Before test No. 7 the bridge wall construction was changed and a curtain wall or hanging arch was provided almost directly above the bridge wall. There was a marked decrease in the amount of cinders discharged from the boiler during the test. Test No. 8 was run with the general construction of furnace as in test No. 7 except that four fuel holes were used to feed the furnace rather than one. Before this test the grate area was reduced from that in previous test by taking out some of the grates at the back of the furnace. During this test only two of the front firing holes were used. In test No. 10 especially dry fuel was used. The general furnace arrangement was as in previous test. Test No. 12 was made on boiler No. 6 at Station "L" of the Portland Railway, Light & Power Company plant. The grates were 8 ft. long, the front portion of the grates being about 6 ft. 5 in. below the crown of the arch and in the rear about 7 ft. 10 in. The grates were therefore considerably lower, approximately 1 ft. 1½ in., than the grates in boiler No. 3. In test No. 13 boiler No. 7 at Station "L" was used. Grates were 7 ft. 2 in. long by 12 ft. 2 in. wide. Two fuel holes covered the width of the grates. Secondary air for combustion was admitted through grates placed at the top of the hollow bridge wall.

the fuel along a smooth trough from one point to another. Another common means of moving it is by blowing the lighter fuels, such as planing-mill shavings, etc., with a strong blast of air from one point to another, depositing it in bins or other conveyors.

There are limitations to the use of belt conveyers, narrow belts being unsatisfactory because so much of the fuel is lost over the side. Then, again, it is not very satisfactory to unload the belt at more than one point unless a tripper is used, and this is so expensive a piece of apparatus that its use is not warranted in small plants. There is a question as to whether belt conveyors should be troughed or flat, although there seems to be no serious objection to the troughed belt.

Storing Refuse Fuel

In sawmill plants it has been the custom to store the fuel in fuel houses, at which point all of the various kinds of refuse that come from the mill are collected, excepting of course the larger sticks and pieces, which are usually burned up in a refuse burner. Such storing of the fuel is quite satisfactory where large quantities do not have to be handled, but experience has indicated that a great deal of difficulty is experienced in removing this fuel from large fuel-storage bins. In such containers when the fuel is allowed to stand for a time it settles down into a very compact mass, and some mechanical means should always be used for loosening the fuel up on the surface and gradually working it down from the top.

On account of the difficulty of storing the fuel in houses large quantities have recently been stored in the open and later reclaimed for fuel use. The two largest storages at present are the one at Station "L" of the Portland Railway, Light & Power Company and the one at the plant of the Northwestern Electric Company, both at Portland, Ore. It is not very expensive to store fuel in this manner if ground space is not too valuable. The fuel is moved with specially made rakes, and in a well-designed installation little labor is necessary.

There has been a great deal of discussion as to the possible fire hazard in storing large quantities of this fuel either in fuel houses or out in the open. No record has been found of any fire due to spontaneous combustion and but few fires have occurred which have destroyed fuel houses. When piled up in a large mass this fuel is very hard to burn and can be burned from the surface only, so that severe conflagrations are not at all likely.

There is unquestionably some depreciation in the fuel value of mill refuse when stored, particularly in the open, for a material length of time. Under ordinary circumstances this amounts to little. At least one sample of fuel which had been stored eight months in the open was analyzed by the Portland Railway, Light & Power Company, and the analysis seemed to indicate that there was a large increase in the moisture content of the fuel, some slight increase in the amount of ash and a little falling off in the B.t.u. per pound dry fuel.

This fuel in general gives a very even heat for absorption by the boiler, and any well-designed boiler should be satisfactory. As the ash and cinder from the fuel is very light it is readily carried over into the boiler heating surface, and the design of the boiler should be such as to eliminate as far as possible horizontal baffles or other horizontal surfaces where the cinder might collect, cutting off the heating surface of the boiler and possibly causing trouble if allowed to remain and get moist.

Although it is quite probable that as good or possibly better efficiencies could be obtained with hand firing, the great majority of installations feed the fuel to the furnace in a more or less continuous stream, the fuel being delivered through a hole in the top of the furnace to pile up in a cone on the grates. This method of firing is much the most simple and economical from a labor standpoint, one man being able to take care of several thousand horsepower of boilers in a properly designed plant.

In order to expose the greatest possible amount of surface of the cone for burning and yet to prevent excessive infiltration of air through the grates each fuel pile should cover practically a square section of grate. Experience has indicated also that this is essential for the best operating conditions. If additional grade surface is desired in front of a boiler, then the furnace can be so designed that there will be two fuel piles for each furnace, piles being arranged in tandem, the grates then being virtually twice as long as they are wide.

A furnace approximately 6 ft. (1.8 m.) wide appears to be ideal, but in many installations it is impossible to secure ideal conditions, and therefore furnaces have to be designed, many of them operating in an entirely satisfactory way, which vary from the width specified above. It is very probable that a reduction in the width of the furnace is more serious than an increase and many satisfactory installations have been made where furnaces are 12 ft. (3.6 m.) wide, but in such cases the grates are covered by at least two fuel holes across the width of the furnace.

Experience has indicated that with any type of fuel furnace temperatures can be varied by changing the area through the throat of the furnace. Any tendency to bottle up the furnace results in a material increase in furnace temperatures. High temperatures are desirable for burning ordinary sawmill refuse, and this bottling effect can be and is obtained most advantageously by running the bridge wall up to such a point as will give desired temperature without interfering materially with the draft. The furnace should be surrounded on top and sides with incandescent firebrick. The reflected heat aids in the combustion of the fuel and the distillation of the moisture present.

The area through the throat of the furnace should be from 6 sq.in. to 14 sq.in. (39 sq.cm. to 90 sq.cm.) per rated boiler horsepower, depending upon fuel conditions, design of furnace, the rating which is to be expected and the available draft. As the combustion is mostly on the surface of the cones of fuel the air should be available at these points. It is as undesirable to have excess air with this class of fuel as with any other.

High Furnace Temperature Needed for Distilling Off Volatiles

The analyses of this class of fuel that have been made indicate that they contain a very large percentage of volatile. It can readily be understood that this will be quickly distilled off in a hot furnace, and in addition much of the finer fuel is quickly carried out of the furnace by the force of the draft. These conditions make it highly desirable that the installation be provided with a combustion space back of the furnace and before the heating surface of the boiler is reached, in order that this unconsumed fuel can have an opportunity to burn before it reaches the heating surface of the boiler. In this combustion space there should be tuyères and a door or damper to control the admission of air to them.

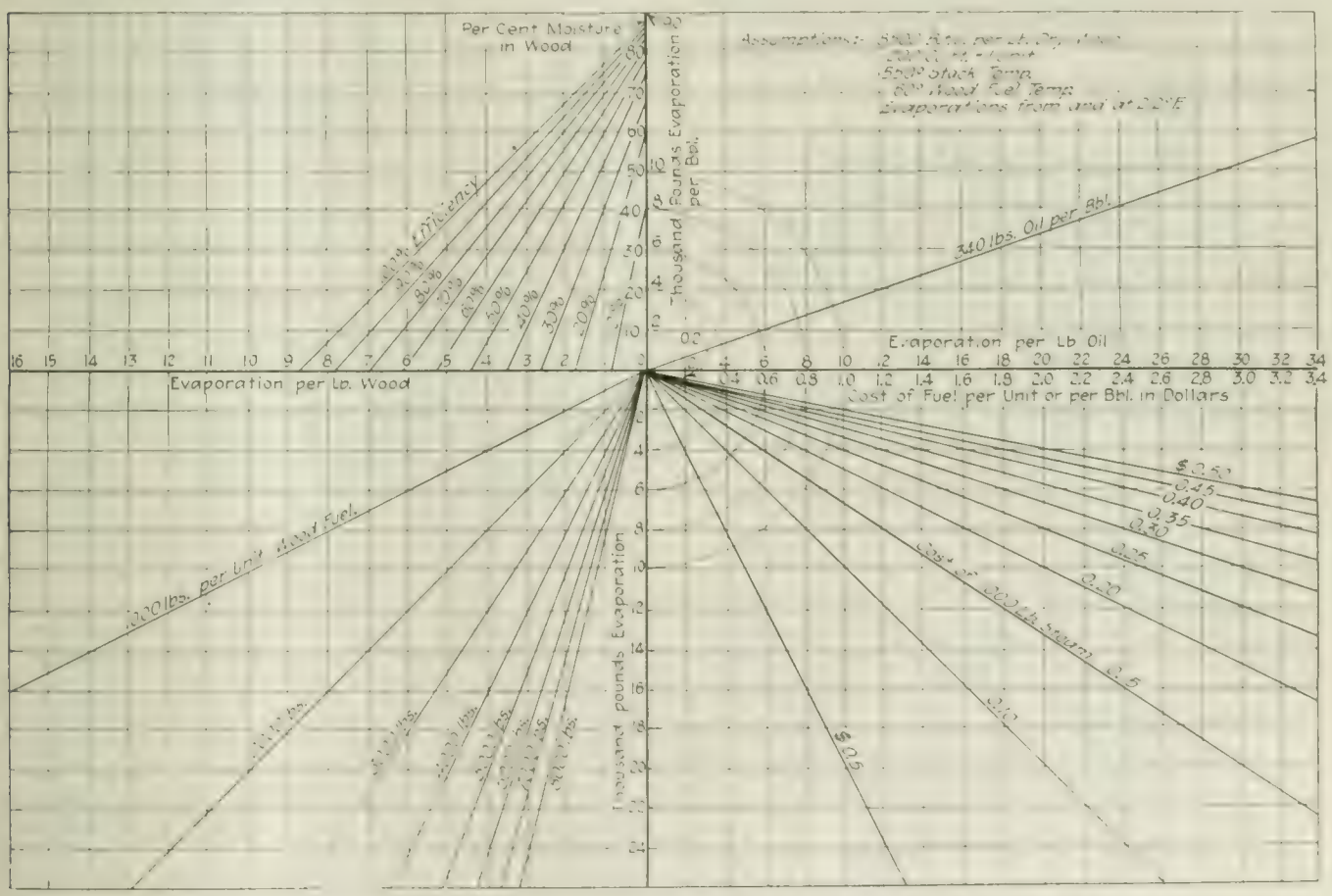
Experiments have indicated that the most satisfactory place for admitting air is either on the top of the bridge wall or on the back face of it. On the top of the bridge wall the air can be admitted through grate bars and on the back face of the bridge wall through openings made by leaving out single bricks. The difficulty with the opening on the top of the bridge wall is that it may become clogged with soot or ash. Under any circumstance, for the most efficient conditions, the arch of the furnace should extend beyond the point where the supplementary air is admitted. This arrangement brings the gases and the air most intimately in contact with each other.

There are many different designs of grates for sawmill refuse, but the simpler grates are much the best, either the straight bar or the herringbone. Smaller bars are preferable owing to the fact that in overheating they will not warp so far out of line as a longer bar and it is less expensive to replace them. The width of air opening in the grate is very important and depends upon the class of fuel to be handled. Where there is a large amount of fine sawdust the width of air space should be less. There is a certain amount of fuel that falls through the grates, and this should be prevented as far as possible. Experience has seemed to indicate that the width of the air space should not be more than ½ in. While no experimental data are available, it would seem that sawmill refuse fuel burned on shaking grates should be satisfactory on account of the very large percentage of air space (35 per cent or more) which can be obtained with this type of grate and with an air opening not to exceed ¼ in. (6.3 mm.). It would be particularly easy to keep such a grate clean. Ordinarily there is a certain amount of dirt fed into the furnace with sawmill refuse. This collects on the grate surface and has periodically to be removed.

In the majority of plants the ash pit below the grates is comparatively shallow, and the fuel which sifts through the grates burns readily on account of the high temperature. Great difficulty is experienced in making grate bars and bearers stand up under these severe conditions. Practically all installations are provided with some means for flooding the ash pit or quenching fire in the ash pit with a hose. Sluicing ashes out or designing the installation to provide a deep ash pit would be a good method to use in overcoming this difficulty.

The fuel value of woods in general varies directly as the specific gravity. As the calculated calorific value of resin is about two times that of wood, it is evident that the resin present has considerable influence on the heating value.

There is also a variation in the mixture of woods making up the fuel.



PRICE WHICH CAN BE PAID FOR SAWMILL REFUSE TO EQUAL FUEL OIL AT ANY PRICE

As an explanation of the use of the curve assume the following conditions and follow through a determination: Oil, $1 a barrel, 12 lb. evaporation per pound of oil; sawmill refuse fuel containing 45 per cent moisture, weighing 20 lb. per cubic foot, efficiency 60 per cent. The problem is to determine what can be paid for sawmill refuse fuel per unit to equal the fuel value of oil at the price stated.

Starting with the value of 12 lb. of evaporation per pound of oil, directly above this at the point of intersection with the line indicating the pound of oil per barrel note that on the left the total evaporation per barrel of oil is 4,080 lb. Transferring this below the line as indicated by the semicircle, and carrying 4,080 lb. evaporation across to the right, note that under the figure $1 per barrel the cost of 1,000 lb. of steam is about 24½ cents.

Starting again with 45 per cent moisture in the sawmill fuel and going to the left to the point of intersection of 60 per cent efficiency, note that the evaporation per pound of wood is approximately 2.3 lb. water, or with 4,000 lb. per unit is equivalent to about 9,200 lb. of water per unit of fuel. Carrying this to the right to the point of intersection with the line indicating cost of steam, 24½ cents per 1,000 lb., note $2.25 as the equivalent cost of a unit of fuel. (A unit of sawmill refuse fuel is 200 cu ft. of hogged wood.)

Readers' Views and Comments

Senator Walsh of Montana and the Water-Power Act

To the Editor of the ELECTRICAL WORLD:

SIR: No mention has been made by the ELECTRICAL WORLD of the able services performed by Senator Thomas J. Walsh of Montana in behalf of the recent water-power legislation, although credit has been given to most of the others instrumental in obtaining its passage. I think that this oversight, due to Senator Walsh's own modesty, should be repaired. Personally I feel deeply grateful to the Senator, as well as to all who contributed toward this law, and think that in all fairness I should make his efforts in the public interest known.

Senator Walsh has worked actively for a good power law ever since he went to Washington, as the records for the last six years will show. I have personally gone to him for help often, and several times when the bill was in danger. He always responded promptly and with splendid results. JOHN J. HARRIS.

Big Horn Canyon Irrigation & Power Company,
Hardin, Mont.

Duration of Insulation Tests

To the Editor of the ELECTRICAL WORLD:

SIR: Many specifications call for high-potential tests to be applied for extended periods. Usually it is not possible to meet these specifications with standard material, and as a result it is necessary in each case to take exceptions to the specifications or to quote upon more expensive equipment.

Undoubtedly the insulation tests are specified through lack of information regarding the real purpose of such tests, and for the assistance of engineers and users of electrical apparatus the following statement regarding the practice advocated by the American Institute of Electrical Engineers has been prepared.

The practice advocated by the A. I. E. E. in regard to the duration of dielectric strength tests of insulation is expressed in the following sections of the 1918 Rules:

485—Duration of Application of Test Voltage—The testing voltage for all classes of apparatus shall be supplied continuously for a period of sixty seconds. (See exception 485-A.)

485-A, Exception—For all standard devices produced in large quantities and with a standard test pressure of 2,500 volts or less a test pressure applied for one second 20 per cent higher than the one-minute test pressure will be satisfactory.

While the majority of users are satisfied with apparatus which meets the above tests, occasionally specifications call for insulation tests of longer duration. Increasing the time of test above that specified in the A. I. E. E. rules is undesirable for the following reasons:

Solid insulations will withstand about three times the voltage for one cycle that they will withstand continuously. The principal reason for this is that solid insulation heats if subjected to a stress near its ultimate strength and that the strength of all insulation decreases with increase in temperature.

A manufacturer must therefore so design his apparatus that the insulation will not appreciably heat on application of test voltage for test period; otherwise he will have the apparatus failing in factory test.

Therefore, when a specification calls for more than a one-minute test, three courses are open to the manufacturer:

1. He can consider it safe to take more chances than usual and make no change.
2. He can increase the amount of insulation so that the heat at the end of the long-time test is no more than at the end of the usual one-minute test.
3. He can in the case of oil-immersed apparatus use more oil space and less solid insulation, thereby putting a larger part of the stress on oil that does not heat up under stress like solid insulation.

Course No. 1 is clearly undesirable because the user gets no more insulation than usual. Moreover, the solid insulation may be permanently weakened by the test.

Course No. 3 is also undesirable from the user's standpoint, for although he has a stronger piece of apparatus at the time of test, moisture or other foreign material in the oil may greatly reduce its strength at time of abnormal conditions, as compared with a structure having a greater proportion of solid insulation.

Course No. 2 is evidently an entirely satisfactory one to pursue when the design permits except for the extra and needless cost involved.

Evidently the longer test serves the interest of the user only when Course No. 2 is followed, and here the additional insulation strength must be offset against greater cost and less efficient use of other material.

From the above it is evident that a standard duration of test should be used when standard test voltages are prescribed, and the question remaining is as to whether the A. I. E. E. is justified in selecting one minute as a standard period.

It should be remembered that the test is for the purpose of detecting flaws in design, in material or in workmanship and should not be so severe as to cause injury to insulation of normal strength.

It is evident that increase of time of test beyond a value sufficient to determine the safety of insulation in service is expensive and objectionable. It is similar in effect to an unnecessary increase in the voltage.

Curves have been made by various investigators on different classes of insulating material that show the breakdown point as related to duration of test. It is apparent from such curves that a test of about one minute's duration is a good compromise test between the instantaneous test which might be applied for the purpose of detecting flaws that would cause trouble when surges or other transients occur and the longer time test which might be applied for the purpose of determining the endurance of the insulation under normal load conditions.

Consideration of these facts has caused the A. I. E. E. to adopt the one-minute test in connection with a standard set of test voltages to be applied under various conditions, the combination of voltage and time being the result of extended experience. It is recommended that this practice be adhered to wherever possible.

R. C. MUIR.

International General Electric Company,
New York.

Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Branching Five 13,200-Volt Circuits on Three Poles

ECONOMY of line material has been secured by the New England Power Company in an installation at Greendale, Mass., where five 13,200-volt, three-phase lines are brought from a substation to the street in an easterly and westerly run and then divided into north and south runs. Only three poles are required for the necessary changes in direction. These are set in line and are tied together by four pairs of angle irons running north and south. The east and west lines from the substation are dead-ended on two-disk strain insulators which are fastened to the angle irons. The north and south lines are similarly dead-ended on strain insulators fastened to cross-arms on the intermediate pole, with attachment to the usual pin-type insulators on the outer pole cross-arms as they enter the first line span on each side of the three-pole installation. Short, direct vertical taps between the lines running at right angles complete the installation, which is of great mechanical simplicity and clear-cut electrical symmetry.

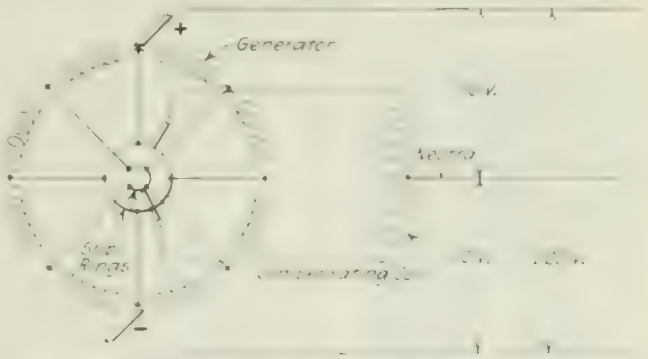


FIVE 13,200-VOLT TRANSMISSION CIRCUITS ARE BRANCHED ON THREE POLES

Unbalanced Reactor on Three-Wire Generator Causes Flicker

FLICKERING of lights on a circuit connected to a three-wire generator which recently came to the attention of the writer was found to be caused by unbalanced reactance and resistance in the compensating coil of the generator. By balancing up the resistance and reactance all flickering was eliminated from the system. The armature winding of this machine is divided into the same number of parts as there are magnetic poles, and alternate division points are connected to one slip ring and the remaining points to a second slip ring. A coil of low resistance and high reactance mounted on a closed magnetic circuit of laminated iron is connected to the two slip rings and a tap is taken from the center of this coil for the neutral conductor of the system. The two outside wires of the system are connected to brushes of the machine in the manner of any direct-current generator. The slip rings have an alternating current impressed upon them, and, for better understanding, the machine may be thought of as a rotary converter with a neutral wire taken from the transformer to the direct-current line. The machine, which is a 300-kw., 220-volt, 1,324-amp., three-wire generator, has eight poles and runs at 150 r.p.m. Therefore the frequency of the alternating current impressed upon the slip rings is only 10 cycles per minute. The application of this alternating current to the compensating coil with a balanced load on the circuit produces in the coil only a small magnetizing current. However, when the load on the direct-current circuit becomes unbalanced the compensating coil tends to draw a heavier current and by auto-transformer action tends to keep the neutral of the system 110 volts from either outside wire. The machines are guaranteed by the manufacturer to operate satisfactorily with a 50 per cent unbalance in load. However, on their acceptance test, when a load of from 20 to 25 per cent out of balance was applied, a noticeable flicker could be seen in the lights.

At first this trouble was looked for in the generator proper, but without success. Then lamps were connected across the slip rings, and owing to the low frequency their light could be clearly seen to fluctuate. It was noticed that this fluctuation was in synchronism with the flicker on the lighting system, and therefore it was thought that the trouble lay in the compensator coil. Upon investigating this coil it was found that half of the winding had three-quarters of a turn more than the remaining half, causing the reactance to be lower on this side of the winding. To remedy this, three-quarters of a turn was added to the winding. However, this only partially relieved the trouble. Therefore a resistance test was made on the two sections of the coil and it was again found out of balance as regards resistance. This trouble was remedied by inserting a German-silver resistance in series with the coil of least resistance. After both reactance and resistance were corrected the machine was operated 400 amp. out of balance and the flicker had disappeared.

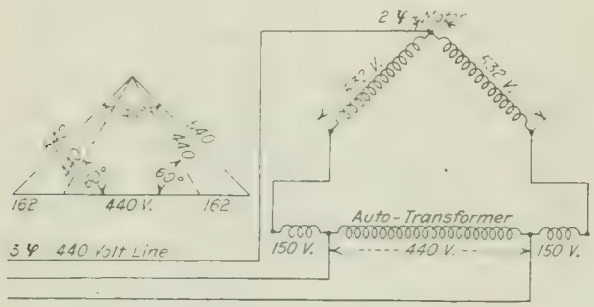


UNBALANCED COMPENSATING COIL CAUSED LIGHTS ON THIS SYSTEM TO FLICKER

R. H. N. LOCKYER.
Trail, B. C.

Auto-Transformer for Feeding Two-Phase Motor from Three-Phase Line

IN ORDER to run a two-phase motor from a three-phase line, an auto-transformer connected as shown in the accompanying drawing was used some time ago by the Pacific Gas & Electric Company, Sacramento, Cal. The three-phase voltage in this case was 440 volts and the auto-transformer taps were 150 volts on each side



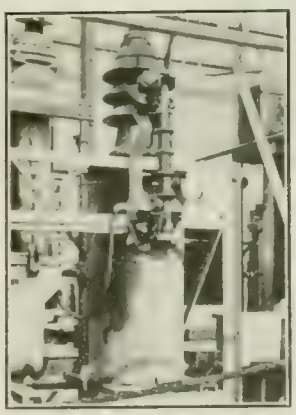
METHOD OF CONNECTING AUTO-TRANSFORMER TO THREE-PHASE LINE FOR FURNISHING ENERGY TO TWO-PHASE MOTOR

of the main winding. This resulted in a voltage of 532 on each phase of the motor. The two phases are slightly less than 90 deg. apart, but this does not affect the motor operation as the motor starts satisfactorily under full load and runs without abnormal heating. This connection was installed several years ago in an emergency, and it proved so satisfactory that it has remained in operation since that time. The voltage diagram shows the exact ratio which the auto-transformer should have in order to place the phases 90 deg. apart. Here it is seen that the outside taps of the transformer should be for 152 volts and the resulting two-phase voltage would be 540 volts. These voltages were calculated from the following formula:

Three-phase volts $\times$ 0.867 $\times$ $\sqrt{2}$ = two-phase volts.

Pacific Gas & Electric Co., Sacramento, Cal. E. C. Wescott.

Strap Iron Employed as Rigid Lead for Potential Transformer



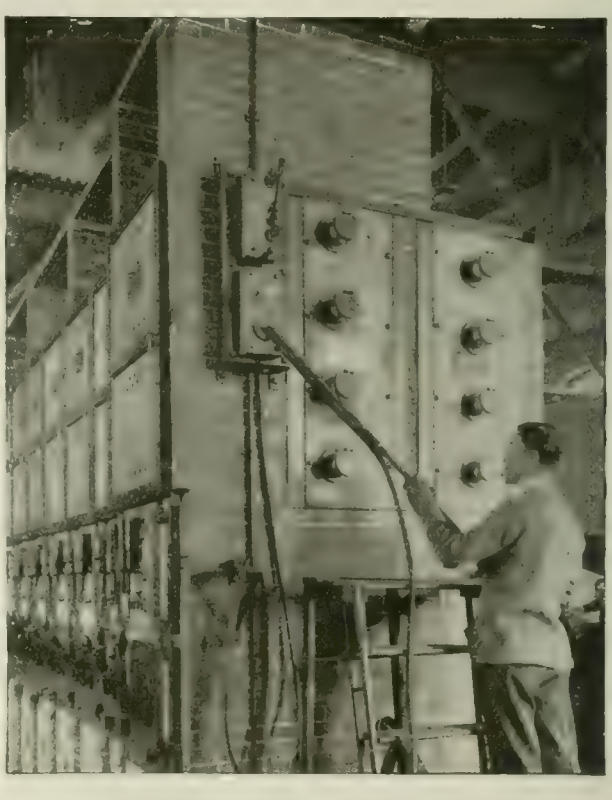
STRAP-IRON LEAD FOR POTENTIAL TRANSFORMER CANNOT SWING TO GROUNDED FRAME

TO PREVENT the potential transformer lead shown in the accompanying photograph swinging over and making contact with the grounded frame, a flat strip of iron 1¼ in. x ¼ in. (32 mm. x 6.3 mm.) has been used in place of wire in a Massachusetts outdoor substation. This lead serves to make a connection from a potential transformer of 15,000-volt rating to the terminal of an expulsion-type fuse mounted nearby. The strap iron gives adequate conductivity for the purpose and at the same time keeps the alignment of the wiring far better than flexible conductors would do and thus avoids likelihood of displacement through mechanical vibration. V. R. Bauket.

Worcester, Mass.

Testing High-Tension Lines, Etc., Before Applying Protective Grounds

IT IS always desirable to have some means of testing a high-tension line or circuit before grounds are applied or it is pronounced safe for men to work on. For this purpose several methods may be employed. Electrolytic lightning arresters may be used to test the line to which they are connected. Where this test cannot be made, an ordinary switch hook held close to the conductor will draw a static spark if the conductor is alive. A metal ball or some form of condenser mounted on an impregnated wooden pole and used in the same manner as a switch hook will give a more positive indication than a switch hook owing to the larger surface exposed to the static charge. If there is a potential transformer on the line side of the switch a pilot light connected to it may be used as an indication of line conditions. Care should be



IF THE BUS IS ALIVE THE TEST FUSE WILL BLOW

taken in observing that the lamp is not burned out, or the fuses blown. An exploring coil in conjunction with a telephone receiver to produce an audible signal can be used in some cases, the signal being given when the coil is near an energized line or cable. A Geissler tube, which glows when given a static charge, makes a fairly reliable test and offers a promising field for experiment and further development. In the method of testing used by the New York Edison Company an expulsion fuse is connected to ground in series with a limiting resistance.

To test the fuse it is connected to one side of a 110-volt lamp, the other side of which is connected to an ungrounded wire of a grounded-neutral lighting circuit. If the lamp lights, the fuse is good. After the fuse has been tested a lead from the fuse is touched to the bus to be worked on. If the fuse does not blow, the

bus may be safely grounded. This method is positive and satisfactory for distribution voltages up to and including 15,000. Care should be taken in the design and installation of the limiting resistance and the "bomb fuse."



SCHEME TO DETERMINE IF BUS IS ALIVE

Whatever test is made to ascertain whether or not a circuit is energized, the circuit should always be grounded and short-circuited before it is touched or closely approached, because even with the most reliable test there is a possibility of energy through induction or contact with another circuit, which energy may be intermittent or of such a nature that it will not be observed by any of the previously mentioned tests.

These schemes were described in the report of the accident prevention committee at the 1920 convention of the National Electric Light Association at Pasadena, Cal.

Test of Fusing Point of Coal Ash

TESTS to determine the fusing temperature of coal ash should be made by power-plant operators in addition to the usual tests to determine the amount of this ash. The reason for this is that if ash fuses and flows on boiler-furnace stokers it may cause serious trouble. Tests have indicated that the ash of good coal should not fuse at temperatures much below 2,500 deg. Fahr. (137 deg. C.). Coal of which the ash fuses at a lower temperature will very likely cause stoker operating difficulties.

The first requisite for this test is a source of heat, usually an oil-fired furnace, sufficient to attain temperatures up to about 3,000 deg. Fahr. (1,650 deg. C.). Samples of the ash to be tested are mixed with a small amount of a 10 per cent solution of dextrine, which cements the ash particles together, making it possible to form the ash into small pyramids. These are allowed to dry, and the dextrine is burned off at a low heat.

In order that the temperature of the furnace may be known, so-called standard Seger cones are placed in the furnace along with the unknown coal-ash cones, and, in addition, temperatures are read by means of an optical pyrometer. Seger cones are made from known mixtures of refractory materials, each mixture having a fairly definite fusing temperature. The standard Seger cone and the unknown coal ash cones are laid in a horizontal position on the "fusion block," placed in the furnace and the furnace temperature is then gradually raised. When the standard Seger cone and the optical pyrometer indicate that 2,500 deg. Fahr. has been reached, the furnace is shut down.

When cold, the fusion blocks are removed and a study of the condition of the coal-ash cones is made. Coal of which the ash fuses completely can be eliminated from consideration; coal of which the ash is practically unaffected by heating at 2,500 deg. Fahr. may be considered satisfactory. Those coal ashes which show partial fusion must be carefully considered and, if there still is doubt, retested so that a final decision may be made.

WAYNE EDWARDS.

Detroit (Mich.) Edison Company.

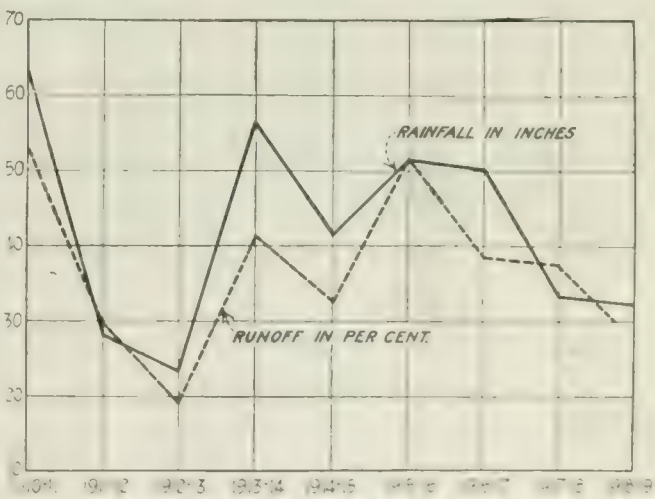
Run-off Has No Constant Ratio to Rainfall

ALTHOUGH the available run-off water which can be used for developing power is in approximate proportion to the rainfall, the exact proportion, as shown by the accompanying curves, is difficult to calculate. These curves and the accompanying table are taken from data collected by G. R. Kenny, valuation engineer of the San Joaquin Light & Power Corporation, on the run-off from the watershed feeding the Crane Valley Development.

Although it is already understood that in a dry year, when storms are widely separated, the ground absorbs the greatest percentage of the precipitation, this curve presents some eccentricities which show that the problem is not a simple one. For instance, the drop in run-off percentage in the year 1913-14 may perhaps be explained through the dryness of the preceding year, but the low run-off in 1916-17, the second of two wet years, can be explained only through the characteristics of the season, which probably involved storms so spaced that the ground did not become properly saturated and when also there was no great precipitation of snow in the mountains.

RATIO OF RUN-OFF TO RAINFALL IS NOT CONSTANT
Crane Valley Watershed, San Joaquin Light & Power Corporation
Area of watershed, 52 square miles, or 33,280 acres.

Season, July to June	Rainfall, Inches	Acre Feet of Precipitation	Actual Acre Feet Run-off	Percent Run-off
1910-11	63.26	175,385.6	93,544	53.33
1911-12	28.2	78,208.0	23,556	30.11
1912-13	23.15	63,397.6	12,332	19.29
1913-14	55.93	155,084.8	64,426	41.54
1914-15	41.22	114,150.4	37,351	32.72
1915-16	51.47	142,438.4	73,337	51.48
1916-17	50.00	153,444.8	53,635	38.74
1917-18	33.49	93,184.0	35,007	37.57
1918-19	32.62	89,956.0	26,302	29.25
Average	42.15	116,812.8	47,403	40.49



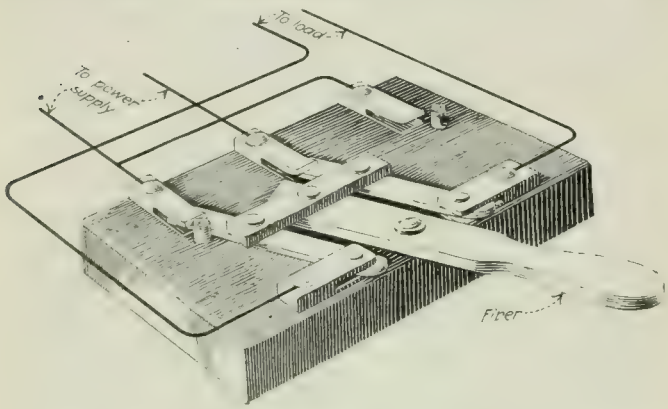
RAINFALL AND PERCENTAGE OF THIS RAINFALL AVAILABLE FOR POWER IN RUN-OFF WATER

Industrial Applications

The Economical Utilization of Electrical Energy
in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

Home-Made Inclosed Reversing Switch Prevents Shock

AS THE ordinary double-pole, double-throw reversing switch cannot conveniently have its live parts protected, a reversing switch such as shown in the sketch was made in an Eastern factory from old switch parts and mounted in such a manner that the operator can



ALL LIVE PARTS OF THIS REVERSING SWITCH MAY BE INCLOSED

touch only the fiber handle. The parts of this switch are mounted on a fiber block and the handle and crossbar are also made of fiber. To limit the throw of the handle small screws are set in the fiber block. Holes are drilled through the block and countersunk to take the screws by means of which the switch is mounted.

Switches of this kind replaced several of the old-type double-pole, double-throw reversing switches which were installed on automatic machines in this factory for reversing rotation. Since the operators were working on a piece-work basis they operated the switches hurriedly and often received shocks. The installation of the new switches not only eliminated all possibility of shock to the operator but also cut down the time required to reverse the machine and thus increased the plant's production.

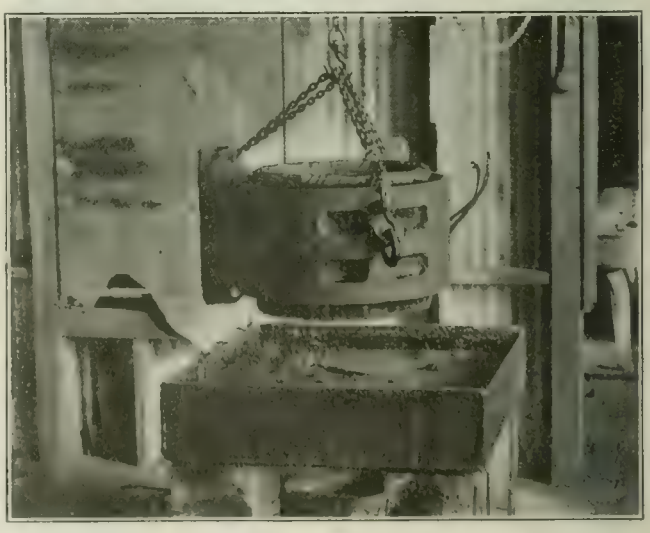
E. C. SOARES,
Ampere, N. J. Electrical Engineer.

Method of Protecting Motor Windings Against Acid Fumes

FOR protecting motor windings against very active acid fumes the system of impregnating and coating motors with compound described here has greatly minimized motor troubles in the plants of E. I. du Pont de Nemours & Company, Wilmington, Del. Where factory-impregnated motors have lasted only about two weeks, and in one case only a day, they now have a normal life after this treatment. It has been found that the most effective solution for insulating coils of motors is a one-to-one mixture of flexible black enamel and flexible compound.* After coils are wound they are held together by skip layers of cotton tape. They are then dipped in the solution. After a layer of cambric and then cotton tape is put on, they are formed and dipped again in the same solution and placed in the motor slots while the paint is green. In the case of closed slots, taping is done after coils are in the slot and the second coat of compound is applied with a brush. After the winding has been completed still another coating of the solution is applied by means of a paint gun. The motor is then placed in the oven and baked from forty-eight to sixty hours at 75 deg. Fahr. (36 deg. C.).

When the motor is removed from the oven and while still hot it is suspended by a sling so that the protruding windings can be lowered into a large, flat pan containing rubrax.† Rubrax is very similar to asphalt, but its melting temperature is higher, so that it does not run from the windings when the motor is heavily loaded. After the motor has been dipped on both sides it is allowed to cool, after which all excess rubrax is removed by use of a gasoline blow torch and a putty knife. By dipping while hot the rubrax penetrates the smallest openings as it does not become chilled.

Motors receiving this treatment will withstand any exposure to fumes existing in the du Pont plants under ordinary operating conditions for a reasonable length of



DIPPING COIL ENDS TO PROTECT AGAINST ACID FUMES

time, but any protection to the windings is gradually broken down, particularly at the ends of slots, caused partly by contraction and expansion of metals due to temperature changes, but mostly on account of vibration of the iron in the alternating-current magnetic field. The

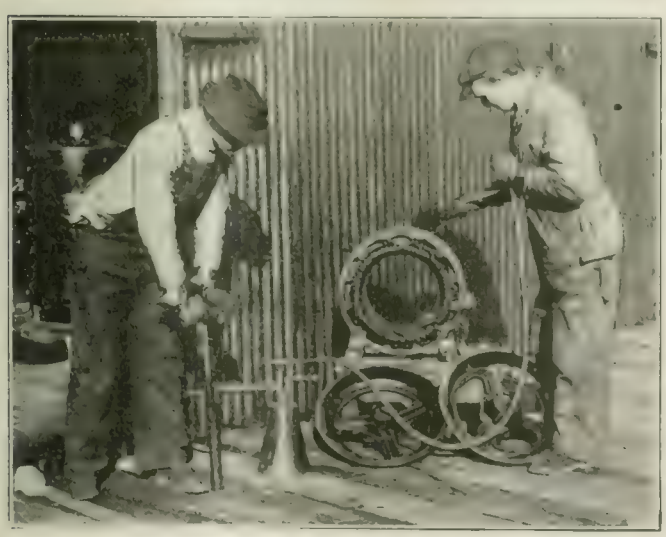
*No. 75 black enamel and flexible compound are made by the Flexible Compound Company, Inc.
†Rubrax is made by the Interocean Oil Company.

"dope" at this point gradually becomes crystalline and porous and would soon crumble unless preventive measures were taken.

A "dope gang" is employed for this purpose. The work originally laid out for this gang was to neutralize acid deposits on motors, clean motor surfaces, especially vital parts, apply a protective coating of shellac to exposed metal surfaces within the air-gap areas and paint the windings and the stator frame when necessary. Later its duties were made to include checking up all deficiencies of equipment, beginning at the main switch and ending at the driven shaft. This gang is made up of one leading man and eight or ten helpers for the routine work and one electrician for inspecting and repairing switches, relays and compensators. The routine of the work is as follows: The motor is disassembled and the windings and metal surfaces in the air-gap areas are swabbed with a solution of soda ash in alcohol—the alcohol being used merely as a quick-drying conveyor. After the soda ash dries the bare metal parts of the stator are rubbed with a wire brush and sandpapered, and dust and soda ash are removed by an air jet from the paint gun. The iron surface of the stator then receives a coat of thin shellac, and the windings are coated with Harrison's quick-drying asphaltum paint applied with the paint gun. The paint gun is superior to a brush in applying the paint into every recess where fumes can enter.

The outside surface of the motor is first scraped with a wire brush and sandpapered, after which a thin coat of shellac is applied. This thin coating seems to be more satisfactory as a protective coating than a thicker coat, probably because it dries so quickly that there is little chance to puncture the coating while replacing the rotor. As soon as the stator is dry the motor is ready to be reassembled and put into service.

While this process is going on the electrician is



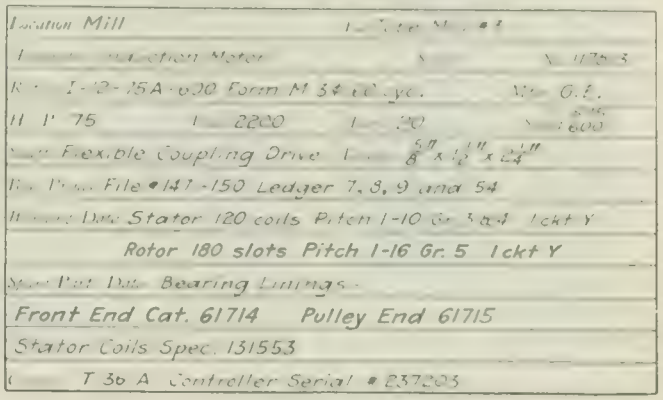
PROTECTIVE PAINT APPLIED WITH PAINT GUN MORE EFFECTIVELY THAN WITH A BRUSH

inspecting bearings, main switches, fuses, relays and compensators and making necessary repairs. Whenever a motor is found where it has been necessary to cut coils in the stator, the electrician fills up any opening made in the protective compound by melting rubrax into the opening and smoothing with a putty knife.

E. I. du Pont de Nemours & Co., W. B. TODD,
Wilmington, Del. Operative Engineering Division.

Motor Record Card Which Facilitates Ordering Spare Parts

IN INDUSTRIAL plants where numerous motors are installed it has been found very useful for the man in charge of electrical equipment to have on his desk for ready reference a card-index system with an individual card for each installed machine, containing the nameplate, rating and such other data as the circumstances of the installation may call for. There is shown



FILING CARD WHICH CONTAINS USEFUL DATA ON INSTALLED MOTOR

here a card that has proved its worth in the electrical department of a large silver mining company, where ready data are very useful on account of the wide distribution of the apparatus and the necessity of keeping a large stock of spare parts because of the isolated location. In addition to the nameplate data, this card contains information on the motor winding, the blueprint file numbers and the ledger numbers, the spare parts which should be carried, and data on the type of coupling, the size of brushes and the control apparatus. In addition to the data on the face of the cards, it has been found useful to record on the reverse side such items as date of changing bearings, troubles encountered, etc. With modifications fitting particular applications, this card should prove useful to any industrial plant where electric energy is employed.

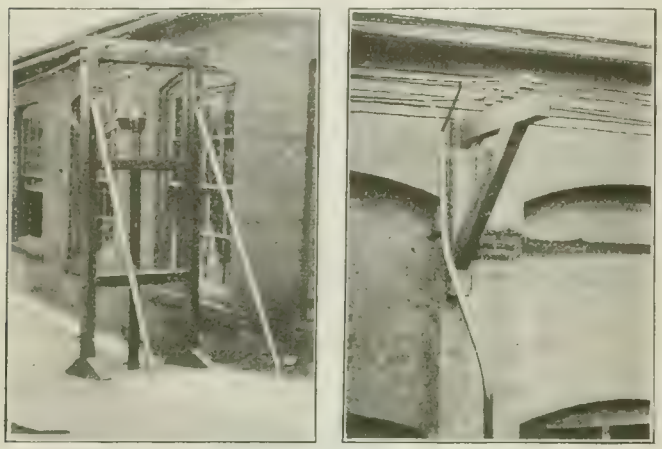
FREDERICK KRUG.
San Juancito. Honduras, C. A.

Open and Conduit Wiring Combined for Economical Factory Distribution

IN AN economical and reliable system of distribution to the various shops of a Springfield, Mass., industrial plant the mains are run with open-wire construction on the building roof and walls and the branch circuits are run into the building in conduit. The mechanical ruggedness of the outside wiring is illustrated in the accompanying photographs. The circuit shown on top of the roof, which feeds various branch lines, is brought out of the building in 3-in. (7.6-cm.) conduit through a waterproof fitting, whence it is tapped into a horizontal three-phase line carried on strain insulators attached to ½-in. (1.3 cm.) bolts carried into and through the vertical wooden frame. The conduit is clamped to the frame at the two horizontal cross-braces. The uprights are of 2½-in. x 5-in. (6.3-cm. x 12.6-cm.) timber, with 1⅝-in. (4.1-cm.) diagonal iron-rod braces to the roof, and are 7 ft. 9 in. (2.3 m.) high. The cross-braces are

stiffened by ½-in. (1.3-cm.) bolts, and the braces are 2 ft. 7 in. (7.8 m.) long and of 3-in. x 5½-in. (7.6-cm x 14-cm.) section. This size is also used in horizontal top pieces.

By the simple bracket construction shown at the right a tap is made from a horizontal branch open-line run into a productive department in the building below. The bracket is built of 3-in. x 6-in. (7.6-cm. x 15.2-cm.)



COMBINES ECONOMY OF OPEN WIRING AND SAFETY OF CONDUIT WORK

main timbers and these are bolted into the wall by ⅝-in. (1.8-cm.) bolts. A slight offset in the conduit is used to change direction, and the latter is clamped near its upper end to the bracket by a 1-in. x ¼-in. (2.5-cm. x 0.6-cm.) strap.

JOHN SCHIEHSER.

Springfield, Mass.

Calculating Stresses in Armature Bands

IN PLACING bands on armatures at high temperatures it is quite important to calculate the stresses that may be set up due to the contraction of the bands at low temperatures. Breaking of bands on railway motors is often due to starting at high speeds in cold weather, causing strains in excess of ultimate strength.

If the bands were placed on at a temperature of say 150 deg. Fahr. and the armature then placed in a car for shipment where the temperature was 0 deg. Fahr., a change of 150 deg. Fahr. which is probable under average conditions, the factor of safety might be reduced to a dangerous point. Assume that the wires in the band are steel having a modulus of elasticity $E = 3 \times 10^7$ and are soldered across so that one wire can be considered as about the circumference in the calculations. The coefficient of linear expansion, c, may be taken at 6.5×10^{-6} per degree Fahrenheit.

If a No. 22 gage music-wire steel is used having a diameter of 0.047 in. and is put on with a pull of 200 lb., then the initial stress is $(P/A) \times (200/0.047)$ 34,200 lb. per square inch. Since the wire is constrained so that it can neither contract nor expand, the constraint must exert on it a force which can be calculated from

$$S = E\left[\frac{\pi D \quad [\pi D \quad cD\pi(t_1 - t)}{\pi D - cD\pi(t_1 - t)}\right]$$

= pounds per square inch tension when the temperature is lowered.

In the above D is the armature diameter at the band, which for the purpose is assumed as 20 in.; t_1 is the temperature of the band when placed and t is the temperature to be considered.

Substituting numerical values in above equation gives

$$S = 3 \times 10^7 \left[\frac{20\pi - [20\pi - (6.5 \times 10^{-6} \times 20\pi \times 150)]}{20\pi - (6.5 \times 10^{-6} \times 20\pi \times 150)}\right]$$

$$= 28{,}000 \text{ lb. per square inch.}$$

This added to the initial stress of 34,200 gives 62,200 lb. per square inch. If the ultimate strength of the wire is 200,000 lb. per square inch, the factor of safety is $f = 200{,}000/62{,}200 = 3.2$, which is a fair value.

At operating temperature the bands should show a factor of safety of from five to ten, and under conditions of minimum temperature the factor of safety can be as low as two if the machine is not overspeeded.

Chicago, Ill. H. E. WEIGHTMAN.

Switchboard Arranged for Quickly Making Wide Range of Tests

SPEED in testing various electrical devices is greatly facilitated by the arrangement of the switchboard described herein on which may be obtained variable-voltage alternating current from 30 cycles to 90 cycles, three-phase, and direct current which may be increased from zero in small steps up to 220 volts. Another feature is that the meters are arranged to be always in the load circuit.

The left-hand panel (Fig. 1) carries the alternating-current equipment, and the right-hand panel the direct-current equipment. The power supply is a three-wire, 110/220-volt direct-current circuit, while the alternating current is supplied by a motor-generator controlled from the switchboard. The motor-generator was built for this laboratory by the General Electric Company. It consists of a 2½-hp., 220-volt compound-wound direct-current motor, directly coupled to a 1½-kw., three-phase, four-pole alternating-current generator giving 110 volts at 1,800 r.p.m. The motor is controlled by a combined

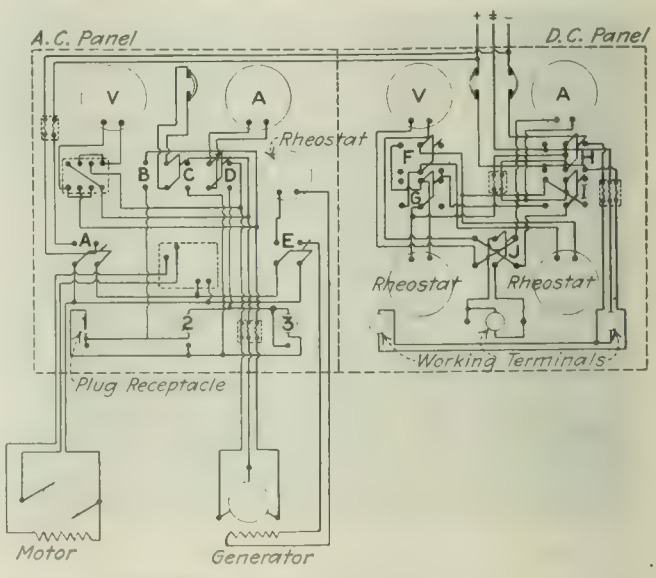


FIG. 1—CONVENIENTLY ARRANGED FOR WIDE RANGE OF TESTS

starting box and speed controller by which the speed may be varied between 900 r.p.m. and 2,700 r.p.m. This gives a range of frequency of from 30 cycles to 90 cycles. By means of a rheostat of comparatively high resistance the voltage may be varied about 30 per cent at any given motor speed, the extreme limits being about 40 volts at 30 cycles and 180 volts at 90 cycles. By using transformers any desired voltage can be obtained.

On the alternating-current panel are mounted the starting and control box for the motor-generator, the field rheostat, a 125-volt Weston alternating-current ammeter, the control switches for the motor and generator, a circuit breaker and three sets of terminals for the alternating current. Switch *A* controls the motor and

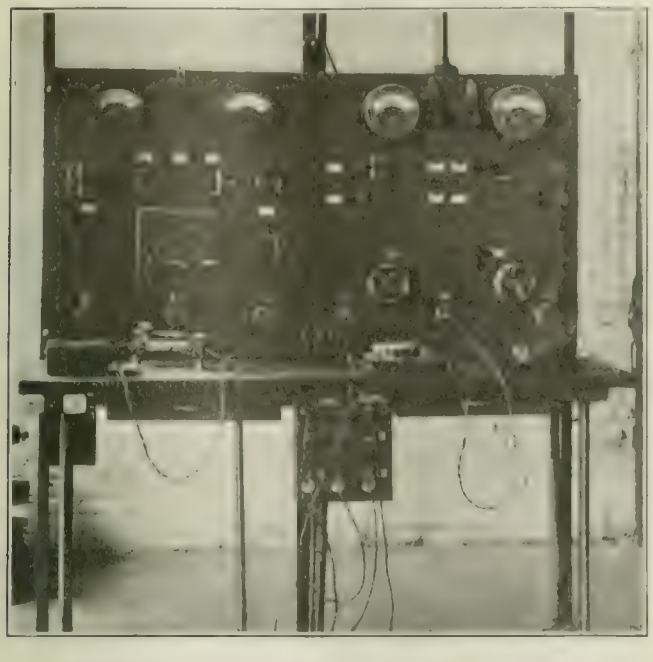


FIG. 2—GIVES ANY COMMERCIAL FREQUENCY AND FROM ZERO TO 220 VOLTS

E the generator field. The voltmeter is connected through a standard three-phase voltmeter plug, by means of which the voltage of any phase may be read with the same meter. The ammeter is connected through a special switch which has two pairs of blades and three pairs of clips, so arranged that either pair of blades will engage the center pair of clips. The switches in the positions *B* and *C* connect phase 1; *B* and *D*, phase 2, and *C* and *D*, phase 3. For three-phase work the third contact is closed with a removable clip. As the ammeter is connected across the blades of one switch and the circuit breaker across the other, they are always in circuit. Each phase is wired to a separate plug receptacle at the bottom of the panel for convenience in attaching single-phase apparatus, while for three-phase work three binding posts are provided. The middle receptacle at the bottom of the direct-current panel is the "working circuit" which is connected through the switches, meters and rheostats. This circuit is also connected to two binding posts, one on each side of the receptacle. The other two receptacles are independent circuits, for 110 volts and 220 volts, respectively. The equipment on this panel includes a 250-volt direct-current Weston voltmeter, a 25-amp. direct-current Weston ammeter, two rheostats, a double-pole circuit breaker, and five double-pole, double-throw switches. Switch *H* is closed to the left for 110 volts and to the right for 220 volts.

To obtain both high and low current values readily two rheostats are used. Switches *F* and *G* closed to the right connect the rheostats in series and to the left connect them in parallel. Either rheostat may be used singly by closing the corresponding switch to the left, leaving the other one open. Cutler-Hammer three-plate field rheostats are used, rated at 40 ohms and 12.5 amp. The rheostats have about sixty-five steps each. There are some requirements in direct-current testing which cannot be met with series resistance, such as calibrating voltmeters or testing low-voltage motors, lamps or coils. For such work the rheostats are connected in series, and the working terminals are shunted across the right-hand rheostat by closing *F* and *G* to the right and *I* to the left. With *I* closed to the right, the rheostats are in series with the working terminals. The voltmeter is so connected that it indicates the voltage across the working terminals rather than the line voltage. Similarly, the ammeter is connected to indicate the current flowing through the working circuit. This arrangement of the meters is a time-saving convenience.

In connection with the switchboard a distributing system has been installed for supplying to any part of the laboratory or to other rooms any current or voltage which may be desired. For this purpose three six-gang receptacles are mounted under the testing shelf. In the upper row are three 110-volt and three 220-volt circuits. The other twelve receptacles are wired to the showroom, the dark room, the inspection department and the various benches in the laboratory. Connections are made by means of flexible cords having a two-finger type of plug at each end.

Among the work done on this board are calibrating instruments—testing heating devices, small motor-driven devices, rectifiers, transformers, X-ray and other vacuum tubes and charging storage batteries. In locating faults in appliances the meters in the board allow more accurate testing than the test lamp usually employed.

W. H. FARR.
Central Scientific Company,
Chicago, Ill.

Economy in Electric Baking of Steel Wire

THE application of electric heat to the process of baking steel wire has given such excellent results and is so economical of operation that it should be of interest to all plants where wire drawing is done. The superior control characteristic of electric ovens makes economical production possible even where the cost of electrical energy is higher than heat produced by coke. In the data shown herewith the net cost per ton of steel wire for electric ovens is only about two-thirds of that for coke ovens. The figures, moreover, do not include the fact that a superior quality of wire is obtained electrically.

In the manufacture of steel wire the rods as received from the hot rolls are pickled in acid to remove the scale, dipped in lime water to neutralize the excess acid, and then baked, to drive out the "acid in the steel," the amount of baking depending on how small the wire is to be drawn. If it is to be drawn only one or two holes, a short bake is enough, but for five or six holes the stock must be baked for several hours to withstand the severe drawing. The wire may be in some cases additionally heated to dry off grease or oil, or for a low anneal.

At the plant of the Halcomb Steel Company, at Syracuse, where the following operation figures were obtained, there are two electric drying ovens, of General Electric make, one 16 ft. x 6 ft. x 6 ft. (4.9 m. x 1.8 m. x 1.8 m.), with 96 kw. connected, used for drying off

the wire, at a maximum temperature of 600 deg. Fahr. (315 deg. C.), the other 40 ft. x 6 ft. x 6 ft. (12.2 m. x 1.8 m. x 1.8 m.), with 234 kw., for drying "acid in the steel," the wire being in the oven from one to ten hours at an average temperature of 350 deg. Fahr. (175 deg. C.). Coke and steam-heated ovens are also used to



DRYING ACID OUT OF WIRE IN ELECTRIC OVEN

do the same work; thus it is possible to obtain comparative operation costs.

The data herewith show the cost of operation of the electric and coke oven for a considerable period of time on the ovens used in drying grease and oil from the steel, with normal production, and also the figures which would have been applicable if full production had been possible. The cost of electric power in these tables is figured at 0.95 cent per kilowatt-hour.

This shows that, as actually operated, the coke oven cost $22.289 per net ton against $12.926 per net ton for the electric, a saving of $9.36, while if operated at maximum capacity there would be a saving of $0.237 per ton in favor of the electrically heated oven. The effi-

	Production	
Electric:	Normal	Maximum
Cost of power net ton steel	$5.087	$1 19
Annual charges per net ton	7 839	727
Total cost per net ton	$12 926	$1 917
Coke:		
Cost coke per net ton, steel	$0 921	$0 171
Annual charges per net ton	21 368	1.983
Total cost per net ton	$22 289	$2 154

ciency of the electrically heated oven as actually operated amounts to 3.75 lb. (1.7 kg.) per kilowatt-hour, or 535 kw.-hr. per ton, the maximum figures being 16 lb. (7.2 kg.) per kilowatt-hour, or 125 kw.-hr. per ton.

The figures on the operation costs of the kiln for drying "acid in the steel" also show a greater economy in the use of the electric oven.

These figures show that the coke oven as actually operated costs $2.019 per net ton against $1.435 for the electric, or a saving of $0.584 per net ton in favor of the latter. If they were operated at maximum capacity, there would be a cost of $0.046 per net ton higher for the electric than for the coke oven. As operated the efficiency of the electric oven is 24.1 lb. (10.9 kg.) per kilowatt-hour, or 83 kw.-hr. per ton, while the maximum production figures would be 36.8 lb. (16.7 kg.) per kilowatt-hour, or 54.4 kw.-hr.

These figures show that the electric oven can actually be operated more cheaply than the coke except in one case where it showed a cost of 7 per cent higher. However, the figures take no account of increased perfection and duplication of results of the finished product due

	Production	
Electric:	Normal	Maximum
Cost power per net ton steel	$0.787	$0.515
Annual charges per net ton	.648	.187
Total cost per net ton.	$1.435	$0 702
Coke:		
Cost coke per net ton steel	$0.253	$0 146
Annual charges per net ton	1 766	.510
Total cost per net ton	$2 019	$0 656

to the perfect temperature control, whereby the operating temperature can be quickly changed when desired. Nor do they take into account the freedom from delay due either to difficulty of obtaining coke at ovens or slower treating of the oven from "cold" to start of work.

In another plant where the wire is not drawn so small, and where consequently such a long baking is not necessary, the electric oven installed has an efficiency of 110 kw-hr. per ton on comparatively long bakes at 400 deg. F. (180 deg. C.).

Graphic Charts Showing Cost of Electric Power Help Plant Management

THE importance of graphic charts to industrial management cannot be too strongly emphasized. A good example of such charts which have been prepared to show the cost of electric power in typical steel and iron works is shown here. It will be noted that the curves are plotted yearly until the beginning of the present year, when monthly points are plotted. The curves were made to indicate the possible effect of the war and the present economic conditions.

These curves are easily read and have such relation-

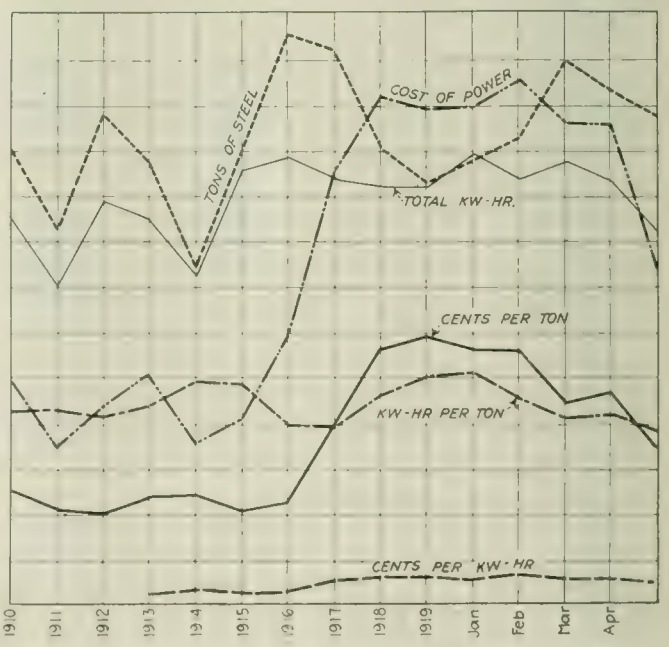


CHART SHOWS TOTAL AND UNIT COST OF ELECTRIC POWER

ships that the conditions may be seen without much study. They are plotted in units of such size that only one scale is shown at the side of the chart.

Pittsburgh, Pa. D. W. BLAKESLEE.

Static Condenser Raises Industrial Power Factor from 60 to 90 per Cent

BY THE installation of static condensers the power factor on the Rochester (N. Y.) Motors Company has been raised from 58 per cent to 90 per cent at a cost of approximately $6 per kva. of load on the plant.

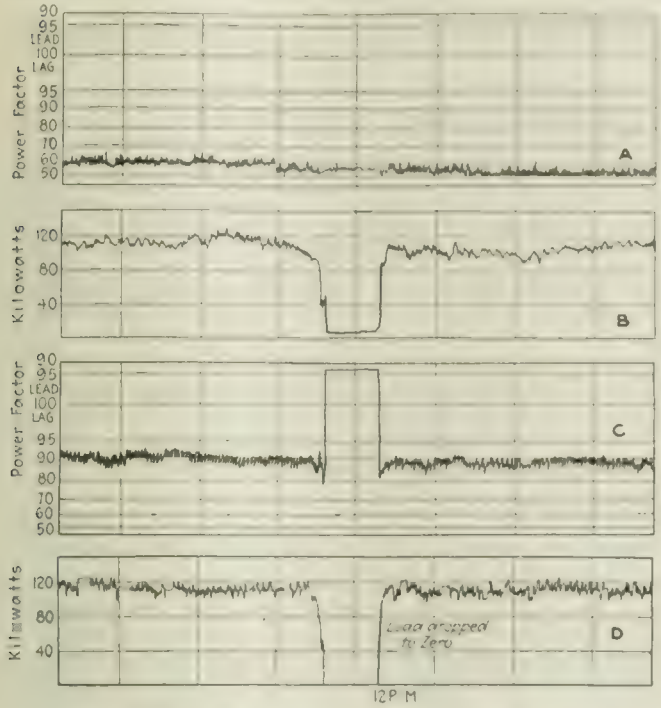


FIG 1—POWER FACTOR RAISED FROM 60 TO 90 PER CENT BY INSTALLATION OF STATIC CONDENSERS

A and B—Power factor and load before condenser was installed. C and D—Power factor and load after installation of static condenser.

Each of the twenty-one condensers used in this installation is built with a rating of 5 kva. when subject to a voltage of 1,242. These condensers are connected as shown in Fig. 2 to a high-reactance auto-transformer, with a fuse in series with each set of condensers. Each condenser is manufactured in such a manner that after assembling the elements the mechanical pressure is increased or decreased until a definite kva. rating is attained. This point is of considerable significance in view of the possibility of sectionalizing the condensers to obtain ratings corresponding to certain operating conditions and to maintain a balanced load.

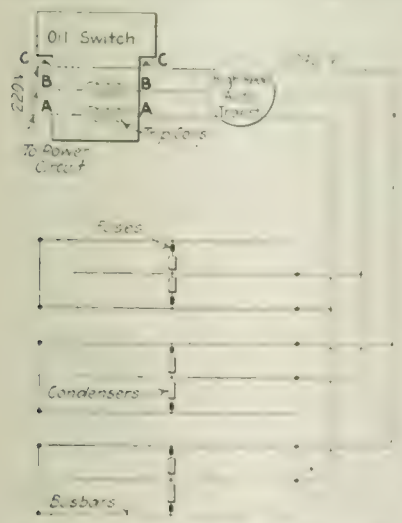


FIG. 2—SCHEME OF INSTALLING STATIC CONDENSER CONNECTED TO AUTO-TRANSFORMER

This installation, complete with steel frames, galvanized covered housing, pole line and auxiliary switches, costs approximately $35 per kva. The cost of operation on the basis of 15 per cent capital charges, 3 per cent losses in transformer and condenser, and energy at 2 cents per kilowatt-hour, is as follows:

3,000 Hours' Operation per Year:
$35 × 0.15 = $5.25 per kva.
3 per cent losses = 30 watt-hours per hour per kva.
7,000 × 30 = 210,000 watt-hours, or 210 kw.-hr.
210 kw.-hr. × 0.02 = $4.20.
Total annual operating expense = $5.25 + $4.20, or $9.45.

2,700 Hours' Operation per Year:
$35 × 0.15 = $5.25 per kva.
2,700 × 30 = 81,000 watt-hr. or 81 kw.-hr.
81 kw.-hr. × 0.02 = $1.62.
Total annual operating expense = $5.25 + $1.62, or $6.87.

Twenty-seven hundred hours' operation would correspond to the operating time of an industrial or isolated plant. With a cost of $6.87 per reactive kva., the cost of correcting a power factor from about 60 per cent to 90 per cent will be about $6 per kva. load.

Rochester Gas & Electric Corp. E. A. ROESER,
Rochester, N. Y. Industrial Sales Engineer.

Energy Consumption in Manufacture of Ferro Alloys

DATA on the manufacture of ferro alloys in an electric furnace are given in the tables shown herewith. These values give a fairly close check on the power requirements, materials charged and tonnage output for the more common ferro alloys, according to C. B. Gibson as set forth in a recent paper before the American Electrochemical Society at Boston.

TABLE I—POWER CONSUMPTION AND RAW MATERIALS FOR SOME FERRO ALLOYS (F. J. COTES' DATA)

Product	Per Ton of Manufactured Product—Kw.-Day (24 Hours)	Raw Material Handled, Tons	Tons Raw Material Handled per Kw.-Year
Ferro-silicon, 50 per cent	300	3 0	3 3
Ferro-silicon, 80 per cent	650	4 0	2 0
Ferro-chromium, 8 per cent	360	4 0	3 7
Ferro-molybdenum	360	3 5	3 2
Ferro-tungsten	325	3 0	3 0

TABLE II—PROF. GEORGES URBAIN'S DATA

Product	Per Ton of Manufactured Product—Kw.-Day (24 Hours)	Raw Material Handled, Tons	Tons Raw Material Handled per Kw.-Year
Ferro-silicon, 10-12 per cent	109	1 55	4 7
Ferro-silicon, 25-30 per cent	172	1 90	3 65
Ferro-silicon, 45-50 per cent	333	2 90	2 87
Ferro-silicon, 70-80 per cent	714	4 30	1 99
Ferro-silicon, 90-95 per cent	1,000	6 40	2 11
Ferro-manganese, 18-20 per cent	67	1 80	8 85
Ferro-manganese, 70-75 per cent	167	3 15	6 23
Ferro-chromium, 10 per cent C	286	2 97	3 34
Ferro-chromium, 1 per cent C	555	4 05	2 41
Ferro-tungsten	286 to 400	2 70	3 11 to 2 23
Silico-manganese, 10 per cent Si, 20 per cent Mn	133	2 20	5 46
Silico-manganese, 10 per cent Si, 70 per cent Mn	217	2 50	3 80
Silico-manganese, 25 per cent Si, 50 per cent Mn	333	2 70	2 69

TABLE III—KILOWATT-HOURS PER POUND FOR CERTAIN FERRO ALLOYS (R. H. KEENEY'S DATA)

Product	Size Furnace: Tons Charged	Kilowatts	Type	Per Cent Recovery	Kw.-Hrs. Per Lb. Tapped
Ferro-silicon, 50-70 per cent	3-4	1,000	1-ph.		2 5-3
Ferro-manganese, 75-80 per cent Mn	15	1,200	3-ph.	70-85	2 2-3
Ferro-chromium, 60-65 per cent Cr, 4-6 per cent C	13-15	750	3-ph.	70-80	3-4 5
Ferro-tungsten, 70-75 per cent W	0 75	150	1-ph.	80-90	2 1 [illegible] 1 7 Ref
Ferro-molybdenum, 60-65 per cent Mn, 15-20 per cent C		150	1-ph.	78-80	7-7 5†
Ferro-vanadium, 30-35 per cent V, 3-4 per cent Si	1	150	3-ph.	75 av.	3 4
Ferro-uranium, 35-50 per cent U, 3-4 per cent C	800 lb.	75	1-ph.	75	3.5

† Per lb. of Mo. in alloy.

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

Interesting Use of "Want Ads" to Fill Vacancies

TO PROCURE suitable persons to fill vacancies, the Consolidated Gas, Electric Light & Power Company of Baltimore makes an interesting use of the "help wanted" columns of the newspapers. Its officials realize that one of the most important problems facing business executives is that of obtaining satisfactory labor. The company's advertisements do not state in a few concise words what positions are open, but considerable thought is given to presenting reasons why the company is a good one to work for and information about the advantages it offers its employees. One of the advertisements reads:

The Gas & Electric Company offers attractive opportunities for congenial, interesting and productive work. It offers substantial advantages in the way of welfare and pleasant working conditions, stability of employment and opportunities for advancement.

The company provides attractive educational advantages.

To preserve the health of employees, to prevent disease and to promote sanitary, healthful conditions, the company has a medical department.

Employees are encouraged to invest their savings in the capital stock of the company. It promotes a savings and investment fund. Employees do not contribute to these funds.

Vacations are allowed each year to all employees whose length of service entitles them to a vacation. The company has a pension system and a sick and death benefit plan. Employees do not contribute directly to these funds.

For the convenience of its employees the company has two lunchrooms, where good, wholesome food can be purchased.

In many ways the Gas & Electric Company offers its employees advantages and attractions. At present there are opportunities with the company for

ADDING MACHINE OPERATOR,
RECORD CLERKS,
TYPISTS,
COMPETENT STENOGRAPHERS,
CLERKS FOR TEMPORARY WORK.

A representative of the employment department will be glad to talk with you about these positions; Room 561, fifth floor, Lexington Building. Send or telephone St. Paul 8000 for the booklet, "Information for the New Member."

It is not the aim of the Baltimore company merely to fill positions alone but to try to fill them in the same manner that it sells its service and merchandise. The quality features and personal, human factors that enter into using its service and the merchandise the company sells are touched upon in every "help wanted" advertisement.

Central Station Regulations for Use of Starting Compensators

By Vernon Tallman

IT IS interesting to note the variation in practice pertaining to the use of compensators for starting three-phase motors disclosed by a questionnaire sent to several of the large central stations in New England. Several of the companies make no distinction between the 40-deg. and 50-deg. motor, nor are any allowances made for billing purposes. Other companies, however, recognize the fact that the 50-deg. motor is a piece of equipment with a maximum rating which is the limit of its output. For example, in the accompanying tabulation Company No. 4 allows motors up to 5 hp. (40-deg. motors) and up to 7½ hp. (50-deg. motors) without compensators.

In cases where the actual measured demand is used for purposes of billing, the name-plate rating of the motor has no effect upon the net bill paid by the consumer. In other cases, however, where the name-plate rating is used, the consumer seems to be penalized a certain amount by using the name-plate rating as compared to the rating of a 40-deg. motor which would do the work.

The 50-deg. motor, if properly applied, should give good results to the users, and it seems as if the central stations should study this piece of apparatus and decide upon its limitations and merits and make such provisions in its rates as will be equitable to the customers who will have to use it.

DATA ON USE OF COMPENSATORS IN NEW ENGLAND CENTRAL STATION

Company No.	40-Deg. Motors: What Motors Allowed Without Compensators	40-Deg. Motors: Above What Hp Is Compensator Required	50-Deg. Motors: What Motors Allowed Without Compensators	50-Deg. Motors: Above What Hp Is Compensator Required	What Provision for 50-Deg. Motor in Billing
1	Below 5 hp	5 hp. and above	Below 5 hp.....	5 hp. and above	No differential in rates. Do not contemplate any Full name-plate rating used as connected load.
2	Up to 5 hp.	7½ hp. and above	Up to 5 hp.....	7½ hp. and above	Maximum demand based on connected load. Very few 50 deg. motors at present. Are considering effect of 50 deg. motor on connected load and demand billing.
3	No distinction is made as far as starting devices are concerned between 40-deg. motors and 50-deg. motors.				No differential on billing.
4	Up to 5 hp.	7½ hp. and above	Up to 7½ hp.	10 hp. and above	Billing based upon actual measured demand.
5	5 hp. and below	7½ hp. and above	5 hp. and below	7½ hp. and above	Name-plate rating irrespective of whether 40-deg. or 50-deg. This affects minimum charge. Increases it for 50-deg. motor.
6	Starting currents below 5 hp. must not exceed three times full-load current. Starting currents 5 hp. to 50 hp. must not exceed two and one-half times full-load current. Special provisions and rules in effect.				
7	5 hp. and below	7½ hp. and above	5 hp. and below	7½ hp. and above	Billing based upon actual measured demand.

Intercompany Meetings of Commercial Representatives

INTERCOMPANY meetings of the commercial representatives of the properties managed by Day & Zimmerman have recently been inaugurated. For convenience the properties are divided geographically into two groups, the northern group embracing the Penn-Central system at Altoona, Pa., Olean, Bradford, Erie, and the Salem, Oil City and Franklin divisions of the municipal service system. The southern group includes the Eastern Shore system and the Chester Valley, Alexandria, Staunton, Waynesboro and Valdosta divisions of the municipal service system. Meetings are to be held every three months.

Each group has held its first meeting, at which the purpose of this plan was outlined and the subject of "maintaining list prices" was introduced for discussion. It is intended that the meetings shall bring out discussions of questions by suggesting problems rather than through papers dealing with a subject. In this way each man's opinion and experience will be presented for the benefit of all the representatives.

The meetings are supplemented by inspection trips over the company's property and through interesting industrial plants in the vicinity. Representatives from the electrical manufacturers have also been induced to give talks on methods of advertising and improving sales of electrical appliances.

Encouraging Comments on Utility's Sale of Stock to Customers

J. E. SHUTE, superintendent of personnel of the Penn Central Light & Power Company, Altoona, Pa., who was in charge of the sale of Penn Central preference stock in the district covered by the company, has prepared an interesting report of the results of the sale. Of the 3,231 shares of stock offered, 1,201 were purchased by Penn Central employees, an average of four shares per employee; 218 shares were purchased by employees in the company's Philadelphia office, and 1,812 shares were purchased by 237 persons in Altoona, an average of 13.7 shares per person.

Analyzing the different purchasers of the stock, Mr. Shute's report says: "Very few of the purchasers were what could be termed 'investors in corporation securities.' Quite a number subscribed without an explanation of the underwriters' statement. They were entirely satisfied to invest their money on the reputation of the company. Their answer when we offered to explain the statement usually was that they were satisfied that the company was sound and would not ask its customers to invest unless it were. Little or no solicitation was necessary. Practically all the stock was sold at the company's office, and inquiries are being received daily, although our allotment of stock has been sold entirely.

"We received many expressions of confidence in our company, its management and employees. We believe a large number of shares were sold to the working class through the fact that they were acquainted with some employee or his family and were influenced by their high regard for our personnel.

"The sale has thoroughly established one fact in the writer's mind, which is that the satisfied customer is vastly in the majority. The kickers we shall always have with us; frequently their kicks are justified, but by making one satisfied we have made another friend."

Two-Month Electric Appliance Campaign in New York City

ON JULY 6 the United Electric Light & Power Company started a "summer comfort" campaign for the sale of electric appliances through advertisements in the newspapers of New York City. Believing that the total sales of electric appliances would be greatly increased by encouraging the contractor-dealers to push their sale, the United company has included a co-operative feature in the advertisements calling attention to the fact that appliances are sold by local electrical dealers as well as by the company's branch offices.

A series of twenty advertisements has been prepared and will appear in the evening newspapers during July and August, and in order that the dealers may realize the fullest benefit from the advertising, a pamphlet showing all of the advertisements and the date on which each will appear has been sent to all electrical dealers in the city. This will enable them to time their own advertising and window displays to the best advantage.

The campaign is under the direction of Ralph Neumuller, advertising manager of the United Electric Light & Power Company.





TWO OF A SERIES OF TWENTY ADVERTISEMENTS APPEARING IN NEW YORK CITY NEWSPAPERS DURING JULY AND AUGUST

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Calculating the Weight of Copper Needed for a Dynamo.—F. LOPPÉ.—Starting with fundamental formulas relating to air-gap density, armature length, number of poles, pole pitch, etc., the author derives expressions for the weight of armature and field windings for a direct-current dynamo. After fixing certain practical limits for current density, magnetic induction and geometrical proportions, these expressions permit the determination of extreme cases so that all practical machines would come within these limits. Thus the weight of armature copper in a direct-current machine is found to be between 0.36 kg. and 3.47 kg. (0.79 lb. to 7.64 lb.) per kilowatt. The weight of the field winding, on the other hand, is found to be practically independent of the output, while the product of number of revolutions per minute and field-winding copper weight (in kilograms) is found to be from 34,000 to 400,000 (75,000 lb. to 882,000 lb.). Another conclusion is that the amount of copper used in the field will be smaller for high angular velocity and few poles.—*Revue Générale d'Electricité,* April 3, 1920.

Commutation in Direct-Current Machines.—EMIL ALM.—On the basis of Lamme's suggestion that all the various voltage components in a commutating coil may be assumed to be induced by rotation in a constant magnetic field, the author reviews the commutation problem and gives analytical expressions for the induced emf. components. Special attention is given the application of the theory to special problems such as the commutation in fractional-pitch windings and the effect for high angular velocity and few poles.—*Revue Générale d'Electricité,* April 3, 1920.

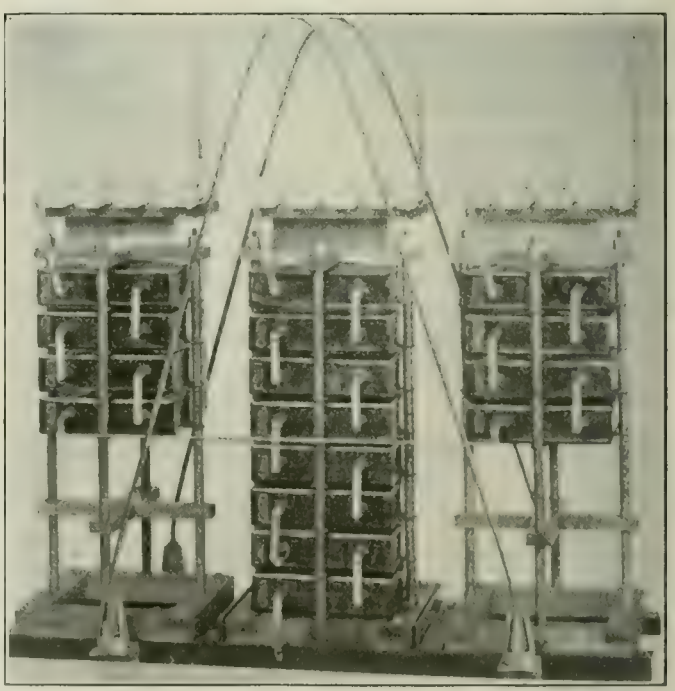
Generation, Transmission and Distribution

Three-Phase Transmission Line Constants as Referred to the Frequency of the Third Harmonic.—SWYNGEDAUM.—In considering the ordinary equations for voltage and current along a transmission line the author establishes some simple approximate rules for determining the apparent impedence of a relatively short line, as measured from the sending end. Numerous examples are worked out as illustrations, and particular stress is laid upon the third-harmonic resonance which may occur if the constants of a distribution system take on certain values.—*Revue Générale d'Electricité,* April 10, 1920.

Quarter-Wave Transmission Lines.—BUNET.—After a brief discussion of difficulties, such as poor voltage regulation, which are met in an attempt to operate lines of more than 300 miles at 50 cycles the author considers the possibility of extending present transmission ranges by utilizing the peculiar properties of the so-called "quarter-wave" line. On an open alternating-current line of certain length, equal to one-fourth of a wavelength—around 900 miles at 50 cycles—a particular type of resonance will occur, the received voltage being many times higher than the voltage at the generator end and lagging just 90 deg. behind it. Such a quarter-wave line, therefore, is utterly unsuitable for ordinary constant-voltage transmission. It has been shown, however, by Steinmetz and others, that if the generator current is maintained at a constant value the received voltage will remain substantially constant whatever the load. This suggestion is taken up and numerical cases are worked out and presented in tables to illustrate the feasibility of a practical application of the scheme. Naturally, ordinary alternators could not be used with a quarter-wave line, but there are certain types of constant-current machines which may be better adapted for this form of power transmission.—*Revue Générale d'Electricité,* March 20, 1920.

Installations, Systems and Appliances

Alternating-Current Lightning Arresters.—V. E. GOODWIN.—For a number of years the standard form of lightning arrester has been the electrolytic cell. This cell has a high discharge rate and high electrostatic capacity and is effective for large power stations where attendants are on hand to look after the charging, etc.,



HIGH-FREQUENCY ABSORBER, 15,000 TO 25,000 VOLTS

that is required. A more recent form of lightning protector is the oxide-film arrester. The electrostatic capacity of this cell is lower than that of the aluminum cell, and from laboratory data the latter would appear to possess better qualities for protection, but in actual service the relative merits are more nearly equal. The

oxide-film arrester requires no attention and hence is more suitable for isolated installation. Neither of these arresters offers protection against high-frequency surges, and therefore it has been necessary to develop a device known as the high-frequency absorber, which consists of a static condenser connected in series with a resistor. The condenser acts as an automatic relief valve for high frequencies and the resistor as a means of absorbing the energy which is tending to produce these oscillations. They are so designed as to pass on'y small leakage current at normal frequency. If the frequency should increase from some extraneous source, such as an arcing ground, the current through the device would tend to increase nearly in proportion to the frequency if the energy supplying this condition were not limited. This fortunately is the case as the high-frequency energy is limited in value. Hence as the current through the condenser and series resistance increases the resistance absorbs the energy and dampens the oscillations, thus rendering them less dangerous to the system. One of these devices is shown in the illustration. It is installed as an auxiliary to the lightning arrester.—*General Electric Review*, May, 1920.

Electrophysics and Magnetism

Variation of Residual Induction and Coercive Force with Magnetizing Force.—R. L. SANFORD and W. L. CHENEY.—A report of an investigation to ascertain whether or not analytical expressions similar to the reluctivity relationship of Kennelly correctly represent the variation of residual induction and coercive force with the maximum magnetizing force. Hysteresis measurements were made on a number of samples covering a wide range of materials using magnetizing forces up to 2,500 gausses. The relationships $H_m/B_r = a_1 + b_1H_m$ and $H_m/H_c = a_2 + b_2H_m$ were found to hold within the limits of the probable experimental error.—*Scientific Paper No. 384, Bureau of Standards.*

Units, Measurements and Instruments

Accuracy of Commercial Electrical Measurements.—H. B. BROOKS.—In this paper are discussed the accuracy required in commercial electrical measurements and the means of obtaining it, namely. proper choice, installation, use and maintenance of instruments. Conditions of use, external disturbing influences and features of design and construction affecting the accuracy are considered in detail. The best types of instrument for measuring voltage and current are mentioned. The sources of error in electrodynamic wattmeters are discussed, including the effect of instrument transformer errors. The principal factors affecting the accuracy of watt-hour meters are given. In conclusion some improvements which should be forthcoming soon are mentioned.—Paper presented before the A. I. E. E., Feb. 20, 1920.

Measurement of Hysteresis Values from High Magnetizing Forces.—W. L. CHENEY.—A study of the possible causes for the divergence of hysteresis data as compared with those obtained on standard apparatus has led the writer to believe that readings are affected by (1) the residual magnetism in the core of the electromagnet after the primary circuit has been broken; (2) a change in the distribution of the flux about the specimen when the magnetizing force is changed from a high value to a low one, and (3) magnetic viscosity. As a result of this study a method for measuring the coercive force which yields results comparing more favorably within the experimental error with data obtained on standard apparatus has been developed. The coercive forces and residual inductions from maximum magnetizing forces ranging from zero to 2,500 gausses have been plotted against the latter as the independent variable. Both curves resemble in shape the intensity of magnetization curve.—*Scientific Paper No. 383, Bureau of Standards.*

Telegraphy, Telephony and Signals

A Secret Common-Battery Intercommunication Telephone System.—In this article details of an intercommunicating telephone set developed by the British Post Office for both inside and outside use are given.—London *Engineer*, May 28, 1920.

Duplex Radio Between the United States and Germany.—Practice in modern radio seems to tend toward the use of a duplex arrangement, comprising a powerful transmitting station with a large sending antenna, and a co-ordinated receiving station at 15 to 25 km. (10 to 15 miles) distance, with a coil antenna of high selectivity and tube amplifiers of various kinds. The Nauen station in Germany is now working on such a duplex plan with the receiving station at Getlow, 30 km. (19 miles) distant. The latter station has two square six-turn coil antennas, each with 28-m. (92-ft.) side and at 1 m. (3.3 ft.) distance from each other on the same support. One of these receives Annapolis at 17,000 m., the other New Brunswick at 13,500 m. wave length, neither of them suffering any serious disturbance from the Nauen 12,600-m. wave. By use of radio and audio amplifiers and an acoustic resonance transformer it has been possible to establish reliable high-speed reception of the American stations directly on a Morse inker.—*Elektrotechnische Zeitschrift*, Jan. 8, 1920, abstracted from *Telefunken-Zeitung*, No. 18 and 19, 1919.

Distance of 7,500 Miles Covered by 80-kw. Stations.—It is said that the Getlow station recently has succeeded in receiving the two 80-kw. stations Tjililin and Malabar, in the Dutch Indies, on a Morse inker. The distance covered in these cases is about 12,000 km. (7,500 miles).—*Elektrotechnik und Maschinenbau*, April 4, and *Elektrotechnische Zeitschrift*, Feb. 12, 1920.

The Rome Radio Station of the Italian Navy.—CYRIL F. ELWELL.—The antennas, ground system, arc, generating and control equipment at the Rome transmitting station are described and the numerical data are offered by the author.—*Proceedings Institute of Radio Engineers*, June, 1920.

Wireless-Telephone Progress.—Details of apparatus used in recent experiments.—London *Electrician*, May 21, 1920.

Use of Ground Wires at Remote-Control Stations.—A. HOYT TAYLOR.—By utilizing the directional selectivity of subterranean receiving antennas it has proved possible to install receiving stations in the immediate vicinity of transmitting stations. The proper design of the underground antennas, the construction of the shielded rooms for the receiving sets and the mode of "remotely" controlling the nearby transmitting station are described in detail. The complete design, layout and installation of several such naval "remote" control stations is then given. Their proper mode of use and advantages are considered.—*Proceedings Institute Radio Engineers*, June, 1920.

News in Brief

Summary of Market Conditions and of Recent and Approaching Happenings of Importance to the Industry

JOBBERS' reports show a continued slight slackening in most sections, although in the Middle West no fluctuation is yet apparent and in the Northwest retail trade is as brisk as ever. Stocks are beginning to improve and deliveries are getting easier. On the Pacific Coast and in the Middle West collections are tightening, but in the East they are in fair shape and in the South a surplus of money is looked for with the harvest of the cotton crop. Trade acceptances have been found of value in the credit situation.

CONSTRUCTION work, especially for industrial purposes, is under way in good volume in the East and South, and an optimistic feeling prevails throughout the country as to business conditions. Crop reports are generally favorable.

EXCEPT for increases on heating appliances and schedule material, prices remain steady. Fan sales are light, though warm weather helped them in New England. Rigid conduit is almost unobtainable in the East. Flexible armored conduit is spotty.

ELECTRICAL exports for May reached nearly $9,000,000, surpassing April's by $2,000,000 and making a record for the year. Total exports for the first five months of 1920 are $37,712,177, a gain of $100,000 over the corresponding period of 1919.

ELECTRIC furnaces for melting non-ferrous metals have increased in number at a good rate, and inquiries are received in good volume. Sales this year are reported to be four times as large as those of a year ago.

FINISHED stocks of pole-line hardware have been about cleaned out by the heavy demand on manufacturers, and it is very difficult to take care of the business on hand even after discrimination in accepting orders.

CAR SHORTAGE is curtailing industrial production in all sections of the country through the inability of manufacturers to procure delivery of their raw materials.

A MOVEMENT toward the standardization of service voltages is receiving consideration in central-station and manufacturing circles, following the success attained in transformer rating standardization in the last four years.

A DECIDED improvement in trade conditions in the brass industry is noted as a result of the failure of labor agitators in the Naugatuck Valley of Connecticut to carry through a successful strike for higher wages.

STANDARDIZATION of transformers in the last four years has reduced the number of kva. and voltage ratings to about 40 per cent of the listings formerly carried. Orders for special transformers are only one-third as numerous as in the pre-standardization days.

ONE OF the two 25,000-kva. units to be installed at the West Penn Power Company's new six-million-dollar station at Springdale, Pa., was started recently.

NO PROPOSAL for home rule or municipal ownership of public utilities has been thus far adopted by the Illinois Constitutional Convention, which has adjourned to Sept. 21.

STEPS to tie together the 30-cycle and 60-cycle, 140-kv. systems of the Consumers' Power Company in Michigan are being taken. When this work is completed there will be a 140-kv. steel-tower transmission line approximately 450 miles in length.

FOLLOWING the increase in rates recently granted to the Pacific Gas & Electric Company and the Great Western Power Company the oil companies of California have announced an increase in the cost of oil in the fields of 12 cents. This raises the cost from $1.48 to $1.60 a barrel, which will mean an increase of approximately $500,000 in the operating expenses of the Pacific Gas & Electric Company. The Great Western Power Company will not be affected by the increase until the first of next year.

H. G. BUTLER, power administrator of the Railroad Commission of California, in announcing that the danger of power shortage is over for this year, says that all restrictions for southern California will be removed by Sept. 1 and that restrictions on acceptance of new contracts will be modified at once.

MUCH damage to transmission and distribution systems has been caused in Idaho and Nevada by an electrical storm that swept the Northwest. All the mines at Goldfield, Nev., were forced to shut down because of the failure of electrical supply.

INCREASING disposition on the part of the public to help public utilities was reported at the convention of the Sales Managers' Association at Association Island, N. Y. R. H. Tillman was chosen as chairman of the executive committee for the coming year.

DEFERRED plans for building a large dam across the Colorado River at Marble Falls, Tex., and the installation of a 100,000-hp. hydro-electric plant are to be pushed.

THREE electric utility issues, totaling $12,500,000, were placed on the market this week. The largest of these, $8,000,000 of first mortgage 6 per cent gold bonds, issued by the Duquesne Light Company, Pittsburgh, will be used to increase to 120,000 kw. the capacity of its new Colfax plant and for adding a 40,000-kw. turbo-generator to its Brunot Island plant.

ACCORDING to a ruling by the Comptroller of the Treasury, the new Federal Water Power Commission has no power to use any of its appropriation to employ clerical, technical or other assistance but must depend on the present personnel of the Departments of War, the Interior and Agriculture.

SPEAKING before the Ohio Electric Light Association, George H. Cushing, a prominent Chicago coal man, said enough bituminous coal had been produced this year for the entire needs of the country but that uncontrolled industries, fearing a shortage, had got possession of most of it.

ANNOUNCEMENT has been made this week of the appointment of Sidney Z. Mitchell, president Electric Bond & Share Company, as chairman of the public policy committee of the N. E. L. A.

PRICES for spot coal continue to move upward, and a prominent Eastern utility is reported as having paid $18 a ton last week.

UTILITIES are beginning to take advantage of the Interstate Commerce Commission coal transportation priority order and as a result are obtaining more contract coal at a price considerably below that prevailing in the open markets.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Coal Priority Order Means More Coal at Contract Price

QUICKLY following the order of the Interstate Commerce Commission last week granting to public utilities coal transportation priority, numerous electric light and power companies filed requests for assignment of cars, and coal is now being shipped in accordance.

Not only does this order assure the utilities of a supply of coal for current requirements, but the utility men see in the order an opportunity to procure more coal on contract. This would mean a very considerable saving in money to utilities.

According to the order the coal operator must become a party to each car assignment order. Consequently it is not compulsory on his part to supply coal on contract, but it is thought that the operators will in most cases find it expedient to load assigned cars at the contract price.

S. Z. Mitchell to Head N. E. L. A. Public Policy Committee

ANNOUNCEMENT was made this week of the appointment of Sidney Z. Mitchell, president of the Electric Bond & Share Company, as chairman of the public policy committee of the National Electric Light Association.

The public policy committee will have an unusual amount of important work come before it this year, including the guidance of the new Public Relations Section. From the executive committee of this section President Martin J. Insull has appointed M. S. Sloan, John F. Gilchrist and Chairman J. E. Davidson members of the public policy committee.

It is understood that Mr. Mitchell is planning special sub-committees of the public policy committee on national questions, one of which is public utility financing. He is also planning one or more important meetings which will call for discussion and co-operation from the leading business men of the nation, bankers and men in public life. Upon inquiry Mr. Mitchell said he would announce in detail his program at a later date.

Water-Power Act Starts Many Activities in Northwest

FOLLOWING the signing of the water-power bill a large number of new developments have been started or planned in the Northwest, the great importance of the act to that section of the country having thus already become manifest. One of these developments is that at the "Z" Canyon on the Pend Oreille River at Metaline Falls, where 400,000 hp. will be developed at a cost of approximately $20,000,000. The city of Vale, Ore., is to construct a municipal plant at a cost of $300,000. The International Portland Cement Company will construct a quarry at Portrock, Idaho, and will spend $50,000 on a power house and crusher on Pend Oreille Lake. Plans are being made to install a large power and industrial plant at Priests Rapids, on the Columbia River, that will require an initial expenditure of $5,000,000 and will cost more than three times that sum before the ultimate amount of power is produced. The Kane Pneumatic Shock Absorber Company of Centralia, Wash., is to build a 1,500-kw. plant at Fords Prairie. To Scio, Ore., has been granted the right to develop 362 hp. from Thomas Creek for municipal purposes. The Bend Water, Light & Power Company is to develop 4,233 hp. on Tumalo Creek near the town of Bend. The Grangeville (Idaho) Electric Light & Power Company is increasing the capacity of its plant on Lolo Creek, as well as the capacity of its transmission lines. Work on a new plant on the Wallowa River will be started at once by the Enterprise (Ore.) Electric Company. The first unit will be 1,500-kw., and developments will be made up to 15,000 kw. as the demand increases. Application has been filed with the registrar of public lands in Helena, Mont., by the Rocky Mountain Company of Butte for a permit to develop water power on the Flathead River. The proposed development would involve the construction of five dams, with an expenditure of approximately $10,000,000.

Appointive Powers of Federal Water-Power Commission Limited

SEVERE limitations have been placed upon the Federal Power Commission by an opinion just rendered by the Comptroller of the Treasury. That official rules that the commission may use none of its appropriation for the employment of clerical, technical or other personnel. The commission will have to depend entirely upon such help as may be loaned by the War, Agriculture and Interior Departments.

In view of the slashing of appropriations which took place during the last Congress, the departments are in no position to part with stenographers and clerks, to say nothing of technical men. In handing down his opinion, the Comptroller said in part:

"I think it is reasonably clear that these provisions negative the suggestion of any intent to vest in the commission authority to build up an organization of employees, either by original appointment or by transfer from other branches of the government service. The responsibility for the work of this commission is placed by law upon the Secretary of War, the Secretary of the Interior and the Secretary of Agriculture, and each of these secretaries is authorized to use the personnel and other facilities of his department to accomplish such work. If the personnel of the three departments concerned is not adequate to perform properly the regular work of said departments and also the work of the commission, it is for the three secretaries, who are also the members of the commis-

sion, to determine what work shall be accomplished and what shall be left unperformed.

"When Congress provides a lump sum appropriation for the expenses of the commission or board, it usually stipulates that the appropriation is available for the employment of personal services, if the employment of such services is contemplated, and specific authorization is required by law if personal services are to be employed by the commission at the seat of government. The comparatively small appropriation made for the expenses made necessary by this act contains no such provision, although it expressly mentions other items such as rent and transportation and subsistence. This is another indication that the appropriation for the expenses of the commission was not intended to be available for the payment of any salaries other than the salary of the executive secretary.

"Any department or agency of the government is authorized upon the request of the commission to detail temporarily such of its officers or employees as may be necessary in connection with the investigations provided in Section 4 of the act; such number of officers or employees in the Departments of War, the Interior and Agriculture, of any grade or class, as may be necessary in connection with any authorized work of the commission, may be assigned to duty with said commission, but transfers from said departments to the commission are neither necessary nor authorized; and no appointments by the commission of officers or employees other than the executive secretary are authorized either by way of original appointment or by transfer from another department or establishment of the government."

Power Restrictions in Southern California to Be Removed

THE power administrator of the Railroad Commission of California, H. G. Butler, has announced that all power restrictions for southern California will be removed by the first of September and that the restrictions on the acceptance of new contracts by the power companies will be modified at once. "The power companies," he stated, "acting under instructions of the power administration early this spring, modified the hours of use by consumers so as to conserve storage water and limited new business to that which was essential. These restrictions, together with cold weather in April, May and June and late rains, increased the water supply and kept the load light.

"This with a new power plant of 17,000 hp. of the city of Los Angeles placed in operation a week ago and three plants that will be put in operation within thirty days, one of 8,000 hp. of the city of Los Angeles, and two of the San Joaquin Light & Power Corporation totaling 70,000 hp., has relieved the situation to such an extent that the danger of shortage this year has passed."

It will be necessary, however, it was pointed out, to operate all steam plants to practically full capacity during this season. Accidents in the power plants might make temporary restrictions necessary again.

The companies that will be affected by the lifting of the power restrictions are: Southern California Edison Company, Southern Sierras Power Company, San Joaquin Light & Power Corporation, Ontario Power Company, Los Angeles Gas & Electric Company, Mount Whitney Power & Electric Company and the Bureau of Power and Light of the city of Los Angeles.

New Securities Totaling $12,500,000 Marketed This Week

THREE electric utility issues totaling $12,500,000 were placed on the market this week. The Duquesne Light Company, Pittsburgh, Pa., placed $8,000,000 first mortgage 6 per cent thirty-year bonds which were sold to yield 7¼ per cent; the Louisville (Ky.) Gas & Electric Company sold $3,500,000 of 8 per cent notes due Jan. 15, 1923, and the United Electric Light Company, Springfield, Mass., issued $1,000,000 ten-year 7 per cent notes at 96.53, yielding 7½ per cent. The two latter issues are to retire previous ones.

Final Steps Being Taken in Unifying 140-Kv. Consumers' Power System

STEPS toward the tying together of the 30-cycle and 60-cycle, 140-kv. systems of the Consumers' Power Company in Michigan are under way. The northern division between Jaskson and the plants north of Saginaw operates at 60 cycles with main transmission at 140 kv., while the southern division between Jackson and Battle Creek has been operating at 44 kv., 60 cycles, though the main transmission lines were built to operate at 140 kv. The western division north and south of Grand Rapids is 30 cycles, operating at 140 kv. A 140-kv. steel-tower line from Argenta to Battle Creek is under construction and will furnish the tie between the existing 140-kv. lines in the three divisions. A 15,000-kva., 60 to 30-cycle frequency changed at Battle Creek will complete the tie between the two systems and make a 140-kv. transmission system of approximately 450 miles of steel-tower line when the circuits from Jackson to Battle Creek are changed to 140-kv. operation. A new 10,000-kva. turbo-generator and six 900-hp. B. & W. water-tube boilers with economizers, replacing eighteen 400-hp. boilers now in use, are in process of installation at the Battle Creek plant. A new 140-kv. outdoor substation of 16,000 kva. is also under way. The work represents the detailed carrying out of plans formulated several years ago for the unification of the system with a main transmission voltage of 140 kv., though it has been tied together for some time through the 40-kv. lines of the southern division and a 5,500-kva. frequency changer at Kalamazoo.

Industries Outbid Utilities for Coal

ENOUGH bituminous coal has been mined and delivered this year to supply the entire needs of the country, but most of this fuel has gone to uncontrolled industries that have become panic-stricken by the continual cry of a coal shortage and have bought coal regardless of price, according to statements made by George H. Cushing, director of the American Wholesale Coal Association of Chicago, a coal jobbing organization, in an address before the recent convention of the Ohio Electric Light Association.

As a result of the alleged coal-shortage propaganda the buying for winter storage, which the speaker said, ordinarily never started before July 15 and often not before Aug. 15, was started months earlier this year, and those with the most money got the most coal. This unreasonable buying and the inequitable distribution of the coal created a coal shortage based on demand at a time when there would have been ample for all consumption needs if it had only been placed where it was most needed.

The speaker blamed government agencies for propagating the coal shortage idea, but some of the members present thought that it was the coal men who had started the story in an effort to keep up prices. Be that as it may, it all seemed to agree that the coal men are now endeavoring to stave off a return of government control.

Supply Manufacturers Elect New Section Chairmen

DURING the sessions of the various sections of the Associated Manufacturers of Electrical Supplies at Eastern Point, Conn., June 28 and 29, several of the sections elected new officers. A. H. Fleet, Cutler-Hammer Manufacturing Company, was elected chairman of the Attachment Plug Section; Louis McCarthy, Macallan Company, of the Line Material Section; W. D. Steele, Benjamin Electric Manufacturing Company, of the Industrial Lighting Section; G. A. Burnham, Condit Electrical Manufacturing Company, of the Air-Circuit Breaker Section, and C. A. Bates, Bryant Electric Company, of the Fuse Section.

Coal Price Anywhere Up to $23 a Ton

SPOT coal prices are, as one person expressed it, "all over the lot." Within the past ten days prices as high as $23 a ton delivered have been reported paid by Eastern utilities. Middle Western and Northwestern utilities are not paying such high prices for spot coal as are the Eastern properties.

The Public Service Corporation of New Jersey last week paid $14 for one lot and had more offered at $17.50 which it refused to buy on the basis that the cost was exorbitant. The Public Service Commission of the Second District of New York stated that New York utilities within the past few days had paid anywhere from $16.40 to $23.10 for coal. One shipment of 2,000 tons was bought f.o.b. Staten Island for $14.50. This coal, delivered at the boilers, will probably cost between $16 and $18 per ton.

It is interesting to note in this connection that tidewater coal for New York was quoted in 1914 from $2.82 to $3.25.

Some interesting figures on the cost of coal in June, 1920, compared with June, 1914 and 1919, are available. The Nebraska Power Company in June, 1920, paid $5.65 f.o.b. destination against $4.85 in June, 1919, and $2.78 in June, 1914.

The Columbus, Delaware & Marion (Ohio) Electric Company reports its May coal cost just 125 per cent greater than that for the previous May, with exactly the same plant and practically the same output and load

The Northern States Power Company, Minneapolis, Minn., paid $8.69 for Hocking screenings in June, 1920, against $5.30 in June, 1919, and $3.10 in June, 1914.

The Boston Edison Company reports the following price per long ton delivered to the boilers: June, 1920, $11.223; June, 1919, $7.010; June, 1914, $3.929.

Coal Age reports the following prices this week for bituminous coal from the sections named: Boston Cambrias and Somersets, f.o.b. mines, $11.50 to $13, net tons; f.o.b. Philadelphia, gross tons, $14.75 to $16.50; f.o.b. New York, gross tons, $15.10 to $16.85. New York, f.o.b. piers from $16 to $16.25, alongside from $17 to $17.25. Philadelphia, $12.50 to $14, f.o.b. Pennsylvania mines. Baltimore, $11 to $13 per net ton f.o.b. mine. Buffalo, $10 to $10.50 f.o.b. mine. Uniontown, Pa., $11.25 and $11.75 for classified coals. Columbus, Hocking screenings, $5 to $8 f.o.b. mine with 50 cents additional for mine-run. Chicago, mine-run, $5.50 to $6.50, f.o.b. mines. Birmingham, $6.50 to $8.50 for spot coal, f.o.b. mines. Louisville, western Kentucky mine-run, $5 to $5.25, f.o.b. mine.

James J. Storrow, fuel administrator for Massachusetts, testifying in New York before the United States Senate committee on reconstruction and production on Tuesday, stated that under the Fuel Administration West Virginia coal was $2.60 and Pennsylvania $3, which allowed a fair profit. The price of soft coal at the mines now, he testified, is from $11 to $14.

California Co-operative Campaign to Be Tried in Ohio

THE last two days of the Ohio Electric Light Association's twenty-sixth annual convention were devoted to the consideration of commercial topics, rural business and means for obtaining coal.

The California co-operative plan is to be tried in Ohio at the suggestion of P. J. Williams of Cincinnati, and C. G. Eichelberger of Cincinnati and J. C. Matthieu of Dayton were appointed to represent the central stations in a conference with men from other branches of the electrical industry. One of the principal objects is to foster the installation of more convenience outlets.

Electric cooking, rural business and the need of convenient outlets were all touched upon in the report of Chairman C. G. Eichelberger of the new-business cooperations committee, and each of the subjects was discussed at length. P. L Miles of the Edison Electric Appliance Company said that an investigation conducted by his company indicated that there are only about 75,000 electric ranges in use in the United States, while the estimated output of the factories during 1920 is about 50,000. Next year the manufacturers expect to have a production capacity of 125,000 electric ranges.

The rural-line discussion on the paper "Under What Conditions Is Rural Business Profitable?" by D. O. Vaughn of Sidney, Ohio (see abstract in the ELECTRICAL WORLD of July 3, page 29), was led by D. L. Gaskill, Greenville, Ohio, who has had considerable experience with small and not over-prosperous farmers. To keep the farmers from going to the Legislature and demanding service the central stations should take the business now and on a profitable basis. However, he advised the farmers' owning and maintaining the rural lines.

Electric heat treatment of steel was the subject of a paper by R. T. Kaighan of Cleveland. Additional data on high temperature electric furnaces were submitted by A. D. Dauch, Pittsburgh, and on furnaces operated at less than 1,000 deg. Fahr. by R. P. Dunning of Cincinnati.

George H. Cushing of the Wholesale Coal Association of Chicago, as reported elsewhere, said that there was really no coal shortage and, calling upon the state association to condemn by resolution the recent order of the Interstate Commerce Commission granting a coal priority to public utilities for current use, presented arguments against regulation both as to the coal business and public utilities.

J. C. Martin of Columbus, attorney for the Ohio association, answered Mr. Cushing by emphatically stating that the public utilities were unable to obtain the coal necessary for operation and argued not only for state regulation of public utilities but also for the regulation of the coal business in the interest of the consumers.

M. H. Aylesworth, in his discussion of the general public utility situation and the National Electric Light Association organization, contended that the Ohio Electric Light Association should go on record in favor of a fuel priority order and should commend the Interstate Commerce Commission for its order protecting the consuming public by providing coal to the public utilities for current use. The speaker said that a recent public utility coal survey made by the National Electric Light Association and presented to the Interstate Commerce Commission prior to its order of July 13 proved conclusively that the public utilities were unable in many instances to obtain coal at any price, and that unless some immediate relief was granted by the proper authorities the public utilities of the nation would enter the winter months without a reserve supply of coal, which would be disastrous in the event of a heavy blizzard or a railroad strike.

Features of Federated Societies Explained

ANSWERS to many questions asked by engineers not fully informed of the objects and methods of the Federated American Engineering Societies are contained in Bulletin No. 2, just issued by the joint conference committee, which emphasizes the fact that, strictly speaking, the organization is not a new one but the successor to the existing Engineering Council, the work of which will be amplified as to scope, and a much more extended plan of membership adopted.

Some confusion exists as to the basis of representation where there are both a state organization and strong local organizations and affiliations. The constitution provides that a state council or organization, representative of the engineers and allied technologists in the state, can be represented on the American Engineering Council on the basis of all the engineers and allied technologists in the state. If, however, there exists a strong local organization or affiliation which elects to have its own representative or representatives on the council, then the state organization is entitled to representation on the basis of all the engineers and allied technologists in the state, less the engineers and technologists that are to be represented through their local organization

Another point brought out in the bulletin is that there is no provision for membership dues in the constitution or bylaws. These provide for funds contributed by the member societies for the support of the federated societies. Inasmuch as it would be unreasonable for a small local society to pay as large a contribution as a national society, the constitution provides that the contribution shall be on the basis of the number of members in the organization at the rate of $1.50 per member for national societies and $1 per member for local, state and regional organizations or affiliations. The individual, therefore, does not directly pay any dues, but the member society of which he is a member contributes on a per capita basis of its membership.

Pacific Coast A. I. E. E. Discusses Insulators

THE ninth annual Pacific Coast convention of the American Institute of Electrical Engineers opened at the Multnomah Hotel, Portland, Ore., on Wednesday, with an attendance of 150, which is in excess of that at previous conventions. Vice-president-elect C. E. Magnusson recalled the fact the day was the centennial of some of the most important events in early electrical history. Whereas formerly most discoveries were made in universities, he said, the present tendency is for the research departments of large manufacturers to make discoveries and apply the latest scientific advances. For this reason the Pacific Coast is in some danger, Professor Magnusson said, as without industrial research manufacturing will not prosper.

Three papers on insulators were presented and discussed jointly. These were "Design and Application of Suspension Insulators," by W. D. Peaslee; "Electrical Characteristics of the Suspension Insulator at the Higher Voltages," by F. W. Peek, Jr., and "Unit Voltage Duties in Long Suspension Insulator Strings," by Prof. H. J. Ryan and H. H. Henline. A great many instances were pointed out where insulators which had been in service from ten to twenty years had given the most satisfactory results. In some cases no failures whatever had been experienced in lots of 10,000 insulators in service more than twenty years, while in other cases insulators of more recent manufacture had failed after only a few years' service. The Portland Railway, Light & Power Company, with 1,000-volt megger, discovered 12 per cent of defective units on its line after three years' service. After six years' more service 7 per cent were found defective, although units testing 100 megohms were not replaced. A. C. Clarke questioned the use of 1,000-volt meggers having a scale of 2,000 megohms, and Professor Ryan agreed that if the insulator resistance reached the lower range of such meggers they were defective.

Discussion of the merits of various types of suspension units took place, manufacturers' agents being the principal proponents of different types. Causes of failure pointed out were improper treatment prior to firing and improper control of temperature during firing.

There was a diversity of opinion upon the danger of cascading. W. A. Miller maintained that corona would prevent cascading because of its shielding effect, although the papers by F. W. Peek, Jr., and H. J. Ryan gave expression to a contrary opinion. The likelihood of vibration causing deterioration was advanced by S. C. Lindsay. Professor Ryan pointed out that there was little likelihood of vibrational damage within the porcelain due to the Piezo electrical effect.

The electrostatic field in its relation to design was thought to be the most important matter now confronting insulator manufacture.

It was advocated that the Institute revise the specifications for testing and rating of suspension units because at present identical insulators of different makes have widely divergent ratings, due probably to varying methods of testing. In tests of insulators by high frequency, which is now accepted as the most satisfactory method, Professor Ryan urged that not only the frequency but the period between succeeding impulses be specified.

The convention continued on Thursday and Friday.

First 25,000-Kva. Unit Started at Springdale (Pa.) Station

ONE of the two 25,000-kva. units in the West Penn Power Company's new six-million-dollar station at Springdale, Pa., was started on July 1. It is expected that the second unit will be operating by Sept. 1. Coal for this station, which is situated virtually at the mouth of the mine, will be conveyed from the mine through a tunnel under the Allegheny River directly to the boiler room. The company owns or has under lease 4,000 acres of coal land, and development of this is now under way. It is estimated that there are more than 40,000,000 tons of coal at the door of the plant.

Construction of the Springdale plant was begun in September, 1917, and continued without interruption during the war. The government has advanced $2,409,000 toward the cost of the project. Two more units will be added to the station later.

New Million Dollar Power Line for Toledo

CONTRACTS have been closed by the Toledo (Ohio) Railways & Light Company for the building of a 12-mile high-tension overhead power transmission line to circle the city of Toledo, for the most part adjacent to the right-of-way of the Toledo Terminal Railroad, at an estimated cost of approximately $1,000,000. Work will be started this summer. The new line will be carried on specially constructed steel towers, averaging 65 ft. in height and consisting of two circuits designed for about 65,000 volts and 80,000 hp.

The power will be generated at the Acme Power Company's plant on the East Side. The line will cross the Maumee River and extend along the Terminal belt line to Fitch, a station at the intersection of the Terminal and Toledo & Western Railroads. This is a distance of nearly 12 miles and is almost half of the city circle.

The new line will furnish power for practically 85 per cent of Toledo's industries. The largest user is the Willys-Overland Automobile Company.

The steel towers are being built by the American Bridge Company, a Toledo concern, and the work of construction has been awarded to A. Bentley & Sons Company and several other Toledo contractors.

Puget Sound Company Gets Increased Rates

THE Public Service Commission of Washington State has issued an order which made effective on July 21 an increased rate schedule for lighting and power furnished by the Puget Sound Power & Light Company. The order was issued upon application of the company for waiver of statutory notice. The company's increase in rates becomes effective on the same date as the increase recently announced by the Seattle municipal light plant and is identical with the municipal rate schedules. An exception is made in the commission's order, however, in the cases of contracts with large power users. The company is directed to file all such unexpired contracts with the commission within ten days for investigation and official modification if the commission finds their continuance would constitute discrimination. All other contracts are terminated as of July 21.

Increases granted are from 5½ cents to 6 cents a kilowatt-hour up to 45 kw. for residential lighting and from 2 cents to 2½ cents on energy consumed in excess of 45 kw. The initial increase on power rates is 3½ cents to 4 cents up to 100 kw., from which point the power rate decreases by quantity discounts.

Duquesne Light Issue of $8,000,000 to Finance Increased Capacity

PROCEEDS from the $8,000,000 of first mortgage and collateral trust 6 per cent gold bonds of the Duquesne Light Company, Pittsburgh, Pa., placed on the market this week, will be used principally for increasing to 120,000 kw. the original initial installed capacity of the new Colfax plant and for adding to the 120,000 kw in the Brunot Island plant a second 40,000-kw. turbo-generator. The issue was offered at 85, thereby yielding 7¼ per cent.

The new Colfax plant is within two miles of a developed coal mine owned by an affiliated company. It is proposed that the plant shall have an ultimate capacity of 300,000 kw. Initially two 60,000-kw. three unit turbo-generator sets will be installed. The first of these is expected to be in operation about Oct. 1, 1920. The entire output of this plant, which is owned by a closely allied company, the Cheswick Power Company, will be taken by the Duquesne Light Company, which will complete the construction of a 66,000-volt line tying in the Colfax and Brunot Island plants and encircling the greater part of the manufacturing and business section of the Pittsburgh district.

Business and Pleasure to Blend at Contractor-Dealers' Convention

THE tentative program for the twentieth annual meeting of the National Association of Electrical Contractors and Dealers, which will be held at the Southern Hotel, Baltimore, Md., from Oct. 4 to Oct. 9 next, provides for executive committee meetings on the first two days, the proceedings proper beginning on Wednesday, Oct. 6, with an address by S. C. Blumenthal, chairman of the Maryland State Association; the formal welcome by the Mayor and the response by Chairman W. Creighton Peet of the national body. Committee reports will be taken up and an address made on "The Industrial Outlook." On Thursday J. A. Clark of the Westinghouse Electric & Manufacturing Company will make an address on "Sale of Motors for Industrial Use," A. S. Abbot of the Electric Construction Company, St. Paul, Minn., will discuss "Successful Conduct of a Contracting Business," and another address, on "Proper Handling of Fixture Sales," will be made. In the afternoon the delegates will visit Annapolis and the Naval Academy.

H. B. Kirkland will speak on "A Two-Billion-Dollar Industry" on Friday, Samuel A. Chase and W. L. Goodwin will make addresses, W. G. McKettrick of the National Lamp Works will discuss industrial lighting, and the annual dinner will take place, followed by dancing The executive committee will hold its final meeting on Saturday, and arrangements for a sight-seeing tour in Washington on that day have been made for those who wish to visit the capital.

Illinois Constitutional Convention Rejects Utility Measures

THE Illinois Constitutional Convention has adjourned to Sept. 21 without adopting any measures proposed for home rule or municipal ownership of public utilities. So many proposals were submitted and so much difference of opinion between the city of Chicago and the rest of the state developed that the convention has thus far failed to agree on any measures, several committee reports having been rejected.

Electrical Storm Causes Great Damage to Northwest System

AN ELECTRICAL storm that swept the Northwest lately caused severe damage to the transmission and distribution systems of the various power companies operating in that district. Besides tearing down great sections of lines, the power plant at Lewiston, Idaho, was put out of commission, as were substations at Moscow, Idaho, and the effects of the storm were felt as far south as Goldfield, Nev., where the substation of the Nevada-California Power Company was burned out.

Sales Managers See Desire on Part of Customers to Help the Utility

EVEN though the papers and discussions were on widely different subjects, the constantly recurring keynote of the convention of the Sales Managers' Association, made up of representatives of fourteen of the large central stations, held at Association Island, N. Y., on July 12 to 14, seemed to be the co-operative spirit which is being shown by customers and prospective customers in helping central stations meet the unusual demand for service. In numerous cities represented in the convention customers have voluntarily asked how they could help the central stations meet the problems. This spirit has found expression in the rearrangement of peak hours, readjusting hours of employment and helping to raise funds through company financing.

The convention was called to order Monday morning, July 12, by the chairman of the executive committee, T. I. Jones, who is general sales manager of the Brooklyn Edison Company. The program was so arranged that a reasonable amount of time was given to recreation, but from six to eight hours a day was devoted to the sessions of the convention. It included the following papers:

"Some Economic Problems of Interest to the Sales Manager," by R. S. Hale, superintendent special research department Edison Electrical Illuminating Company of Boston.

"Discussions on Central-Station Financing with Relation to the Present Value of the Service Rendered to the Public," introduced by Charles J. Russell, general commercial manager Philadelphia Electric Company.

"The Present Practice and Policy in Connection with Line Extensions," by Douglas Burnett, commercial manager Consolidated Gas, Electric Light & Power Company, Baltimore.

"Telephone-Order System," by E. W. Lloyd, general contract agent Commonwealth Edison Company, Chicago.

"Co-ordination of Central-Station Service with Private-Plant Operation," by L. R. Wallis, superintendent sales department Edison Electric Illuminating Company of Boston.

"Isolated-Plant Costs," by John W. Meyer, assistant general commercial manager Philadelphia Electric Company.

"The Merchandising of Incandescent Lamps," by Clarence Law, manager bureau illuminating engineering New York Edison Company.

"Special Sales and Window Displays," by E. A. Edkins, general manager electric shops Commonwealth Edison Company.

"The Supply of Electrical Energy to Large Customers," by R. H. Tillman, manager new-business department Consolidated Gas, Electric Light & Power Company, Baltimore.

In retiring from the chairmanship, T. I. Jones, general sales manager of the Brooklyn Edison Company, expressed his appreciation of the co-operation and courtesies that had been extended to him. R. H. Tillman was chosen chairman of the executive committee for the coming year, with R. R. Young and E. A. Edkins as other members of that committee.

Deferred Texas Water-Power Project Now to Be Carried Out

COL. C. H. ALEXANDER of Dallas, who promoted the construction of a large dam across the Colorado River at Marble Falls, Tex., and the installation of a hydro-electric plant of more than 100,000 hp. capacity several years ago, has just finished reorganizing the Syndicate Power Company, which will carry out the deferred enterprise. The dam is partly finished. According to Colonel Alexander, the contract for the construction of the first unit of the hydro-electric plant and the completion of the dam has been let to J. P. Nelson of San Antonio. It is estimated that the total cost of the project, including the building of power transmission lines to San Antonio, Austin and other towns within 150 miles, will be approximately $8,000,000.

Society for Electrical Development's First Bi-monthly Meeting

THE first of the bi-monthly meetings of the executive committee of the Society for Electrical Development, established by Chairman Charles L. Edgar, was held on July 16, when a number of important questions were discussed, including the plan for co-operation between the society and the California Electrical Co-operative Campaign. It was agreed that the society should take up with the Harvard School of Business Research the matter of the Research Bureau, co-operating in collecting data relative to the cost of doing retail merchandising in the electrical business.

J. M. Wakeman, general manager of the society, was instructed to take up with manufacturers the importance of more carefully scrutinizing their advertising copy to avoid showing appliances attached to lamp sockets which are not suitable for such use, as well as impossible combinations of appliances upon one socket. It was resolved that the society encourage the use by manufacturers of advertising copy similar in character to that now being used by the Western Electric Company and the G. & W. Electric Specialty Company, setting forth the necessity of public utility companies securing adequate financial support.

Samuel E. Doane attended the afternoon session and presented to the committee for its consideration a plan for demonstrating the industrial illumination exhibit which was shown at the National Electric Light Association convention at Pasadena. The general manager was instructed to meet with Mr. Aylesworth of the N. E. L. A. to decide what can be done to further the plan.

Decisive Defeat for Municipal Ownership.—At a special election in the city of Minot, N. D., July 13, to determine whether or not the city should own and operate its electric light, steam heat and telephone utilities, the vote stood 560 for municipal ownership and 877 against.

New Hydrophone for Navy Service.—For the past year the Navy Department has been at work on an improved type of hydrophone rather than telephone as was reported on page 1391 in the ELECTRICAL WORLD for June 12. The instrument can be used by naval vessels for determining the depth of water underneath a vessel and for locating and communicating with other vessels or harbor entrances.

Alaska's Water-Power Resources.—More than 25,000 hp. in water is available in the Resurrection Bay district of Alaska according to information just gathered by the Alaskan Engineering Commission. This power is easy of access and ready to be harnessed, it is declared. It is in the heart of a belt rich in pulp woods and close to the Alaska railroad. Everything indicates the possibility of utilizing this water power to establish a pulp industry in Alaska.

Aluminum Wire May Be Used Instead of Copper in Japan.—The proposed extensive hydro-electric projects in Japan will involve the building of about 1,000 miles of high-tension transmission lines in the next two years, most of which will probably be of the steel-tower type. Although copper has hitherto been used exclusively for the heavy transmission cables, a change to aluminum may be found commercially advantageous, in spite of a 25 per cent duty on that metal.

Modern Illumination Captures Conservative Stronghold.—London's famous Albert Hall, "the home of Sunday concerts and of midweek pugilism," says the *Electrical Times*, "after preserving for many years the full flavor of Victorianism, has at last adopted up-to-date lighting. Gone now are the flickering arc lamps which in the past distracted the attention of music-loving audiences." Instead of the arc lamps sixteen 1,000-watt tungstens of the half-watt type in large metal reflectors, fixed high up in the central dome, now shed an intense light over the whole auditorium.

Good Time Made in Pole Setting.—Under direction of William Doran, line foreman, a gang of five men in the employ of the Genesee Light & Power Company, Batavia, N. Y., recently set, back-filled and tamped sixty 30-ft. class B cedar poles in eight and a half hours, which the company believes to be record time. Three men in the gang had never helped set poles before. The poles were all piked in and were not set with the rigger. On the following day in seven and one-half hours the same gang set, back-filled and tamped twelve 30-ft. class B cedar poles and thirty 30-ft. class B chestnut poles.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Advances in Electric Rates.—The City Commission of Sandusky, Ohio, has approved the application of the Sandusky Gas & Electric Company for permission to advance its lighting and power rates approximately 25 per cent. The City Council of Kinston, N. C., has advanced the rates in that city, where the municipal plant has a monopoly, 20 per cent.

Water Powers in Africa.—Pretoria, the capital of South Africa, is about to spend £200,000 on electrical development, including a dam on town lands to provide water for a new power station, iron-mine operation and other industrial undertakings. In Nigeria, on the west African coast, a project is on foot to develop power from the Kurra Falls, which, at the confluence of two rivers, possess a fall of 700 ft. It is said that 5,500 hp. would be made available and that by this means electric power could be furnished to the mines for many miles around.

An Electrically Backward Island.—Although the island of Jamaica, in the British West Indies, has a population of about 900,000, it is, according to an English electrical engineer, C. Sylvester, who gives in the London *Electrical Times* an account of a recent visit there, decidedly unprogressive from an electrical point of view. It contains only two power houses, one steam and one hydro-electric. The former is very small. The latter, situated 20 miles from Kingston, the capital, has three turbo-generators, rated at 300 kw. each, under a head of 50 ft. Energy at 14,000 volts is transmitted to Kingston, where it furnishes light and power and operates a single-track trolley line 25 miles in length. "The telephone system in Jamaica," observes Mr. Sylvester, "is probably the worst system in the whole world." It exists only in the capital. Better things, however, are hoped for.

French Plans for Radio-Telegraphic Extension.—One of the most ambitious of the comprehensive schemes for extending wireless telegraphy is that of the French government for the linking up of the French colonies with France. Extremely powerful stations will be necessary, as the scheme embraces Saigon, in Cochin China, and Noumea and Tahiti, in the South Pacific. The distance from Paris to Saigon is roughly 6,200 miles and that from Saigon to Tahiti 6,800 miles, or 7,300 miles by way of Noumea. Thus stations capable of transmitting messages 7,500 miles will be established at Paris, Saigon and Tahiti, and less powerful stations of about 4,300 miles range will be constructed at Jiboutil, in East Africa; Antananarivo, the capital of Madagascar; Noumea and Martinique. Still smaller stations will link up the French possessions in Africa, connect Martinique with French Guinea and Saigon with Pondichery.

A Hydro-Electric Development in South Carolina.—A plant to furnish electric lighting and power to Saluda, S. C., and six other towns has been built by the Blue Ridge Power Company on the Green River, 4 miles from Saluda. It has a present capacity of 8,000 hp., to which another 4,000-hp. unit will be added. A 125-ft. dam was built in the river, forming a reservoir which covers about 300 acres of land.

Italy's Hydro-Electric Progress.—Notwithstanding the difficulties caused by the war, Italy carried on her hydro-electric projects to such good effect that the development on the Lys River begun early in 1917 will now be put into use as soon as delay caused by an accident to the conduit and defects in the pipes is overcome. The fall of which advantage has been taken in this project is about 1,800 ft., says the correspondent of a London electrical paper. The power house contains two 14,000-hp. and two 7,000-hp. turbo-alternators, with accommodation for 28,000 hp. additional. A 75,000-volt transmission line extends 76 miles. Another central station is being built in the same locality on a similar scale, and the two, which represent the first phase in the development of the Lys Valley, will yield 150,000,000 kw.-hr.

Ajax-Northrup Furnace Safety Tests.—Under the sanction of the New Jersey Board f Health, the Ajax Electrothermic Corporation recently made some interesting tests on the effect of the voltage used in its high-frequency induction furnace when applied to rabbits. The company's object was to establish the high degree of safety insured by its furnace, which is operated at from 500 volts to 2,000 volts, varying in frequency from 5,000 to 25,000 cycles. Four applications of this high-tension, high-frequency current were made to a rabbit with different methods of attachment, and in each case the current was applied for five seconds. In the first instance, the contact being at the potential of the earth, no effect was appreciable. In the second case, when the assumption was that half the voltage reached the rabbit, it stiffened and closed its eyes, making a slight cry when the switch was opened. In the third trial, under full voltage, the stiffening was more intense and the cry on release a trifle louder. Finally, a pair of 110-volt, 40-watt bulbs were placed in series with the circuit and glowed brightly when the switch was closed, proving that not less than 0.32 amp. passed through the rabbit's body without inflicting permanent injury. Low-frequency current of the same strength would have caused death in much less than five seconds.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Corporations Have No Liability for Injuries Incurred While They Were in Federal Control.—The Court of Appeals of Kentucky has found that no liability exists on the part of a telegraph and telephone company for injuries to an employee occurring while the company was under the control of the United States government. (221 S. W. 547.)

Owners Not Liable for Injury to Uninvited Visitor.—While a "frequenter," as well as an employee, of a mill or similar place may recover damages for injuries resulting from unsafe conditions, an uninvited sightseer does not, according to the Supreme Court of Wisconsin, come in the category of frequenters as defined by the statutes of the state, but is a trespasser with no cause of action. (177 N. W. 903.)

Functions of Public Service Commission.—Whether rules, regulations and practices of a public service corporation adopted by the company to govern its dealings with its patrons are unreasonable or unduly discriminatory are questions primarily within the competency of the Public Service Commission of the state, according to the West Virginia Supreme Court of Appeals, and not subject to judicial supervision until the former body has had an opportunity to exert its delegated administrative functions. (103 S. E. 340.)

Jurisdiction of Court of Equity in Case Appealed from Commission.—The Supreme Court of Pennsylvania, in Slate Belt Electric Street Railway Company vs. Pennsylvania Utilities Company, has declared that a court of equity has no jurisdiction to enjoin the charge of an alleged excessive rate pending appeal in another court from a decision of the Public Service Commission, nor will an appeal from an order granting or refusing a preliminary injunction be reviewed when eighteen months have elapsed since the order was given. (110 A. 345.)

Negligence in Furnishing Safe Place to Work a Question of Fact.—In a suit for damages because of the death of an employee of an electrified railroad who came into contact with a charged electric wire on the bridge where he was equired to work, the New York Supreme Court, Appellate Division, has found that where there was no evidence that screening the wire or so placing it that workmen would not come into contact with it was impossible it could not be said as a matter of law that a safe place to work had been furnished and the question of fact was for the jury. (181 N. Y. S. 675.)

Tree-Trimming Rights.—A clearance of 10 ft. being shown by evidence satisfactory to the Supreme Court of Wisconsin to be necessary to prevent high-tension electricity in a transmission line from leaping from wires to tree branches, a power company in that state had the right, under its contract for a strip of land for a right-of-way for its transmission line stipulating that trees might be trimmed so as "not to interfere" with the lines, to trim them so that no branches were left within 10 ft. (174 N. W. 905.)

Liability for Injury from Wire Over Unopened Highway.—In a suit for damages against a coal company held responsible for the existence of an electric wire strung across an unfinished highway with which wire, owing to the filling in of the road, defendant came into contact, though it had previously been at a safe height, the Supreme Court of Appeals of West Virginia held that the fact that the road had not been formally opened to public use did not do away with liability for damages, because a person maintaining a heavily charged electric wire across such a road was bound to anticipate the probability of public travel on it before its completion and to take reasonable precaution against injury from such wire. (103 S. E. 359.)

Company Liable for Injury to Child from Wire Strung Through Tree.—Asserting that while electric companies are not liable as insurers to any who may come in contact with their wires, the Appellate Court of Indiana none the less found against the Fort Wayne & Northern Indiana Traction Company, which had appealed from a verdict finding it responsible for injury to a child who had climbed a small tree and touched an improperly insulated wire. While the child was a trespasser and while the wire was not an "attractive nuisance," the court held that the company should have anticipated that children might climb the tree and that the maintenance of a wire with defective insulation in such a position was a breach of duty. (127 N. E. 460.)

Negligence of Electric Company Must Be Proximate Cause of Death to Justify Verdict for Damages.—In a suit for damages because of the death from electric shock of an employee of a fuel company which purchased its energy from the Milwaukee Electric Railway & Light Company, it appeared that a motor had been improperly repaired and installed by the central-station company. This fact had been discovered by employees of the fuel company, who thereupon undertook to remedy the trouble themselves although they were not electricians. In spite of the fact that a laborer had already received a severe shock the motor, after the attempted repairs, was continued in use, with the resultant fatality. The Supreme Court of Wisconsin has upset a verdict against the electric company on the ground that its negligence was not the proximate cause of the accident. (177 N. W. 876.)

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Payments to Municipality in Lieu of Franchise Tax.—Payments made to a municipality in lieu of a franchise tax must not, according to a recent decision of the Idaho Public Utilities Commission, be charged into the general operating expenses of an electric company, but should be charged against those patrons residing in the municipality concerned, since such payments inure to the benefit of that city only.

Effect of Deferred Maintenance in Small Plant on Rates.—In granting a substantial increase in rates to a very small electrical plant, the Utah Public Utilities Commission said that inadequate revenue had caused maintenance to be so long deferred that rates which would yield a proper return on investment and provide adequately for depreciation would prove prohibitive and therefore decrease the company's revenue. The petitioner, added the commission, must look to improved service and consequent increased consumption of energy to enable it to enjoy a return upon the investment.

Extension of Service in Rural Communities.—In its discussion and approval of the rules for electric rural extensions adopted by the Wisconsin Power, Light & Heat Company, the Central Wisconsin Utilities Company, the Wisconsin Valley Utilities Company and the Mineral Point Public Service Company, the Railroad Commission of Wisconsin said: "The proposed rules provide no method of apportionment of the construction cost of the line among the various consumers. This is frequently one of the most difficult points to settle in connection with the promotion of a rural extension. While in the final analysis strict justice probably demands that no consumer should be required to pay more as a member of a group than he would be required to pay if he were to be served under the rules as an individual, it is our opinion that a rural extension should, as is apparently the intent of these rules, be considered so far as practical as a community enterprise in which all will benefit equally. It has been suggested that one or more individuals may feel financially unable to meet their share of the construction cost at once, and that a partial-payment plan be developed to handle such cases. While the existence of such an alternative might tend to hamper the financing of some extensions, it is greatly to the advantage of both consumer and utility that the rural line reach its ultimate development as early as possible. Such a plan might be of advantage in attaining this end."

Men of the Industry

Changes in Personnel and Position—Biographical Notes

C. M. Masson, who designed the illumination of the grounds of the Huntington Hotel at Pasadena during the recent National Electric Light Association convention, a lighting scheme which brought forth much praise from the delegates, is illuminating engineer of the Southern California Edison Company. He was born at Hammondsport, N. Y, Aug. 9, 1876. Upon his graduation from Lehigh University as mechanical engineer, he did three years' special apprentice work with the Westinghouse Electric & Manufacturing Company. In 1903 he went to California and was associated with his cousin, R. S. Masson, then consulting engineer for all the Huntington interests in Southern California. Returning to the East, Mr. Masson took a position about 1910 as electrolysis engineer with the Pennsylvania Railroad in its electrified zone about New York City, but relinquished that to return to California in 1912, since which time he has been associated with the Southern California Edison Company.



C. M. MASSON

M. O. Leighton, Major **C. T. Chenery** and **A. C. Oliphant** have formed a copartnership under the name of M. O. Leighton & Company, with offices at 700 Tenth Street, Washington, D. C., for the purpose of engaging in general engineering practice and industrial representation before the federal departments. Mr. Leighton and Major Chenery will continue for the time being as chairman and secretary of the National Public Works Department Association, while Mr. Leighton and Mr. Oliphant will continue service in the Washington office of the Engineering Council pending the reconstruction of that body by the Federated American Engineering Societies.

Frank D. Paine, professor of electrical engineering at Iowa State College, Ames, Iowa, is also engaged in consulting engineering work on power plants and transmission lines. It was Professor Paine who initiated the short metermen's courses which were later taken up by other universities and central stations in the Middle West.

Lieut.-Col. William Kelly, who has been assigned by the War Department to be engineering officer on the newly created Federal Power Commission, was graduated from the United States Military Academy in 1899. He began his service with the Engineer Corps immediately as an assistant on river and harbor work in the San Francisco district. His next assignment was on public works in Manila. In 1902 and 1903 he served with troops at Washington Barracks, afterward becoming assistant to the district engineer at New London, Conn. He was with troops at Fort Leavenworth and San Francisco in 1904 and 1905 and served as an assistant commissioner of the District of Columbia in 1906. In 1910 he was in the Philippines, returning to Washington to become assistant to the chief of engineers. In 1917 Colonel Kelly took command of the 117th Engineers at Camp Mills. He took the regiment to France. In 1918 he was made chief engineer of the Fourth Army Corps. Later he was commanding officer at Base Sectors Nos. 7 and 9. At the time of his appointment as engineer officer to the Power Commission he was serving on river and harbor work in the San Francisco district.

Prof. Comfort A. Adams, whose resignation as dean of the Harvard School of Engineering has been accepted by the governing boards of the university, has been chosen chairman of the division of engineering of the National Research Council. Professor Adams has been dean of the Harvard School of Engineering only a year. He was president last year of the American Institute of Electrical Engineers.

Dr. T. S. Taylor has resigned from the Mellon Institute, University of Pittsburgh, where he had charge of the research work for the Magnesia Association of America, and has returned after an absence of a few months to the research division of the Westinghouse Electric & Manufacturing Company, where he will take charge of thermal research.

J. W. Rose of the Marysville district of the Pacific Gas & Electric Company, San Francisco, Cal., has been transferred to the Redwood district to act as assistant electrical superintendent of that district in place of T. W. Snell.

T. W. Snell, formerly assistant electrical superintendent of the Redwood district of the Pacific Gas & Electric Company, has resigned to accept a position with the Southern Valleys Power Company.

Edwin Gruhl, assistant to the president of the North American Company since November, 1912, was appointed a vice-president of the company at the recent meeting of the board of directors. Mr. Gruhl was graduated from the University of Wisconsin in 1908. While attending the university he delayed his course one year, during which time he was engaged in valuation work with the engineering staff of the Wisconsin Railroad and Tax Commissions. Following the resignation of W. J. Hagenah, Mr. Gruhl succeeded him as statistician of the Railroad Commission of Wisconsin, which position he occupied up to the time he joined the North American Company. During the time he was statistician of the commission he lectured at the University of Wisconsin on public utility economics. Mr. Gruhl has for some years been vice-president of the Wisconsin Edison Company, Inc., and president of the Wells Power Company, a subsidiary of that company. He has also been assistant to the president of the Milwaukee Electric Railway & Light Company and the Union Electric Light & Power Company of St. Louis.



E. GRUHL

Paul B. McKee, assistant to the president of the California Oregon Power Company, has formed with Donald McKee, Paul R. Parker and Byron H. Hurd the California Engineering Company, with offices at 131 Leidesdorff Street, San Francisco. Mr. McKee is president of the new company.

A. A. Potter has resigned from the Kansas State Agricultural College, where for the last six years he has been dean of the division of engineering, to become dean of engineering and director of the engineering experiment station at Purdue University, Lafayette, Ind.

W. de L. Carr, formerly of Philadelphia, has been appointed superintendent of the Northern Indiana Gas & Electric Company, Hammond, Ind.

R. F. Schuchardt, electrical engineer of the Commonwealth Edison Company, Chicago, sails today for a visit to England and the European continent.

Trade and Market Conditions

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

Jobbers in General Finding Collections Somewhat Harder

IN GENERAL, the credit situation among jobbers is becoming tighter and tighter and collections are harder to make. A bright spot in this connection shows in the New England territory, where reports state that collections are somewhat improved over the past two or three weeks.

The tendency throughout the country, though, at least in regard to accounts of utilities, contractors and dealers on jobbers' books, is to keep on putting off payments when they are about to become due and to request the acceptance of a note. Where jobbers have been able to use the trade acceptance, however, these are being met in a very satisfactory way. Although opinions differ in regard to this method of payment, it is being found that the standing of the customer is attaining a higher level through the use of these instruments and that collection troubles diminish.

Through the Middle West reports show that financial conditions are difficult to meet, but in no way alarming. Collections are very tight. Jobbers and manufacturers are a unit in saying that only by constant pressure are they being maintained, and that very little discounting of bills is being done even by the most solid concerns. In many cases the manufacturer's supplies of raw materials, under contract, are unable to furnish adequate deliveries, thereby forcing him into the open market for his commodities. Such open-market buying is at premium prices and is invariable for spot cash. This makes slow collections a real annoyance and is causing considerable pressure to be put on all classes of accounts.

Eastern and Southern returns give a fair report on collections. At the same time virtually all jobbers report that the tightening of the money market is being reflected in their collections, and they in turn are extending credit with a great deal more caution than has been the case heretofore.

In the Northwest, one reason given for the dropping off of the volume of jobbers' sales is the refusal of banks to grant credit for any considerable length of time. West Coast credits are being extended very sparingly, it seems, because of a rather general deflation which is felt to be near at hand and which must be minimized.

Non-Ferrous Electric Furnace Orders Holding Well

ELECTRIC furnaces for the melting of non-ferrous metals have been increasing in number at a good rate throughout the first half of the year, although the demand over the first quarter was heavier than it is at present. Inquiries, however, are being received in good volume, but the recommendations of engineers are being held up in many cases because of the tightness and high rate of money.

In view of the existing high costs of oil, coke and coal for fuel and their scarcity, it is expected that the demand for non-ferrous melting furnaces will pick up and keep on a high level. Although it is frequently difficult to make initial sales in a new territory, the success of one installation makes it much easier to sell other units. It has been reported that sales this year have been four times as big as those a year ago.

Estimates place the number of non-ferrous melting furnaces in use at the present time at about 260, while those which have actually been ordered and are under construction will bring this number to approximately 385. About 90 per cent of these are for melting copper, brass and bronze, and the total outlay will probably reach $2,500,000. Central-station revenue to be derived from the sale of energy to this class of apparatus depends upon the number of hours per day the furnace is operated, but it is likely to be in the neighborhood of $1,000,000 a year when those furnaces under way have been installed.

Of course, embargoes and other transit delays are affecting shipments, but producers are quoting on a basis of from sixty to ninety days. From different quarters structural steel, refractories and some of the electrical apparatus are said to be hard to obtain, but in general there is little difficulty in meeting the shipments. In one case delay in receipt of transformers and oil switches is adding six to eight weeks to a shipping date, but no delays have been reported because of inability to get other switch gear and motors. As a whole, refractory deliveries have been reported rather easy.

The price situation is holding at a steady level, according to accounts, and as far as can be learned the prices which went into effect last fall and early this year are still holding. Because of the characteristics of the apparatus under consideration small price changes in any of the component parts are not likely to be reflected in that of the finished equipment.

Foreign business is having a good run. Countries outstanding in this respect are Canada, Japan, England, Sweden and Mexico.

Poor Shipments Keep Line-Material Stocks Low

UNUSUALLY strong demand for pole-line hardware seems to have virtually cleaned out manufacturers' stocks of finished goods. One large company states that its volume of business for June was the largest in its history, and the general situation seems to reveal more business on hand than can be taken care of.

Naturally, with transportation in its present state of chaos, and steel mills accepting orders for material on condition of no promise being made as to date of shipment, deliveries are running rather long, and according to representative producers they range from three to five months. One important jobber, however, states that he is able to obtain supplies in from six to eight weeks.

In spite of impatience at long unfilled orders, very few customers are availing themselves of the privilege of canceling their orders. This may be owing, as one of the manufacturers expressed it, to careful supervision of the new orders accepted, since producers can afford to use some discrimination.

Labor troubles in the past have been affecting this market, but at present little difficulty seems to be experienced in that respect, and though production probably is not yet up to normal capacity, it is said to be improving.

Back orders of long standing are generally the rule, thus effectually preventing the accumulation of any stocks worth mentioning, although a representative company in the field has very large supplies on the way and with their expected arrival in about four weeks the situation for this firm will be relieved. Indications are that the greater part of the material used is for repair work rather than for the construction of new lines.

No price changes have been reported since the general increase of from 15 to 25 per cent about a month ago. Reports on collections vary considerably, one manufacturer stating that instead of his bills being met in thirty days, a large part of the customers were running over as long as ninety days. Other companies, however, gave a favorable reply to the interrogation as to collections.

May's Electrical Exports Highest for Present Year

MUCH encouragement is given to the export industry in view of the returns just received from the Bureau of Foreign and Domestic Commerce wherein it is shown that during the month of May electrical material to the amount of $8,952,277 was shipped for foreign consumption. This value surpasses that for the month of April by virtually $2,000,000 and is nearly $1,250,000 greater than for May, 1919. At the same time it represents the greatest value of electrical exports for any month of the present year, surpassing the previous high month of March by over $77,000.

Up to date total exports for the year amount to $37,712,177, a gain of about $100,000 over the corresponding five months of 1919. This gives a rate for 1920 of $90,500,000, or $1,500,000 better than last year's actual volume.

	May		Five Months Ended May	
	1919	1920	1919	1920
Batteries	$516,001	$676,624	$2,409,387	$2,756,664
Carbons	130,982	129,546	683,015	559,270
Dynamos and generators	257,908	549,251	1,799,8 5	2,426,424
Fans	201,125	152,100	865,021	526,264
Heating and cooking apparatus	146,765	227,227	621,451	757,231
Insulated wire and cable	838,188	791,303	4,169,357	3,090,283
Interior wiring supplies	179,931	341,302	976,551	1,244,111
Arc lamps	1,300	3,817	7,405	5,866
Carbon-filament lamps	44,157	5,566	107,995	53,945
Metal-filament lamps	434,894	334,843	2,294,727	1,689,948
Magnetos, spark plugs, etc	291,415	360,317	1,460,556	1,628,719
Meters and measuring instruments	245,589	288,021	1,347,751	1,084,926
Motors	817,118	1,132,811	4,272,829	4,863,262
Rheostats and controllers	64,478	43,365	198,719	287,690
Switches and accessories	255,099	269,794	1,078,072	1,574,344
Telegraph apparatus	70,296	41,752	423,388	347,830
Telephones	285,785	414,838	1,514,664	1,639,429
Transformers	326,224	319,992	1,794,592	1,482,712
All others	2,610,263	2,869,808	11,590,180	11,693,259
Total	$7,717,518	$8,952,277	$37,614,525	$37,712,177

Seven of the items in the list have made records for the year—fans, heating and cooking apparatus, insulated wire and cable, interior wiring supplies, arc lamps, meters and telephones, while batteries, carbons, magnetos, motors, transformers and miscellaneous materials were exported to greater value in May than in the preceding month. With the exception of arc lamps, which bettered any previous month this year by more than threefold, May showed up particularly well in heating and cooking apparatus, insulated wire and cable, meters and interior wiring devices. The 1919 figures have been revised and include all exports made during that month, but the revision has effected no change in the values enumerated in these columns of Aug. 2 last.

Majestic Patents Upheld in Beam Type Heater Suits

THE Majestic Electric Development Company advises the trade that in its suits against the Edison Electric Appliance Company and the Hotpoint Electric Heating Company, for infringement of its patents on the beam type of electric heater, the validity of these patents has been upheld and licenses have been issued these companies to sell "Hedlite" type of heaters. Suit has been brought also against the Westinghouse Electric & Manufacturing Company on the same claims, and the Majestic company announces that similar suits against other manufacturers have been commenced.

Tendencies of Motor Market Point to Higher Cost

MOTOR manufacturers generally are very doubtful as to whether the highest prices for their products have yet been reached, notwithstanding the talk of prices having passed the high point. The curves showing the cost and selling prices of motors have converged so much since the last general price increase that the reduced margins of profit, it seems, would have justified many manufacturers in making further price increases before this. However, they realize that further advances in selling prices, unless absolutely imperative, would help further to extend the credit structure at a time when every effort is being made to effect deflation. The financial difficulties of jobbers and dealers would also be increased when prices begin to fall. Unfortunately production costs have not commenced to drop, and unless they fall soon it is difficult to see how many of the motor manufacturers can continue to sell at existing prices.

It is perhaps fortunate that during the war the smaller manufacturers were able to increase their prices above those of their larger competitors, owing in the main to their ability to make better deliveries. If it were not for this price differential, it would hardly have been possible for the small manufacturers, with limited resources, to operate so long on their last advance in price.

Ready Sale for Standard Motors

Practically any standard motor that happens to be in stock can be sold without difficulty, but when a customer is asked to wait many months, and by some manufacturers almost a year and a half, for standard motors of less than 20 hp., the customer hesitates, because he is not sure whether he will have the need or the money for the motor when it is delivered. The possibility of lower prices is a growing excuse for not buying, but in most cases the business uncertainty of the future is the real deterrent.

The purchases of industrial concerns have been falling off for some time, but the central-station buying is increasing and it is expected to grow steadily in volume. Deliveries are expected to improve, but how soon and to what extent will largely depend on conditions over which neither the manufacturer nor the buyer has any appreciable control.

Many manufacturers have been accepting orders only on the open-price basis, the billing price to be based on the actual costs of material and labor entering into the manufacture of the apparatus. Some companies guarantee the increase not to exceed a certain percentage for a certain period.

Car Shortage Curtailing Industrial Production

ALTHOUGH relief is being afforded utilities and industrials in respect to coal supplies through the extension of the time on the use of open-top cars for coal carrying and through priorities to utilities, the industrials and the steel mills, on the other hand, are suffering for lack of transportation of steel and iron and other raw materials which were being shipped in open cars. Production has been cut down 50 per cent in many instances, according to reports from all over the country, and considerable nonemployment is resulting.

There is enough business on the books of most industries to keep them going to capacity for some months to come and as a whole there is little labor disturbance. The chief cause of the situation which exists is the absolute lack of cars to do the work required. Quick unloading of all freight cars, more mileage per day and elimination of reconsignment have been urged by the Interstate Commerce Commission, and the action resulting has been effective to a small degree. Too much emphasis cannot be placed on the strictest interpretation of these suggestions by all manufacturers and jobbers in the electrical trade and by all utilities.

The Pittsburgh district is feeling the strain through a slow paralysis of industry, and although coal is more plentiful, it is getting harder to move steel products. Although shutdowns have been few to date, they are imminent unless more cars are forthcoming. Local railroad embargoes hit isolated manufacturers on outgoing materials.

Through Chicago, Cleveland, Youngstown, Baltimore and Detroit production is being reduced to around 50 and 75 per cent where isolated plants have been dependent on their own coal supplies. So far as is known, the central stations have been able to maintain service in most instances through their coal priority order, but plants on these lines have had to reduce production because of raw-material shortage.

This has had a bad effect on employment, and in the Youngstown district it is said that about 10,000 are idle. At the same time, the inability to move building materials and the high prices attached to those available are reacting on building construction and releasing electrical workers. On the other hand, it is reported that there is no oversupply of labor in New England sections nor in Philadelphia.

The Western portions of the country have plenty of labor. Although car shortage is cutting down the lumber production in the Northwest, the Coast industries are going in good shape.

An interesting development is found in the reports that more work is being done by the average laborer per hour of the working day. This is not the case throughout the whole country, but it is so in many sections, although the increase is not yet large.

Metal Market Situation

THE expected increase in copper buying of a week or so ago has failed to materialize and seems to be put still further off with the uncertainty of the transportation situation. Producers are making small sales at 19 cents for July, August and September delivery, and these are being made to large consumers, it is said, who have been in the habit of buying from the outside market. This may indicate a shortage of copper in the outside market, but quotations here are set at 18.75 cents for delivery through July.

There is little demand for copper beyond October, but some activity is found for deliveries for that month; producers are hesitant about accepting orders for delivery beyond October.

An encouraging feature in the copper market is the termination of the strike of brass workers at Waterbury, Conn., where the men returned to work without increase in rate of pay. It is expected that the mills affected will again be in the market for large tonnages.

The zinc market is holding steady but is rather quiet, while the lead market shows renewed activity. Official prices hold at 8 cents, but the outside market is quoting 9.10 cents, New York, for prompt Western shipment. Inquiry is better, but supply is low.

NEW YORK METAL MARKET PRICES

	July 13	July 20
Copper	£ s d	£ s d
London, standard spot	90 15 0	91 5 0
	Cents per Pound	Cents per Pound
Prime Lake	19 00	19 00
Electrolytic	19 00	19 00
Casting	18 25	18 25
Wire base	22 50 23 00	22 50 23 00
Lead, trust price	8 00	8 00
Antimony	7 50	7 50
Nickel, ingot	43 00	43 00
Sheet zinc, f.o.b. smelter	12.50	12.50
Zinc, spot	8 25	8 25
Tin	50.25	49 75
Aluminum, 98 to 99 per cent	33 00	33.00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	15 00 to 15 75	15 50 to 16 00
Brass, heavy	9.00 to 9.75	9.50 to 9.75
Brass, light	7.00 to 7.50	7.25 to 7.75
Lead, heavy	7 00 to 7 25	7 00 to 7 37½
Zinc, old scrap	5 00 to 5 25	5 00 to 5 50

THE WEEK
IN TRADE

REPORTS of jobbers on their volume of business show a further slight slackening in all districts except the Middle West, where no fluctuation is as yet apparent. In the Northwest the situation is curious in that, while jobbers' sales are decreasing, retail trade is meeting as brisk a demand as ever.

Stocks are generally beginning to improve as most sections continue to find deliveries easing up. On the West Coast collections are tightening as credit is more and more cautiously extended, but in the East the situation seems favorable, with collections somewhat improved if anything, and in the South an actual surplus of money is expected to materialize in rural districts with the harvest of the cotton crop, which is reported good.

Prices seem to remain steady except for some reported increases on heating appliances and schedule material. Fan sales are light over the country except where a spell of warm weather moves stocks, as in New England last week. Rigid conduit is almost unobtainable in the East, but on the West Coast a lighter demand and better receipts have relieved the situation. Stocks of flexible armored conductor are pretty generally spotty.

NEW YORK

Some jobbers report business as holding up well the past week, but others, who seem to be in the majority, have experienced a slowing up in the volume of trade.

Opinions on the transportation situation show the same variance, with a preponderance, however, holding to the view that conditions are easing materially, both for incoming and outgoing shipments. Collections are reported fairly good.

The great boom in construction work for office buildings, factories and hotels seems to be crowding out residence building. This condition has its reflection in sales of some of the electrical material used in house wiring, while the big projects in general have not progressed far enough to affect the trade. According to the Dow reports in the Metropolitan district alone sixty-eight theaters are under construction at present and more than a hundred steel-girder buildings. The sale of about 3,000 building lots to private investors within the past month, however, is significant as perhaps indicating a return of residential construction. Further price increases on heating appliances are reported, and several manufacturers have withdrawn list prices on porcelain and on schedule material during the past week. Fan stocks are still moving very slowly.

Rubber-Covered Wire.—Demand is nothing extraordinary, with good stocks the rule. Shipments are received in good shape. No. 14 single-braid is quoted at from $11.50 to $12.50, depending upon the quantity.

Flexible Armored Conductor.—Stocks are spotty, some jobbers who are willing to pay expressage obtaining supplies in that way. Many back orders are unfilled, but in some quarters a slight lessening of demand is reported. One jobber has reduced his price but considers it only a temporary reduction. Price for No. 14 two-wire ranges between extremes of $105 and $121 per 1,000 ft. in 1,000-ft. lots.

Rigid Conduit.—Supplies are generally short, with many orders unfilled and an unslackening demand. Shipments are very poor. The price for ½-in. black ranges from $95 to $103 and for 1-in. from $200 to $220 per 1,000 ft., with some jobbers not quoting.

Fans.—Good stocks are the usual thing, as this has been a poor fan season thus far. Many jobbers will order no more fans this year.

Non-Metallic Flexible Conduit.—One jobber is accepting no new orders for the remainder of the year, but this seems to be an exceptional case in spite of the fact that some shortage does exist.

Lamp Cord.—Reports on demand vary from fair to good. Stocks are spotty; in some quarters a scarcity is felt with a reported refusal of new business by manufacturers, but other jobbers have good stocks. Silk and cotton are about on the same basis, though silk cord is in slightly better shape if anything. Shipments are fairly good.

Porcelain.—Prices on porcelain and items containing this material have been withdrawn by several manufacturers. Demand holds up well, with such a thing as stocks unknown.

Lead-Covered Wire.—Good stocks and fairly heavy demand are reported, with little or no difficulty in obtaining supplies. Prices for No. 14 duplex cover a wide range of from $50 to $75 per 1,000 ft.

Schedule Material.—The shortage of brass and porcelain is beginning to make itself felt in a scarcity of certain items. Expected price increases have materialized in the withdrawal of all prices on this material by several manufacturers.

BOSTON

Jobbers report little falling off in business, although the demand for appliances is less active. Collections have improved somewhat over the past two or three weeks. Deliveries are being made with less delay and stocks are in better shape, with the exception of motors, percolators and rigid conduit. Prices hold firm, with an upward tendency in ranges. Labor unrest is yielding somewhat to the shadow of non-employment in the textile and leather industries, and production is increasing in wire mills lately restricted in output by strike difficulties. Building and engineering construction contracts in New England to July 15 for 1920 total $193,683,000 against $95,739,000 for the same period in 1919. The rate of new building commitments, however, has fallen off considerably during the past few weeks owing to the high cost of labor and materials. Central-station financing is proceeding well in Massachusetts, but the fuel situation is very disquieting in industrial circles.

Motors.—Manufacturers are busy on back orders and new business is also being booked, but not at earlier rates. Stocks are at a low ebb, and the sale of second-hand motors is active. Prices are firm.

Fans.—Last week's hot weather increased sales materially, but some local stocks are still reported in jobbers' warehouses. Present prices are a drag upon sales.

Ranges.—Sales in New England are very active and exceed the capacity of manufacturers. One factory, however, is quoting deliveries on a standard type based on shipment within a few days of the receipt of order. Raw material is coming to hand in better shape. Hughes ranges are up 10 per cent in price and Simplex ranges will be advanced about 10 per cent at the end of the month.

Wire.—Rubber-covered wire is in good supply, No. 14 being quoted at $11 per 1,000 ft. in 5,000-ft. lots or over. Weatherproof base is 26½ to 27 cents, with discounts on quantity purchases. Bare base is 23 cents, with a quiet market and better conditions in the factories as regards labor.

Rigid Conduit.—Little can be obtained, and shipments into New England of old orders are soon absorbed by the trade.

Flexible Armored Conductor.—Stocks are spotty, but immediate needs are being pretty well cared for. One jobber recently received 25,000 ft. by express from Pittsburgh and reports being three months behind on shipments of earlier orders. No. 14 single-strip is quoted around $110 per 1,000 ft. in 1,000-ft. lots, with fair Boston stocks.

Nail-it Knobs.—The recent shortage appears to have been relieved. With a healthy demand, current prices are steady. Including barrel, the quotation is $36.25 per 1,000, in barrel lots.

Metallic Flexible Conduit.—This material is scarce and stocks are virtually cleaned out.

Heating Appliances.—Flacirons are selling steadily, a well-known make selling at $5.40 wholesale in single units. Toasters are still somewhat hard to get. Industrial heating equipment is growing in popularity, and a few radiator sales are being made for summer cottage use.

Washing Machines.—Prices are steady, and the market continues to absorb shipments nearly as fast as they come in. Some jobbers are handicapped by the delay of manufacturers in the Middle West in getting into full continuous production. Agents for New England washer factories are faring better, in view of railroad congestion.

Dry Cells.—One of the largest Boston jobbers was out of stock on the No. 790 flashlamp battery at the end of the week. In general dry cells are obtainable in good quantities, the No. 6 selling for $32.95 per 100 in barrel lots and the igniter at $33.95.

Flashlights.—Jobbers are overstocked in some places. An excellent trade is reported.

CHICAGO

No great fluctuation in demand for electrical goods is noted in this market. In general jobbers' stocks are improving, as shipments are moving more freely in all directions. Sales of seasonal goods are below expectation owing to the prevailing temperature being far below normal for this time of year. However, manufacturers are coping with this reduced demand with difficulty.

Transportation troubles have to do largely with incoming shipments. Temporary embargoes lasting from a day to a week are frequently placed on shipments to various points, but the alert shipper, by keeping in daily touch with the situation, avoids serious embarrassment. The feeling prevails that current production is sufficient for all needs and that when improper speculation is stopped distribution will automatically adjust itself.

Fractional Motors.—While leading interests report an undiminished demand and orders for months to come, other quarters report some cancellations of orders, and even an inability to place completed goods in some cases. Duplication of orders seems to be partly to blame, and the limited washing-machine output is also a contributing factor.

Outdoor Transformers.—Producers have been able to fill orders on three to four weeks' delivery, but the porcelain supply is such as to cause a marked reduction in output if it is not soon relieved. Demand and inquiries remain heavy. No recent price changes have been noted in spite of the fact that manufacturers are forced to bid for supplies in the open market.

Switchboard and Busbar Pipe Fittings.—Owing to the increased cost of malleable iron various switchboard and busbar structural devices have recently been advanced 10 per cent. Stocks are at a minimum, but prompt deliveries are still possible.

Steel-Tape Park Cable.—Raw-material difficulties have caused the Habirshaw Wire Company to issue a new list bearing certain increases. In 2,000-ft. lots, 600-volt solid duplex No. 8 steel-tape cable is now $205.47 per 1,000 ft., and the 2,500-volt solid single No. 6 is $202.73. Deliveries range upward of four months.

Ornamental Light Fixtures.—Demand keeps ahead of supply and an advance on metal poles is anticipated. The General Electric Company has announced a new list on Novalux tops for light poles, but quotations are not yet available.

Wood Poles.—Dealers in Southern white-cedar poles are quoting deliveries of all sizes, dependent only on transportation facilities. List, f.o.b. Chicago, on 30-ft., 7-in. poles is $7.75 each. On 40-ft., 8-in. poles the quotation is $16.

Fans.—Continued cool weather has kept retail sales down materially. Jobbers report that demand for large-size fans for industrial use is heavy with an adequate supply, and the call for smaller sizes for domestic use is light but in excess of supply.

ATLANTA

Atlanta is in the midst of a tremendous building boom, the construction consisting of almost every kind of building from the small residence up to the large industrial plant. This, of course, has created a big demand for labor, building material and electrical supplies of all kinds.

A general survey shows that while there has been a slight slackening throughout the territory business can still be classed as above the average, particularly in and around the large cities. There has been a slight reduction in the rural demand, especially in south Georgia, this being undoubtedly the reaction from poor crop reports up to the first of June. The latest report of the cotton crop for the thirteen Southern states, however, shows a condition aproximately 70.7 per cent normal as against 62.4 per cent for May last and 70 per cent for June a year ago. Preliminary reports indicate a crop of approximately 11,500,000 bales as against last year's crop of 11,330,000 bales. If this estimate is correct tremendous sums of money will be placed in the hands of the rural population within the next four months.

Jobbers report that the delivery of material is easing up somewhat, receipt of steel products showing the greatest improvement, though car shortage is still being keenly felt throughout the territory.

Farm-Lighting Outfits.—The demand continues good, while deliveries are reported somewhat easier than they have been for some months past. Fair stocks are on hand and are moving rapidly.

Stamped-Steel Boxes.—Stocks continue very spotty, though there are fair supplies of certain sizes available from stock. Shipments continue slow in the face of a very good demand.

Wood Poles.—Car shortage is causing a great deal of difficulty in shipments of poles, for which the demand continues very strong. Jobbers report it almost impossible to obtain Western red and white cedars in quantities, though producers report good stocks on hand. Chestnut poles are more readily available. Prices, cedar, 30-ft., 6-in. top, $10; chestnut, $7.

High-Tension Transformers.—Shipments are becoming longer in the face of the brisk demand caused not only by new construction but also by electrostatic disturbances to existing installations. Shipments of transformers and repair parts are reported on standard units at from sixteen to twenty weeks.

Motors.—No relief of the motor situation is in sight, and the demand is reported very strong in the face of shipments quoted at from thirty-eight to forty weeks on motors up to 20 hp. and twenty-four weeks on motors from 25 hp. to 250 hp. The shortage is particularly acute in the 220-volt, three-phase type, and the small slip-ring motors, designed for printing-press service, are quoted at from fifty to seventy weeks. Single-phase shipments are quoted at from twenty to thirty weeks.

Wall Boxes and Fittings.—Manufacturers report a falling off in these items, due in all probability to the placing of heavy orders by jobbers in the early spring. Shipments are being received, but stocks throughout the territory are reported spotty.

Flexible Armored Conductor.—Small shipments continue to be received and are being allotted on the basis of 3,000 ft. to 5,000 ft. to various jobbers, who in turn make small shipments to contractors. Few new orders are coming in, though back orders amounting to between 200,000 ft. and 300,000 ft. are reported by one of the largest jobbers.

SEATTLE—PORTLAND

Sales volumes in the Puget Sound district, according to prominent jobbing firms, show further decreases during the past week. This condition is attributed primarily to the mid-summer closing of lumber mills and logging camps, to vacation season dullness and to the general feeling of uncertainty which prevails throughout the country.

The refusal of banks to grant credit for any considerable length of time no doubt is another determining factor, however. In spite of what jobbers say, retailers as a whole assert that counter business is holding up well and that demand for household appliances especially is far in excess of their stocks. Generally speaking stocks as a whole are in far better condition than a month back. Deliveries are also easier. In some cases shipments are coming through fast enough to enable jobbers to build up depleted stocks.

During the past ten days there have been slight price increases along appliance lines, schedule materials and housewiring devices. Collections are fair, with tightening credit extended to all but the oldest customers. Although lumber mills throughout the Northwest are far behind in their orders the cut for the past week was 58 per cent below normal because of transportation troubles and the summer shutdown. Crop damage estimated at approximately half a million dollars was the result of a severe wind and rain storm which swept over a portion of eastern Washington recently. This estimate does not include damage to farm buildings and orchards. Jobbers report business as picking up along all lines. This may be attributable to a general improvement in business conditions or it may be merely a spasmodic demand. Collections are reported as very slow, and jobbers state that they have decided on a tightening of credit to customers. Contractors report business as appreciably better than for the past two or three weeks and prospects good for future work.

Rigid Conduit.—Recent shipments have relieved the local situation materially and it is believed that if demand does not increase jobbers will be able to rebuild sadly depleted stocks. At present the demand is comparatively light.

Schedule Material.—Demand, which earlier in the season far exceeded available stocks, has shown a gradual decrease for the past several weeks. Building work is dropping off considerably, and because of recent price advances along this line it will show further decreases, it is thought.

SAN FRANCISCO

Credits are being extended very sparingly because a general deflation is no doubt near at hand and must be minimized. Contractors are being asked to anticipate their requirements so that factories may not be swamped through sudden demands that could have been easily foreseen, and these contractors are especially urged to figure the labor on jobs at the present rate of operation, for recent investigation has shown that many customers have been actually losing money on their labor. The crop outlook is very good. It will be difficult to get cars for moving the crops, however.

Lamps.—Lamp deliveries are naturally very good during this season of the year and every endeavor is being made to anticipate expected large fall sales.

Industrial Reflectors.—In the Bay district alone it is estimated that there are 25,000 commercial plants where work is being done and which accordingly require scientific illumination. Very few of these are large enough to be called industrial plants, but they will provide good business nevertheless. Committees are now working on a standardization of lamps, reflectors and interior surfaces. There is an especial call just now for angle reflectors. Stocks are only fair.

Protective Apparatus.—The alarming increase in daylight robberies has provided a receptive market for bank protective systems. The necessary cabinets and stations are not carried on the Coast but are shipped from the factories on promises of thirty-day to sixty-day deliveries. The field is very little canvassed by dealers, or has been up to this time, but efforts are being made to increase the dealers' sales and several of the factories have placed men in California to do missionary work in this line.

Flashlights.—The "Eveready" campaign has produced an enormous number of inquiries, 1,000,000 blanks having been distributed on the Pacific Coast during the past six weeks. The resulting demand added to the customary summer calls of campers and tourists has cleaned out dealers' and jobbers' stocks almost without exception.

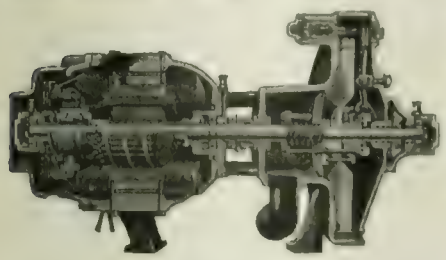
Metal Molding.—Stocks are very good but the call is rather light and mostly for the larger sizes.

NEW APPARATUS & APPLIANCES

A Record of Latest Developments
and Improvements in Manufacturers' Products
Used in the Electrical Field

Small Steam-Driven Electric Generator

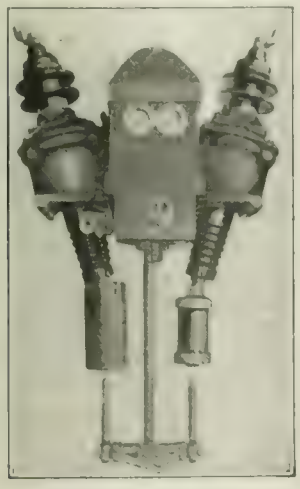
A 3-kw. size has been added to the line of steam-driven electric generators manufactured by the Lucy Manufacturing Corporation, Woolworth Building, New York City. Although nearly similar to its 1½-kw. generator, it is built principally for marine use.



3-KW. GENERATOR FOR MARINE USE

High-Voltage Oil Circuit Breakers

A new line of high-voltage oil circuit breakers (Type FK 36), with voltage ratings from 15,000 to 155,000, has been developed by the General Electric Company. The company is also extending the development to include breakers of this line for higher voltages. There are two types of these breakers, one for indoor and the other for outdoor use, both being alike except for the inclosure of the solenoid and the use of low-temperature oil in the outdoor type, where the temperature is below 0 deg. C. The bushings of these breakers are interchangeable with oil circuit breakers, lightning arresters and power transformers, and above 73,000 volts with instrument transformers, of the same voltage rating manufactured by the General Electric Company.



UNAFFECTED BY CLIMATE OR ALTITUDE

For voltages above 73,000 bushings adapted to all altitudes of installation can be supplied and mounted on breakers without other structural changes in the breakers, thereby making it possible to keep the same voltage rating at various altitudes. The breakers are built in three interrupting capacity sizes for each voltage above 15,000, and for 15,000 volts in the medium and large sizes, the principle of operation being the same in all cases but with a variation in constructional details.

Separation Plug Receptacle

An angular separation plug receptacle has been brought out by the Benjamin Electric Manufacturing Company, Chicago, Ill. The cap is of high-heat molded composition and can be separated from the base by a pressure on the cap at any angle, the manufacturer says. The receptacle is used for conduit box and open work.



PRESSURE ON CAP AT ANY ANGLE SEPARATES DEVICE

Notes on Recent Appliances

Safety Inclosed Cut-Out

A standardized inclosed cut-out for use with Square D switches has been developed by the Square D Company, Detroit, Mich.

Rotary Spark-Gap

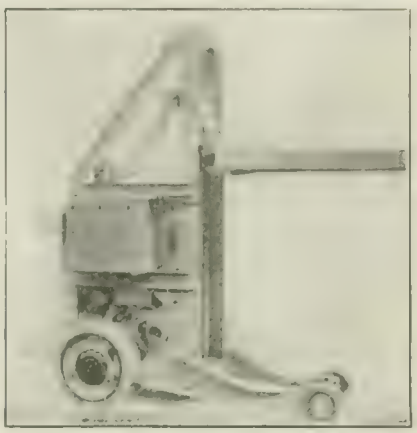
A. H. Grebe & Company, Inc., Richmond Hill, N. Y., are marketing a synchronous rotary spark gap for wireless use.

Electric Sign

A reflector-type electric sign has been developed by the Root Electric Sign Company, Lockport, N. Y.

Industrial Tiering Truck

A new tiering-lifting truck has recently been placed on the market by the Automatic Transportation Company, Buffalo, N. Y. The function of this truck is to pick up and elevate loads with its own power to heights sufficient for placing material in box cars, on trucks, wagons, etc., without rehandling. It has a capacity of 4,000 lb. and has a lift from 1 in. to 6 ft.



LIFTS 4,000 LB. ONE FOOT IN FIFTEEN SECONDS

The elevating motor and the lifting gears are placed below the battery box to give the best possible protection to these parts. Maximum loads are elevated one foot in fifteen seconds. The truck is equipped with an automatic limit cut-out.

Christmas-Tree Outfit

The "G.E. Christmas Arberlux" is a multiple-connected Christmas-tree lighting set recently developed by the General Electric Company. The 110-volt transformer has three taps on its low side, giving 10, 14 and 24 volts, so that electric toys may be operated when the tree lamps are not on. The terminals on the 9½-ft. tree-lighting cord will fit the 14-volt transformer connection only. Twenty branches of twisted twin conductor are connected to the tree cord.



LIGHTS OPERATED IN MULTIPLE ON 14-VOLT CIRCUIT

MANUFACTURERS' ACTIVITIES

Record of Changes Affecting Sales and Distribution
Together with Trade Personals and Notes on Foreign Trade,
Jobbers' News and New Trade Literature

LEE DE FOREST, INC., San Francisco, Cal., recently incorporated, has established a factory at 451 Third Street, San Francisco, for the manufacture of radio-telephone equipment, including modern vacuum bulbs, telephone transmitters, etc. The company will also carry a full stock of the Eastern De Forest Radio Telephone & Telegraph Company's apparatus to supply Pacific Coast dealers.

THE AMERICAN JOBBERS' SUPPLY COMPANY, Woolworth Building, New York City, as the Eastern associated company of the Joslyn Manufacturing & Supply Company, Chicago, has taken over the exclusive sale in the East of the Lindsley Brothers Company, producer and distributer of Western red and Northern white cedar poles. R. D. Patterson, formerly Eastern representative of the Lindsley Brothers Company, is now associated with the American Jobbers' Supply Company.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia, Pa., has increased its capital stock from $18,000,000 to $30,000,000.

CHARLES H. AVERY has severed his connection with the V. V. Fittings Company, Philadelphia, to accept a position with the Holt Electric Company, Jacksonville, Fla., as general manager of sales and purchases. Mr. Avery was associated with the sales organization of the New York office of the V. V. Fittings Company, and for a period of sixteen years has traveled throughout the United States in the interest of electrical manufacturers.

THE JEWELL BELTING COMPANY, Hartford, Conn., is erecting a large plant opposite Charter Oak Park, to cost about $1,000,000. The new works consist of a main manufacturing building, 393 ft. x 60 ft., four stories high; carpenter and machine shop, 102 ft. x 60 ft., two stories; hide and leather storage building, 122 ft. x 100 ft., two stories; chrome and lace tannery, 122 ft. x 60 ft., two stories; also boiler house, garage and transformer station. It is expected to have the plant ready for occupancy this fall. The year 1920 marks the one hundred and fiftieth anniversary of the name of Jewell with the leather industry. The first Jewell tannery was started in Winchester, N. H., in 1770. The Hartford plant was established in 1846 by Pliny Jewell. In 1847 he took his sons into business with him under the name of P. Jewell & Sons. The present company was incorporated in 1883, under the name it now bears.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., is having plans prepared for the first unit of its proposed new plant at Philadelphia, on Elmwood Avenue, between Sixty-eighth and Seventieth Streets. The building will be of reinforced concrete, 80 ft x 600 ft., six stories high, and will cost about $500,000

THE WESTERN ELECTRIC COMPANY, Forty-eighth Avenue and Twenty-fourth Street, Chicago, is planning to erect a one-story building, 160 ft. x 180 ft., to cost about $250,000

THE REQUA ELECTRICAL SUPPLY COMPANY, 95 St. Paul Street, Rochester, N. Y., has filed notice of increase in capital stock from $25,000 to $50,000.

THE WELCH ARMATURE COMPANY, Welch, W. Va., manufacturer of electrical equipment, etc., has awarded contract for the erection of a three-story building, 63 ft. x 65 ft., to cost about $25,000.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., is taking preliminary estimates for the erection of a brick and steel factory, 70 ft. x 260 ft., one and one-half stories, to be built at New Kensington, Pa. The cost is estimated at about $100,000.

THE BUSSMAN MANUFACTURING COMPANY, St. Louis, Mo., has purchased the fuse department of the Appleton Electric Company, Chicago.

THE COXE STOKER SALES COMPANY is located at the Maikle Bank Building, Hazelton, Pa.

GENERAL MOTORS CORPORATION'S NEW DIRECTORS.—Last week the following were elected directors of the General Motors Corporation: E. R. Stettinius of J. P. Morgan & Company; Owen D. Young, vice-president of General Electric Company; W. H. Woodin, president of American Car & Foundry Company; G. F. Baker, Jr., vice-president of First National Bank; Seward Prosser, president Bankers' Trust Company, and C. M. Wooley. The General Motors Corporation's connection with the electrical industry is through its heavy investments in the Independent Lamp & Wire Company, Novelty Incandescent Lamp Company, Doehler Die Casting Company, Remy Electric Company, Dayton Engineering Laboratories Company, New Departure Manufacturing Company, Frigidaire Corporation, and Sampson Tractor Company.

THE STOKER MANUFACTURERS' ASSOCIATION announces the appointment of the following officers and executive committee at a meeting held recently at Lakewood, N. J.: Sanford Riley, president; M. Alpern, vice-president; A. C. Pratt, treasurer; S. A. Armstrong, H. A. Hatton, and J. G. Worker, secretary.

THE BLAW-KNOX COMPANY announces a change in the name of Hoboken, Pa., the home of the Blaw-Knox Company, to Blawnox. The Blaw-Knox Company was first established in Hoboken, Pa., about five years ago, at the same time operating another plant at Wheatland, Pa. About two years ago the latter plant was removed and added to the Hoboken works, which has since been enlarged.

A. H. GRAYBURN, for the past four years assistant to the vice-president of the Norma Company of America, Long Island City, N. Y., has been made assistant secretary and assistant treasurer of the company. Norman Bell has been appointed sales manager of the company. This appointment follows a connection over three years with the company as sales engineer.

THE APPLIANCE COMPANY OF AMERICA, INC., 9 East Thirty-fifth Street, New York City, has been organized for the purpose of distributing "Air-Way" electric cleaners, manufactured by the Air-Way Company, Toledo, Ohio, exclusively, in New England States, New York, New Jersey, Pennsylvania, Maryland, and the District of Columbia. J. W. Beck is president and C. B. Angenette is secretary and treasurer. The company already has fifteen salesmen in the field.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, East Pittsburgh, Pa., has completed plans for the construction of 200 two-story houses in Lester for its employees. The total cost is estimated at about $2,000,000.

HERMAN L. WITTSTEIN, recently works manager of the Chapman Valve Manufacturing Company, Springfield, Mass., has been appointed production manager of the Morris Metal Products Company, Bridgeport, Conn. Mr. Wittstein served during the war at the United States Arsenal in Springfield, with the rank of captain, and formerly was production manager of the Knox Motor Company, Springfield.

J. H. BUNNELL & COMPANY, 32 Park Place, New York City, manufacturers of electrical specialties, have filed notice of increase in capital stock from $150,000 to $300,000

THE SPENCER TURBINE COMPANY, 181 New Park Avenue, Hartford, Conn., manufacturer of blowers, etc., contemplates building an addition to its plant, 60 ft. x 125 ft., to cost about $45,000.

THE NATIONAL CARBON COMPANY of Cleveland and San Francisco has recently increased the scope and efficiency of the Columbia data sheet service for users of motors and generators in regard to correct brushes for these machines.

Supply Jobbers' Notes

THE WESTERN ELECTRIC COMPANY has opened a branch jobbing depot at 233 Harris Avenue, Providence, R. I., in charge of N. I. Allen, to facilitate distribution in Southern New England.

C. B. HAWLEY, manager of the Intermountain Electric Company, Salt Lake City, Utah, has recently been elected president of the Salt Lake Commercial Club. Mr. Hawley has been actively engaged in the electrical industry all of his life in Salt Lake City and, after having built up a retail business, organized the Intermountain Electric Company for jobbing and distributing electrical equipment in the intermountain territory.

THE ERNER ELECTRIC COMPANY, Cleveland, Ohio, is now established in its new plant. The building is 64 ft. x 151 ft., four stories and basement, and is equipped with every facility for the economical and speedy handling of a wholesale electrical business. A permanent exhibition of every class of electrical merchandise will occupy the top floor. Other features of the building include a complete electrical kitchen and a lecture or assembly hall in which electrical meetings will be held.

THE B-R ELECTRIC COMPANY, Kansas City, Mo., has just issued its first (July) number of the *B-R Current*, a monthly house organ published for its dealers. The company announces that it has been twenty-four years in business as a distributer of electrical apparatus, and for more than sixteen years continuously it has been without reorganization. With two warehouses in addition to its four-story-and-basement building at Fifteenth and Walnut Streets the company announces its preparation to handle orders more promptly and satisfactorily than ever before.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning this number.

An importer from the Netherlands (No. 33,187) is in the United States for a short time and desires to purchase and secure an agency for electrical goods, etc.

A merchant firm in India (No. 33,189) desires to be placed in touch with manufacturers and secure samples and sole agency for electrical goods, etc.

An electrical company in Canada (No 33,194) desires to purchase electrical goods, such as lamp sockets, adapters and connectors.

New Incorporations

THE HILL COUNTY ELECTRIC COMPANY, Hillsboro, Tex., has been charatered with a capital stock of $6,000 by W. A. Pierce, J. R. Griffin, Sr., and J. R. Griffin, Jr.

THE MORGAN POWER COMPANY, Great Cacapon, W. Va., has been incorporated by William B. Osler, B. S. Cross, T. H. Compton, E. C. Wisner and F. M. Alderton, all of great Cacapon. The company is capitalized at $50,000 and proposes to develop water power in Morgan and Hampshire Counties.

THE CLINTON (KY.) LIGHT & WATER COMPANY has been chartered with a capital stock of $2,000 by M. T. and T. J. Dilger and F. M. Sugg.

THE MacCONNELL ELECTRICAL SUPPLY & CONSTRUCTION COMPANY, Burlington, N. C., has been incorporated by T. F. MacConnell, F. V. MacConnell and H. C. Pollard. The company is capitalized at $25,000 and proposes to do a general supply and construction business.

THE HUBBELL LIGHT COMPANY, Watertown, S. D., has been incorporated with a capital stock of $100,000 by H. L. Hubbell, C. E. Pope and George Feerna.

New England States

GREENE, ME.—The Central Maine Power Company has petitioned the Town Council for a franchise to extend the company's electric lighting system to Greene.

OLD TOWN, ME.—Plans are under way for repairs to the local pumping plant and substation of the Bangor Railway & Electric Company to cost about $15,000. C. P. Crowell and W. S. Lancaster, Exchange Building, Bangor, are architects.

BROCKTON, MASS.—Plans are under way for extensions to the "white way" street-lighting system on West Elm Street from Main Street to the Eldon B. Keith memorial field.

FALL RIVER, MASS.—Contract has been awarded to the N. E. Concrete Construction Company, 201 Devonshire Street, Boston, for the erection of a transformer house, 21 ft. x 71 ft., for the Sanford Spinning Company.

HOUSATONIC, MASS.—The Eaton-Dikeman Company contemplates the erection of an electric power house at its local mill.

LOWELL, MASS.—Work is under way on the construction of an addition to the local plant of the Lowell Electric Light Corporation on Perry Street.

NEW BEDFORD, MASS.—Bids will be received at the office of Harold Winslow, clerk of committees, Room 220, Municipal Building, until July 27 for electrical work for the Summer Street school. Plans and specifications may be obtained at the office of the Superintendent of Public Buildings, Room 307, Municipal Building.

FAIRFIELD, CONN.—Plans are under way for the construction of an addition to the local power plant of the Bullard Machine Tool Company, 575 Broad Street, Bridgeport. Fletcher-Thompson, Inc., 1082 Broad Street, Bridgeport, are engineers.

GREENVILLE, CONN.—Plans are under way for the erection of a power plant at the local textile works of the United States Finishing Company, to cost about $300,000. Day & Zimmerman, 611 Chestnut Street, Philadelphia, Pa., are engineers.

HARTFORD, CONN.—The St. Francis Hospital, Sister Valencia in charge, will soon award contract for the erection of a hospital building to cost about $500,000. Electric lighting system will be installed.

NEW HAVEN, CONN.—Contract will soon be awarded by the New Haven Hospital, Colonel I. Ullman, chairman, for additions to the institution to cost about $1,100,000. An electric lighting system will be installed. Charles S. Palmer, 191 Church Street, is architect.

WATERBURY, CONN.—The Connecticut Military Emergency Board, State Armory, will soon award contract for the construction of an armory to cost about $400,000. Electric lighting equipment will be installed.

Middle Atlantic States

HAMMOND, N. Y.—Application has been made to the State Public Service Commission by the St. Lawrence Transmission Company of Potsdam for extension of its electric service to the town of Hammond.

LIMA, N. Y.—Work will soon be started on the construction of a local factory for the Porcelain Insulator Company, recently incorporated with a capital of $250,000, for the manufacture of high-voltage porcelain insulators and electrical appliances.

LYONS FALLS, N. Y.—Application has been made to the State Public Service Commission by H. P. Gould for permission to make an extension to the electric lighting plant which he now operates in connection with the Lyons Falls Paper Mills, in order to furnish electricity in Constableville, 3 miles distant.

MANLIUS, N. Y.—Willard J. Phillips has made application to the Public Service Commission for authority to erect an extension to his electric system.

ROSSIE, N. Y.—George Jucngst & Sons have applied to the State Public Service Commission for permission to make improvements to their electric plant.

ATLANTIC CITY, N. J.—The City Council of Ventnor has authorized the water and sewer committee to prepare plans for a municipal electric light and power plant.

CAPE MAY, N. J.—General contract has been awarded by the chief of the Bureau of Yards and Docks, Navy Department, Washington, D. C., to George S. Curtis of Cape May, for the construction of a power plant at the local navy yard.

HOBOKEN, N. J.—The rebuilding of the Boulevard power house at Laurel Hill and the installation of new equipment to cost about $30,000 is under consideration.

Construction News

Projects, Plans, Bids and Contracts Contemplated or Under Way

TOMS RIVER, N. J.—Work, it is understood, has been started by Henderson Brothers of Philadelphia, Pa., for the Ocean County Electric Company, on the construction of a hydro-electric plant on the Toms River, to cost about $600,000. Equipment will consist of four 700-kva. generators, each direct-connected to a waterwheel. Total capacity of the plant is rated at 3,000 hp. Edmund S. Fritz of Philadelphia, Pa., is president.

PHILADELPHIA, PA.—An ordinance has been recommended to the finance committee for the appropriation of $200,000 for the installation of new electrically operated elevators in the City Hall, in place of the hydraulic elevators now used.

READING, PA.—Plans are under way by the Metropolitan Edison Company for an addition to its electric power plant. E. West is president.

SCRANTON, PA.—Contract will soon be awarded by E. J. & P. Casey, 214 Lackawanna Avenue, for the erection of a power house, laundry and loft building to cost about $75,000. E. H. Davis and G. M. D. Lewis, Union Building, are architects.

WEST MIDDLESEX, PA.—Extensions to the electric light plant and waterworks to cost about $49,000 are contemplated by the borough authorities.

SMYRNA, DEL.—The Town Council has been authorized to borrow money for the erection of an electric light and water plant.

FORT MYER, VA.—General contract has been awarded to the H. C. Ball Construction Company, District National Bank Building, Washington, D. C., for the construction of a laundry building and a power house at Fort Myer to cost about $55,000. Brig. Gen. R. C. Marshall, Jr., Construction Division, Seventh and B Streets, Washington, D. C., is in charge.

North Central States

FLINT, MICH.—General contract has been awarded to the Industrial Construction Company, Patterson Building, by the Champion Ignition Company, Industrial Avenue and Harriet Street, for the construction of a power house to cost about $60,000.

CLEVELAND, OHIO.—General and separate bids will be received by the Board of Education, E. C. Ammerman clerk, 930 Williamson Building, East Cleveland, until July 30, for a central power plant to be erected near Prospect School, East Cleveland, at a cost of about $125,000.

CLEVELAND, OHIO.—The St. Alexis Hospital, C. A. Grasselli, chairman of the Building Commission, Broadway and McBride Avenue, contemplates the erection of a hospital addition to cost about $450,000. Electric wiring and elevators will be installed.

CLEVELAND, OHIO.—The Mechanical Rubber Company, Lisbon Road, has awarded contract to Stone & Webster, Leader-News Building, for the erection of a power substation to cost about $100,000. Lockwood, Green & Company, Bangor Building, are engineers and architects.

COLUMBUS, OHIO.—Survey of the municipal electric light plant is being made by Esselstyn, Murphy & Hanford, electrical engineers of Detroit, Mich.

COSHOCTON, OHIO.—The Northern Ohio Traction & Light Company of Akron contemplates the erection of a local power house. J. G. White, 37 Wall Street, New York, N. Y., is engineer.

BLACKEY, KY.—The Kentucky & West Virginia Power Company of Whitesburg contemplates the extension of its transmission lines from Blackey into the Elkhorn coal fields, terminating at Pikeville, where a large substation will be maintained.

JACKSON, KY.—The Breathitt County Light & Power Company has increased its capital stock from $100,000 to $150,000 and contemplates immediate improvements.

AUBURN, IND.—Plans are under way for improvements to the municipal electric power plant. E. E. Wineland, City Hall, is superintendent.

COLLAMER, IND.—A plan is under consideration for the establishment of a number of electric light plants along the Eel River from Collamer to Roann, for the purpose of furnishing power to the small towns along the line, including Liberty Mills, Sidney, Servia and Laketon.

DUNLAPS, IND.—The local power station of the Chicago, South Bend & Northern Indiana Railway Company has been recently destroyed by fire.

MUNCIE, IND.—Arrangements have been made for the installation of ornamental street lights on the north side of the public square. It is expected the movement will be a start toward a "white way" system for the city.

SYRACUSE, IND.—The Wawasee Tire & Rubber Company is having plans prepared for the construction of a factory to cost about $600,000. Complete electrical equipment will be required. R. L. Simmons of Elkhart is architect.

CHICAGO, ILL.—Felt & Tarrant, manufacturers of comptometers, 1713-35 North Paulina Street, contemplate the erection of a $1,000,000 addition and a power plant.

CHICAGO, ILL.—Bids will be received by R. G. Pierce, architect, 10 South La Salle Street, until Aug. 1 for the erection of an addition to the plant of the Delta Star Electric Company, 2437 Fulton Street, manufacturers of high-tension equipment. Electric light equipment will be installed. The cost is estimated at about $40,000.

DESPLAINES, ILL.—Plans are under way for the construction of a power house, 77 ft. x 147 ft., for the Benjamin Electric Company, 800 West Washington Street, Chicago. H. A. Dutt & Company, 123 West Madison Street, Chicago, are engineers.

LA GRANGE, ILL.—The directors of the Masonic Orphans' Home have plans under way for the construction of a new power house to cost about $90,000.

MADISON, WIS.—The Peninsular Power Company will require turbines, generators, switchboards, etc., in connection with its hydro-electric plant now being constructed near Florence. The cost is estimated at about $750,000. Mead & Seastone of Madison are engineers.

TAYCHEEDAH, WIS.—The State Board of Control has awarded contract to the Immel Construction Company of Fond du Lac for the construction of a power house at the State Home for Women, at a cost of about $26,483.

BRECKENRIDGE, MINN.—Bonds to the amount of $40,000 have been voted for the erection of an electric light plant and waterworks. R. R. Waite is city clerk.

HENDRUM, MINN.—At a recent local meeting it was decided to erect an electric transmission line from Hendrum to Halstead. L. A. Anderson is city clerk.

MINNEAPOLIS, MINN.—Rennie B. Fanning, consulting engineer, 602 Kasota Building, Minneapolis, has made a preliminary survey for the construction of a power plant rated at 15,000 hp. to be located on a site between Minneapolis and St. Paul, for the Municipal Power Corporation.

SAUK CENTER, MINN.—Bids will be received by the State Board of Control, State Capitol Building, St. Paul, until July 27, for the erection and completion of a school building at the State Home School for Girls at Sauk Center, including general contract work, electrical work, etc. C. H. Johnston, 715 Capital Bank Building, St. Paul, is architect.

DINSDALE, IOWA.—At a recent meeting the matter of erecting an electric transmission line between Dinsdale and Traer was discussed.

MUSCATINE, IOWA.—General contract has been awarded to the Federation Construction Company, 532 Davidson Building, Sioux City, for the erection of a local packing plant to include a power house, 50 ft. x 100 ft., at a total cost of about $1,000,000. Gardener & Lindberg, 140 South Dearborn Street, Chicago, Ill., are architects.

ST. JOSEPH, MO.—The Western Tablet Company, Eleventh and Mitchell Streets, contemplates the erection of a power house to cost about $35,000. R. & E. R. Meier, 203 Lincoln Building, are architects.

GRAND FORKS, N. D.—Bids will be received by the Industrial Commission of North Dakota until Aug. 3 for seventeen motors of various sizes to be used in connection with the new terminal mill and elevator. The C. A. Pillsbury Company, 805 Metropolitan Life Building, Minneapolis, Minn., is engineer.

VALLEY CITY, N. D.—Bonds have been voted for the erection of a municipal electric light and water plant.

WAHPETON, N. D.—The Richland County Electric Company, recently organized with a capital of $75,000, contemplates the erection of an electric transmission line from Wahpeton to Wyndmere.

VOLGA, S. D.—The city officials contemplate the installation of an electric lighting system to cost about $25,000.

Southern States

CHARLOTTE, N. C.—The Southern Public Utilities Company contemplates extensions to its plant and system to cost about $150,000. Z. V. Taylor is president.

MIAMI, FLA.—The City Council has authorized extensions to the street-lighting system.

MEMPHIS, TENN.—The United States Gas & Electric Company, it is understood, will expend $190,000 for repairs and equipment.

DANVILLE, ARK.—The Danville Light Company has been leased by P. F. Arnold of Hot Springs, who contemplates improvements.

LITTLE ROCK, ARK.—A hydro-electric development in Cleburne and White Counties on the Little Red River, to cost about $3,000,000, is under consideration. Plans include the construction of two dams, 50 ft. and 60 ft. high respectively, with a total generating capacity of 16,500 kw., and the erection of 130 miles of transmission line. Dickinson and Watkins, Little Rock, are engineers.

VIOLET, LA.—The Violet Ice & Electric Company with a capital stock of $50,000 has been organized for the purpose of furnishing electricity in Violet and Borgnemouth and supplying other towns with ice.

Pacific and Mountain States

PRIESTS RAPIDS, WASH.—H. J. Pearce and others are planning to install an industrial plant on the Columbia River at Priests Rapids. The initial investment of $5,000,000 is one-third of the amount which will be required before completion of the project.

SHELTON, WASH.—The County Commissioners have granted the Olympic Electric Reduction Company a franchise to transmit current over the roads and highways of Mason County, provided that the hydro-electric plant shall be in operation and the main lines ready to serve Shelton and Union City within nine months of its date.

PORTLAND, ORE.—Application has been filed by Joseph R. Keep, 313 Couch Building, with Percy A. Cupper, state engineer, for permission to divert 4,000 sec.ft. of water from Sandy River and its tributaries. It is understood that the project involves the erection of a power plant, rated at 45,000 hp., in Clackamas County and the construction of a large dam.

SAN BERNARDINO, CAL.—Extensions to the street-lighting system on Third Street from Arrowhead to Mount Vernon Avenue are contemplated.

VENTURA, CAL.—Bids will be received by the board of supervisors of Ventura County until Aug. 4 for electric wiring for the additions and the completion of the administration building at the Ventura County Hospital. Plans and specifications may be obtained at the office of Albert C. Martin, architect, 430 Higgins Building, Los Angeles.

BOISE, IDAHO.—A number of residents of Wilder and Homedale have petitioned the Idaho Power Company to extend its electric transmission lines to furnish light and power to those towns.

CLINTON, MONT.—Judge F. C. Webster John and Vincent Shaughnessy, all of Missoula, plan the incorporation of a company for the purpose of erecting a hydro-electric plant at the mouth of Rock Creek, east of Clinton.

MISSOULA, MONT.—Preliminary power permit has been granted for the development of electric light, heating and power system in Missoula.

Canada

EDMUNDSTON, N. B.—Plans are under way for the construction of a new pumping station, including the installation of an electrically driven centrifugal pump and 7,000 ft. of 16-in. main to the old reservoir, to cost about $90,000. L. L. Theriault is town manager.

KITCHENER, ONT.—Bids will be received by A. R. Kaufman, chairman of the hospital board, until Aug. 7 for the erection of a new power house and steam heating plant for the General Hospital to cost about $15,000.

NIAGARA FALLS, ONT.—The City Council passed a bylaw to raise $33,000 for extensions and improvements to the municipal hydro-electric system. W. J. Seymour is clerk.

WINDSOR, ONT.—Contract will soon be awarded by the Border Cities Hotel Company for the construction of a hotel to cost about $1,000,000. Electric light equipment and electric elevators will be installed. Watt & Blackwell of London are architects.

WESTMOUNT, QUE.—Extensions to the municipal electric light system are contemplated. P. E. Jarman is city engineer.

Record of Electrical Patents

Notes on United States Patents

(Issued July 6, 1920)

14,910 (reissue). TELEGRAPH TRANSMITTER; Edwin H. Piersen, Topeka, Kan. App. filed Oct. 19, 1915. Recording system.

1,344,689. ELECTRIC REGULATOR; Nelson R. Haas, Dayton, Ohio. App. filed May 23, 1916. Regulation varied with temperature changes.

1,345,352. WIRELESS TELEGRAPHY; Fulton Cutting, Tuxedo Park, N. Y. App. filed Dec. 4, 1916. Wave trains of audible frequency.

1,345,370. DYNAMO-ELECTRIC MACHINE; Austin Kimble, Wausau, Wis. App. filed March 19, 1919. Ventilating windings.

1,345,431. ELECTRICAL APPARATUS FOR THE ELECTROCHEMICAL TREATMENT OF VAPORS; Louis B. Cherry, Kansas City, Mo. App. filed Oct. 9, 1917. Treatment of liquid hydrocarbon and other compounds.

1,345,466. INCANDESCENT-LAMP-PROTECTING DEVICE; Holroyd F. Way, Oregon City, Ore. App. filed June 5, 1919. To prevent theft.

1,345,484. ELECTRICAL COIL; Arthur W. Fisher, Wilkinsburg, Pa. App. filed Jan. 29, 1919. For magnetos, relays, etc.

1,345,538. ALTERNATING-CURRENT MOTOR; Valere A. Fynn, St. Louis, Mo. App. filed Dec. 15, 1916. Single-phase commutator motor.

1,345,539. SPEED-REGULATING APPARATUS; Valere A. Fynn, St. Louis, Mo. App. filed April 25, 1918. Controlling speed of prime movers.

1,345,540. SPEED-REGULATING APPARATUS; Valere A. Fynn, St. Louis, Mo. App. filed July 5, 1919. For direct-current generators.

1,345,556. APPARATUS FOR THE DETERMINATION OF VERTICAL VELOCITIES IN OR OF AIR OR WATER; Cornelis Schoute, De Bilt, near Utrecht, Netherlands. App. filed March 26, 1918. For navigation and flying.

1,345,560. SPARK-PLUG INTENSIFIER; William F. Smith, St. Louis, Mo. App. filed Nov. 30, 1917. Auxiliary gap.

1,345,566. ELECTRIC POWER SYSTEM; John G. Thornburgh, Indianapolis, Ind. App. filed April 3, 1918. Automatic control of generator or battery.

1,345,586. RADIOPHONE; William W. Coblentz, Washington, D. C. App. filed March 3, 1883. Heat rays utilized as means of communication.

1,345,593. INCUBATOR; Francis Giddens, Ottawa, Ontario, Canada. App. filed May 31, 1918. Heated by incandescent lamp.

1,345,626. RECORDING APPARATUS; Rudolph S. O'Neil, London, England. App. filed April 11, 1917. For recording position of engine telegraph.

1,345,645. ELECTRIC SOLDERING IRON; Otto Stalhane and Olof Oskar Kring, Djursholm, Sweden. App. filed April 3, 1919. Heating element in refractory tube.

1,345,656. APPARATUS FOR PRODUCING LIGHT HYDROCARBONS; John A. Yunck, South Orange, N. J. App. filed Oct. 15, 1918. From crude oil or kerosene.

1,345,679. ELECTRIC RIVETING MACHINE; Frank P. Kobert, Amityville, N. Y. App. filed Sept. 29, 1917. Rivet heated electrically.

1,345,691. ELECTRIC METER; Willard E. Porter, Lynn, Mass. App. filed Feb. 26, 1917. Commutator type.

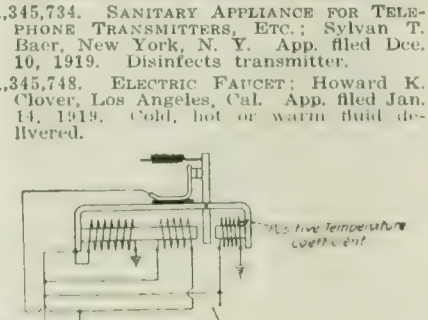
1,345,696. ELECTRIC HEATING DEVICE; Earl H. Richardson, Ontario, Cal. App. filed Dec. 16, 1918. For electric cooking.

1,345,712. ELECTRIC APPARATUS; Howard O. Stephens, Pittsfield, Mass. App. filed Dec. 18, 1916. Transformer.

1,345,730. ELECTRIC HEATER; Charles C. Abbott, Pittsfield, Mass. App. filed April 16, 1919. Used on electric ranges.

1,345,734. SANITARY APPLIANCE FOR TELEPHONE TRANSMITTERS, ETC.; Sylvan T. Baer, New York, N. Y. App. filed Dec. 10, 1919. Disinfects transmitter.

1,345,748. ELECTRIC FAUCET; Howard K. Clover, Los Angeles, Cal. App. filed Jan. 14, 1919. Cold, hot or warm fluid delivered.



1,344,689. Electric Regulator

1,345,754. CONDENSER AND METHOD OF MAKING THE SAME; William Dubilier, New York, N. Y. App. filed Oct. 30, 1918. Special arrangement of plates.

1,345,817. WELDER'S TOOL; Roy O. Williams, Columbus, Ohio. App. filed Aug. 4, 1919. For holding electrode.

1,345,835. APPARATUS FOR SEPARATING OR CONCENTRATING FINE METALS FROM PULVERIZED MATERIAL; Giulio Clement, Milan, Italy. App. filed Dec. 16, 1916. High-voltage separator.

1,345,839. TELEPHONE-RECEIVER HOLDER; Alfred J. Diebold, Pittsburgh, Pa. App. filed April 2, 1919. To support receiver from user's shoulder.

1,345,846. PROCESS OF EXTRACTING METALS FROM THEIR ORES; William E. Greenawalt, Denver, Col. App. filed Dec. 13, 1915. Electrolytic deposition.

1,345,852. TELEPHONIC CALL SYSTEM; Ruben C. M. Hastings, Columbus, Ohio. App. filed Dec. 9, 1915. Automatic system.

1,345,853. TERMINAL POST FOR BATTERY CARBONS; Edwin W. Henger, Waterbury, Conn. App. filed March 13, 1920. Securely anchored.

1,345,879. MACHINE-SWITCHING TELEPHONE-EXCHANGE SYSTEM; Lipa Polinkowsky, London, England. App. filed March 9, 1918. For connecting automatic to non-automatic station.

1,345,893. HYDROCARBON MOTOR; Herman Schwarze, Detroit, Mich. App. filed Dec. 22, 1916. High-speed multicylinder internal-combustion engine.

1,345,962. PEN OR PENCIL ATTACHMENT; Aura J. Sanders, Cedar Springs, Mich. App. filed Feb. 28, 1917. Writing end of pen illuminated.

1,345,976. ELECTRICAL FURNACE; Raymond S. Wirel, New York, N. Y. App. filed Feb. 26, 1920. For melting gold, silver, etc.

1,346,003. SPARK PLUG; Carl D. Cleland, Jean, Nev. App. filed July 3, 1917. Make-and-break type.

1,346,051. METHOD OF RIVETING; Harry R. Pennington, Kansas City, Mo. App. filed Oct. 19, 1918. By electric arc.

1,346,057. APPARATUS FOR MEASURING OHMIC RESISTANCE OF LIQUIDS AND SOLUTIONS; Timothy H. Reardon, North Adams, Mass. App. filed Nov. 8, 1918. Measures resistance of electrolytes.

1,346,090. ELECTROLYTIC METER; Henry S. Hatfield and George Hookham, Birmingham, England. App. filed June 2, 1919. Automatically reset.

1,346,093. AUTOMATIC TELEPHONE SYSTEM; Emil Jacobsen, Chicago, Ill. App. filed May 4, 1918. Automatically selects a trunk line.

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The Coal Situation

NOTWITHSTANDING Mr. Cushing's assurance to the Ohio Electric Light Association that there is no shortage of coal and that the industry is being unnecessarily harangued on the coal situation, the outlook is not very bright. On top of an already acute transportation situation comes the strike of the miners in the Middle West, which only serves to add to the predicament. Every effort should therefore be made by electric public utilities to obtain coal not only for present consumption but also for storage, despite the high cost of the fuel. While it is particularly galling to a utility to be compelled to pay from $15 to $20 a ton for coal which during the war was obtainable at one-third that price, it is nevertheless obligatory on the industry to give service and apply to the commissions for increased rates to cover the added operating expense. Nor will it be an easy matter to obtain coal. The recent ruling of the Interstate Commerce Commission whereby the Northwest and New England must be supplied with fuel during the summer months, and the priority order issued by the same body affecting public utilities during times of emergency, constitute heavy liens upon coal production, so that there will be no very large equity left for other purposes. On the other hand, production is increasing and, barring strikes, will continue to increase. It is therefore expedient for public utilities to do everything possible to store coal during the summer months, and it must not be overlooked that coal for storage will have to be bought in competition with other industries likewise endeavoring to provide for their future needs.

The Return to Normal

PROSPECT of an old-fashioned campaign for the Presidency, on time-honored partisan lines, with the dreaded new third party a laughing-stock, the Socialists subdued and sober and the advocates of communistic revolution in peril of that banishment from newspaper headlines, which to them is exile, surely marks the beginning of the subsidence in the United States of the noisy unrest that always follows war. In desolated Europe the commotion may continue long, but in America its echoes are already dying away. Prosperity and revolution do not run together; and, despite high prices, despite the scarcity of dwellings, despite disorganized industries and inadequate products, it is only necessary to glance around to see a majority riot of cheerful expenditure and determined enjoyment that may be deplorable in some of its aspects but has at any rate nothing in common with despair or gloom. Underneath political effervescence of every kind lies, too, a solid substratum of common-sense patriotism that defies the upsetters.

"Here is what moves in magnificent masses, careless of particulars—
The Union, always swarming with blatherers and always sure and impregnable.'

The outlook in the fall elections is for the triumph of the average man in nation, state and municipality. There are disadvantages in his victory, but, after all, it is what democracy spells, and out of it will come gradual adjustments to the new money values and the new wage tariffs and the new world relationships that will bring substantial justice to almost all, including, let us hope, the public utilities now so heavily handicapped.

Education of Labor a Good Investment

TO PROVIDE an incentive for doing better and more work, shop facilities at the Lynn (Mass.) works of the General Electric Company include a remarkably wide range of educational opportunities. Richard H. Rice, manager of this plant, has declared that the application of the Golden Rule in the treatment of labor lies at the foundation of successful production. Manufacturers are today virtually in competition for labor, and the provision of educational and social opportunities, combined with healthful and attractive working conditions, is "good business," wholly apart from ethical considerations. Workers at Lynn who show a desire to advance are taught to operate machines of increasing complexity, and the educational facilities of the plant embrace a wide range from courses adapted to fitting technical graduates for drafting and designing engineering to instruction in individual tool operation, training for foremen, and fitting men for larger executive tasks. More than ever, community interest and sympathy are sought by the manufacturing company, and false ideas are combated by frankly meeting employees, co-operating along educational lines, making the plants "good places in which to work," and in many other ways.

Safety of Electrical Investments

STEEL production and agriculture have long been the basic industries of the nation, and to them should now be added the electrical industry. For were it not for the electric spark in the motor truck which hauls the steel products, electric lighting to make possible effective continuous work, the electric motor to drive the rolls, and the electric testing devices to check the product, the steel production of today would be impossible. As to agriculture, particularly in those parts of the country where pumped water is vital for irrigation, electric power is not only accomplishing wonders but upon it all plans for extensions to the cultivated area are based. In the home also electricity has become so important that no household is complete without its aid. The stocks and bonds of the electric utilities have a security, therefore, greater than that of others. Not only are the securities assured by tangible assets in power plants and lines, but, more than all, by vital and essential service to the human race.

Determining Cost Prices

AMONG many suggested preventives for profiteering is a proposal to compel by law the marking of its cost price on the article offered for sale. This brings up the interesting question, "What is the cost price?" No two individuals, no two shop cost systems, would define it the same way. It would seem, therefore, that such a law would have to establish a cost-keeping system for every kind of shop in each industry. While a procedure of this kind would probably cost as much or more than any price reduction, it would without question throw a great deal of light on inefficiency and waste and place competition on a fair basis.

Corrective methods for high prices and punishment for profiteers certainly deserve attention in many industries. From such investigations the electrical industry has little to fear, for no other business has been so remarkably free from profiteering. However, to harass all industries by inflexible price control laws will never accomplish the results that might be attained through action that on sufficient evidence can now be exercised by our criminal courts.

Opportunity for Standardizing Industrial Substations

SUBSTATIONS for the supply of industrial power and lighting differ in principle very little from those supplying miscellaneous service. The transforming equipment is substantially the same. Safety and control equipment is of much the same nature, and the general principles of location remain unchanged whatever the purpose to which the secondary current is applied. The industrial plant, from its limited range of distribution, generally does not require any special provisions for feeder regulation, and as a rule there are fewer high-tension feeders with their necessary equipment. The paper by R. H. Tillman in this issue contains a very practical account of industrial substation design, one particularly useful because it gives information regarding present construction costs. These run, for a substation housed in a regular building, somewhere in the vicinity of $15 per kva., of which the building can be brought down to somewhere near 10 per cent. Of course, the amount of transforming apparatus in the station affects the cost considerably.

The economy to be obtained by the use of outdoor substations varies much with conditions involving the complexity of the necessary equipment. The transformers and their auxiliaries being the main item in the total, the saving by abolishing the substation building is not very large, and probably the removal of temptation for the installation of unnecessary equipment plays a larger part in the economies of the outdoor substation than does the mere abolition of the walls. Mr. Tillman takes up the principles of substation design in a way that will prove most instructive, and it is certainly grateful to have data on recent costs collated and tabulated. Labor and material have advanced so rapidly in the past three or four years that all old figures must be thrown into the discard and a completely new schedule established.

Since service to industrial plants from individual substations is greatly increasing, it seems that there is an excellent opportunity for central stations to reduce the time and cost of establishing service by adopting a few standard forms of construction for such stations. By so doing special engineering work on each job can be avoided and stock parts can be kept on hand so that when service is required type A, B or C station can be ordered and quickly installed.

Economies in Storeroom Stocks

IT IS an odd fact that in the handling of the cash drawer the utmost precautions are taken by most central-station companies to prevent losses, while in the handling of supply stocks, which are essentially cash, cases of the utmost carelessness are constantly observed. The storeroom is frequently a serious offender, the offence consisting of careless methods of handling and accounting and the purchasing and carrying in stock of unnecessary items. One central station has been able after a careful study to reduce the number of distribution brackets in use from thirty-nine to eleven types. It was found that the large number of types in use was due to the individual preferences of the construction and maintenance forces and that orders were frequently placed when material that was usable was actually in stock. One of the easiest methods of reducing storeroom stocks and therefore reducing the cost of storeroom service and releasing capital for other necessary uses lies in a careful study of the ways and means of using material in construction work. Not only is investment cut down but the handling of material is simplified because there are fewer items and the simplifications lead to lower costs of handling. In these days of enforced economies and need for standardization, a strong N. E. L. A. committee can serve the industry well and profitably not only for the present but later as well.

Conditioning Big Motors to Assure Reliable Service

OF ALL the uses to which electric motors are put the operation of steel mills is perhaps the most strenuous. Not only are the machines big, up to 10,000 hp. or more in maximum output, but they have to endure mechanical strains of exceptionally severe character and suffer to an unusual degree from chances of dirt and moisture affecting the insulation. O. Needham contributes to this issue some very practical suggestions for the testing and inspection of this class of motors prior to installation and periodically thereafter.

The mere trying out of a machine which has remained for some time uninstalled or unused is no trifling matter. Mr. Needham's instructions for carrying on the drying process afford some useful details in the carrying out of the methods ordinarily employed. The combination of exterior heat and heating current is particularly useful in dealing with great moisture, since the external heating can bring the coils into condition for the application of heating current when otherwise some risk would be incurred. By coupling the process with insulation measurements the progress of the work can be followed up, and finally low-voltage current can be applied until the resistance becomes entirely steady. After this an actual overvoltage test with a small transformer will bring the process to a suitable end.

Once in action again, steady care is the main requirement for continuous operation. Mr. Needham's suggestion of inspection and blowing out by air pressure every week or two, together with at least an annual

treatment with insulating varnish as far as the insulation can be reached, is a good one. Many a hard-worked motor has finally struck, not from unpreventable faults, but from dirt, moisture and general neglect. At the present price of motors rigorous inspection pays.

Engineering Reticence

THE personal quality of reticence is one which has long been associated with the engineering profession. "To do much and say little" has been almost an axiom with men of large responsibilities. Reticence is indeed a commendable trait at times, but, unfortunately, if carried to excesss it reacts on the profession. An illustration of this tendency is the unwillingness of a large number of engineers to talk or write for publication. One has only to serve on any of the paper committees of the national societies or to be connected with the technical press to realize the significance of this fact. Only men who have had such opportunities for observation will realize how many excellent ideas have gone to oblivion unrecorded owing to this characteristic trait. Every engineer should record his ideas and conclusions drawn from his experience, at engineering meetings and on any other appropriate occasion, from a sheer sense of duty to the industry of which he is a representative.

The Importance of Storing Coal

IT HAS been only too evident of late that railway transportation is an uncertain factor to rely on for coal supply so far as continuity of service is concerned. Therefore a central station which expects to keep up steady service must be prepared to carry a reserve fuel supply as near to the point of consumption as available space permits. The manner of storage is particularly important. In this issue Prof. H. H. Stoek takes up with considerable detail the deterioration of stored coal. When subjected to alternate wetting and drying, the surface coal crumbles and pulverizes, thus subjecting itself to spontaneous combustion. So far as its heating value is concerned, recent studies on the subject show that there is very little depreciation, and in the cases where the coal can be stored under water, as is sometimes convenient, none at all. The prevailing impression that stored coal burns a little less freely than when it is fresh has no sound basis if the coal is burned in proper furnaces and care is taken not to grub up the earth in handling the coal.

The most noticeable deterioration of coal is generally caused by its heating, even though it does not actually ignite. Where the coal can be kept under water and consequently effectively out of air this danger is eliminated, but if stored on the surface of the ground it is necessary either to give the coal very thorough ventilation or, better, no ventilation at all. Most attempts at ventilation are likely to lead to trouble rather than to avert it.

One common error which Professor Stoek takes pains to contradict is that the locality from which the coal comes has a considerable bearing on success in storing it. Differences in friability and also in the likelihood of heating do exist, but they are of less importance than the size of the coal, the care exercised in its preparation and the manner of storage. If dust and fine coal can be kept out of the pile, it is not likely that the fuel will be heated to the ignition point. If a considerable amount of fine coal exists, however, any ventilation likely to be provided may rather increase the danger, while close packing so as to keep out the circulation of air that induces combustion is preferable. If the coal is clean, screened and of uniform size, loose piling succeeds where it would fail if there were a considerable amount of fine material.

Cost of storage varies enormously on account of the various situations in which piles have to be placed. Figures obtained two years ago show variations from 1.5 cents to 34 cents for storage and from 2 cents to 20 cents per ton for reclaiming. In these days the figures given amount to so small a part of the actual cost of the coal that storage as a provision against the failure of transportation should no longer be put off for this reason.

Complete Analyses of Costs

TOO many industrial establishments which install electrical apparatus of one kind or another for labor-saving or quality-improvement work fail to check operating results in sufficient detail. Haphazard records often baffle the search for economic finality, and in many cases there are no reliable data whatever upon which to judge accurately the "fit" of the installation into its surroundings. Without deprecating the usefulness of honest, painstaking operating information, it must be said that truly complete analyses which include the "overhead" expenses of equipment are a great rarity. Lack of information as to the installation cost doubtless is responsible for this in the vast majority of cases, coupled with the fact that in dealing with depreciation and maintenance it is commonly necessary to make assumptions in order to attain complete figures. A sore need of the electrical industry at the present time is thoroughgoing analyses of installation and operating costs.

Sincere but Misguided

RECENTLY a certain public utility company requested a rate increase from the public service commission of the state and the general manager of the company promptly set about finding out what stand the city officials were going to take in the matter. The city attorney was consulted by the general manager and the case explained to him. As a result the attorney became assured of the reasonableness of the rate increase. He said so openly, even expressing the opinion that the commission was sure to grant the request. The manager of the company then asked him, "And what is your office going to do about the case?" The reply was made immediately, "We shall oppose it." In other words, the city officer was fully convinced of and admitted the fairness of the company's plea, but still sincerely believed it the duty of his office to oppose it. This attitude of antagonism between city and utility company is, to say the least, antiquated and unnecessary. But still it persists widely. We wonder how much longer the public will lend political support to men who thus oppose the real interests of the community. Surely these unreasonable practices will soon become unprofitable also to officialdom.



Henry Marison Byllesby

Engineer and financier—A pioneer in both steam and water-power central-station design.

IN 1881, when the first steam-power central electric station was projected—the famous Pearl Street station in New York—H. M. Byllesby, a young man of twenty-two, was engaged as draftsman and made all of the drawings for the structure and the placing of the equipment. Almost continuously since then he has devoted his energies to the upbuilding of the electrical industry not only in this country but in Canada and Europe as well. He has been an engineer, a manufacturer, a salesman and a central-station executive. In fact, there is almost no phase of the electrical industry which some time in the past forty years has not been enriched by his participation therein.

After two years in charge of building, selling and installing Edison apparatus in Canada, Mr. Byllesby was engaged on his own account in contracting for electric lighting installations. This brought him in 1885 to a turning point in his career, when he became associated with the late George Westinghouse. Shortly afterward the original Westinghouse Electric Company was formed, with Mr. Byllesby as vice-president and general manager. Under his guidance the first commercial alternating-current lighting was introduced. He was active both in the engineering and sales field, remaining with the Westinghouse interests until 1891, the last two years having been spent for the most part in Europe in connection with the development of foreign business. He then became connected with the Thomson-Houston Electric Company as president of the subsidiary handling the Northwest territory.

In 1895 he was again working for himself and during the next seven years he did much of the pioneer hydro-electric work in Montana and northern Minnesota. It was in 1902 that he established the house of H. M. Byllesby & Company, then as an engineering organization. As time went on, however, the functions of the company broadened until now it is probably more widely known for its financial undertakings in the utility, oil and shipping industries and for its management of the numerous utilities under its control.

Mr. Byllesby was born in Pittsburgh, Feb. 16, 1859. He received his preparatory education at the Western University of Pennsylvania. At Lehigh University he studied mechanical engineering, but did not complete his course, leaving at the end of his junior year to work in the laboratory and machine shop of the Weston Dynamo & Electric Machine Company. In recognition of his overseas work, when as lieutenant colonel he had charge of purchasing in Great Britain and Scandinavian countries for the A. E. F., the British Government awarded him the Distinguished Service medal.

Storage of Coal for Central Stations

The Experience of Recent Years Has Emphasized the Necessity for Storage of Coal—The Coal Should Be of Uniform Size and Free from Dust, but, with Proper Care, Slack and Run of Mine May Be Stored

By H. H. STOEK
Professor of Mining Engineering University of Illinois

ALTHOUGH companies are having difficulty securing sufficient coal for daily needs, to say nothing of building up a reserve, the present situation indicates that many companies would be in a better position if they had larger coal-storage facilities. It is true that money has to be tied up in storage space and coal reserve, but it is quite likely that the fixed charges on this investment would become relatively small compared with the extra price which must be paid for coal in the open market during a shortage. In view of possible future hold-ups in deliveries, congestion of transportation, etc., central stations which do not already have ample coal-storage space might do well to reconsider providing it.

The most troublesome problem in connection with the storage of coal in quantity is the prevention of fires from spontaneous combustion. It is therefore the purpose of this article to discuss experience in storing the usual kinds of bituminous coal with especial reference to fire prevention. Weathering is also considered.

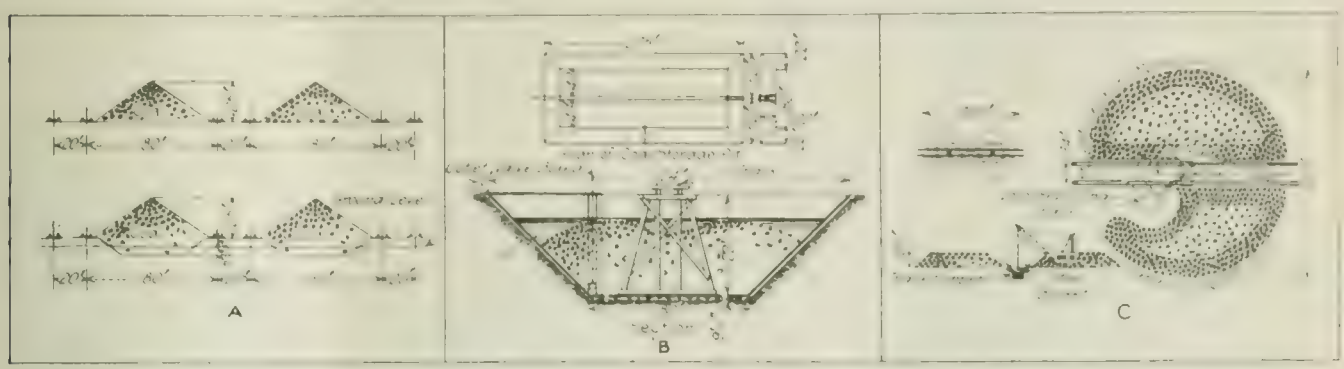
On account of the unequal demands for coal at different seasons of the year, the mines operate irregularly and the demand upon the railroads for hauling the coal is very irregularly distributed throughout the year, the greatest demand upon the railroads being during the fall and winter months, when the equipment is also needed for moving the crops and when the cost of transportation is at a maximum. Equalization of mining and transportation throughout the year help to stabilize other industries and permit of a lower price of coal to the consumer to offset the necessary cost of storage.

Experience has shown that unless mine operating and transporting conditions are rendered more stable the supply of power will continue to reach manufacturing and power plants irregularly, on different days and during different seasons, and, in case of a storm or flood, the supply may be cut off completely for an indefinite period.

That storage is practicable has been demonstrated in all branches of industry, and particularly by the by-product coke companies and other similar industries where continuous operation is necessary. Not only has storage been demonstrated to be practicable in a great variety of industries but in widely separated communities, under greatly different conditions and with great varieties of bituminous coals.

The storage should be as near to the point of actual consumption as is possible and practicable so as to insure to the user a steady supply and to avoid the extra cost and extra breakage incident to each rehandling, and, also, so as best to utilize the transportation facilities. Storage at the point of actual consumption is, of course, frequently out of the question, for in the congested business districts of cities space is too valuable for renting purposes to permit its use for the storing of coal. In such cases storage in any quantity at the point where the fuel is to be used is impracticable.

Many of the large users of coal, however, provide a storage supply on the outskirts of the city or outside the city limits, within range of suburban railroad service or even motor-truck hauling distance. A striking example of this is the Commonwealth Edison Company of Chicago, which, in addition to keeping fair-sized storage piles at each of its power houses within the city limits, keeps a supply of several hundred thousand tons just outside the city limits. Some of this coal has been in storage for about ten years. The supply is kept mostly for emergency purposes and is not drawn on for current uses. Most of the coal is ordinary central Illinois coal from which all coal below 1¼ in. (3.2 cm.) has been removed and used for current consumption. There has been virtually no trouble from spontaneous combustion. During the strike of 1919 this storage supply was reduced to about 15,000 tons.



A FEW TYPICAL METHODS OF STORING COAL IN SUCCESSFUL OPERATION

A—Arrangements of tracks and storage piles employed by the Commonwealth Edison Company. B—Storage pit of Illinois Traction Company at Mackinaw, Ill. C—Open storage pile of Dodge type, a convenient method where [illegible]

Does Coal in Storage Deteriorate?

The effect of storage upon the properties of coal may be considered under the following heads:

Physical Properties.—(1) Appearance; (2) degradation or increase in fine coal.

Chemical Properties.—(1) Loss of heating value; (2) loss in firing qualities; (3) loss in coking and gas making qualities; (4) loss from spontaneous combustion.

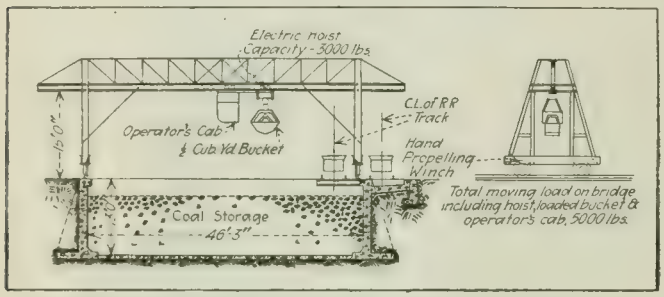
Appearance.—Some coals upon exposure to air

become covered with a coating of white iron sulphate which looks like frost. This simply means that some of the sulphur has oxidized to sulphate, which is usually washed off by rain. This white coating is not found on the coal beneath the surface.

Degradation, or breakage of large lumps into smaller sizes, is due to: (1) Weathering, which causes the lumps to crack and break; (2) handling.

Coal in storage alternately dries out and again absorbs moisture. Pyrite also oxidizes, and both of these causes tend to break the coal. The amount of this weathering depends on the variety of coal, to some extent upon the time in storage, and mainly upon the size of the storage pile. The depth to which weathering extends is not great and any loss due to it is inconsiderable.

Breakage of coal in handling does not materially affect its value for use in central-station plants when stokers are used, but it is of great importance in connection with spontaneous combustion, as fine coal and dust greatly increase the liability to spontaneous combustion. Such breakage depends entirely upon the appliances used and the care taken in handling the coal.



UNDER-WATER STORAGE PLANT OF 1,200 TONS CAPACITY, BUILT AT A COST OF $15,300 BY THE WESTERN CLOCK WORKS

Heating Value of Coal Not Greatly Affected by Storage

The heating value of coal as expressed in B.t.u. has been shown by Professor Parr[1] at the University of Illinois, by the experiments of the United States Bureau of Mines and by a number of other investigators to be very little decreased by storage and practically not at all with under-water storage.

The opinion is widespread, however, though by no means universally held, that storage coal burns less freely than fresh coal. It must be remembered that sometimes the apparent deterioration is due not to any change in the coal but to the fact that the clamshell or other reclaiming device digs into the soil under the coal pile and mixes soil or refuse with the reclaimed coal. Experiments at the University of Illinois indicate that storage coal may be burned as readily as fresh coal in a stationary plant if a thinner bed is kept and the draft regulated properly.

Coking and Gas-Making Properties.—There are few recorded data concerning the effect of storage upon the coking properties of coal, although the replies to the questionnaires sent out by the writer agree generally in the opinion that heating injures the coal for this purpose. Much of the injurious effect attributed to storage is no doubt due to the heating of the stored coal and is not due to storage *per se,* though the heating is of course an incident that sometimes accompanies storage.

The experiences of the following light, heat and power companies are given in Circular 6, Engineering Experiment Station, University of Illinois, pages 165-169, in too great detail to be quoted here: Rockford Electric Company, Wisconsin Gas & Electric Company, United Railways Company of St. Louis, Aurora, Elgin & Chicago Railway, Union Light & Power Company, St. Louis; Laclede Gas Light Company, St. Louis; Cleveland Illuminating Company, East St. Louis Light & Power Company, and Commonwealth Edison Company, Chicago. The detailed practices of a large number of coke plants, manufacturing concerns, railroads, etc., are also given in the same circular.

Prevention of Spontaneous Combustion

The greatest difficulty in the storage of coal is undoubtedly the tendency of many coals to take fire spontaneously. As previously mentioned, it is the deterioration due to this cause which is often confused with a supposed decrease of heating value as a result of storage.

The gradual heating of a coal pile is due mainly to slow oxidation of the carbon in the coal and, to a less extent, to the oxidation of the sulphur in the iron pyrites contained in the coal. If the air supply is sufficient to permit oxidation but not sufficient to carry away the heat as rapidly as it is formed, the temperature in the pile will rise gradually and finally the coal will take fire. Any method of storage to be successful must be so designed that the heat generated in the pile will not exceed the heat lost by radiation. Freshly mined coal has a special tendency to oxidize and thus to heat. While this property varies with different varieties of coal, it is generally true of all coals. The greater the time elapsing between the mining and storing of any coal, the less is the liability to firing; hence, if possible, coal should be exposed to the air, that is, allowed to become seasoned before it is put in storage. That is, of course, frequently impracticable.

Oxidation of both the carbon and the sulphur takes place more rapidly as the temperature increases; hence coal stored during hot weather is more likely to heat than that stored on cool days. Experience shows that after being in storage three months the liability to heating decreases rapidly.

Space will not permit a more detailed discussion of spontaneous combustion, which can be found in the series of bulletins of the Engineering Experiment Station of the University of Illinois by Prof. S. W. Parr, in the publications of the United States Bureau of Mines and in the publications in Canada by Prof. J. B. Porter.

Importance of Size of Coal in Storage

There is an erroneous, misleading but widespread opinion that the locality from which the coal comes determines whether or not it can be stored. One frequently hears remarks to the effect that eastern coals (meaning those from Pennsylvania and West Virginia) can be easily stored, but Western coals (meaning those from Illinois and Indiana) cannot be, as they are much more liable to spontaneous combustion." Both parts of this statement are too broad, for scientific research and the experience of those storing coal, as shown by the questionnaire sent out by the writer, agree that while there are undoubtedly differences in various coals that affect their liability to spontaneous combustion and

[1] See Circular 6, p. 107, Engineering Experiment Station, University of Illinois, for detailed description and analyses of stored coal.

also their liability to degradation, these differences are of less importance than the size of the coal stored, the care with which it has been prepared and the way in which it is stored.

All varieties of bituminous coal have been stored without spontaneous combustion resulting and it is equally true that all varieties of bituminous coal have fired when stored. This does not mean that all coal stores equally well, as there is undoubtedly a difference in storage quality in coals from different districts and even from mines in the same district. Coals from the same district, however, differ more because of difference in preparation than from inherent liability to spontaneous heating. The kind of coal that is to be stored should be inquired into, and coals that are known to be particularly liable to spontaneous combustion should not be selected for storage if it is possible to avoid doing so.

There are not sufficient data available at this time to classify coals as to their liability to spontaneous combustion, and it is doubtful if this ever can be done, because liability to spontaneous combustion does not seem to be an inherent quality of the coal from any given seam, district or mine, but seems to depend more upon the size of the coal, its freedom from dust, to a less extent the amount of pyrite (sulphur) present, and to a very great extent upon the way in which it is piled.

The spontaneous combustion of the coal is due largely to the oxidation of the fine coal and dust and the confining of the resulting heat; consequently the liability to spontaneous combustion in stored coal is greatly reduced and in many cases eliminated:

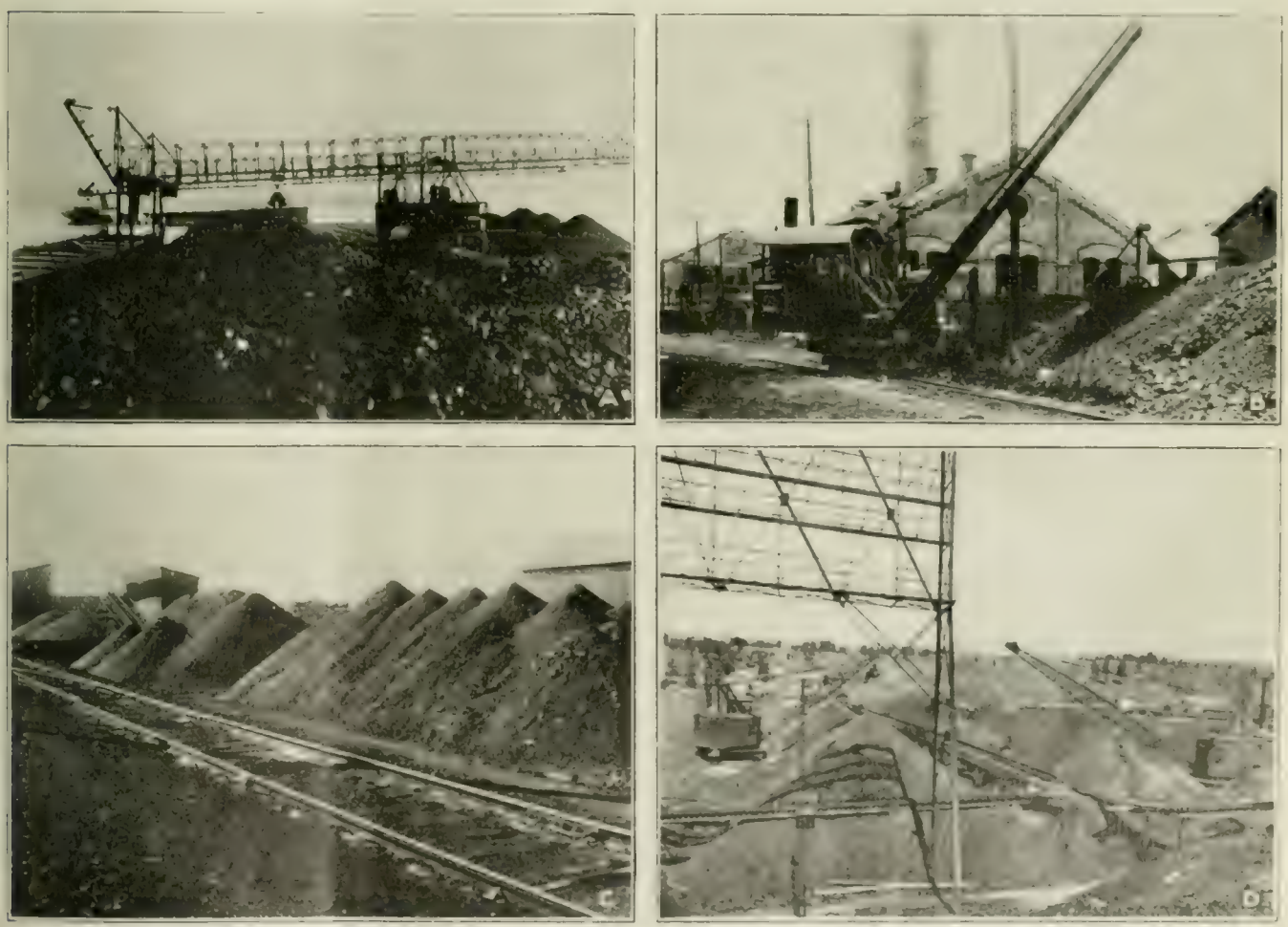
(1) If dust and fine coal can be kept out of the pile.

(2) If the coal is of such size and so piled that there is a sufficient air current throughout the pile to carry off the heat due to the oxidation that goes on, so that the coal is not heated at any spot to the ignition point.

(3) If the coal is so closely packed that sufficient air cannot come in contact with the fine coal to cause oxidation.

It should not be forgotten that for every case of spontaneous combustion in a coal pile many instances can be cited where no heating has occurred in the same coal. Even if the coal heats slightly, this can be detected readily and the coal moved and cooled off. Clean, screened coal of a uniform size should be chosen, if possible. The larger and more uniform the lumps the better, so as to give an open-textured pile. Coal of one size is, therefore, better than a mixture of sizes. Sized coal should not be stored upon a foundation of fine coal.

The coal should be handled in such a way as to prevent breakage as much as possible. If there is a choice of coals for storage, the least friable should be chosen and the one in which there is the least fine material. Breakage not only produces dust, but the fresh surfaces of coal oxidize more readily than the weathered ones. Coal should not be dropped upon a pile from a height, but the bucket or other receptacle should be lowered to the pile before being dumped.



COAL SHOULD BE SIZED FOR STORAGE WHERE POSSIBLE AND PROVIDED WITH ADEQUATE HANDLING ARRANGEMENTS

A—Conveyor bridges for handling coal in storage, Coal Dock & Wharf Company, Duluth, Minn. B—Storage for small power plant. C—Coal piled for storage by clamshell at the District of Columbia storage yard. D—Two circular storage locomotive cranes in operation at the coal storage plant of the New York Edison Company, Shadyside, N. J.

In every case of a fire in so-called lump coal investigated by the writer it was found that the coal had been dropped through a considerable height, so that coal on the pile was far from being lump coal and contained a large amount of dust.

How to Store Run-of-Mine and Slack Coal

While many varieties of mine-run coal cannot be stored under ordinary conditions because of the presence of fine coal and dust, such coal has been successfully stored in small, low piles. In storing mine-run coal it should be piled in uniform layers and segregation of the sizes prevented. The piles should be as low as space will permit, carefully watched, and provision made to quickly move the coal if heating occurs.

In general, fine coal or slack is more liable to spontaneous combustion than clean sized coal, or usually than run-of mine. If stored, it should be very carefully watched to detect evidence of heating. If practicable, a slack pile should be rolled with a roller so as to exclude the air and to give as nearly as possible storage under water conditions. Fine clean coal and slack have been successfully stored, particularly where closely packed, but the only absolutely safe way of storing slack is under water.

Although experimentation has shown that the sulphur contained in the coal in the form of pyrite is not the chief cause of spontaneous combustion, as was formerly supposed, the oxidation of the sulphur in the coal not only produces heat but also assists in breaking up the lumps and thus increases the amount of fine coal in the pile. Any considerable rise in temperature either from external or internal sources promotes the oxidation of the iron pyrites and produces heat, and thus increases the liability of the coal to spontaneous combustion. It is wise to select low sulphur coals for storage if obtainable, but it must not be taken for granted that a low-sulphur coal will necessarily store well or that a high-sulphur coal will fire in storage.

Precautions to Be Taken in Storing Coal

It seems to make little difference in the liability to spontaneous combustion whether the coal is stored under cover or in the open, but under cover there is less degradation and weathering. Storage under cover is of course impracticable for large amounts.

If possible, a place should be chosen that is dry and well drained, or, if not drained naturally, drains should be provided about the storage pile, not underneath it, as a drain beneath a pile may admit air currents to the pile sufficient to produce oxidation but not enough to keep down the temperature.

Coal should not be dumped on ground covered with ashes or refuse of any kind, because in addition to furnishing flues for the admission of an inadequate air supply to the coal pile, such refuse often contains material that will assist spontaneous combustion. Furthermore, it is likely to become mixed with the coal and when it is reclaimed from storage the value of the coal is thus depreciated. If possible, the ground should be clear of vegetation and leveled off, so that the reclaiming of the coal may be done as easily as possible and so that dirt and refuse will not be taken up by the shovel or other devices used in reclaiming. Some of the objections of firemen to using coal that has been stored are justified because of the dirt and other refuse that have been mixed with the coal in taking it from the storage pile. A hard-clay bottom thoroughly drained is desirable, if a concrete floor is too expensive.

If possible, adequate space should be provided so that the coal can be moved to another place if heating occurs

Coal should not be piled around hot pipes, against a boiler or hot walls, around a chimney, or in any place where it will be subjected to outside heat, because the liability to spontaneous combustion increases rapidly with a rise in temperature.

Coal should not be stored above flues that will permit small amounts of air to enter the coal; hot air, such as that from a sewer, is particularly to be avoided.

Method of Piling Is Important

Coal should be so piled for storage that any part of the pile can be moved promptly if necessary.

Coal should either be so piled that air may circulate freely through it and thus carry off any heat generated in the pile by oxidation, or else it should be so closely packed that air cannot enter the pile; *i.e.*, approximate as nearly as possible under-water conditions. Slack has been successfully placed in storage by rolling it or by running a heavy truck over the pile.

Stratification, or the segregation of the fine and lump coal into layers, should be avoided, since an open stratum of coarse lumps provides a passage for air to reach and oxidize the fine coal, and the stratum of fine coal does not permit the heated air to pass off rapidly enough to keep down the temperature of the pile below the combustion temperature.

Coal should not be dumped at one point at the top of a conical pile, since then the fine coal stays in the center at the top of the pile and the lumps roll to the bottom. Many coal fires start near the top of the pile, where the fine coal has prevented the escape of the heated gases rising through the pile.

The depth and area of storage piles will be determined largely by the storage space available and the mechanical appliances to be used for storing and reclaiming the coal. Other conditions being equal, the deeper the pile and the greater the area, the greater the difficulty in inspecting it and moving it quickly, if necessary. Hence a number of small piles, if practicable, are better than one large pile. Lack of space, however, usually prevents such spreading out of coal. It is impossible to advise exact heights, as so much depends upon the kind and size of coal and the local conditions, but the lower the pile the better.

Inflammable material, such as waste, paper, rags, wood, rosin, oil and tar, in a coal pile often forms a starting point for a fire, and every effort should be made to keep such material from the coal as it is being placed in storage. Timbers extending to the outside of the pile may permit the entrance of air around the pile. The admission of air into a coal pile around the legs of a trestle, through a porous bottom such as coarse cinders, or through cracks between boards, etc., should be avoided. Coal should not be piled about timber posts.

The effect of ventilating coal piles is a disputed point, but the weight of evidence in the United States seems to be against the practice. This may possibly be due to the fact that ventilation has been inadequately done. Imperfect ventilation, such as that generally attempted in the United States, is certainly disadvantageous. Reports from Canadian practice favor ventilation by pipes placed close together in the coal pile.

The cost of storing and reclaiming coal should be included under the following heads: Overhead, labor, supplies, depreciation on mechanical equipment, interest on investment, rental on land on which coal is stored,

insurance on equipment, and insurance on coal. Very few if any costs thus itemized are available, and most of those furnished in response to questionnaires include labor only and sometimes supplies.

Costs collected in 1917-18 showed a variation for storage of from 1.5 cents to 34 cents per ton for storage and 2 cents to 20 cents per ton for reclaiming and a total variation for storing and reclaiming of from 4 cents to 54 cents. The cost for storage and reclaiming by steam shovel or locomotive crane averages from 10 cents to 20 cents for labor and materials. The detailed costs for 1917-18 for a number of plants will be found in Circular 6. An attempt has been made to get present construction and operating costs from the same and other companies, but the replies received have not been very complete, and the costs reported vary as compared with those in 1917 up to as much as 100 per cent more.*

The methods of storing coal may be included under the following general headings: Hand-operated—wheelbarrows, etc.; motor trucks; side hill without a trestle; trestle storage; locomotive crane storage; circular storage; combined trestle and crane system; mast and gaff; steeple towers; movable bridges; buckets moving on monorail or cableway; silo storage; conveyor belts; portable and semi-portable conveyors; under-water storage. Space will not permit a discussion of each of these types, but detailed and illustrated descriptions will be found in Circular 6 and Bulletin 116.

In conclusion, it may be stated that it has been conclusively demonstrated by utility companies, using coal in both large and small amounts and under a great variety of conditions, that bituminous coal which has been properly prepared and properly piled can be stored with very little danger from loss due to spontaneous combustion, provided that the pile is carefully watched and appliances are provided for getting at a point where heating may develop so as promptly to spread out the coal that it may cool. If coal is stored in a haphazard method, as is usually done, spontaneous combustion frequently occurs.

For a central power station continuous operation is of more importance even than for a single plant, and the insurance of an adequate coal supply at all times is very necessary. Hence coal storage for such a plant must be considered as necessary insurance. Experience has shown that any kind of coal may be stored if properly prepared and piled.

*See *Mining and Metallurgy*, March, 1920, for costs presented by writer at annual meeting of American Institute of Mining and Metallurgical Engineers.

Water-Power Development in Canada

Total Potential Water Power About 20,000,000 Hp., of Which Only 2,418,000 Hp. Is Developed, 72 per Cent in Central Stations

THE Dominion Water Power Branch, Department of the Interior, and the Dominion Bureau of Statistics, Department of Trade and Commerce, have through cooperation just completed an exhaustive census and analysis of the developed water power in Canada. The figures, which are complete to Jan. 1, 1920, are exceptionally interesting and are indicative of the marked manner in which the water-power resources of the Dominion are being put to advantageous use. Practically every great industrial center in Canada is now served with hydro-electric energy and has within easy transmission distance ample reserves of water power. Active construction in hydro-electric enterprise is fast linking up the few centers which are still unserved and which have water-power resources in their vicinity. In those localities where water power is not available there are fuel reserves of coal, gas or oil.

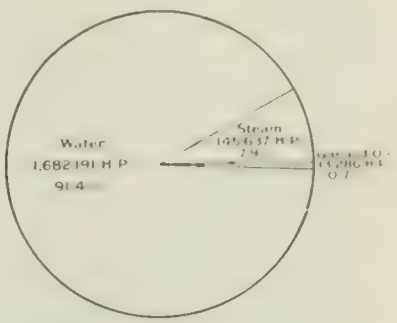
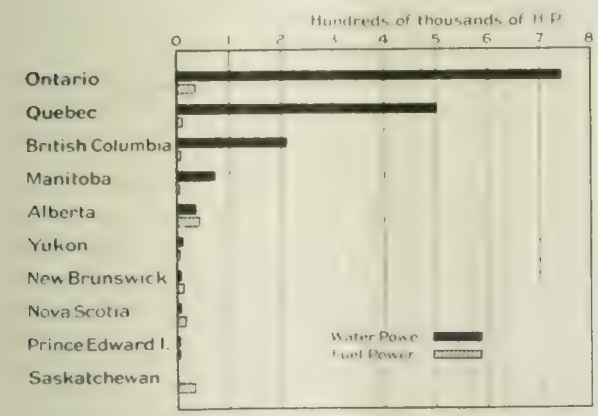


FIG. 1 — PRIMARY POWER OF CENTRAL STATIONS, NOT INCLUDING AUXILIARY FUEL PLANTS

According to a recent computation the water-power resources of the British Empire have been placed at from 50,000,000 hp. to 70,000,000 hp. This does not include such territories formerly under control of the Central Powers as will fall in future under British influence. To this total Canada contributes in the neighborhood of 20,000,000 hp. This figure represents the power available at sites at which more or less definite information is to hand. Continued investigation will undoubtedly add to this figure.

According to the statistics just compiled, there is installed throughout the Dominion some 2,418,000 turbine or waterwheel horsepower (Table I), of which 2,215,000 hp. is actually and regularly employed in useful work. The larger figure includes the total installed



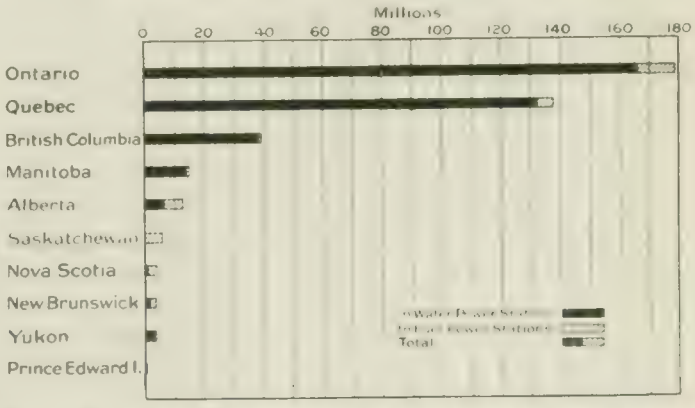


FIG. 2 (AT LEFT) — WATER VERSUS FUEL POWER, NOT INCLUDING PRIMARY POWER EQUIPMENT OF AUXILIARY POWER PLANTS.
FIG. 3 (AT RIGHT) — CAPITAL INVESTED, BY PROVINCES, 1918

capacity at full gate, including reserve units. It does not, however, include hydraulic exciter units. A large number of the plants now operating are designed for the addition of further units as the market demands. The ultimate capacity of such plants and that of new plants now under construction totals about 3,385,000 hp.

Of the total power installed, 1,756,791 hp., or 72.7 per cent, is installed in central electric stations. Central-station power is sold for lighting, mining, electrochemical and electrometallurgical industry, milling and general manufacturing. It is apparent, therefore, that the central-station total listed in column 3 includes a portion of the totals listed in columns 4 and 5 as used in other industries. In the pulp and paper industry 473,265 hp. is utilized, of which 381,631 hp. is generated directly from water in pulp and paper establishments, while 91,634 hp. is purchased from hydro-electric stations.

Hydro-electric power used for other purposes and other industries may be listed as follows: For lighting purposes, 434,613 hp.; in mining industry, 177,728 hp.;

TABLE I—DISTRIBUTION OF DEVELOPED WATER POWER IN CANADA

	Developed Water Power					
	Total Waterwheel and Turbine Horsepower Installed	Total Waterwheel and Turbine Horsepower Installed for Use in			Total Horsepower Actually Employed	Ultimate Capacity, Horsepower
		Central Electric Stations	Pulp and Paper Industry	Other Manufacturing Industries		
Yukon	13,199	10,000	.....	.....	11,349	13,199
British Columbia	308,167	211,043	46,962	46,094	276,795	350,832
Alberta	32,992	32,580	.....	17	31,754	33,070
Saskatchewan	.....	.....	.....	.....	.....	.....
Manitoba	83,447	71,790	.....	.....	75,100	297,047
Ontario	1,015,726	794,621	158,095	99,230	934,015	1,460,920
Quebec	910,029	623,088	249,332	270,961	838,071	1,146,465
New Brunswick	18,080	9,378	2,693	6,009	16,657	29,115
Nova Scotia	34,323	4,064	16,183	12,276	29,359	52,202
Prince Edward Island	1,933	227	.....	1,789	1,621	1,958
Totals	2,417,896	1,756,791	473,265	436,376	2,214,721	3,384,808

Ultimate designed capacity of plants now operating or under construction in hp.

in flour and grist mills, 42,736 hp.; in lumber mills and sawmills, 37,918 hp.; in other manufacturing industries, 172,955 hp. These figures are evidence of the widespread manner in which the Dominion's water-power resources are being applied to the furtherance of its industrial development. During the fiscal year ended March 31, 1919, there was exported from plants included in the tabulation energy amounting to 175,000 hp.-years.

Table II, analyzing the number and capacity of the waterwheels and turbines installed, is of considerable interest. The total installation of 2,417,896 hp. is composed of 3,370 units of an average capacity of 715 hp. While 2,244 of these units are of 100 hp. or under, they contribute only 82,204 hp., or 3.4 per cent, to the total. A total of 1,845,427 hp., or 76.3 per cent of the whole, is contributed by units of 2,000 hp. and over; 1,391,025 hp., or 57.6 per cent, by units of 5,000 hp. and over; 1,029,900 hp., or 42.6 per cent, by units of 10,000 hp. and over, and 160,000 hp., or 6.6 per cent, by units of 20,000 hp. and over. This table is illustrative of the modern tendency toward the installation of large units.

The statistics in Table III refer to the developed water power used in connection with the central-station industry. This industry has made great strides in Canada in recent years. A network of transmission systems, which are being rapidly extended from year to year, covers central and southwestern Ontario and southern Quebec. Other systems established in numerous centers from coast to coast are likewise rapidly extending their scope. Ninety-one and four-tenths per cent of the primary power used in the central stations throughout the Dominion is derived from water, evi-

TABLE II—TURBINES AND WATERWHEELS INSTALLED IN WATER-POWER PLANTS

	Total Water-Wheels and Turbines	Units of 2,000 Hp. and Under 5,000 Hp.		Units of 5,000 Hp. and Under 10,000 Hp.		Units of 10,000 Hp. and Under 20,000 Hp.		Units of 20,000 Hp. and Over	
	Hp.	No.	Hp.	No.	Hp.	No.	Hp.	No.	Hp.
Yukon	13,199	..	.....	2	10,000	..	.....	..	.....
Brit. Columbia	308,167	19	62,100	6	42,000	12	144,600	..	.....
Alberta	32,992	2	8,000	4	23,600	..	.....	..	.....
Saskatchewan	.....	..	.....	..	.....	..	.....	..	.....
Manitoba	83,447	9	35,597	8	46,400	..	.....	..	.....
Ontario	1,015,726	77	186,380	14	88,050	36	474,200	2	40,000
Quebec	910,029	51	157,825	22	151,075	20	251,100	6	120,000
New Brunswick	18,080	1	2,000	..	.....	..	.....	..	.....
Nova Scotia	34,323	1	2,500	..	.....	..	.....	..	.....
Prince Edward Island	1,933	..	.....	..	.....	..	.....	..	.....
Totals	2,417,896	160	454,402	56	361,125	68	869,900	8	160,000

dencing in a striking manner the advantageous location of the water-power resources with regard to industrial centers.

The total installed waterwheel and turbine horsepower in hydro-electric stations is 1,756,791 hp. Fuel auxiliaries to these stations bring the total installed primary capacity up to 1,873,989 hp., connected to a dynamo capacity of 1,449,180 kva. The total capital invested in these central stations, inclusive of transmission and distribution systems, is $369,461,961, or an average of $210 per installed primary horsepower.

Of special interest to engineers is the actual cost of construction of hydro-electric power stations, exclusive of transmission and distribution systems. The figures of seventy representative hydro-electric stations throughout the Dominion, with an aggregate turbine installation of 745,797 hp., show a total construction

TABLE III—CENTRAL ELECTRIC STATIONS OPERATED BY WATER-POWER

	Installed Horsepower				Capital Invested	
	Water-wheels and Turbines	Fuel Auxiliaries	Total	Total Installed Dynamo Capacity in Kva.	Total	Per Horsepower
Yukon	10,000	.....	10,000	6,000	3,471,678	347
British Columbia	211,043	26,780	237,823	154,571	38,450,131	182
Alberta	32,580	2,405	34,985	24,260	6,990,972	214
Saskatchewan	.....	.....	.....	.....	.....	.....
Manitoba	71,790	19,400	91,190	62,313	14,340,458	200
Ontario	794,621	39,530	834,151	670,053	170,112,988	215
Quebec	623,088	28,163	651,251	522,461	133,645,655	214
New Brunswick	9,378	500	9,878	6,160	1,543,727	165
Nova Scotia	4,064	420	4,484	3,016	842,122	207
Prince Edward Island	227	.....	227	346	67,230	296
Totals	1,756,791	117,198	1,873,989	1,449,180	369,464,961	210

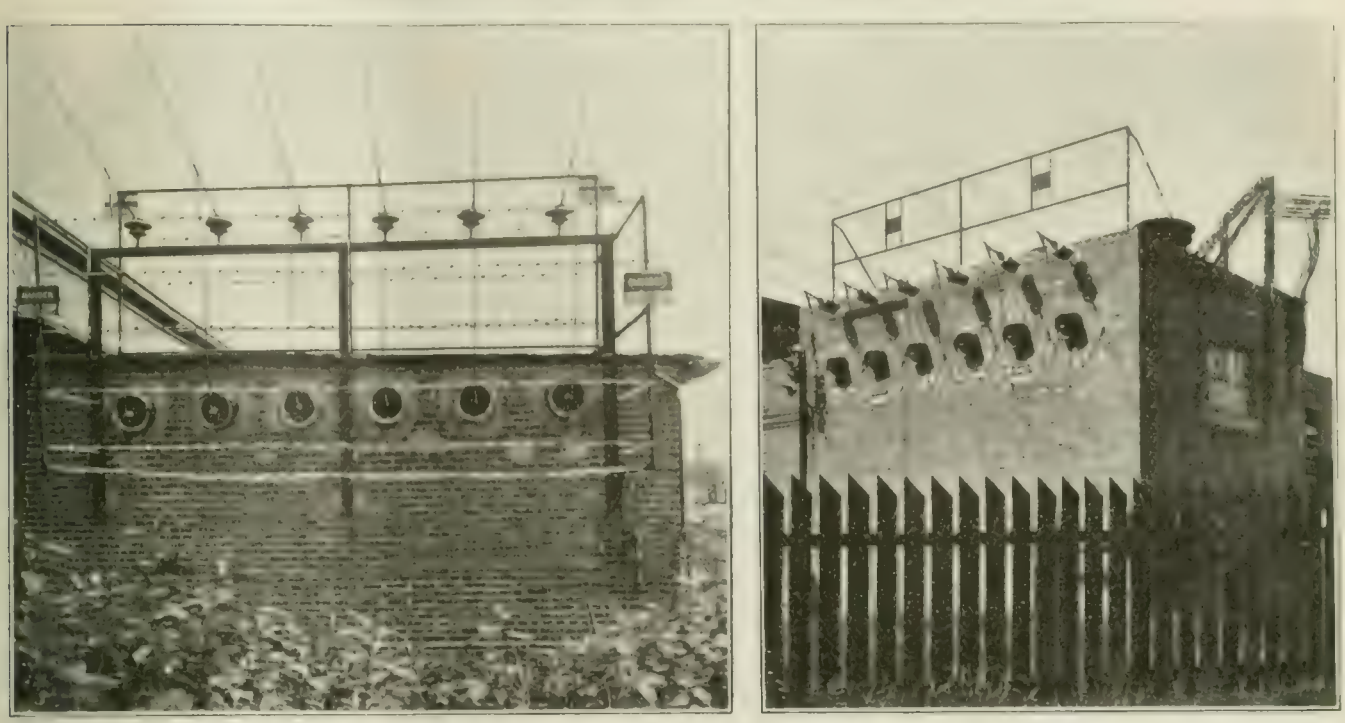
cost of $50,740,468 (pre-war figures), or an average of $69.11 per installed horsepower. This cost includes the capital invested in construction of dams, flumes, penstocks and all hydraulic works and of power stations and equipment. It excludes real estate and transmission and distribution equipment. The figures in brief show capital cost of construction at the power site.

With a water-power development of 274 hp. per thousand population, Canada stands well in the forefront in respect to availability and utilization of hydro-power resources, being surpassed in this respect only by Norway. The enormous water-power reserves still untouched are an assurance of continued industrial expansion and prosperity.

Substations for Supplying Large Industries

Factors to Be Considered in Design and Installation — Typical Substations Vary in Cost from $11.36 to $38.68 per Kva. of Installed Capacity — Simplicity in Arrangement and Wiring Is Important

By R. H. TILLMAN
Consolidated Gas, Electric Light & Power Company, Baltimore



TWO TYPICAL 13,200-VOLT OVERHEAD ENTRANCES, SHOWING METHOD OF INCREASING SAFETY OF INSTALLATION

FOR an industrial substation to perform its function well consideration must be given to transformation, metering, protection and control requirements, with particular reference to simplicity in arrangement of equipment, wiring and neatness in appearance. The transforming equipment is the most expensive part of the station, and since it is the portion that does the work, it should be considered most carefully. Sufficient metering equipment should be installed to measure the actual energy consumed and the amount of demand in kilowatts and kilovolt-amperes. Protection of the equipment from lightning disturbances, line surges and overloads should receive the best of engineering thought. Control in an industrial substation does not usually play so important a part as it does in the large utility companies' substations, but nevertheless the location of switches should be such that control of the various circuits can be easily and quickly accomplished and that certain parts or the whole of the station can be disconnected to take care of repairs in case of emergency. These factors and others will be considered in detail in this article.

Locating the Substation

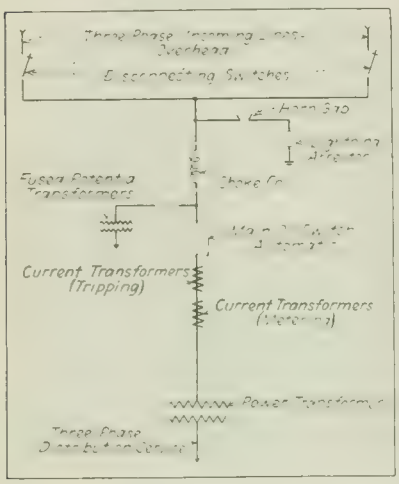
An industrial substation should be located as near as possible to its heaviest load, or near the center of distribution, taking into consideration the possibilities of this position changing with the growth in the industry's business. The station may be placed in a separate building, in one corner of one of the manufacturing buildings, or, where the plant is outside of the city limits, it may be installed as an outdoor substation. The way of access should never be blocked, since materials and apparatus must be carried to and from the substation in making repairs and extensions. The question of future extensions to the substation and the direction of growth of an industrial load deserves thorough consideration. Many stations are made useless after a year or so by the failure to consider these points. Experience shows that industries are constantly increasing their loads as their business grows, and therefore stations should be so designed and located that future increases can be easily made with the least interruption to manufacturing operations. This is especially true with a new industry. Owing to rapid increase in industrial business it often happens that an entire substation first considered permanent must be changed and relocated, the removal causing great expense. Cleanliness and ventilation, which are both required in substations, should also affect the choice of a site.

All buildings used for substations should be constructed of some approved fireproof material, such as brick, stone, concrete, tile or corrugated galvanized steel, with concrete floor. This floor should be at least 6 in. (15 cm.) in thickness and should be drained at a suitable point to the sewer. Provision should also be made for suitable ventilation through one or more sides and the roof. Louvers placed in the side walls close to the ground have been found to be a very effective means of ventilation. Where it is to be used for rotary converters and motor-generator sets in addi-

tion to transformers, a suitable air duct should be placed in the floor, starting from the outside wall of the building and terminating in the pit under the rotary converter or motor-generator set.

Space should be allowed for making repairs, and the distances between the various pieces of apparatus should be such that the largest pieces can be readily removed, and the door should be large enough to allow an easy entrance for all machines.

With the usual type of industrial substation buildings for capacities of 1,500 kw. or less, a floor area of approximately 300 sq.ft. (27.6 sq.m.) is sufficient where no provision is made for a spare transforming unit. The addition of another transformer will add approximately 50 sq.ft. (4.6 sq.m.) to the floor area. The usual height for substations of this size is approximately 15 ft. (4.5 m.), and the cubical contents of the building averages about 4,500 cu.ft. (126 cu.m.), considering the inside dimensions only.



THIS WIRING DIAGRAM SHOWS RELATIVE POSITIONS OF EQUIPMENT NECESSARY IN INDUSTRIAL SUBSTATION

A—A compact arrangement of oil and disconnecting switches, choke coils, lightning arresters and the metering installation. B—Wiring on the ceiling and walls lends itself to a simple and neat installation if the work is properly done. C—Pipe work for supporting the high-tension wiring offers a good arrangement.

Owing to the rapidly increasing cost of electrical equipment and building construction during the last few years, it is next to impossible to give any definite idea as to unit cost in connection with substations. However, the tabulation will give a general idea as to the present cost. It can be considered that a substation for a normal transformer installation of 1,000 kva. capacity would require a building of 300 sq.ft. floor area, with a height of 15 ft. and with cubical contents of 4,500 cu.ft., and would cost approximately $1,500. The transformers, installed complete, would cost approximately $15,000, or the total cost of the transformer station ready for operation may be estimated at $16,500.

In the last few years the use of outdoor substations has rapidly increased, largely because of efforts on the part of large hydro-electric utility companies to reach rural communities from their high-tension transmission lines, and also because of the lower first cost of installation. In most cases, therefore, outside of large city limits, the outdoor substation would naturally be adopted, except where the atmospheric conditions such as acid and gas fumes or dust would make an outdoor substation inadvisable. However, there are many conditions to be considered besides the first cost of installation in connection with industrial substations, and as previously mentioned, reliability of service is of prime importance and repairs and maintenance should not be forgotten.

Where the industry is within the city limits, and where circumstances such as the character of property surrounding the station require it, underground service is usually adopted. In these cases the service cables are pulled through the duct line up the wall in tile duct, terminating in a standard pothead at least 6 ft. (1.5 m.) from the floor, or in such a position that persons cannot come into contact with the high voltage. The various pieces of apparatus in the station should be so arranged that a straight-away feed can be used—that is, a service entrance in one end of the building and a straight feed directly through the opposite end.

Where industrial plants are outside of the city limits, and where the conditions are favorable, the service entrance should be made overhead. For safety reasons all high-voltage lines should be properly guarded so that no one can readily come in contact with live wires. The arrangements of these entrances are shown in the illustrations.

Important Details of Substation Equipment

In installations where overhead entrances are used devices for safeguarding against lightning and line surges should be installed, depending, however, on the voltage. The equipment usually consists of aluminum lightning arresters and choke coils and should be installed inside or outside of the substation as close as possible to the service entrance.

Disconnecting switches of the spring-lock, knife-blade type, installed immediately after the service entrance, are usually placed at such a height from the floor that contact with live parts would be impossible. The switches should be opened and closed only with a hook attached to a long wooden pole. To insure against damage to the transformers due to overloads, automatic oil switches arranged for either hand or electric operation should be installed. The type and capacity of these oil switches will depend upon the voltage and amount of energy to be delivered, as well as on the reactance of the circuit. For the automatic control of these switches reverse-time-element relays should be used, and where several switches are installed in the station the relays should be set for selective action.

As all industrial substations should be as nearly foolproof as possible, it is evident that oil-insulated, self-cooled transformers should be used for this work, and the specifications for such transformers should include the following: Type of transformer; normal full-load rating, giving the normal voltage both primary and secondary; additional primary and secondary voltages and taps; the conditions under which the transformers must operate, as to number in group, type of connection, voltage and phase to transform; exciting current of transformer; position of terminals on transformers.

Lighting transformers are necessary in industrial substations having a secondary voltage of more than 230, unless taps are placed in the secondary windings of the power transformers.

Special transformers wound for a primary voltage the same as the primary voltage of power transformers have the advantage, when a separate oil switch is used for their control, that the lighting installation is operated without the power transformer bank being used at the same time. The use of additional taps on the secondary windings of the power transformer is also a method of handling lighting but involves an additional cost, and some unbalancing will result.

By using a special transformer wound for a primary voltage the same as a secondary voltage of the power

PRESENT DAY COSTS FOR INDUSTRIAL TYPE SUBSTATIONS

Kva Rating	Primary Voltage	Frequency	Secondary Voltage	Character of Secondary Voltage	Remarks for Direct Current	Area of Station Sq. Ft.	Total Cost of Station Equipment	Cost per Kva	Cost per Sq. Ft.	Remarks
300	4,000	60	230–115				$4,900 00	$16 33		
600	13,200	25	575			272	8,114 00	13 52		
600	13,200	25	575			298	9,316 00	15 52		
1,200	13,200	25	575			490	17,117 64	14 26		
900	13,200	25	575			270	12,587 80	13 98		
500	13,200	25	125–250	D.C.	Electrolytic		19,340 00	38 68		
950	13,200	25	460			360	10,860 00	11 36	$1,760 00	
750	13,200	25	230			360	12,348 76	16 73	1,930 50	
750	13,200	25	460			189	10,730 62	14 30		
300	13,200	25	550			180	6,164 00	20 54	1,630 00	
300	4,000	60	230			494	4,055 58	13 51	2,374 90	

transformers the cheapest method of installation is possible. While this method has the disadvantage of requiring that power transformers be connected to the line at all times when lights are in use, still in the majority of industrial plants it would not cause a serious loss in energy, owing to the fact that usually some power machinery is operated twenty-four hours a day.

CAREFUL ATTENTION SHOULD BE GIVEN METERING EQUIPMENT

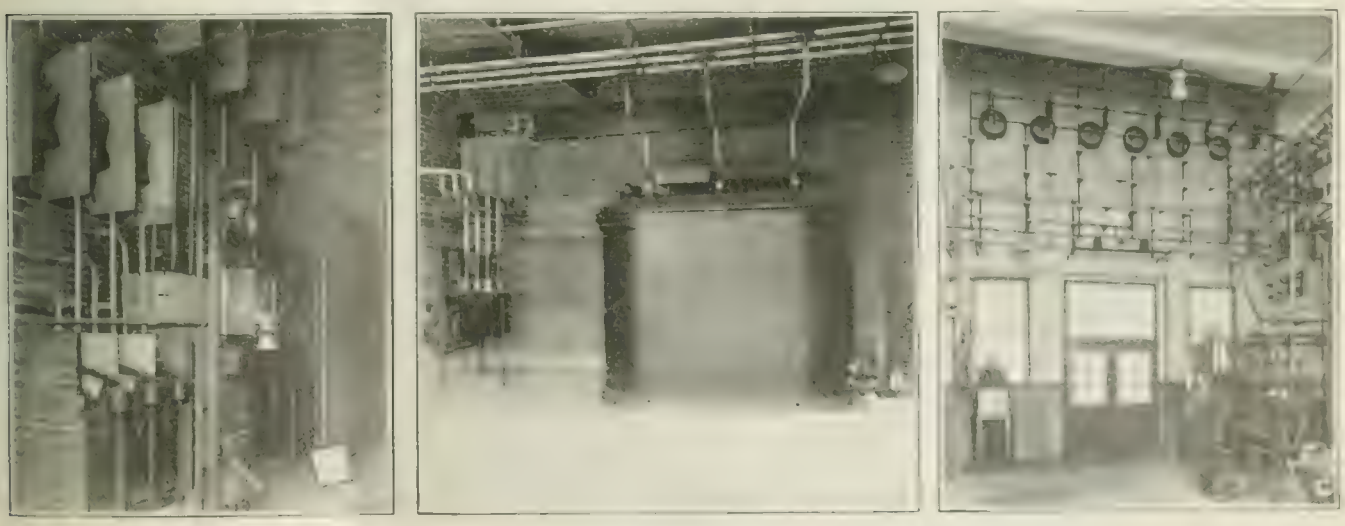
As it is almost a universal practice of the public utility companies to have their rate schedules based on a maximum-demand charge as well as an energy consumption charge, it is essential that both the watt-hour meter and a demand-measuring device be installed and that the potential transformer fuses be of a size to afford sufficient strength mechanically. For convenience of both the industry and the public utility company it is recognized that a recording watt-meter that will record continuously the energy demanded by the industry day by day throughout the year is the proper method of measurement so far as the maximum demand is concerned. Therefore provision should be made in the industrial substation for the public utility company's integrating watt-hour meter and one graphic wattmeter. Most public utility companies have a power-factor clause in their schedules of rates, so in addition to the above meters, a reactive volt-ampere indicator for the registration of power factor would be required.

Finally, since among the arguments that utility companies employ in selling electrical energy to manufacturing industries is that with central-station service the manufacturer is free from worry, the industrial substation must be so designed that simplicity is one of its features. No apparatus should be installed that does not carry with it the feeling of absolute reliability.

Water-Power Development in Austria

AN APPROPRIATION of 95,000,000 Austrian crowns has been made available for beginning the electrification of the government railroads of Austria. Construction work has been started, this including the erection of a hydro-electric power plant on Lake Spuller, in the western part of the Tyrol, which will probably be completed by the end of 1921, and other plants in Salzburg and Carinthia in the latter part of 1923.

The *Neue Freie Presse* of Vienna, which prints this information, also states that progress has recently been made in supplying Vienna with electric power by the utilization of the Danube River. It is hoped that by the end of the year work will be started on a plant capable of furnishing 30,000 hp. even in the first stage of construction. Opposition to proposals from Vienna to co-operate in this development has arisen in Styria, which has a hydro-electric power plant on the Enns River but refuses to sell any of its output to the Austrian capital, insisting on a policy of "Styrian hydraulic power for the Styrians." This separatist spirit among the different communities of Austria has a retarding effect on water-power development, which is accentuated by the absence of foreign capital. However, Linz, in upper Austria, is actually engaged in preliminary construction work, and the plans of Vienna have taken definite shape, involving, in addition to the Danube River plant, installations in the Ybbs Valley and on the Alpine springs conduit in Gaming.



EXAMPLES OF NEAT AND WORKMANLIKE INDUSTRIAL SUBSTATION INSTALLATIONS

Selection and Design of Exciter System

Factors Which Determine the Selection of an Excitation System for a Generating Plant Are Comprehensively Discussed in A. I. E. E. Paper—Considerations of Layout After General System Has Been Decided Upon

FOR the purpose of discussing, in a broad way, the characteristics of excitation systems, J. T. Barron and Alex. E. Bauhan have considered them in four groups: A—central systems with separately driven exciters; B—central systems with direct-connected exciters; C—individual systems with direct-connected exciters; D—individual systems with separately driven exciters. These four systems are compared from every important angle, and then problems of design of the system are taken up for the purpose of calling attention to the advantages and limitations of common layout schemes and types of apparatus.

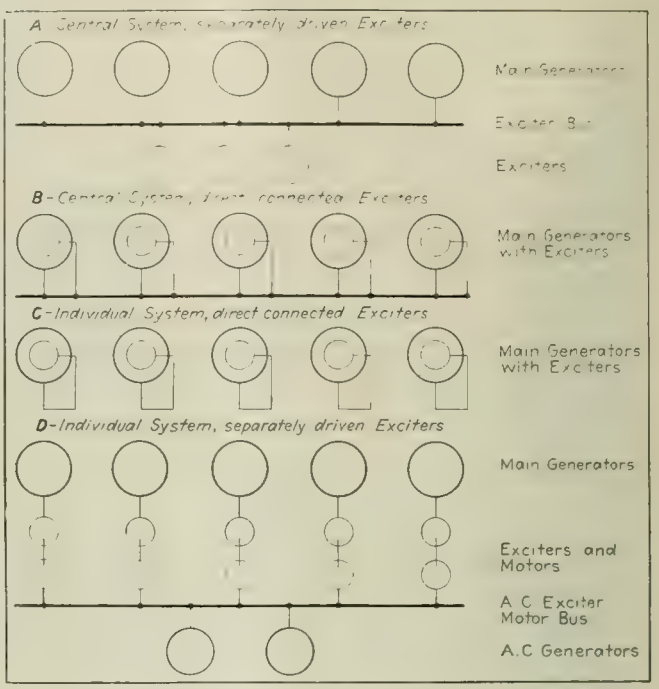
A very comprehensive table has been prepared by the authors in making the comparison between systems. This table is here printed in full.

The practice of using the excitation system to supply auxiliaries is common in hydro-electric plants but is not the general practice in steam plants. It is not within the scope of the paper to discuss the merits of the different methods of driving auxiliaries, but if it is decided that some of the auxiliaries must be fed by the excitation system the choice of system is affected. If the exciters are controlled by a voltage regulator, it is not advisable to supply any auxiliaries from the excitation bus. It must be remembered that high voltages may be induced in the field circuits from main system troubles or by the loss of exciter supply, and if provision is not made against this the high voltage may affect auxiliaries at least to the extent of blowing fuses. System D offers a good source of power for auxiliaries. If the individual exciters are driven by induction motors at low voltage, the auxiliaries can be driven from the same bus as the exciter motors.

Regarding voltage regulation, where exciters are to be controlled by voltage regulators it should be borne in mind that they should be especially designed for this purpose. The special features usually consist of providing for low saturation and for ample range without going too far above the knee of the saturation curve. In systems A and B voltage regulation can be obtained by the use of one voltage regulator of either alternating-current or direct-current type or of the alternating-current coil type operating on the field rheostats of all the exciters. In the case of systems C and D, however, if the alternating-current and direct-current coil type of regulator is used, a separate regulator is usually used on each exciter. Each of these regulators must be equipped with a current connection which receives a current proportional to the generator current and at ninety degrees to the potential in the alternating-current coil in order to stabilize reactive component distribution.

Correct Use of Storage Batteries

A storage battery cannot be considered as taking the place of spare capacity. Its function is rather to take over immediately and automatically the load of an exciter which trips by relay action or ceases to generate



SCHEMATIC DIAGRAMS OF FOUR EXCITATION SYSTEMS

and to carry that load until the exciter is restored to service or a spare put in its place. It does away with the necessity of keeping spare exciters on the bus and thereby permits more efficient operation. A battery is said to be justified only if the cost of operating spare exciters on the bus, or if the value of increased assurance of continuous service during times when no spare exciters are available, is greater than the fixed and operating costs of the battery. The storage battery must be at least large enough to take over the entire load of one of the exciters for ten minutes. The battery system A therefore most be larger than the battery for any of the other systems. It is not customary in systems A and B to make the storage battery larger than would be necessary to carry the entire load for more than one hour, seldom for more than one-half hour.

Regarding space requirements, it is said that this is important only to the extent that it affects the building and substructure costs. Definite space limitations may exist in a crowded city station.

While it has not been found possible to arrive at any definite comparison of costs that would be of value to any one intending to select a system of excitation for a certain station, it is probable that system D will cost more than any of the other systems. System A will cost more than systems B and C in any except a very low-head plant having a large number of units. Relative costs for high and low heads are given in the table of comparison. For a very low-head plant the advantage in favor of the direct-connected systems will be lessened by the rapidly increasing cost of the low-speed exciters.

Maintenance, material and labor are dependent on the

number of pieces and the class of equipment and the amount of complication rather than on the system used. Ten small exciters will thus require about ten times as much maintenance as one large exciter. For efficiency comparison the following table gives comparative overall efficiencies for the various systems in the case of a hydro-electric plant, assuming the efficiencies of the component parts to be as indicated. Full-load efficiencies are assumed, and no attempt was made to make a comparison on the basis of all-day efficiencies or to take into account various operating considerations which might interfere with obtaining best results.

Rheostat losses may be reduced in systems A and B if voltage regulators are used on exciters. It is evident from this table that the direct-connected systems without rheostats give the best efficiencies. The direct-connected systems will also probably have the best all-day efficiencies. A similar table for a steam plant cannot be conveniently drawn up on account of the varying conditions and the extent to which the exhaust steam is utilized.

Regarding the effect of short circuit on a feeder or on the bus which is not cleared promptly, this has in some cases caused a reversal of exciter polarity even though the exciters were shunt-wound. Except in the case of compound exciters on central systems, however, reversals will be of rare occurrence. Speed fluctuation with resultant variation of exciter voltage is the most important effect of short circuits and may be partially overcome by voltage regulators. System D is the most desirable in this respect. System A is the next best, being almost equal to system D if the exciters are prime-mover-driven or if the motor-driven exciter load can be picked up by other exciters or battery. System C has a slight preference over system B, which is the least desirable.

COMPARISON OF EXCITATION EFFICIENCIES BY SYSTEMS

	A Central Separate	B Central Direct	C Individual Direct	D Individual Separate
Prime-Mover-Driven:				
Turbine	85	90	90	85
Exciter	95	90	90	Average 94
Rheostats	80	80		Motor gen. 85
Over all	63	65	81	67
Motor-Driven:				
Main turbine	90			90 | By
Main generator	96			96 | emer-
Exciter	98			98 | gency
Motor generator	87			85 | trans-
Rheostats	80			| former
Over all	59			72

In case of trouble causing generators to fall out of step, with separately driven exciters of either the central or individual system there is more chance of the generators coming back into step than there is with the direct-connected exciters of either the central or individual systems, as the better the excitation the more will be the synchronizing power between machines. Systems D and A are preferable to systems B and C.

From the standpoint of physical simplicity, if the number of units is small, system C is the simplest in that it has no special prime movers, governors, steam

COMPARISON OF SYSTEMS

	A Central Separate	B Central Direct	C Individual Direct	D Individual Separate
(1) Power supply to auxiliaries	Good	Good	Not suitable	Excellent
(2)—Automatic voltage regulation	If used for auxiliaries or with battery requires booster system of regulation		Permits use of individual regulators	
(3) —Use of storage battery	Most advantageous use of battery. Requires booster system of regulation		Battery cannot be floated.	Can be used only with complications
(4)—Space requirements	Large	Small	Small	Large
(5) —Initial cost (A = 100%)				
Low-head hydro	100%	70% to 90%	70% to 90%	120% to 140%
Steam or high-head hydro	100%	50% to 70%	50% to 70%	120% to 140%
(6)—Efficiency (hydro, including rheostats)	Good	Excellent	Excellent	Poor
(7)—Effect of power system troubles				
(a) Sustained short circuit	Prime-mover-driven exciters unaffected Speed of motor-driven exciters affected	If speed increases, higher short-circuit currents and better synchronizing power. If speed decreases, lower short-circuit currents and lower synchronizing power		Unaffected
(b) Sudden loss of load	Speed of motor-driven exciters affected	Speed of exciters affected		Unaffected
(c) Generators falling out of step	Speed of motor-driven exciters may be affected	Speed of some of exciters affected. Synchronizing power may be decreased		Unaffected
(d) Opening of fields to clear bus trouble	Excitation unchanged	If speed is below normal, generators are more likely to fall out of step owing to poor reduced excitation		Excitation unchanged
(e) Splitting station with regulating potential on one section and compensating coil on other section	Voltage fluctuation equal to twice line drop compensation results		Unaffected with individual regulators. If only one regulator voltage fluctuation results	
(f) Shutdown of generator with direct-connected exciter needed for other units	Unaffected	Serious disturbance to service	Loss of excitation on a running generator which may fall out of step	Unaffected
(8)—Effect of exciter system troubles				
(a) Ice and trash (hydro)	Serious reduction of service unless ample motor-driven spare is available	Unaffected	Unaffected	Serious reduction of service unless ample motor-driven or transformer spare is available
(b) Short-circuited exciter	Unaffected if exciter can be spared. Serious if exciter cannot be spared		If generator is large in comparison with size of system it may fall out of step	
(c) Short circuit on exciter bus	Short circuit usually clears itself. If not total interruption results		Unaffected	Short circuit usually clears itself. If not total interruption results
(d) Accidental shutdown of exciter	Serious disturbance unless exciter can be spared		Unaffected	If a. c. exciter, may cause generator to fall out of step. If a. c. exciter serious disturbance unless machine can be spared
(e) Open circuit in exciter field	Serious disturbance unless exciter can be spared		Generator may fall out of step	
(f) High voltage from opening last exciter breaker	Affects entire excitation system. May cause breakdown of insulation. Will blow fuses and breakers on auxiliary circuits		Ordinarily not possible. In any event affects only one unit	
(g) Regulator troubles	Affects entire system		Affects entire system if only one regulator is used and only one unit if individual regulators are used	
(9)—Simplicity physical	Simple for small or moderate size station. Complicated if many exciters and battery are used		Very simple for small number of generators. Complicated for large number of generators	Complicated
Normal operation	Simplest	Simple	Simple	Complicated
During trouble	Simple	Complicated	Complicated	Simplest
(10)—Reliability	Depends on number of pieces of equipment, amount of remote control, automatic and regulating devices.			

piping, penstocks, headgates, screens, etc.; in that the volume of substructure and building occupied by excitation equipment is small, and also in that ordinarily the system has no rheostats. If the number of units in the station is large, system C is complicated by the addition of so many more exciter units with their regulators. System B is not more complicated than system C when the latter uses a bus and generator field rheostats. System A can be almost as simple as system C, or considerably more complicated, depending on the amount of equipment installed. If only two exciters are used and if these are steam-driven, it compares very favorably with system C for physical simplicity. If a motor-driven exciter and battery are added, system A becomes more complicated than system C except for a large number of generators. System D is physically the most complicated.

From the operating standpoint, considering both normal and trouble operation, system A for a small station is the simplest provided that the exciters are not compound-wound. If steam-driven exciters are used, the complications of heat balance are introduced. If system A has more than two or three exciters, some of them motor-driven, it becomes more complicated with respect to normal operation than system C. With respect to operation during power-system trouble, system A is simpler than system C, especially if only prime-mover-driven exciters are used or if a battery is provided. System B is more complicated from the operating standpoint than either systems A or C. System D is the simplest of all to handle during power-system trouble, but for normal operation is not so simple as the other systems on account of the many operations involved in starting and stopping.

It should be noted that the simplest system fundamentally can be made the most complicated by attempts to make it too flexible, by the addition of an undue amount of remote control and automatic features, or by awkward location of various parts of the system such as putting switches at points which are not easily accessible to the operators.

Under the heading of reliability this discussion is intended to cover merely the inherent reliability of the equipment itself. From this standpoint reliability does not become an important factor in determining the system of excitation for the reason that any of the systems properly designed and laid out in accordance with good practice are very reliable. Many more troubles will be caused by the operating characteristics than by the breakdown of excitation equipment. The number of breakdowns, however, will be proportional to the number of units in use.

Choosing Number and Size of Exciters

In every case the number and size of exciters should be such that the largest exciter can be taken out of service at any time without interfering with the operation of the station. In a few large, important stations it may be advisable to provide for a second exciter being out of service. The ultimate as well as the immediate exciter requirements should be kept in mind in laying out the equipment. The present exciter equipment should as far as possible be such that it can be used to best advantage in the ultimate layout.

For motor-driven exciters the induction motor is satisfactory and preferable in almost every case. The induction motor will ride through almost any kind of disturbance on the main power system even though the voltage may remain low for a considerable length of time. Generally speaking, synchronous motors are more likely to fall out of step during main system troubles, and having a direct-current field requires one additional operation on the part of the operator when starting. In favor of the synchronous motor it may be said that it is possible to specify a synchronous motor in stability during power-system trouble.

Combination motor and turbine drive, either hydraulic or steam, is in successful use and offers a very good way of making a system having two exciters independent of either prime-mover trouble or power-system trouble. Without the installation of any automatic equipment not ordinarily used, this system functions practically automatically. If the exciters are being driven by the motors, loss of voltage with resultant reduction of speed permits the prime-mover governors to function and transfers the drive to the prime mover. When voltage is restored to the motors the increased speed automatically cuts out the prime movers.

Wherever it is necessary that exciters be operated in parallel it is recommended that shunt-wound exciters be used, especially if the exciters are to be controlled by voltage regulators. The instances of compound-wound exciters causing trouble are so many that in spite of all the explanations of causes that may be given it is difficult to convince an operating man that has been through these experiences that compound-wound exciters should ever be used where exciters are operated in parallel.

It is believed that 125 volts is satisfactory for small plants, but for moderate size and large plants 250 volts is preferable from the standpoint of reduced cost and size of apparatus and cables. Where station lighting is at 250 volts alternating current the exciter bus can be used for emergency lighting service if it also is at 250 volts. It is suggested that for large stations consideration may be given to higher voltages than those at present in use, possibly 500 volts or 550 volts.

Bus connections and exciter and field connections should be made as simple as possible consistently with the required degree of flexibility. If complete flexibility is attempted, it is almost certain to result in bus connections which are too complicated to be easily operated and which will be the cause of operating mistakes. A bus arrangement which permits of the exciters being paralleled by more than one set of switches is likely to be dangerous.

The minimum amount of automatic protective equipment consistent with safety to service and apparatus should be installed. The class of attendance which the apparatus is to receive should be kept in mind if unusual or complicated devices are contemplated.

Generator-field breakers are always non-automatic unless some kind of field-destroying device is used. Reverse-current relays should be used on exciters which are to operate in parallel with other exciters or with a battery, but no overload relays should be used. Reverse-current relays for this service are generally not very reliable, but as there is no adequate substitute it is necessary to install them. Low-voltage release on circuit breakers is not considered advisable.

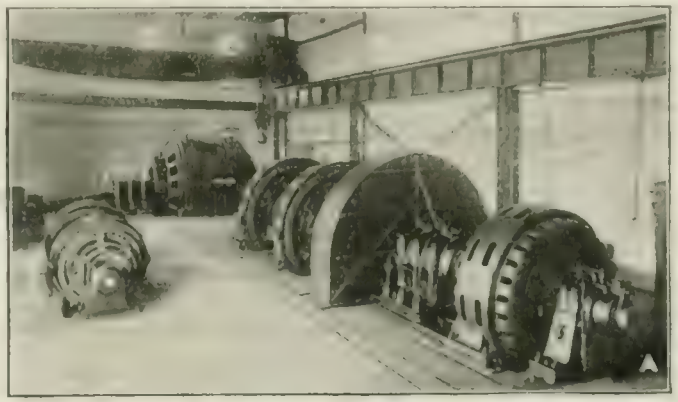
It is recommended that all exciter equipment which is likely to run away, particularly motor-generator sets, be provided with speed-limit devices independent of any protection which might be expected from reverse current relays.

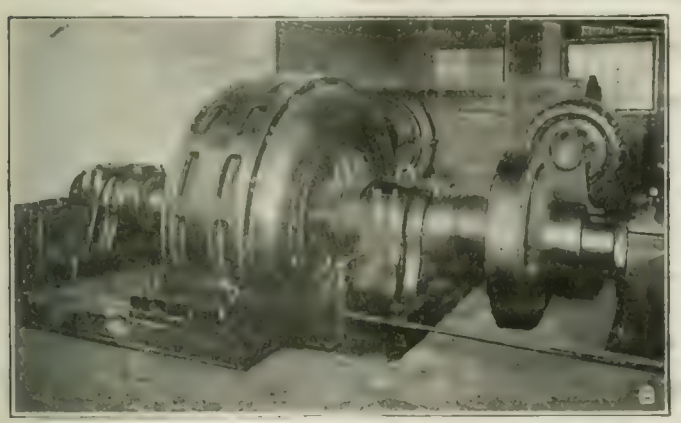
Keeping Steel-Mill Motors in Service

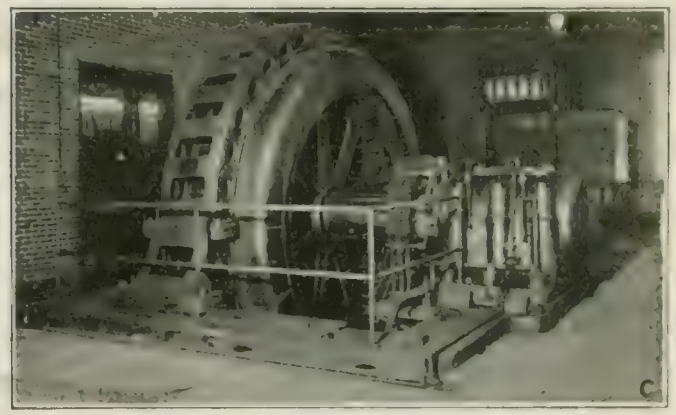
Tests of Various Kinds Are Prescribed for Main Mill Motors Before They Are Started Up and Periodically Thereafter in Order to Let the User Know the Condition of the Insulation in Machines

By O. NEEDHAM
General Engineer Westinghouse Electric & Manufacturing Company

STANDARD control devices have been developed to protect large steel-mill and other motors from overloads and from high voltage, but these abnormal conditions, as well as dirt, moisture, etc., will cause the insulation of the machines to deteriorate in time. Furthermore, the insulation often takes up moisture after the machine leaves the factory and before it is put into service. It is therefore the purpose of this article to suggest methods for drying out the insulation of large steel-mill motors and for making periodical overvoltage tests at times when machines can be best spared and, if necessary, repaired. Faults found in this way are in most cases easier to repair and cause less loss in mill production than when machines are allowed to run until they break down in service.







TYPICAL MILL MOTORS REQUIRING PERIODICAL TESTS

A—View of motor house containing electrical equipment for driving a 34-in. reversing blooming mill. The direct-current reversing mill motor in the background has a maximum rating of 10,000 hp. at from zero to 100 r.p.m. This motor receives its energy from the flywheel motor-generator set on the right. The induction motor of this set is rated at 1,800 hp., 2,200 volts, three-phase, 66⅔ cycles, and the flywheel weighs 100,000 lb.

B—An 800-hp., 2,200-volt, three-phase, 60-cycle, 270-r.p.m. induction motor driving a 10-in. merchant mill.

C—A 132-in. sheared-plate mill that is driven by the 5,000-hp. 2,200-volt, three-phase, 60-cycle induction motor, operating at a speed of 197 r.p.m.

After machines are completely set up in position they should be thoroughly dried out and then tested before being started. The drying can be done by applying heat externally or by circulating current in the windings. External drying can be done by placing resistance grids under the machines to dissipate roughly about 1 kw. per 100 hp. rating of the machine, but no part of the hot grids should be allowed to come in contact with the windings. The machine should be covered with a tarpaulin and an opening provided at the top to allow the moisture to escape, otherwise it will condense on the machine as soon as the heat is discontinued. A thermometer should be kept on the windings and the temperature not allowed to exceed 90 deg. C., unless it is known positively that the insulation is of such a character that higher temperatures will not be injurious.

The time required to dry out a machine thoroughly will vary from a few days to several weeks, depending on the size of the machine and the condition in which the insulation is found. The insulation resistance should be tested two or three times a day at uniform intervals during the drying period, and a curve should be plotted using resistance as ordinates and hours as abscissas. A high-voltage megger is the most convenient method of measuring insulation resistance, but a high-resistance voltmeter and a 600-volt direct-current circuit can be used. In using a megger the instructions coming with the instrument should be carefully followed or misleading and erratic results may be obtained. These readings should be taken while the insulation is warm. When using a high-resistance voltmeter and an ungrounded 600-volt circuit, one side of the circuit is connected to the frame of the machine and the other side to the bare windings, through the voltmeter. If a grounded circuit is used, the grounded side should always be connected to the frame of the machine. The insulation resistance obtained in this manner will then equal:

$$R = \frac{V - v}{v} r.$$

where R = the insulation resistance, r = the resistance of the voltmeter V = the line volts and v = the voltmeter reading. The temperature of the windings should

also be recorded at the time of taking the insulation resistance. These tests should be repeated at regular intervals until the curve shows that the insulation is thoroughly dry; *i.e.*, until there is no further change in resistance.

Machines which have been dried out by applying external heat only may show a very good value of insulation resistance with a megger and still have moisture in the insulation next to the conductor. This is particularly true of high-voltage machines where the insulation is heavy and it is very difficult to entirely drive out the moisture. A much more effective method is to apply the heat internally by circulating current through the windings. Machines of 2,200 volts or higher can generally be dried out by applying 220 volts alternating current directly to the terminals without interposing resistance. The machines should be watched very closely at first by observing thermometers placed on the coils to make sure that there is no overheating. The application of current directly to the coils presupposes that the insulation is in good enough condition to withstand this low voltage. If the insulation is in very poor condition, external heat should be used until it is safe to apply a low voltage for circulating current. Megger readings should then be taken until the insulation resistance reaches a fixed value.

The American Institute of Electrical Engineers recommendation for insulation resistance is:

$$\text{Megohms} = \text{voltage} \div (\text{kva.} + 1{,}000).$$

This value seems to be low for large steel-mill apparatus, and particularly for 2,200-volt machines, which should show at least one megohm per 1,000 volts. It is not the intention that the drying process should be stopped when these values are reached, but in every case the process should be continued until the resistance is constant. If this constant value does not equal that given in the above rule, the manufacturer of the apparatus should be notified.

Machines can be placed in service after the above precautions have been taken with reasonable assurance that the insulation will stand up. However, where continuity of service is important many operators give large apparatus the same insulation test (double voltage + 1,000 volts) that it receives in the factory before shipment. Megger tests, although serving as a measure of precaution, cannot be entirely relied upon, as it is possible to show good resistance values when the insulation is on the verge of a breakdown. The only reliable method of measuring the ability of the insulation to withstand operating voltage is to apply actual potential test to the insulation. This requires a small testing transformer designed to give a wide range of voltage and with a capacity of about 1 kva. per 1,000 volts on the high-tension side.

A voltage test can be applied for a period of one minute, and if a weak point is found, very little damage is done, owing to the small capacity of the transformer. If, on the other hand, the apparatus is allowed to break down in service, it may be connected to a power circuit having considerable capacity, and when the trouble occurs the large amount of power available may damage the machine seriously. Such a breakdown naturally occurs when the mill is in operation, and it causes serious delay. If a testing transformer is used, the fault can be found before the equipment is started up and the repairs made before the mill is placed in operation.

It is advisable to keep all machines painted while they are in regular service. The paint will not only be a benefit to the machines by preventing rust and also making them easier to clean, but it will be an incentive to the operator and attendants to keep the motor room and apparatus neat and clean. In addition to painting the iron and steel parts of the machines the exposed parts of the windings, and particularly the creepage surfaces over the insulation, should be gone over at least once a year with a good insulating varnish. Most of these varnishes will dry in from twenty-four to forty-eight hours with a room temperature of approximately 80 deg. Fahr. (27 deg. C.). If this amount of time cannot be spared, the varnish can be dried more quickly by covering the machines with a tarpaulin, leaving an opening at the top and placing resistance grids under the machine to dissipate energy, as previously mentioned. This treatment will cause the insulation to become smooth and glossy so that dirt will not readily adhere to its surface.

All machines should be periodically inspected, say every week or two, at which time the machine should be thoroughly blown out with a moderate-pressure air blast. About 25 lb. to 30 lb. per square inch (4.4 kg. to 5.4 kg. per sq.cm.) is most satisfactory. As the mill air line is usually operated at a high pressure, it is advisable to provide a reducing valve and water trap so as to obviate any danger to the insulation due to moisture or a high-pressure blast. In some cases a separate low-pressure air compressor is installed for blowing out the motors, etc. Care should be taken to prevent dirt from getting into the bearings during this cleaning process.

Steel-mill motors should be entirely overhauled, both mechanically and electrically, at least once every year. Local conditions will dictate the time of year when a unit can best be spared for a long enough period to make the test and to make repairs should a breakdown occur as a result of the test. At more frequent inspection periods the hot insulation resistance should be measured, and a permanent record should be kept of these tests. They will show whether any deterioration of insulation is taking place. When such is the case preventive steps can be taken before an actual breakdown occurs.

It is unfortunate that insulation must be subjected to the danger of breakdown by overvoltage test in order to find out if it is in proper condition, but this should not deter the operating engineer from making such tests. There are many different opinions as to the best percentage of operating voltage to apply when making a high-potential insulation test. The double-voltage plus 1,000 volts applied when the apparatus is new is presumably a larger margin of safety than is reasonable after the apparatus has been in service for a period of years. It is the writer's opinion that 150 per cent of normal voltage is the minimum to which the insulation should be allowed to deteriorate. If the insulation will break down on the application of 50 per cent in excess of normal voltage, the apparatus should be rewound or some other radical steps should be taken to strengthen the insulation.

Whatever high-potential test is made should be applied with caution. The machine should be blown out and all brass and copper parts wiped clean, as the presence of dirt may cause a failure even when the insulation is in good condition. The insulation must

also be dry and should show a good resistance value. The terminals from the testing transformer should then be placed on the machine to be tested while the testing circuit is dead. Then the high voltage should be applied by closing the low-voltage circuit of the transformer. When the test is completed the high voltage should be removed by opening the low-voltage circuit. The severity of the test depends to a marked degree upon the time the electromotive force is applied, and it is suggested that these tests be of not over one minute in duration.

Governor Adjustment for Efficient Parallel Operation

Principles of Operating Steam and Hydro Plants in Parallel and Methods of Changing Governor Regulation While Running

BY F. OPPENHEIMER
Pennsylvania Water & Power Company, Holtwood, Pa.

SOME principles of governor operation have recently taken on a new significance in efficient distribution of load among units and stations running in parallel. Most important among these are: (1) To make the most economical units carry the main body of the load; (2) to allow a relatively small unit to take care of fluctuations, and at the same time (3) to maintain good speed regulation of the whole system. To follow these principles an operator must have a knowledge of the operation of generators in parallel with various governor adjustments on the prime movers.

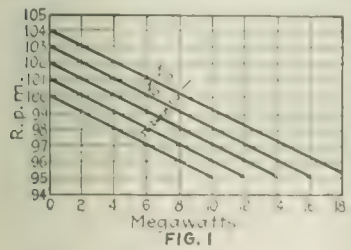


FIG. 1

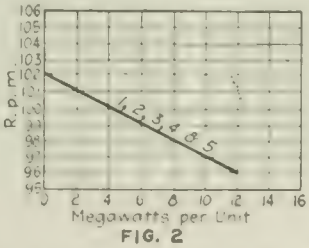


FIG. 2

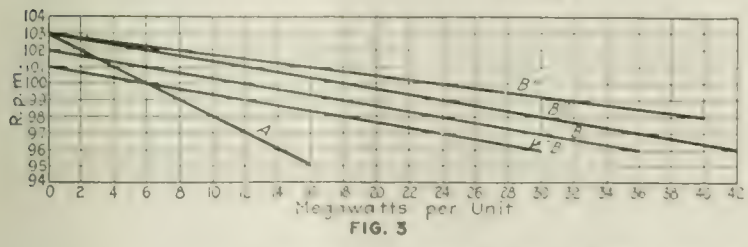


FIG. 3

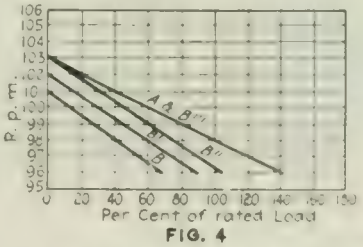


FIG. 4

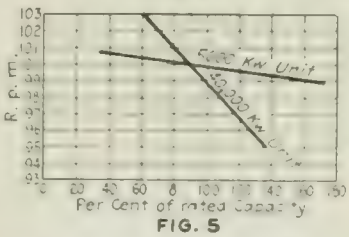


FIG. 5

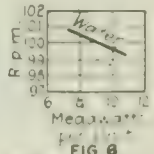


FIG. 8

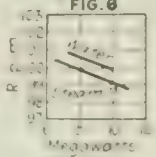


FIG. 7

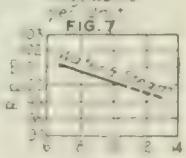


FIG. 6

SPEED-LOAD CURVES OF PRIME MOVERS WITH VARIOUS GOVERNOR ADJUSTMENTS

Fig. 1.—Five identical units operating in parallel but with governors adjusted for different speeds. Fig. 2.—Governors of Fig. 1 have been adjusted so that all units are equally loaded. Fig. 3.—10,000-kw. unit (*A*) operating in parallel with 40,000-kw. unit (*B*, *B'*, *B''* and *B'''*). Fig. 4.—Same as Fig. 3 with loads shown in per cent. Fig. 5.—[illegible] kw. water-power unit [illegible] to any load of about 35,000 kw., while [illegible]-kw. steam unit [illegible] fluctuations, as a small drop in speed causes [illegible] load on the steam unit. Figs. 7 and 8.—Various combinations of operating steam-driven and water-driven units in parallel.

Let it be supposed that there are five units all exactly alike running in parallel, with all governors set for the same regulation, but that the operator has manipulated the individual governors so that the loads are unequal (Fig. 1). In order to eliminate the undesirable unequal loading it is an easy matter for the operator to pull up on No. 4 and No. 5 units and down on Nos. 1 and 2 so that all the lines will coincide with the curve of No. 3 unit as shown in Fig. 2.

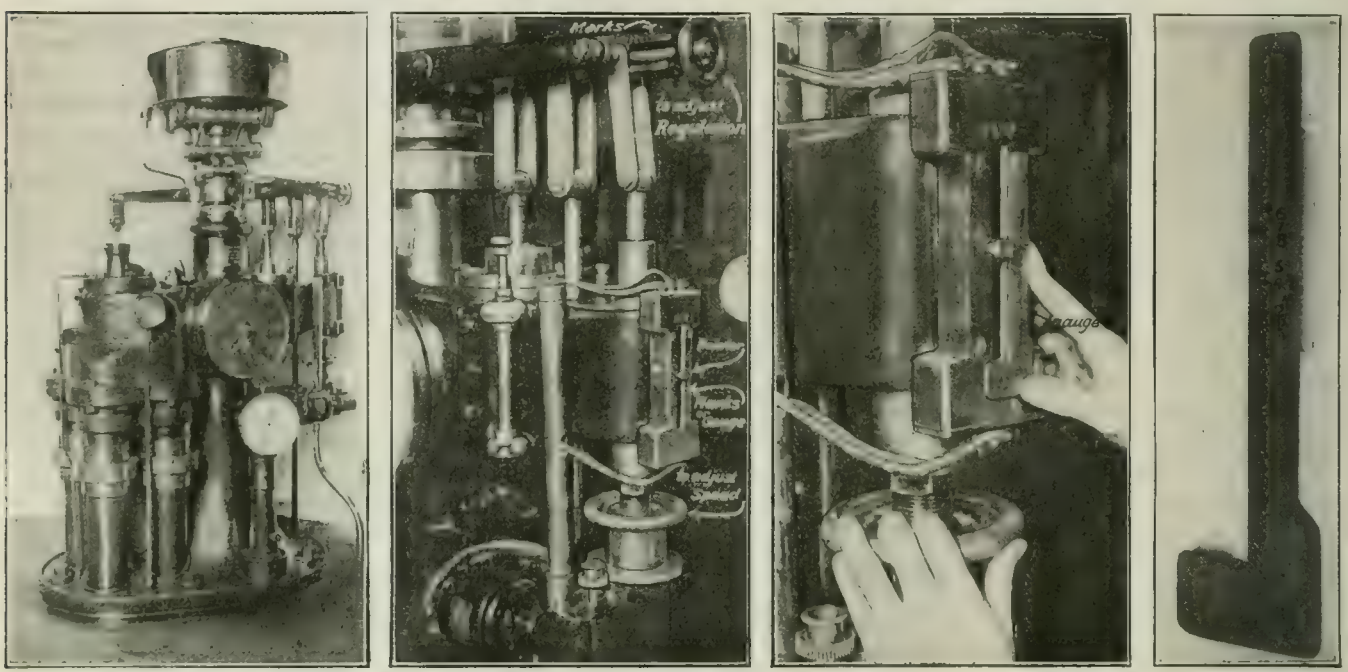
In the case supposed all the governors had the same speed-load characteristics, a condition hardly ever found in one station or one system. To get a more real condition let it be supposed that unit No. 6, rated at 40,000 kw., with a speed-load curve as shown in *B*, Fig. 3, is put on the line in parallel with the others in station *A*. In order that all units shall share the load in exact proportion to size at all speeds it is necessary to regulate the governors so that each unit will change its speed the same amount from no load to full load. If it is desired to change *B*, it will have to give a line *B'''* on which an increase in load from 0 kw. to 40,000 kw. will produce a decrease in speed of 5 r.p.m. (103 — 98), which corresponds to a like change in speed on units *A* for load change from 0 kw. to 10,000 kw. per unit. In order to show more clearly what this means the curves of Fig. 3 are again plotted in Fig. 4, where the load is given in percentage of rated capacity.

If all the governors in one station or on one system were adjusted to give the same regulation, they would divide the load in proportion to their size as in curve *A* and *B'''* (Fig. 4). However, in most systems this is not desirable, as there are generating units which differ greatly in efficiency and capacity, so that it may be better to run a certain type of unit well loaded all the time and take up fluctuations in the system load on another type of unit. A specific case may be assumed where a 40,000-kw. unit operates in parallel with a 10,000-kw. unit and the total load is 40,000 kw. Tests of the units may indicate that the large unit is very efficient at 35,000 kw. and that the best over-all efficiency of the system is obtained by keeping this unit at that load all day if possible. The regulation of the governors in this case should be, in principle, as shown in Fig. 5, where it is seen that small changes in speed affect the amount of load on the large unit very little but cause the smaller unit to take nearly the total amount of the fluctuations in system load. An interesting point to be noted is that in any system the magnitude of the speed fluctuations varies inversely as the number of governors functioning (other things being the same). For instance, in a hydro-electric station of ten units carrying load enough for nine and one-half units, if nine units are operated with gates wide open and one unit at half load, all load fluctuations (up to certain limits) will be taken by the unit at half load, since this is the only governor that is actually doing any regulating. But if each of the ten units carries

95 per cent of its maximum capacity, there will be ten governors functioning, and each will have to take one-tenth as much of the load fluctuations with a consequent variation in speed of only one-tenth as much as before.

The operation of the hydro-electric station just mentioned, running parallel with a steam station, is shown graphically in Fig. 6 to Fig. 8. Fig. 6 shows the speed-load curve of ten water-driven units, each carrying 9,000 kw. at 100 r.p.m. The load increases and a steam-driven unit is put on the line as shown in Fig. 7, where the waterwheels are wide open at 10,000 kw. each and the steam unit has 8,000 kw. Note that the slope of the curves is the same and that an increase of 3,000 kw. would lower the speed one revolution, whereas in Fig. 6 with ten governors working an increase of the same total amount, or 300 per unit, would lower the speed only one-tenth revolution. If the operator now pulls up on the steam unit so that its curve coincides with the other curve, as in Fig. 8, and divides the load equally among eleven units, the result would be 9817.2 kw. pe unit at 100.06 r.p.m. Thus there would b eleven governors working, with consequent excellent speed regulation, but they would waste water by not running the waterwheels wide open and would needlessly burn coal by carrying 9817.2 kw. on the steam instead of 8,000 kw. as in Fig. 7. Of course, the amount of fluctuation in load may dictate the least number of governors required to maintain a certain standard of speed regulation. Before shutting down the steam unit it will be desirable to "back down" on all the waterwheel units, so that they are no longer wide open and can therefore regulate the speed, and at the same time to keep the speed up to 100 the operator has to pull up on the steam unit.

It may be desirable to change the adjustment of governors from time to time in order to get the best efficiency or certain regulation or speed characteristics under various operating conditions. In order that such adjustments may be made quickly and accurately it is a good plan to put marks on the governor mechanism to which certain adjustable parts can be set by the attendant, or it may be advantageous to have metal gages or templates for the same purpose. This makes it possible to change the speed characteristics of a prime mover to a predetermined value while it is in operation. In the Holtwood (Pa.) plant of the Pennsylvania Water & Power Company both of those methods are used on the I. P. Morris double-floating-lever governors which are on all units. The brass gage at the right of the illustration fits directly on the governor over the speed-adjusting wheel. The gage has a mark for each of the eight units in the plant showing the setting for full load at rated speed. When all governors are set by this gage, the units divide the load in proportion to their rating. This will hold, of course, only if the regulation of the governors is the same. As a guide in setting the regulation to a certain amount of speed change for a certain load increase, marks are placed at the top of the governor at the handwheel which changes regulation. By means of such gages and marks an operator may set the governors by hand while the machine is running, so that the total station load will be divided in the most efficient manner. The same principle is applied to the entire system so that the system load of any value is divided between stations in correct proportions.



GAGES AND MARKINGS WHICH ASSIST IN ADJUSTING GOVERNOR FOR DIFFERENT CONDITIONS OF PARALLEL OPERATION

A PUBLIC SERVICE *company, in its broadest sense, is a partnership consisting of the state as an institution, the public as a group of customers, and the company, the state determining the extent to which the company may go, the company furnishing the facilities, and that part of the public constituting the customers furnishing the revenue with which the company is enabled to perform its service. Any act or omission which denies a public service company a reasonable approximation to a fair deal has its immediate and reflex effect upon the customers; and if it is one of the important functions of a public service commission to see that the company and its patrons are treating each other fairly, no lower in the scale stands the duty of seeing to it that the company and its customers are each accorded full justice by every outside agency.*— From a decision of Maine Public Utilities Commission.

Readers' Views and Comments

Electric Welding Machinery

To the Editor of the ELECTRICAL WORLD:

SIR: In your issue of July 10, covering the electric welding session of the A. I. E. E. meeting at White Sulphur Springs, several statements are made which are not exactly in accordance with the facts. At that meeting welding machines were described by A. M. Candy, S. R. Bergman, R. L. Unland and C. J. Holslag, all of them purported to be new and original. The facts are that all of these different welding machines in their essentials were invented, manufactured and placed on the market years ago by the Lincoln Electric Company. They are in no case being manufactured now by this company for the reason that their development has shown that these older types are not entirely satisfactory.

The machine described by Mr. Holslag is an alternating-current transformer, the first one of which for welding purposes, as far as the writer knows, was manufactured in 1907 by the Lincoln Electric Company, placed in operation by the Cleveland Steel Casting Company, Cleveland, Ohio, and was in operation there for a period of months. The same difficulties were present in this machine as are present in the same types now, that is, unstableness of the arc, low-power factor, poor penetration and great difficulty of operation. For these reasons this type was abandoned by the Lincoln Electric Company as being unsatisfactory.

The machine described by A. M. Candy, which is technically known here as the double-shunt machine, is essentially covered by patent No. 1,295,278, issued to this company. Machines of this kind were developed and put into operation during 1913 and 1914. They are at the present time in operation in hundreds of places, examples of which are the Timken Detroit Axle Company, Detroit, Mich.; Strong Steel Foundry Company, Buffalo, N. Y.; the Rock Island Railroad and others. While this scheme produced successful welding equipment, it was abandoned by this company years ago for the following reasons: First, the current regulation of the arc was difficult and with wide variations unstable; second, when the arc was struck the collapse of the self-excited field was sufficient to give a strong tendency toward sparking; third, the adjustment of the flux density in the magnetic circuit was sluggish for the same reason. This machine was fairly successful, although its complication and the difficulty noted above caused its rejection by the Lincoln Electric Company years ago.

The type of machine described by Mr. Bergman and Mr. Unland is essentially the same as the machine developed by this company under patent No. 1,227,809. This was developed in the period between 1909 and 1910. A number of these machines are in operation. Examples are the Henrici Laundry Company, Boston, Mass.; West Steel Casting Company, Cleveland, Ohio; Michigan Malleable Iron Company, Detroit, Mich.; Union Steel Castings Company, Pittsburgh, Pa., and a number of others. This scheme was abandoned on account of the difficulty which developed in service. It is self-evident that an armature reaction which will neutralize the main field to the extent of giving a drooping characteristic that will drop the voltage to practically nothing at the same time will have the same effect on the commutating field and result in difficulty in commutation, thus tending to make the machine cranky at the commutator and rather complicated because of its design. This machine was abandoned nearly ten years ago for the reasons cited above.

The type which has been developed from these various stages is the type covered by Patent No. 1,238,406. This is a single separately excited shunt field with a bucking series and overcomes all of the difficulties experienced with the other types. We do not claim that these other types will not weld, as our experience and the large number of these types in operation prove that they will weld. Experience with them, however, shows that they have difficulties which should be overcome, and the final type mentioned and now manufactured by this company does overcome them.

THE LINCOLN ELECTRIC COMPANY,
Cleveland, Ohio. J. F. LINCOLN, Vice-president.

Vacuum-Tube Amplifiers

To the Editor of the ELECTRICAL WORLD:

SIR: My attention was drawn only today (June 17) to the article published in your paper of March 29, 1919, over the signature of Lieut. Max C. Batsel, in relation to vacuum-tube amplifiers. The author of that article contents himself with saying: "The development work on radio-frequency amplifiers has been carried out entirely by Signal Corps engineers assisted in its initial stages by information gained from the French and the British."

In reality the apparatus described by the author of the article represents substantial reproductions by the Signal Corps of apparatus devised by me for the French military telegraphs in 1916 under the designations "3-ter, L_1, L_2, L_3, L_2-bis," and which was manufactured by thousands. I can even say that the magnetic circuit of the low-frequency transformers for the American amplifiers (see Fig. 1 of the article) has exactly the same form and dimensions as the magnetic circuit of the transformers for the amplifier of type "3-ter."

In regard to the utilization of transformers having a magnetic circuit of iron of low capacity in high-frequency amplifiers, I did that in the amplifiers of type L in 1916 without having had any knowledge of any similar amplification made before that time in any country. The type "L_3 bis" even comprises air-gap transformers like those shown in Fig. 5 of the article, which is perfectly familiar to me. The arrangement shown in Fig. 9 is simply that of the type "L" apparatus, and it therefore comprises a combination of high and low-frequency amplifications with capacities on the low-frequency transformers.

I am aware of the high technical merit of the Americans, and I know all that they have done in the field of amplification. Still, I believe that my practical work in this line was of some usefulness to the American army and that it deserved more than the anonymous reference made to it by the author of the article referred to. MARIUS LATOUR.

Paris, France.

Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Portable Ladder Platform for Low Wire Work



PORTABLE PLATFORM MADE OF CROSSED LADDERS AND PLANK

TWO crossed ladders lashed to an overhead line and provided with a platform of single planking are used successfully in low-hanging cable and wire maintenance work by a southern New England company, as illustrated in the accompanying photograph. Notwithstanding the lightness of this arrangement, it is mechanically stable and provides space for two men to work conveniently and safely on sections of line carried near the ground, as in the viaduct instance illustrated. In looping the supporting straps around the ladders, care is taken to run them below the planking, thus avoiding any tendency for the strap to slip off the top of the ladder. Both vertical and horizontal adjustments of this improvised platform can be made with great rapidity and without difficulty by shifting the plank.

Boilers Should Be Tagged When Being Worked On

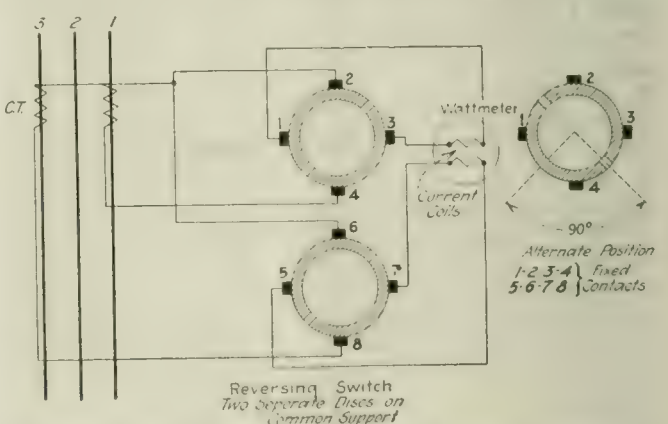
IN ORDER to protect men working in boilers, blow-off and other valves should be properly tagged. An accident that occurred recently in the plant of the Consumers' Power Company, Jackson, Mich., though fortunately not fatal, emphasizes the necessity for workmen to follow a specified safe method of procedure. As a common blow-off header is used with a battery of boilers, if any boiler of that battery is blown down, the dead boiler, with the blow-off valves open, will be filled with scalding water, which will flash in part into steam due to the reduced pressure. If any one should be working in the boiler, a bad accident could scarcely be averted.

In order to prevent such an occurrence this company has developed a system of tagging the blow-off valves and recording the procedure in a log book similar to that used on transmission lines. According to this system, when a boiler is not fired up, the blow-off valve must be closed and tagged for the plant engineer or whoever is in charge of the boiler-room operating force, and a record of this action must be made in the boiler-room log book. In case men working in the boiler want the blow-off valves open, as, for instance, while turbining boiler tubes, the one in charge of the work must notify the plant engineer, who will remove the tag on the blow-off valve in question and place tags on the blow-off valves of the boilers that blow down into the same header. In this way the water tender will not blow down a boiler without first seeing that the blow-off valves to the dead boiler are closed. As soon as the work is completed within the dead boiler the one for whom the blow-off valves are tagged must notify the plant engineer, who will see that the tags for this man are removed from the blow-off valves of the boilers and that the blow-off valves of the boiler in question are closed and tagged again for himself. A complete record of all operations is entered in the boiler-room log book. In short, no one should operate the blow-off valves but the man who is responsible for the blowing down of the boilers, no matter whether the boiler is dead or fired up, and the necessary tags must be placed and records be made so as to eliminate any possibility of a serious accident taking place. Boiler-room foremen are held directly responsible where this system is not followed

Consumers' Power Company, H. HURTH.
Jackson, Mich.

Home-Made Reversing Switch for Wattmeter

ALWAYS to get a positive reading on an indicating wattmeter connected to a circuit in which energy flows in both directions, the writer has modified a General Electric Company's ammeter jack. An ordinary reversing switch would not have answered for this purpose on account of the fact that it is not advisable to open the meter leads connected to current transformers. By



SWITCH WHICH REVERSES WATTMETER READING WITHOUT OPENING TRANSFORMER CIRCUIT

adapting the ammeter jack the current can be reversed without opening the circuits. The ammeter jack as it is manufactured has two cylindrical sections, one of which contains two sectors of copper on which two brushes make contact and the other of which contains six cop-

per sectors with six brushes. To make the change the first section was not altered but two brushes were added as shown in the accompanying drawing. The six sectors of the second section were removed and two large sectors were substituted and four brushes were connected up as shown. To reverse the switch the handle of the jack is turned through an angle of 90 deg., which causes both sections to turn simultaneously through this angle. As the brushes are wide enough to span the opening between the two copper sectors, the circuit from the current transformers always remains closed.

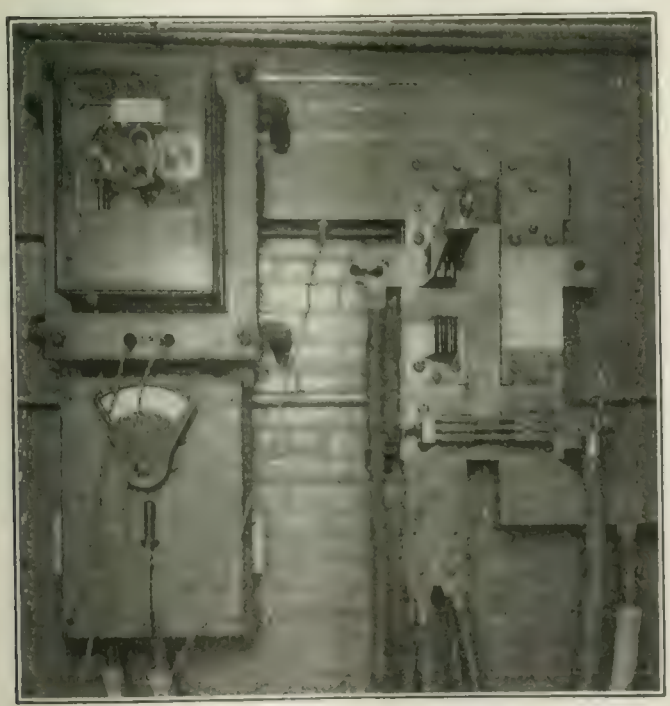
The station in which this meter is installed transmits power in each direction. The net result of the power is recorded by the watt-hour meter, and therefore the connections were so made that the current through the watt-hour meter is not reversed. R. H. N. LOCKYER.

Trail, B. C., Canada.

Shunting Switch Permits Testing Large Meter Without Killing Line

TO AVOID having to test a large railway meter of the Detroit Edison Company at night, when the circuit could be disconnected from the bus, two knife-blade switches were connected to the circuit as shown in the accompanying illustration. One of these switches when closed forms a shunt around the meter while the other switch opens the meter circuit. To test the meter after this meter circuit has been opened, current is sent through it from portable storage batteries through leads attached to the meter bus by temporary connectors. The current in the operating circuit passes across the lower switch and down through the outgoing cable.

Before the installation of these switches it was necessary to shut down this circuit to make a test. This was



METER IS BEING TESTED WHILE ITS CIRCUIT IS CARRYING A LOAD

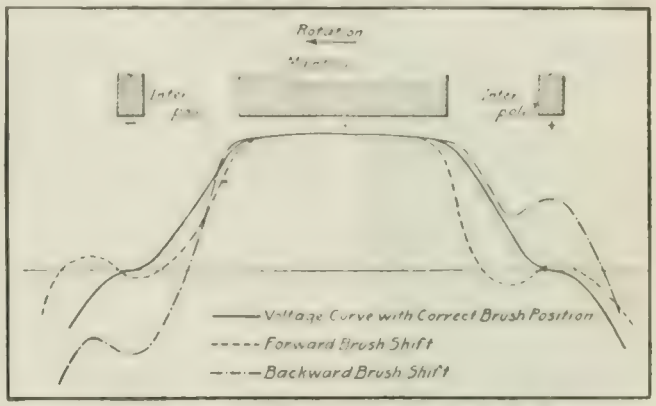
generally possible only at night, and the testing was very expensive on account of the great amount of overtime required. As the switch is now installed, the meter can be tested at any time independently of the load.

Detroit, Mich. J. S. MCCARTHY.

Shifting Brushes on Interpole Generators Changes Voltage

MUCH sparking and change of voltage may be caused on an interpole generator with a very slight shift of the brushes from the correct neutral point. When the brushes are shifted the interpoles either assist the main series field in raising the voltage as load comes on or buck the series field causing reduced voltage or too small an increase of voltage with the load.

If the brushes are given a forward shift, as is often



EFFECT OF BRUSH POSITION ON VOLTAGE OF INTERPOLE GENERATOR

done by operators accustomed to handling non-interpole machines, the coil which is sending current to the brush gets out from the influence of the interpole before it reaches the brush. In other words, the interpole acts on the coil when the coil is still in the field of the main pole just behind the interpole, which is of opposite polarity to the interpole. The net result is a reduction in the total flux and a consequent reduction of the generator voltage as the load increases. The remedy is to set the brushes at the correct position. It should be noted that the brushes may have been set so far ahead that they have reached a second neutral point, indicated in the accompanying diagram by the crossing of the zero line at the extreme left. In this case when an attempt is made to move the brushes back toward the correct position sparking may increase, but with the brushes moved still further back the sparking will again cease. A case of this kind recently occurred on a 300-kw., 250-volt machine in a steel plant. While cleaning the machine the operator had shifted the brushes to the non-sparking point just mentioned. The machine would not hold load properly, but when the operator attempted to shift the brushes back again the increased sparking alarmed him. However, after a troubleman had finally shifted the rocker ring back to the original mark the sparking stopped and the machine held up its voltage properly on load. The false neutral point was 2 in. (5 cm.) on the rocker ring ahead of the correct position.

In case the brushes are given a backward shift, the interpole acts on the coil after it reaches the brush. As each interpole is of the same polarity as the main pole ahead of it, an extra amount of terminal voltage due to the interpole is added to the main field voltage and the terminal voltage of the machine will consequently increase with load. A very small amount of such shift, even half a bar, may cause sparking. In the diagram the voltage of the coil when the brushes are shifted backward is shown by the long dotted line.

Cleveland, Ohio. JAMES DIXON.

Industrial Applications

The Economical Utilization of Electrical Energy
in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

Practical Cut-Out Cabinet with Watchman Switch Adjacent



WATCHMAN SWITCH NEAR LIGHTING CABINET

A TYPICAL lighting control cut-out cabinet in the Westinghouse factory, East Springfield, Mass., shown in the illustration, is fed through conduit from a transformer inside the building. Two main circuits on each floor are controlled by the cabinet, the circuits themselves being of open-wiring construction. An interesting feature of the installation is the snap switch at the left of the cabinet which controls the watchman's lights independently of the main floor lights. Only the few lamps which are connected on this circuit are lighted during the time the watchman is making his rounds.

Boston, Mass. H. S. KNOWLES.

Graphite in Belt Dressing Removes Static Electricity

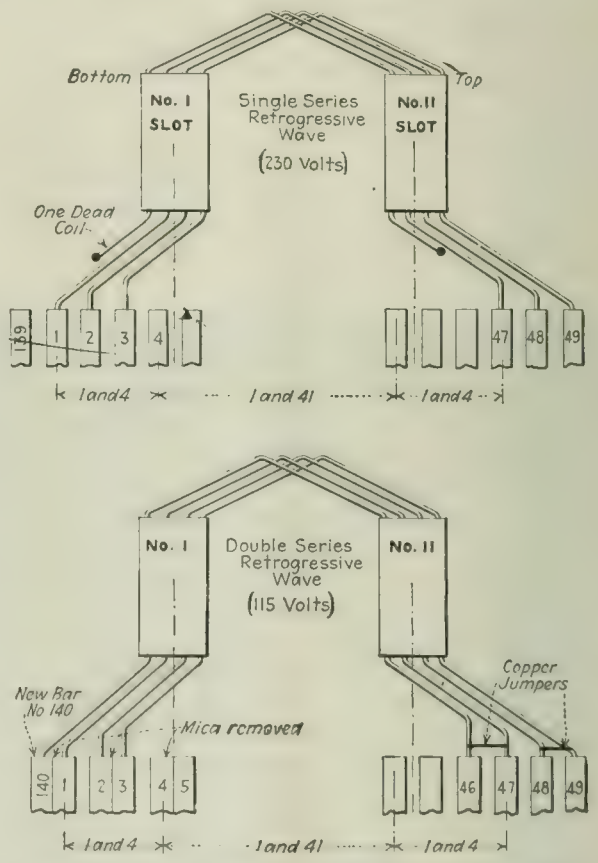
FOR eliminating static electricity from belting in plants where very explosive vapors are present the safest method is probably to mix some graphite with the belt dressing. This makes the belt sufficiently conducting to prevent building up static voltage. An unsuccessful and probably dangerous method that has been tried in the past is to place wire points or pipe and other metallic objects in close proximity to the belt, connecting these objects with the ground in order that they may carry off the static electricity. Such a device, however, has been found ineffective because at times an accumulation of static electricity would pass in a spark from the belt to the device, thus defeating the purpose for which it was designed as the spark is liable to set fire to explosive vapor. A fire was started in this way in a certain japanning factory which afterward adopted the method of mixing graphite with the belt dressing. The new method eliminated the trouble, but it was necessary to keep a check on the condition of the dressing to be sure that it did not wear off. This was accomplished by means of a gold-leaf electroscope held near to the belt. The leaves of such an electroscope will diverge when in proximity to a belt holding static electricity.

This electroscope was made from a wide-mouthed bottle, 2 in. (5 cm.) in diameter and 5 in. (12.5 cm.) high, in which was fitted a cork holding a piece of wire bent at right angles inside the bottle to hold the piece of goldleaf, which was about ¼ in. x 2 in. (6.4 mm. x 5 cm.) in size. An electroscope such as the one described will diverge when it is held in contact with a 600-volt circuit. C. M. GREEN.

Lynn, Mass.

Halving Motor Voltage by Adding Commutator Bar

TO RECONNECT for 115 volts a 230-volt, six-pole series wave-wound motor with 139 commutator bars was a problem recently solved by a motor-repair shop. This job was especially difficult on account of the fact that as the motor had six poles, the winding could not be changed from wave winding to a lap winding in order to reduce the voltage. Therefore the motor had



DOUBLE-SERIES WINDING MADE POSSIBLE BY ADDING A COMMUTATOR BAR

Bar No. 140 was inserted after thirty-two pieces of mica were removed.

to be reconnected as a double-series (four-circuit-wave) winding. However, such a winding cannot be made with 139 commutator bars. Such a winding is possible with 137 bars, but this would necessitate killing two bars and two more of the 140 armature coils of which one was already killed. A 140-bar commutator, however, may be connected for a double-series winding

which would alsc use all the 140 armature coils. Therefore the coil leads were all unsoldered from the commutator necks, the commutator was opened, and the mica was removed from between every second pair of bars until sufficient room was made for adding another bar which was made in the shop. In all thirty-two pieces of mica were removed, making thirty-two bars of double width.

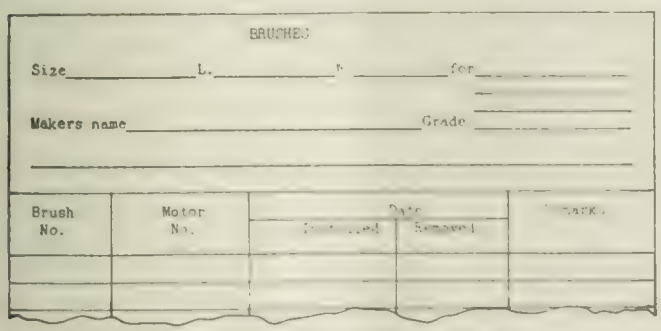
Where the mica had not been taken out copper jumpers were put between adjacent bars, making the whole virtually a seventy-bar commutator. New leads were then spliced on the dead coil and the armature was reconnected with a pitch on the commutator of one-to-forty-seven. As there were only thirty-five slots in the armature and 140 coils, the coils which were paralleled lay in the same slot so that there was no circulating current. After the armature was changed the fields were connected for 115 volts. There were originally six brush studs with four ½-in. x 1¼-in. (13-mm. x 32-mm.) brushes per stud. These brushes were changed to four ⅞-in. x 1¼-in. (22-mm. x 32-mm.) brushes so that one brush would cover approximately three bars of the commutator. After the change was made the motor was put back into service and has been operating satisfactorily ever since.

Bronx, N. Y. C. A. JOHNSON.

Cards for Recording Performance of Motor Brushes

FOR keeping, directly on the bins where brushes are stored, a record of the performance of motor brushes, the system described here has been found very successful in a New York printing shop. The records are kept on cards which may be inserted in clips on the drawers or bins. At the top of this card are recorded the size of the brush and the type of motor for which it is adopted. The marker's name and the grade of the brush are entered on a second line. With the number of each brush are tabulated the number of motor on which it is installed, the date of installation, the date of removal and remarks. To identify the brushes they are marked with numbers. On pigtail brushes the copper lug is stamped, while the number is scratched on the common type of brush.

By means of this system, if the life of the brush on



CARD FOR RECORDING PERFORMANCE OF MOTOR BRUSHES

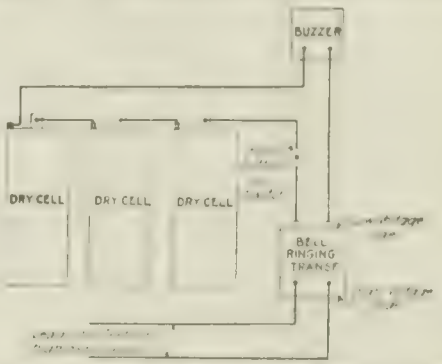
a motor is short, it is clearly shown by the card at the time the brush is removed. Moreover, if a new set of brushes has to be put on a motor, the type of brush to be used can be ascertained by looking at the card record. These cards are slipped into a bracket on the face of the drawer holding the different types of brush.

Each of these cards is large enough to record data on a number of brushes, and after the card is filled another card is slipped in front of it in the bracket.

New York City W. A. HARRIS.

Outfit to Test for Open High-Resistance Circuits

TO TEST the continuity of some high-resistance coils the writer recently employed a bell-ringing transformer, a buzzer and three dry cells. These were all connected in series (the low-voltage side of the transformer being used) with a push-button. The high-voltage side of the transformer was then connected to



OUTFIT TO DETERMINE IF A HIGH-RESISTANCE CIRCUIT IS OPEN

testing leads and these were applied to the high-resistance coils. The condition of the coils was determined by noting the different sounds of the buzzer when the push-button was pushed. For an open circuit the tone of the buzzer stays the same, but for a closed circuit the tone changes in accordance with the resistance of the coil. The high voltage generated by the transformer is sufficient for testing circuits of very high resistance.

As the outfit will test a very high resistance, several outfits of the same kind have been made up for use in the shop in place of magnetos. EUGENE TYLER,
Chief Electrician.

Massillon Bridge & Structural Company,
Massillon, Ohio.

Synchronous Motors for Mill Drives Said to Be Impracticable

ONE reason why a synchronous motor would not be satisfactory for a steel rolling-mill drive is because of the heavy starting conditions and the frequent necessity in case of a cobble to stop the motor and back the billet out of the mill. The starting torque of a synchronous motor would probably be entirely inadequate for such work.

While a synchronous motor would be very desirable as far as the effect on the power factor of the entire mill was concerned, the use of clutches to obtain such drive would not be satisfactory.

There is at the present time one such installation driving a brass rolling mill. There is in this case comparatively light starting duty, and peak loads are not a high percentage of the continuous capacity of the machine; so there is no tendency for the synchronous motor to fall out of step.

These points were brought out by J. D. Wright in a discussion of his paper "Electric Mill Drives," presented before the Philadelphia Section, Association of Iron and Steel Engineers.

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

Electric Energy Has Best of Steam Power

RELATIVE reliability and cost of steam and electrical operation are shown in a recapitulation issued by the Milwaukee railway in which the Missoula division of that system is taken as an example of conditions on the lines west of Mobridge, S. D. In the figures showing relative costs of operation it is shown that on the Missoula division, where electricity is used exclusively as a motive power, the outlay is from 25 to 45 per cent less than on the steam power operations, as the following statistics show: Missoula division, $1; Musselshell division, $1.90; Columbia division, $1.67; Idaho division, $1.90. On the Rocky Mountain division, also electrically operated, the cost is $1.11.

The delay in minutes per mile of line operated is much less on the Missoula division than on the three steam-operated divisions on the lines west, being two-thirds less than on the Avery-Cle Elum division, which until recently was steam operated.

Quarterly Billing of Residential Customers Proves Economical

QUARTERLY billing of residential customers has been the practice of the Philadelphia Electric Company for the past two years. Difficulty in obtaining and keeping efficient meter-reading and clerical forces was one of the chief reasons for the adoption of the plan, which applies only to residential and apartment-house customers. Of the company's 125,000 electric meters, 60,000 are classed as residential and are read quarterly.

Although many of the advantages are obvious it is impossible to tabulate the entire saving effected. Were the company to return to monthly meter reading it would be necessary to double its present force of meter readers. One particular advantage realized has been that with the decreased number of meter readers required the company could afford to maintain a higher personnel in this department. As fewer bills are rendered each month and the number of ledger entries is thus reduced the work has been arranged to make a substantial reduction in the number of clerks. There is also a very considerable saving in the matter of stationery, such as customers' bills and ledger pages.

In number of complaints received there has been no increase, but rather a decrease. When the plan was first put into effect there were naturally many who had paid no attention to the company's notices announcing the change. However, there was no difficulty in explaining the matter to the customers' satisfaction. Complaints on high bills have actually been fewer. Because of the bills covering a period of three months instead of one, as formerly, any unusual use of energy in one month is equalized by comparatively small consumption for the two other months. Losses through uncollectible bills have not increased, as the collection department, having fewer bills, can keep in closer touch with customers. In cases where satisfactory credit has not been established by customers larger deposits are required

Proper Merchandising Expenses Shown by Classification of Accounts

TO PLACE the new business departments of its subsidiary companies on a profit-making basis, the American Gas Company of Philadelphia four years ago adopted a merchandise accounting classification designed to include all proper charges against the cost of merchandising electrical appliances and supplies. This classification has proved very successful as it has made the merchandising and jobbing business profitable by enabling the new-business manager to ascertain just what it costs to conduct his department.

The classification is arranged to show separately the income from each of the following items: (1) Housewiring, (2) fixtures and appliances, (3) motors, (4) specials, (5) merchandise including miscellaneous supplies, lamps and portables. Against each of these are charged four items of expense—material, labor, vehicle and storeroom expense. The difference between the total income and total expense is shown as a net credit to electrical merchandise business. By thus showing the expense charged against each class of sales it is possible to tell where losses occur, and the method also prevents charging a lump expense to the total merchandise income.

The next charge, which would have to be carried by any mercantile business, is that of uncollectible bills. This is determined by taking one-twelfth of the total bad debts for merchandise of the previous year and charging this amount each month against the net credit to merchandise business. Discounts for cash payments and allowances are also charged against the net credit to merchandise business.

The balance after these charges is the profit from merchandising exclusive of new-business department and overhead expenses. The cost of operating the new-business department includes soliciting, demonstration, advertising, free wiring and appliances, supplies and incidental expenses. Deducting the total of these items from profit on merchandising leaves a credit to the new-business department.

Two other expenses which might well be termed "overhead" are, first, rent and interest on the money required to conduct the business; second, general office supervision. The amount of rent charged is not an arbitrary figure, but is determined by the rental paid by other businesses in similar locations. Interest on the money required to conduct the business naturally

varies with conditions. As a general rule the amount considered necessary would be the average total outstanding merchandise accounts plus all-merchandising and new-business expenses for two months. General office supervision is charged only if the general manager actually devotes part of his time to the supervision of the new-business department. After these charges have been made the amount remaining, if any, is the actual profit made by the new-business department from merchandising.

In compiling its schedule the American Gas Company endeavored to include such items of expense as would be incurred in any other merchandising business. Promotion and other expenses not strictly new-business or merchandising expenses are eliminated. Results have been highly satisfactory, and since the adoption of the classification the operations of the new-business departments have shown a profit instead of a deficit.

Data on Cost per Customer Served

TO SHOW the expense of serving individual customers in the twenty-two districts where it operates the Texas Power & Light Company compiles a comparative monthly statement giving the number of customers served in each district and the cost per customer. The following figures include the cost of distribution, municipal street lighting, local commercial expense and local general expense only per customer and do not include the cost of production, new-business expense, taxes, insurance, salaries and expense of the general office, or any expense not controlled by the manager:

Districts	No. of Customers	Cost per Customer
Denison	3,427	0.53
Sherman	2,709	0.54
Cleburne	2,734	0.56
Terrell	1,655	0.60
Tyler	1,886	0.64
Gainesville	1,616	0.75
Bonham	1,802	0.78
Hillsboro	2,499	0.80
Temple	3,856	0.80
Taylor	2,347	0.82
Palestine	1,698	0.84
McKinney	2,907	0.85
Waxahachie	2,424	0.85
Paris	2,877	0.87
Ennis	2,085	0.89
Commerce	1,320	0.93
Waco	6,517	1.07
Brownwood	2,826	1.11
Total	47,185	0.81
Sweetwater	1,399	1.13
Eagle Pass	1,071	1.42
Big Spring	648	1.65
Wichita Falls	6,634	1.70
Total	9,752	1.55
Grand total	56,937	0.95

Providence (R. I.) Company Increases Power Rate

POWER customers of the Narragansett Electric Lighting Company, Providence, R. I., signing a contract for a demand of 200 kw. or more were recently interviewed by representatives of the company relative to an advance of about 15 per cent in rates. Under the new schedule there is a monthly service charge of $1.85 per kilowatt of demand for demands between 200 kw. and 300 kw.; $1.80 from 300 kw. to 500 kw.; $1.75 from 500 kw. to 750 kw.; $1.70 from 750 kw. to 1,000 kw.; $1.65 from 1,000 kw. to 1,500 kw., and $1.60 for 1,500 kw. and more. There is an additional charge of 1.2 cents per kilowatt-hour consumed. In the Providence suburban territory the energy charge is 1.3 cents. A fuel clause adjustment applies on these rates, as recently outlined in the ELECTRICAL WORLD.

Through a contract with the New England Power Company energy may be supplied to these large customers from the central New England hydro-electric system or from the steam-turbine plant of the Providence company as load and water conditions dictate. Before the rates went into effect on July 1 they were filed with the Rhode Island Public Utilities Commission, and as no opposition developed the new charges were automatically adopted. At a conference between Mayor Gainer, representatives of the Narragansett company and members of the City Council of Providence last month, it was pointed out that the new schedule affects only about twenty of the larger customers, most of whom agreed to the rate advance soon after its necessity was set forth. Under the new schedule energy may be used for motors, electrolytic processes, commercial heating apparatus, battery charging, welding and lighting not exceeding 25 per cent of the total demand.

Model Electric Kitchen and Laundry for Demonstrating Appliances

IN ITS electric shop at Tenth and Chestnut Streets the Philadelphia Electric Company has installed a complete electric kitchen and electric laundry, both of which are practical installations in every respect. The kitchen, as shown in the accompanying cut, is equipped



MODEL ELECTRIC KITCHEN OF PHILADELPHIA ELECTRIC COMPANY

with an automatic electric range, an automatic electric refrigerator and an electric dishwasher. In the laundry the equipment consists of an electric washer, an electric ironing machine and an electric iron of household size.

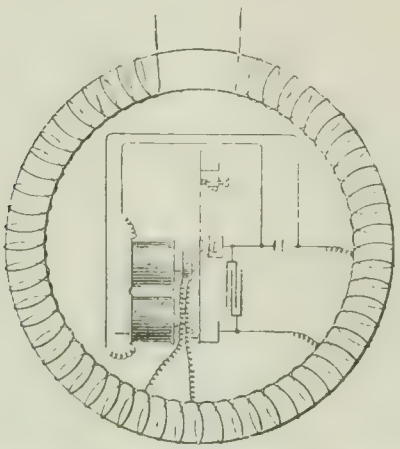
Practical demonstrations in the kitchen and laundry are carried on daily and prospective customers are invited to see the equipment in actual operation. Such demonstrations have been of considerable value in instructing customers in the proper use of appliances at the time they are purchased, thus preventing a great deal of unnecessary trouble that may be caused by the customer not thoroughly understanding the appliance.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Mechanical Rectifiers.—A. SOULIER.—The idea of the mechanical rectifier is old. The classical generators of Brush and Thomson-Houston type were nothing but alternating-current machines provided with rotating commutator rectifiers. More refined devices are now used, operating, however, upon similar principles. They may be built either for single-phase or for three-phase supply. All such rectifiers must be kept in true synchronism, and the brushes must be so adjusted that they open the circuit at the exact moment when the output current passes through its zero value. An interesting type of mechanical rectifier is the oscillating rectifier which makes use of the synchronous motion of a steel tongue in the field of an alternating-current electromagnet. In order not to get a double-frequency oscillation, an initial direct-current excitation is used,



OSCILLATING RECTIFIER FOR CHARGING OF STORAGE BATTERIES

and the alternating magnetic field component is superposed by means of a smaller coupling coil, which is fed from a transformer. The action thus is similar to that of the voice currents in a Bell telephone receiver. In charging storage batteries the direct-current magnetization is taken from the battery itself, so that whatever the battery polarity happens to be, the rectifying tongue will always keep the right phase for charging. When the battery polarity is reversed, the magnetic excitation also is reversed, and thus the oscillating motion will take place in opposite phase, always permitting the correct current half wave to pass through the battery. The necessary phase adjustment is obtained by putting a condenser across the alternating-current input (see diagram), and this arrangement is said to work so quickly that no sparking whatever is to be detected. The contacts of one particular rectifier, after having been in use for seven years, showed no signs of deterioration or misadjustment. The oscillating rectifier gives up to 70 per cent efficiency on battery charging, but utilizes only every other half wave of the supply voltage. It was found that a double-acting rectifier gave lower efficiency, possibly because in the single-wave rectifier the minute hydrogen bubbles will stay on the electrodes during the idle periods and by chemical action cause a deeper penetration of the charge.—*Revue Générale d'Electricité*, May 8, 1920.

Lamps and Lighting

Artificial Daylight for Merchandising and Industry.—G. H. STICKNEY.—The great difficulty in approximating daylight by artificial means is owing mainly to the indefiniteness of the term daylight. Daylight, as it is generally known, is a combination of direct sunlight and reflected skylight and varies widely with the state of the atmosphere, etc. The closeness with which artificial light should approach average daylight varies for different purposes, and the requirements are arranged in three groups by the author. The needs of the silk dyer are most exacting and are closely followed by the requirements of the woolen industry. Other industries involving color matching come in the second classification, while the color matching needs of the merchants are the least exacting and form the third class. The quality of artificial lighting demanded by the first class is produced by expensive and inefficient color-matching units. A more efficient light source of lower color accuracy is provided by the "daylight" lamp. The author mentions specific applications where modified light can be employed.—*General Electric Review*, June, 1920.

Generation, Transmission and Distribution

Allowable Working Stresses in High-Voltage Electric Cables.—C. W. DAVIS and D. M. SIMONS.—It is stated that there is a general belief that the limiting feature in the operation of high-voltage cables is the maximum voltage stress and that if this stress exceeds a value of about 19.5 kv. per centimeter in commercial cables, as made today, the cable will fail in a relatively short time. The authors of this article have compiled extensive tables for both triplex and single conductor cables with paper, rubber and varnished-cambric insulations, which show much higher stresses than 19.5 kv. per centimeter in cables which have been in service for some time. The writers conclude, therefore, that this voltage limit is not the practical one.—*Electric Journal*, July 1920.

The Water-Power Plant at Gösgen, Switzerland.—In a profusely illustrated article, with installments appearing in almost every issue of the *Schweizerische Bauzeitung* for the first half-year 1920, the controlling company, Société Motor, publishes a detailed description of the recently completed hydro-electric plant at Gösgen, on the Aare, in Switzerland. By consolidation of earlier water rights the falls along a 14-km. (8.7-mile) stretch of the Aare are utilized, giving a total fall of from 14 m. to 17 m. (45 ft. to 56 ft.) at 300 cu.m. (10,000 cu.ft.) per second. Great emphasis is put on an accurate description of the hydraulic constructions including all auxiliaries, and various stages of the development are shown on photographs. It is interesting to

note that the first plant in this part of the Aare Valley, built in 1904, was provided with hydraulic storage consisting of a 12,000-cu.m. (423,000-cu.ft.) reservoir, the water being pumped by waste power during the night to this reservoir, which had an elevation of 320 m. (1,050 ft.). In this way the eight-hour capacity of the plant was increased from 2,500 hp. to 3,500 hp. In the present development a total of 45,000 hp. will be delivered by 6 vertical hydro-electric turbo-generator units.—*Schweizerische Bauzeitung*, January to May, 1920.

Traction

3,000-Volt Current Collectors.—W. SCHAAKE.—The writer describes a combination of a double-shoe type of pantagraph trolley and a twin-wire flexibly supported catenary overhead construction which has been developed for the Chicago, Milwaukee & St. Paul locomotives. He states that this arrangement has very effectually solved the problem of heavy current collection.—*Electrical Journal*, July 1920.

Installations, Systems and Appliances

Welded Steel Specials as a Substitute for Castings.—On account of the difficulty in getting large castings during a strike of ironmolders, it has been found possible to build up large pipe fittings, such as elbows, by means of steel plate suitably bent and welded together. It is said that the results were fully satisfactory.—London *Engineering*, May 28, 1920.

Durability of Electric Heaters for Gasoline Distillation.—W. A. JACOBS and E. W. DEAN.—A Bureau of Mines electric gasoline distillation heater and a commercial device sold for the same use have been subjected to life tests at maximum current load. Each failed at the end of approximately 500 hours, the bureau heater through deterioration of the resistance wire and the commercial heater through disintegration of the block of insulating material holding the resistance wire. The bureau heater has an inverted conical resistance element surrounded by a layer of heat-insulating material and mounted in a metal case having a top of hard asbestos (transite) board. The resistance element is a helix of nickel-chromium alloy wire held by a molded core of alundum. The commercial heater has a helix of nickel-chromium alloy wire resting in a spiral groove cut in a depression in a block of heat-insulating composition. The coils of wire are held in place by a special cross of sheet mica.—*Reports of Investigations, U. S. Bureau of Mines*, June 1920.

Electrophysics and Magnetism

Fundamental Phenomena in Electron Tubes Having Tungsten Cathodes, I.—IRVING LANGMUIR.—The phenomena upon which the operation of these tubes depends are so different from those of most electrical devices that confusion has frequently arisen as to the interpretation of their various characteristics, it is said. The author discusses the fundamental factors, such as the electron emission from the filament, the effect of space charge, the disturbances caused by the current passing through the filament, etc., and endeavors to clear up many of the mysterious effects that have been observed.—*General Electric Review*, June 1920.

110,000-Volt Transmission Line from Switzerland to France.—PAUL MEYER.—Up to 20,000 kw. may now be transmitted over a high-tension line 185 km. (115 miles) long from the hydro-electric power station at Gösgen, Switzerland, controlled by the Société Motor, to the substation at Pouxeux, in the Vosges, France. The line was constructed under the auspices of the French Ministry of War, which explains that necessary copper and other material for the line could be obtained in war time. The voltage is 110,000, but temporarily the line is used at 70,000 volts to enable immediate utilization of the power in the distribution systems of the Compagnie Lorraine d'Electricité. The conductors are of electrolytic copper, seven wires twisted, with an external diameter of about 11.5 mm. (0.5 in.) and a sectional area of 78 sq.mm. (154,600 circ.mil). The line is provided with a protecting ground wire of 8 mm. (9.315 in.) diameter and 40 sq.mm. (76,800 circ.mil) area, carried all along the line, on top of the masts. The insulators are metal-cap, eight-unit, chain type, with a dry flashover of more than 150,000 volts and a rain test of 45,000 volts per unit, the mechanical strength being 4,200 kg. (9,250 lb.) The poles are of steel structure, 19.7 m. (64.6 ft.) high and with a standard spacing of 180 m. (591 ft.), which gives a 7-m. (23-ft.) clearance from lowest wire to ground at 35 deg. C. (77 deg. Fahr.). The line was built by the Compagnie Générale d'Electricité on principles similar to those of American practice. Special protective structures are provided at railroad crossings, but, contrary to European usage, telephone crossings are not protected by grounded cages, although at places two insulator chains are used in parallel to give greater safety. The article is profusely illustrated and gives full details regarding the design and construction of the line.—*Revue Générale d'Electricité*, May 1, 1920.

Telegraphy, Telephony and Signals

Telephone from Stockholm to Berlin.—A. HOLMGREN.—Just before the outbreak of the war commercial telephone traffic was established between Stockholm and Berlin. Connections were made over Denmark, and communication took place only between special pay stations provided with Egner-Holmstrom high-current microphones. Recently a new route has been opened, via a direct submarine cable in the Baltic, and connections now are made between subscribers' telephones as far north as Stockholm and Christiania and as far south as Berlin and Frankfort. The cable is of a two-pair paper-insulated type with lead cover and is continually loaded according to the Krarup system. It has a damping of about 1.6. Vacuum-tube amplifiers are used in Malmö and Stralsund. The common telephone-repeater circuits are shown in the article, and an interesting method of designing balancing networks is also described.—*Teknisk Tidskrift, Elektroteknik*, March 3, 1920.

Units, Measurements and Instruments

A Direct-Reading Voltmeter.—ABRAHAM E. BLOCH and L. BLOCH.—Under the auspices of the French Military radio-telegraphy authorities an amplifying voltmeter has been developed which has a remarkably wide field of application, the readings being practically independent of frequency. The instrument works as a multistage amplifier, the last tube also acting as a rectifier and being connected to a direct-current milliammeter. A potential difference of 1 millivolt may easily be observed, and since the voltmeter system has an input impedance of 100,000 ohms, this corresponds to an instrument loss of only ten millionths of a microwatt. A number of interesting applications of the instrument suggest themselves, such as the direct comparison of impedances at radio frequency, etc.—*Bulletin de la Société Française des Electriciens*, January, 1920.

DESPITE the dullness incident to midsummer a good volume of electrical sales is still reported in the East. In the Middle West and on the Pacific Coast sales are slowing up. In the South the heavy building movement has caused a brisk demand to continue.

IMPROVEMENT in the freight situation is reported, though the Atlanta territory is suffering from a car shortage which is holding up the supply of building material. The movement of wheat is now a factor which has to be reckoned with in canvassing the transportation problem.

LABOR is fairly steady. Collections are becoming tight all over the country, but construction reports are encouraging on the whole and an optimistic feeling prevails.

ACTIVITY in the transformer market is reported, power and distribution transformers being sought in about the usual proportions. The new water-power act has opened the door to larger future sales.

ARC-LAMP sales for municipal street-lighting service, which have picked up considerably since war time, are 75 per cent ahead of last year's record, with deliveries at from two to three months.

TRANSFORMERS exported from the United States during 1919 amounted in value to $3,787,851. For the first five months of 1920 they reached $1,482,712, or below last year's figures for the same period.

DEMAND for high-tension insulators has increased to such an extent that it now far outstrips available supply, notwithstanding that production is nearly or quite up to normal.

INCREASED station output from interconnection of the Central Maine Power Company's lines with the Brunswick station of the Bath & Brunswick Light & Power Company reached more than 300 per cent in four years.

RAILROAD electrification, hogged fuel and power-factor correction were extensively discussed at the last two days' session of the convention of the Pacific Coast Section, A. I. E. E., at Portland, Ore.

PROF. ELIHU THOMSON, speaking before the Executive Club of the Lynn works, General Electric Company, expressed the belief that the development of radio-telegraphy and radio-telephony will reach such a state of perfection in time that persons in all parts of the world will be able to converse with ease.

SPOT coal is costing New York City utilities $7,000,000 additional a year, according to testimony before a Senate investigating committee. Attorney-General Palmer is taking steps to end profiteering, and a committee representing the public, the railroads, consumers and wholesalers has been appointed to aid him. The Interstate Commerce Commission has granted for New England a priority order similar to that previously made for the Northwest.

News in Brief

Summary of Market Conditions and of Recent and Approaching Happenings of Importance to the Industry

THE CONVENTION of the Illuminating Engineering Society has been postponed one week and will be held in Cleveland on Oct. 4 to Oct. 7.

THREE more electric utility issues, totaling $4,900,000, are announced, to yield from 7½ to 8.1 per cent.

A POLICY of centralized coal purchasing has been adopted by the Doherty companies.

SHORTAGE of power in Detroit has led to the appointment of a consumers' committee to allot energy to consumers.

RADIO-TELEPHONIC communication between St. Johns, Newfoundland, and a ship 600 miles out has followed on the heels of the establishment of the first commercial radio-telephone service, between the Bell system and the Catalina Islands.

AN ELECTION in Greensboro, N. C., on granting a charter to the Southern Power Company to compete with the North Carolina Public Service Company, now serving that community, resulted in the defeat of the proposition by 990 to 78.

NEW SUBSTATIONS are to be built by the Kansas City Light & Power Company with the object of bringing its generating equipment closer to its load center, and one large substation now in use will be abandoned.

JOHN S. RILLING, a member of the Pennsylvania Public Service Commission, dissenting from an order of that body fixing rates, declared that 7 per cent is no longer a sufficient return for a utility.

AFFILIATION with the Great Lakes Division of the N. E. L. A. has been voted by the Illinois State Electrical Association.

EXPORTS of bituminous coal in the first half of 1920 reached 8,668,000 tons, according to the figures of the Geological Survey. For the month of June exports were 2,175,000 tons, or more than three times the monthly average for 1919.

AN EXTENSION of the Concord (Mass.) municipal lighting plant, to cost $50,000, has been voted in preference to purchasing central-station energy under present conditions of underground-line construction cost.

AGITATION on behalf of the state development and public ownership of water powers in Maine has become virtually a dead issue for the time being. Increasing interest in customer ownership of public utility stocks has improved the situation, to the advantage of the public and existing companies.

OF A BOND issue totaling $1,500,000 the Western States Gas & Electrci Company has placed $200,000 at 96, bringing a yield of 8 per cent.

THE SCHEDULE of fall and winter meetings for the Technical Section of the N. E. L. A. has been completed. It embraces thirty-two committee meetings, divided among its seven technical committees, besides the executive committee meeting.

TWO DIVISION engineers have been appointed by W. S. Murray to assist him as head of the engineering staff of the super-power zone project and a third will soon be designated. Additional advisory board appointments have also been made.

CALVIN COOLIDGE in his speech accepting the Republican nomination for the Vice-Presidency declared for needed development of water-power and other natural resources, but warned against permitting speculation in them.

SUBSTANTIAL rate increases have been granted to West Virginia electric companies by the Public Service Commisison of the state.

REFUSAL by the city authorities of Blackfoot, Idaho, to pay the 10 per cent increase granted by the Public Utilities Commission of the state to the Idaho Power Company has paved the way for a test of the commission's power.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Federal Power Commission Agrees on Organization

THE NATIONAL ORGANIZATION of the Federal Power Commission was agreed upon at a meeting of the commission July 27. It is to be composed of the following subdivisions: Engineering, accounting, statistical, regulating, licensing, legal and operation. The duties of the executive secretary and the engineer officer were outlined in detail for administrative purposes. The country has been divided into five districts with headquarters as follows: No. 1, Washington; No. 2, St. Paul; No. 3, St. Louis; No. 4, Denver; No. 5, San Francisco. Branch offices will be maintained in each district.

The return to Washington of Secretary Meredith is expected to be followed very soon by increased activity on the part of the Federal Power Commission. A number of important matters necessarily have been held in abeyance until the secretary can join in their decision. Great care is being exercised in deciding on the wording to be used in the form of application. It is realized that this is one of the most important of the documents which it will be necessary to draw up.

Attorney-General Takes Steps to End Coal Profiteering

ATTORNEY-GENERAL PALMER was in New York Tuesday conferring with representatives of producers, dealers and consumers of bituminous coal in an effort to check profiteering. A committee was selected by Mr. Palmer representative of the public, the railroads, consumers and wholesale dealers, with the producers' representatives to be named later. John W. Lieb, vice-president of the New York Edison Company, was selected to represent the consumers. A statement issued later by this committee was to the effect that it had not been asked to fix prices but rather to ascertain a maximum margin of reasonable profit beyond which prosecutions under the Lever act will be commenced by the Attorney-General's office.

One of the results which the committee hopes will follow, in addition to a material reduction in bituminous coal prices, is a larger percentage of deliveries under contract prices with a subsequent reduction in spot coal offerings.

Another Step Toward Transoceanic Radio Telephony

ON THE heels of the announcement that the first commercial radio-telephone service had been established, from the Bell System to the Catalina Islands, comes the record of telephonic communication between the Marconi radio plant at St. Johns, Newfoundland, and the steamer Victorian, about 600 miles (1,000 km.) at sea. A phonographic concert on shipboard was plainly heard by those near the receiver at St. Johns.

While the St. Johns test involved the use of special apparatus and the results cannot yet be repeated on a commercial basis, it marks an important advance in the art, and it is believed by radio engineers that such communication will soon be commercially practicable. The good results in this instance are attributed to the use of vacuum tubes of higher power. It is worthy of note, however, that the transmission of speech over 600 miles was in the summer time, when atmospheric conditions are least satisfactory.

Regarding the extension of telephone service to the Catalina Islands by the American Telephone & Telegraph Company, 30 miles (50 km.) of which are by radio, it is said that conversation is no more difficult than over any other long-distance line and that it is not evident to those conversing that there is a gap.

Spot Coal Costing New York Utilities an Additional $7,000,000 a Year

NEW YORK CITY utilities, it was testified last week before the Senate committee on reconstruction and production, of which Senator William M. Calder is chairman, unable to obtain coal on contracts, have been forced to buy in the open market at an additional cost of more than $7,000,000 a year

John W. Lieb, vice-president of the New York Edison Company, told the committee that the Edison company and its affiliated companies had contracts for 1,535,443 tons of coal, but that since April 1 they had received only 52 per cent of the amount their contracted deliveries called for. The average daily consumption he estimated at about 4,000 tons. The company has storage yards at Edgewater with a capacity of 250,000 tons. By this date in normal times the reserve has been built up to about 200,000 tons. The peak of storage is reached about Oct. 1, but instead of mounting toward that peak, he said, the reserve had been dwindling until there is practically none. The company now has a reserve of 49,981 tons, largely because it had gone into the open market and bought spot coal.

Mr. Lieb said the company for the first time in its existence had had to get 35,000 tons at Hampton Roads and bring it to New York at a cost of more than $12 a ton. Even with coal arriving in New York in sufficient volume to allow 4,000 tons for immediate use, the situation, when cold weather comes, will be acute. Mr. Lieb said the daily receipts now should be 5,800 tons to enable the company to build up its winter reserve.

Speaking as of June 26, Mr. Lieb said that prices of spot coal ranged from $7.50 to $10.25 a ton, but that more recently it had sold as high as $12 at the mines. Ordinary prices, he testified, run between $4.25 and $4.75 at the mines.

Senator Calder is planning to hold similar meetings of this committee on the coal question in various other important centers of the country.

Consumers' Committee Allots Energy to Power Users in Detroit

THERE has been an acute shortage of power in Detroit for some time, and the Detroit Edison Company has had to ask its factory customers to cut down their power requirements wherever possible. Within the past month the company carried a peak load of 218,000 kw., which is considerably in excess of the total installed capacity of its plants. It has now become necessary to take a 45,000-kw. unit out of service to await new parts not yet completed by the manufacturer. This has decreased the available generating capacity by about 20 per cent and necessitated a still further curtailment of the use of energy by all large users.

To handle this situation a committee of five, made up of representatives from the power users and the Chamber of Commerce, has been formed. This committee determines how much energy each factory may take and also designates the hours of the day during which power shall be used. Commenting on the situation, Alex Dow, president and general manager of the Detroit Edison Company, stated to a representative of the ELECTRICAL WORLD that the work of the committee in allotting power to approximately a hundred large users had been carried out more satisfactorily than could have been done by the company. The committee was able to deal impartially with all consumers and succeeded in adjusting the morning peak load to 156,000 kw. as compared to the recent peak of 218,000 kw.

New England Gets Coal Priority Order

THE Interstate Commerce Commission this week ordered, effective on Monday, Aug. 2, coal priority for New England similar to that ordered ten days previously for the Northwest. The object of the order is the filling of the fuel requirements of New England for the summer and following winter months. The coal is to be moved from Pennsylvania, Maryland, Virginia and West Virginia mines to tidewater pools, from which coal may be shipped out for use in New England. This is taken to mean a virtual embargo against the export of coal, which in recent months has reached record totals.

This order, however, is not to interfere with the priority recently granted to public utilities.

Record Coal Exports in June

IN VIEW of the coal shortage that has been so generally felt by utilities and others in the past three months, the figures made public this week by the Geological Survey showing the exports of coal during the first six months of 1920 are of great interest. The exports have been increasing, and in June last, when the shortage began to be so acute as to warrant the famous open-top car order of the Interstate Commerce Commission, the exports of bituminous coal reached a record of 2,175,000 net tons. If statistics were available, it would probably be found that this figure is not far different from the amount of bituminous coal used in the electric light and power industry during June.

The figure might well be compared with the monthly average for 1918 of 312,000 tons and the monthly average for 1919 of 691,000 tons. Up to July 1 8,668,000 tons of bituminous coal had been exported in 1920, the monthly figures being: January, 897,000 tons; February, 718,000 tons; March, 1,033,000 tons; April, 1,093,000 tons; May, 1,942,000 tons, and June, 2,175,000 tons.

Doherty Properties Adopt Centralized Coal Purchasing Plan

PURCHASING coal and following up its delivery under existing conditions has required so much of the time of the managers of the Doherty Ohio properties that they have arranged for the handling of all their coal requirements through a centralized department. For this purpose the coal buying organization of the Toledo Railway & Light Company will be expanded. R. E. Connolly, who in the past has had charge of the coal purchases for the Toledo and Acme companies, will be in charge of the work in the field.

The companies affected are the Toledo Railway & Light Company and the Acme Power Company in Toledo, Richland Public Service Company in Mansfield, Massillon Electric & Gas Company, Alliance Gas & Power Company and the Trumbull Public Service Company at Warren, Ohio.

I. E. S. Convention Postponed to October 4-7

BECAUSE the American Legion is to hold its convention in Cleveland during the last week in September the Illuminating Engineering Society has postponed the date for its annual convention one week, to Oct. 4-7. The program is in the hands of Preston S. Millar of the Electrical Testing Laboratories, who expects to be able to make a preliminary announcement early in August. The convention committees have been appointed and a number of papers have already been received.

Adirondack Power Merger Completed

CONSOLIDATION of the former Mohawk-Edison company and the Adirondack Electric Power Corporation into the Adirondack Power & Light Corporation was completed July 23 in conformity with orders of the Public Service Commission of New York. The merged properties operate 300 miles of interconnected transmision line in New York State, extending from Glens Falls south to Schenectady and Albany and west to Oneida. At the present time the company has in operation twenty-one substations, 43,340 kw. in hydro-electric and 6,750 kw. in steam generating plants and will shortly commence the construction of a new hydro-electric plant of 27,500 kw. on the Mohawk River near Amsterdam, N.Y. The aggregate gross income of the consolidated companies for the past year was $4,139,975.

Three More Utility Issues, Totaling $4,900,000

SINCE last week three more issues of electric light and power utility securities have come on the market, totaling $4,900,000. The West Penn Power Company's $3,000,000 of first mortgage 7 per cent bonds, due 1946, are being sold at 94½, yielding 7½ per cent. The Continental Gas & Electric Corporation is issuing $1,400,000 of two-year collateral trust 7 per cent notes at 98, yielding 8.1 per cent, and the Cincinnati Gas & Electric Company has issued $500,000 of 7 per cent notes, due 1922, at 97⅞, yielding 8 per cent.

N. E. L. A. Technical Section Meetings

THE schedule of meetings of the Technical Section of the National Electric Light Association has just been completed and is as follows:

Date	Committee	Meeting Place
1920		
Sept. 11	Hydraulic power	Spokane, Wash.
Sept. 20	Meters	Chicago, Ill.
Sept. 20	Prime movers	Chicago, Ill.
Sept. 20	Underground systems	Detroit, Mich.
Sept. 21	Inductive interference	Chicago, Ill.
Sept. 21	Meters	Chicago, Ill.
Sept. 22	Electrical apparatus	Chicago, Ill.
Sept. 22	Overhead systems	Chicago, Ill.
Sept. 23	Overhead systems	Chicago, Ill.
Oct. 18	Prime movers	Philadelphia, Pa.
Nov. 11	Underground systems	Pittsburgh, Pa.
Nov. 15	Inductive interference	Salt Lake City, Utah
Nov. 15	Prime movers	Salt Lake City, Utah
Nov. 16	Meters	Salt Lake City, Utah
Nov. 16	Overhead systems	Salt Lake City, Utah
Nov. 17	Electrical apparatus	Salt Lake City, Utah
Nov. 17	Meters	Salt Lake City, Utah
Nov. 17	Overhead systems	Salt Lake City, Utah
Nov. 18	Hydraulic power	Salt Lake City, Utah
Dec. 7	Meters	Buffalo, N. Y.
Dec. 8	Meters	Buffalo, N. Y.
Dec. 9	Meters	Buffalo, N. Y.
1921		
Jan. 17	Hydraulic power	New York City
Jan. 17	Underground systems	New York City
Jan. 18	Inductive interference	New York City
Jan. 18	Meters	New York City
Jan. 18	Prime movers	New York City
Jan. 19	Electrical apparatus	New York City
Jan. 19	Meters	New York City
Jan. 19	Overhead systems	New York City
Jan. 19	Executive	New York City
Jan. 20	Overhead systems	New York City
Feb. 21	Prime movers	Schenectady, N. Y.

All technical committee meetings will start promptly at 10 a.m., and the executive committee meeting will be held in the evening, at the call of the chairman of the Technical Section.

Super-Power Zone Engineering Staff Almost Completed

A GENERAL discussion of the problems involved characterized the first meeting of the super-power zone engineering staff, which took place at the Geological Survey's New York office July 23. In addition to members of the engineering staff, the meeting was attended by George Otis Smith, the director of the Geological Survey, and N. C. Grover, the Survey's chief hydraulic engineer. Considerable attention was given to the type of data sheets which will be used.

W. S. Murray, head of the engineering staff, has announced the appointment of two division engineers, and the third probably will be designated within a few days. Those selected are Lorin E. Imlay and Henry W. Butler. Mr. Imlay will have charge of the power transmission division and Mr. Butler will be division engineer of industries. Henry Flood, Jr., has been selected as the engineer secretary of the engineering staff. Harold Goodwin has been appointed assistant industries engineer and L. A. Whitsit assistant power transmission engineer.

Additional appointments to the advisory board are announced as follows: J. B. McCall, representing the National Electric Light Association; John H. Pardee, representing the American Electric Railway Association, and A. T. Hardin, vice-president of operation of the New York Central Railroad, representing the New York railroads.

The work of the engineering staff is now in the formative process of determining the most condensed form of data sheets to be taken up with the central stations, isolated plants and railroads to determine their power-load curves and the direct allocation of load centers relating to the three above interests for the purpose of determining the cost of power production as between an interconnected super-power system and the present individual systems.

The basic principle of the investigation and report is to be a clear-cut statement as to (1) total fuel conservation, (2) the adequate supply of generating capacity to permit normal growth of industries and transportation, and (3) a guarantee of reliability of power service to consumers.

Coolidge Comes Out Against Water-Power Grants for Speculation

IN HIS speech of acceptance of the Republican vice-presidential nomination this week Calvin Coolidge told of the need for conservation of natural resources which will permit development in the public interest. He warns, however, against the use of public grants for private speculation. In this connection he said:

"Diminishing resources warn us of the necessity of conservation. The public domain is the property of the public. It is held in trust for present and future generations. The material resources of our country are great, very great, but they are not inexhaustible. They are becoming more and more valuable and more and more necessary to the public welfare.

"It is not wise either to withhold water power, reservoir sites and mineral deposits from development or to deny a reasonable profit to such operations. But these natural resources are not to be turned over to speculation to the detriment of the public. Such a policy would soon remove these resources from public control and the result would be that soon the people would be paying tribute to private greed. Conservation does not desire to retard development. It permits it and encourages it. It is a desire honestly to administer the public domain. The time has passed for private speculation."

Interconnection More Than Triples Output of Plant

INCREASED output resulted from the interconnection of the Central Maine Power Company's lines with the Brunswick station of the old Bath & Brunswick Light & Power Company, according to a statement made by W. S. Wyman, treasurer and general manager of the former company, at a recent hearing before the Maine Public Utilities Commission. In 1915 the Brunswick plant produced about 2,500,000 kw.-hr.

"We expected," said Mr. Wyman, "to get 5,000,000 kw.-hr. out of this station after connecting it with our system, owing to the better load factor. Actually we obtained in 1919 8,000,000 kw.-hr. from that station.

Mr. Wyman pointed out that at Lewiston the Deer Rips plant of the former Androscoggin Electric company is using about 18,000,000 kw.-hr. from a 30-ft. (9-m.) head, and that when this station is interconnected with the Central Maine system by a new trunk line now under construction from Farmingdale to Deer Rips the plant will be able to deliver about 50,000,000 kw.-hr. if the load conditions on the combined systems are favorable. A similar situation exists at Skowhegan, where a 32-ft. (9.6-m) head is being developed on the Kennebec River. The average flow there closely resembles that of the Androscoggin at Deer Rips. An 8,000-kw. steam auxiliary station of the oil-burning type at Farmingdale is expected to suffice for the combined systems, with a 1,500-kw. reserve plant at Lewiston.

West Virginia Electric Companies Get Increase in Rates

AN INCREASE of 30 per cent in rates has been granted to the Appalachian Power Company by the Public Service Commission of West Virginia to continue until May, 1921. This company serves Bluefield and other West Virginia towns as well as supplying mining and other companies in its territory. The commission also authorized the Princeton Power Company to charge $1.56 a kilowatt-hour. To the Wheeling Electric Company it granted the right to add a surcharge of 27 per cent to its monthly bills from July 1 to Oct. 31, pending investigation by the commission.

Railroad Electrification and Hogged Fuel Discussed by Pacific A. I. E. E.

A PAPER on "Electrification of Railroads," by R. Beeuwkes of Seattle, chief electrical engineer of the Chicago, Milwaukee & St. Paul Railway, was a feature of the second day's session of the Pacific Coast Section, American Institute of Electrical Engineers, at Portland, Ore., of which the opening meetings, on Wednesday, July 21, were reported last week. Instructive papers on hogged fuel, on bridge measurements of alternating currents and on power-factor correction were also presented at the convention, which closed on Friday, July 23.

In the discussion of Mr. Beeuwkes' paper the opinion was expressed that there is at present no basis for standardization of voltage. W. J. Davis believed each case should be determined upon its own merits. On single-track lines 3,000 volts is the most economical, he held; for two-track lines, 1,500 volts, and for four-track lines, 750 volts. These voltages are such that doubling or quadrupling the track would permit of the equipment being readily cut over for lower voltages. There appears no real necessity for standardization as between different roads, according to views expressed, although locomotives are capable of running nearly 1,000 miles without stopping. Mr. Beeuwkes stated that the cost of an increase in voltage from 3,000 to 5,000 would be greater than the increased cost of feeder copper for handling 5,000-ton trains.

Opinion was unanimous that railroads should purchase power from power companies because more feed points would thus be obtainable.

Ownership of transmission lines paralleling track should be vested in the railroad, Mr. Beeuwkes contended, because the trolley maintenance crews could maintain transmission lines at minimum additional expense. Arthur C. Pratt of the Montana Power Company agreed with this contention, but thought a power company should have the use of the lines for tying its own stations together and for supplying other consumers. Railway transmission lines should not take the place of transmission buses, in the opinion of R. F. Hayward of Vancouver, B. C. A further argument for ownership of transmission lines by the railroad is that the control of switching is thereby kept by the railroad.

It was brought out that without load-limiting devices on the Chicago, Milwaukee & St. Paul road the instantaneous demand would be 50 per cent above the limited value. The limit is determined by the point of greatest economy, considering the slowing up of trains and the extra expense due to increased trainmen's wages as against the higher cost of power at lower load factors. Regeneration has, it was asserted, returned 10 per cent of the power to the line. Auxiliary equipment consumes a portion of this regenerated power.

According to J. C. Clarke, electrification will postpone double-tracking ten to fifteen years, and interest on second track for that period would overbalance the cost of electrification.

Mr. Beeuwkes stated that six months' operation on one division caused a power expense of $113,000 against $270,000 for fuel. Any road, he said, could exactly calculate the possible savings under any given condition. The cost of trainmen and enginemen with electric equipment was $48,000 in six months, and the cost with steam was $85,000. Repairs for steam locomotives cost double those for the electric. Automatic substations have been investigated and will be installed on the C., M. & St. P., thereby further reducing cost.

"Hogged Fuel, Fuel Oil and Pulverized Coal" was the topic of a paper by Darrah Corbet. As yet hogged fuel is not sufficiently reliable to be used exclusively, according to L. T. Merwin, general superintendent of the Northwestern Electric Company, Portland. Many interruptions of fuel supply within the plant are due to breakage of the conveyor system, so the Northwestern company maintains heated oil under pressure for quick change-over, which can be effected in two minutes. Oil burned in hogged-fuel furnaces gives lower efficiency than oil in oil furnaces, Mr. Merwin said.

J. H. Polphemus, general manager of the port of Portland, stated that hogged fuel caused $3,000 monthly savings on a dredge and that there was 10,000 lb. (4,500 kg.) evaporation per fuel unit or seven pounds evaporation per hour per square foot heating surface (0.29 kg. per sq.m.). The opinion was expressed by Messrs. Merwin and Corbet that short straight grate bars are preferable to any others and that no difficulty would result from distortion provided there were sufficient supports. The ash pit could be flooded to reduce the temperature of the lower surface of grates. Stokers are too expensive at present prices of fuel.

Mr. Corbet was of the opinion that the wood-moisture content was independent of climatic conditions and entirely dependent on the kind of wood and its treatment before hogging. He thought some moisture was preferable, as extremely dry wood flashed in the furnaces and also introduced an undesirable hazard in storage. A mixture of wet fuel with refuse from kiln-dried wood gives the best firing results.

Japan Is Soon to Have a 160-Kv. Transmission Line

A 140-MILE transmission line between Seto and Osaka, Japan, now under construction, will be operated at 160,000 volts, three-phase, 60 cycles, with neutral grounded through resistance. This is part of an extensive hydro-electric development program involving an ultimate capacity of 200,000 kw. and transmission lines totaling more than 400 miles in length. The project is being undertaken in three successive steps of 30,000 kw. for the first, 70,000 kw. for the second and 100,000 kw. for the third development. All of the power plants will be operated eventually in parallel over two circuits on a single steel-tower line having a capacity of 100,000 kw.

The first development now under way is the construction of two plants, one of 9,000 kw. at Mosegawa and one of 19,000 kw. at Seto.

Chicago Electrical Men Effect Wage Settlement

THE strike on the surface car lines of Chicago which began without warning on Thursday morning, July 15, ended as abruptly on Sunday, July 18, after demoralizing the surface car service completely for one day and partially for three days and threatening strikes that would have affected the city lighting service and industrial plants. The city electrical inspection service was affected by a demand for an increase of $500 per year for forty-three electrical inspectors and $300 per year for twenty-three maintenance men. It was announced that these demands were met, but that when the money already appropriated was spent the men would have to be laid off, though this would not occur until Nov. 15. Action by the city finance committee approving the new rates must be taken before they are effective. In the street-car settlement line foremen get the rate offered by the company of $10 per day, $9 is to be paid to linemen and $7 to helpers, while substation men will receive $120 per month for the first year, $125 for the second, $130 the third and $145 the fourth. Operators will get $210 and $200, the figures offered by the company. Union demands were $225.

Greensboro, N. C., Stands by Its Local Electric Company

AN INTERESTING instance of popular support for an established public utility company is reported from Greensboro, N. C., where at a recent election a franchise sought by a competing company was refused by a vote of 990 to 78. The company which received this signal mark of confidence is the North Carolina Public Service Company. Between this company and the Southern Power Company, from which it purchases energy, a dispute over rates exists which is now awaiting determination in the Superior Court. The local company charges the Southern Power Company with discrimination, and the power company as part of its legal fight sought the Greensboro franchise.

According to R. J. Hole, vice-president and general manager of the North Carolina Public Service Company, the citizens of Greensboro, scorning any possible financial saving that the entry of the larger company might bring, rallied to the support of their local utility. Merchants, professional men, labor unions, the colored clergymen and others of influence made public declarations in its favor, and the result was the overwhelming victory above recounted.

Powers of State Commission to Modify City Franchise

RESTRICTIONS imposed by the public utilities law on the powers of the cities of Utah to control by franchise utilities operating within their boundaries were defined by the Supreme Court of Utah in deciding the case of Murray City against the Utah Light & Traction Company and the Utah Power & Light Company. The suit was brought by Murray City to test the legality of a ruling of the Public Utilities Commission in violation of the rate provisions of the franchise granted by the city to the traction company. It was appealed from the district court to the Supreme Court. That body upholds the district court, pointing out that in a Salt Lake City case against the same company it held that the state retained the power to modify or annul a charge for services rendered by a public utility and that any such order made by the commission is binding. The court explicitly refrains from expressing any opinion on the right of the city to cancel the franchise for failure on the part of the company to comply with other of its provisions, that question not being before it.

Michigan Section, N. E. L. A., Arranges a Diversified Program

THE tentative program for the seventh annual convention of the Michigan Section of the National Electric Light Association, which will be held on Aug. 24 to Aug. 26 at Ottawa Beach, Mich., is as follows:

Tuesday, Aug. 24, 10 a.m.—President's address, W. M. Lewis; "Legislation," by W. M. Smith, chairman Michigan Public Utilities Commission; address by M. J. Insull, president N. E. L. A.; "The Future of the Public Utility," by M. H. Aylesworth, executive manager N. E. L. A.; address by B. J. Mallaney, Illinois Committee on Public Utility Information.

2 p.m.—"Proper Maintenance of Electric Meters," by J. C. Langdell, Consumers' Power Company; "Standardized Construction," by B. L. Huff, Consumers' Power Company; "Boiler-Room Efficiency," by R. C. Felger, Detroit Edison Company.

8 p.m.—Illustrated talk, "Journeys in Cloudland," by M. Luckiesh, National Lamp Works Laboratories.

Wednesday, Aug. 25, 10 a.m.—"Home Rule Versus State Control," by W. J. Hagenah; "Light in the Home," by M. Luckiesh; "Standardization and Application of Electric Equipment as Applied to Farms," by Prof. A. R. Sawyer, Michigan Agricultural College; "Dishwashers and Other Labor-Saving Devices," by C. H. Bay, Detroit Edison Company.

Thursday, Aug. 26, 10 a.m.—"Machine Billing and Ledger Posting," by C. H. Hunsburger, Consumers' Power Company; discussion by J. D. Jacobus, Detroit Edison Company; "The Value of Statistics," by H. A. Snow, Detroit Edison Company.

Entertainment features have been arranged for Tuesday and Wednesday afternoons, and on Wednesday evening there will be a dinner, with an address on "Publicity" by J. B. Wootan of New York City.

Kansas City Company to Build New Substations as Measure of Economy

IN ORDER to insure a better distribution of power and obviate the present heavy transmission losses, the Kansas City (Mo.) Light & Power Company is about to begin work on plans to bring its generating system near its main load, instead of having it at one end of the system as heretofore. With this economical end in view it will expend approximately $500,000 in the next two years in the installation of five new substations in the downtown district between Oak and Wyandotte and Seventh and Fifteenth Streets. The big substation at Fifteenth and Walnut Streets is to be abandoned as facilities for operation under the new substation scheme develop.

The stations will be equipped with automatic motor-generator sets. The company has already purchased one 2,500-kw. rotary converter and a standard 1,500-kw. rotary is to be used in the R. A. Long station. The equipment in use at the Fifteenth Street substation has been 23-cycle; the new substation will be designed for 60 cycles.

Pacific Gas & Electric Sells $10,000,000 of Gold Notes.—It is announced that the issue of $10,000,000 in five-year 7 per cent convertible gold notes of the Pacific Gas & Electric Company has been entirely disposed of, more than $7,000,000 being taken in California.

A Radio Relay Test.—A wireless message was recently sent from Dubuque, Iowa, to Minneapolis, Minn., by a circuitous route involving its relay through twenty-six stations in five states, the total distance thus covered being 3,000 miles. The time taken was two hours.

Railroad Electrification in Japan.—A bill has been introduced into the Japanese Parliament intended to bring about the conversion of steam railroads to electric motive power. It is proposed to organize the Imperial Electric Railroad Company with a capital of $50,000,000, of which one-half will be invested by the government.

Water-Power Resources of Greece.—A syndicate of Greek banks in association with French investors is about to conduct an extended investigation into the hydro-electric possibilities of Greece. The syndicate will be financed by the Greek government, which, though it is not bound to accept the proposals made by the investigators, is thoroughly committed to the policy of water-power development.

Flat-Rate Charges Arouse Protest in British City.—The Corporation of Sheffield, England, has recently adopted a flat-rate system of charges for electricity which has naturally called forth vigorous opposition in that city of manufacturers. The assertion is made that if the users of power have to pay the same rates as lighting customers, orders for electrification of factories will be canceled and use of the city's energy largely discontinued.

Increase Allowed to Atlantic Coast Company.—The New Jersey Board of Public Utilities has granted to the Atlantic Coast Electric Light Company an increase of its base rate in Asbury Park, N. J., and contiguous places from 10 cents to 12 cents a kilowatt-hour, which the board says is virtually a return to a former rate and not excessive. It has also permitted the company to make a connection charge of $3 for each customer, which is to be refunded if the customer remains at the shore more than six months.

Electricity Barred from California Mines.—Yielding to the protests of many farmers in the lower part of Nevada County, Cal., the Railroad Commission of California has denied the application of the Pacific Gas & Electric Company for permission to install electric power in the Empire and North Star mines. In doing so the company would have discontinued the existing water-power supply at the mines and would thus, it was asserted, have deprived the farms of the irrigation service furnished by the distribution of this water after it had served its first purposes.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Hydro-Electric Development in Arkansas.—Final plans of the Arkansas Hydro-Electric Development Company, which contemplates the expenditure of $3,000,000 in White and Cleburne Counties, Ark., in the development of a hydro-electric plant on Little Red River, are for the erection of two power houses and 130 miles of transmission line. One power house will have an installation rated at 10,500 kw. and the other power house one rated at 6,000 kw. The project calls for the development of 22,000 hp. and the construction of two dams 500 ft. and 550 ft. in height.

South Dakota's Water-Power Resources.—Finding fault with an official map of water-power resources reproduced in the New York *Times*, which gives to South Dakota only one-tenth of 1 per cent of the nation's total, Doane Robinson of Pierre, S. D., writes to that newspaper: "Briefly, South Dakota is among the big commonwealths in potential water power, and we are well on our way in the preliminaries which will develop 500,000 commercial horsepower, or about 1 per cent of the total available in the United States, a development which will save the consumption of 2,000,000 tons of coal annually."

Union Opposition to Electricity in Mines.—According to a dispatch to the Philadelphia *Record*, Thomas Kennedy, president of District No. 7, United Mine Workers, has asserted that he contemplates further activities for inducing the next Pennsylvania Legislature to consider prohibition of the use of electricity in mines, as proposed a few years ago when a mine law code was under debate. Mr. Kennedy cited as an instance of the alleged danger in the use of electricity a fire at the Harwood plant which furnishes power to a score of towns and collieries. The service was suspended from 1 to 11 p.m., and Kennedy declared such an occurrence might at any time cause hundreds of fatalities through failure of ventilating systems driven by electricity to work.

The Minneapolis Dam.—As a result of passage by Congress of the water-power bill, St. Paul, Minneapolis and the University of Minnesota, as members of the Municipal Hydro-Electric Corporation, are, says the *Improvement Bulletin* of Minneapolis, in a position to acquire the power created at the high dam in that city. Under the bill, if the government does not erect the high dam plant, the rights may be obtained through lease by the municipal corporation or by private corporations. The municipal corporation has authority to finance the project through legislative enactment. Engineers who made the investigation for the War Industries Board estimated that the plant would cost between $1,250,000 and $1,500,000. It is believed that under present conditions the plant would cost at least $2,000,000. The report also showed that the maximum power to be developed to high-water stages was 12,000 kw. and the minimum 3,000 kw. George R. Smith, former congressman, who led the fight for the measure in Congress in 1916, said: "Expenditure of the money necessary to build and equip the power plant and provide distribution of the electricity, even in these abnormal times, would be warranted, although it might be advisable to wait a short time. The foundation the government built is worth half a million dollars today. To erect a superstructure and equip it with machinery would not cost more than $500,000. But the distribution would be the greater element of expense."

An English Farm Wind Turbine.—Electric plants driven by wind power are to be found in various countries of northern Europe. The *Electrical Times* of London contains an account of a motor being erected on an English farm to replace an oil-driven set. When completed it will drive a dynamo, pump water and do other farm work. Wind turbines like the one in question are from 6 ft. to 20 ft. in diameter, with single or multiple motors, and their power may be increased by adding more vanes. The tower is of steel, fitted with ladder and platform and with veering arrangements to keep the face of the motor square to the wind and automatic gear to cut off wind above the desired velocity. For use with a dynamo batteries are necessary for storage of the energy. The initial outlay at present high prices is about £100 for a turbine developing 1 hp. in a 15-mile-per-hour wind. Fuel costs nothing and upkeep little.

More Rate Increases Granted in Various Sections.—The Board of Electric Light Commissioners of Meriden, Conn., has approved an advance in the rates of the Meriden Electric Light Company of approximately 20 per cent for a three-month period which began July 1. The Public Service Commission of West Virginia has increased the rates of the Hartland Power Company of Clay County, now in the hands of a receiver, by permitting a surcharge of 125 per cent on monthly bills for power used based upon a primary charge and 150 per cent on bills for power based upon a secondary charge. The city of Fort Wayne, Ind., and the Indiana Service Corporation have, with the approval of the Indiana commission, agreed upon a fuel clause providing that for each 5-cent increase in the average monthly cost of coal above $3.60 per ton delivered at the power houses there be added to the monthly bill 0.15 mill per kilowatt-hour, with a corresponding decrease in case the cost of coal is less than $3.40 a ton.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Apportionment of Taxes of Utility Operating Two Departments.—In the case of a utility operating both an electric and a water department, the taxes should, a decision of the West Virginia Public Service Commission affirmed, be borne by each department in proportion to its respective value.

Disconnection Charge Authorized.—Complaint being made concerning a charge of $1 made upon the disconnection of gas or electric service by the People's Power Company in cases where the consumer had used the service less than one year at that location, the Illinois Public Utilities Commission found the charge to be justified by the expense involved, although, owing apparently to an oversight, it had never been included with the scheduled charges on file with the commission.

Neglect to Add Surcharge Does Not Prevent Collection Later.—The Railroad Commission of California in a recent decision held that the fact that the Coast Valleys Gas & Electric Company, through an oversight, neglected to add the surcharge allowed by the Railroad Commission on bills for power furnished a mining company constituted no reason why the mining company should not pay the surcharge when the bill was presented. The commission dismissed the complaint brought against the power company by the mining company because of the power company's effort to collect the surcharge in a lump sum.

Powers of Indiana Commission.—Inasmuch as the Indiana statute contains no emergency clause authorizing regulation of service, the Public Service Commission disclaims power to relieve a utility from the standards of service set up in an unsurrendered franchise. However, notwithstanding the maximum rates provided in franchises, the commission has the power temporarily to increase such rates to meet emergency situations and may also increase minimum rates or establish a minimum charge if none exists. The commission, in its own opinion, does not have the jurisdiction to require a utility to make extensions within a municipality.

Protection from Competition.—On complaint of a customer of the Bucks County Electric Company whose service had been discontinued because he violated a rule of the company forbidding him to use any other electrical energy than that furnished by the company without first obtaining its consent, the Pennsylvania Public Service Commission has ordered the rule in question rescinded, holding it to be "unjust and unreasonable." "The utility may," the commission said, "adopt rates which will secure it an adequate and reasonable return for the service which a particular class of customers demands, but it cannot refuse its service simply because the customer does not purchase all of his electricity from it."

What Constitutes an Electric Utility.—In dismissing the complaint of the Union Electric Light & Power Company against the Tibre Power Company, the Public Service Commission of Missouri has found that an industrial plant selling surplus electrical energy upon its own premises to a few consumers within a limited area is not a public utility subject to the jurisdiction of the commission. The crossing of a public street with the transmission line is not the controlling factor.

Missouri Commission Grants Variable Rates Based on Costs of Coal and Labor.—Permission has been granted by the Missouri Public Service Commission to the Cupples Station Light, Heat & Power Company of St. Louis to increase its rates for all classes of service by means of fuel and labor clauses operating as a sliding scale. These clauses took effect on July 3. By their provisions, which are similar to those of an order obtained by the Union Electric Light & Power Company a year ago, 0.045 per cent per kilowatt-hour shall be added or subtracted for each increase or decrease of 1 cent or major fraction thereof above or below the cost of 14.5 cents per 1,000,000 B.t.u. for coal delivered in the company's bunkers, and 0.012 cent per kilowatt-hour shall be added or subtracted for each increase or decrease of 1 cent or major fraction thereof above or below an equivalent hourly wage of all employees (excluding department heads and officers) of 58 cents an hour.

Contract Limitation of Service to Installations of 75 Kw. Unconstitutional.—A contract entered into between the Niagara & Erie Power Company and the town of Dunkirk for the extension of electric service now furnished to the municipal plant of the city of Dunkirk into the surrounding town has been declared unconstitutional by the Public Service Commission for the Second District of the State of New York, as contravening the transportation corporations law of the state, which forbids discrimination between customers. The discriminatory clauses of the franchise which the commission disapproves are one forbidding the company to furnish electrical energy to consumers whose requirements for power are less than 75 kw. and one specifying that the company shall not be compelled to supply consumers of 75 kw. or more unless "a reasonable return upon the necessary investment" shall be received. Under the contract the company could not sell its product for redistribution to any except the city of Dunkirk, its other customers to be such as the city was unable or unwilling to supply and business with them to be limited by the provisions just stated.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Eminent Domain and Electric Utilities.—The Commission of Appeals of Texas has declared that the laws of that state in providing for condemnation of land by gas and electric companies do not extend to such companies the provision by which railroads, pipe lines and telegraph and telephone lines are enabled, in case of a suit against them by a landowner, to litigate the question of condemnation, the provision alluded to being a special one and not included in the law that governs gas and electric companies. (222 S. W. 217.)

Declaration of Death of Child from Uninsulated Wires Furnishes Legal Cause of Action.—In Love vs. Virginian Power Company, where damages were sought because of the death of a child from electric shock received while playing on a pile of slag placed under defendant's high-tension cables subsequent to their erection, the Supreme Court of Appeals of West Virginia held that sufficient cause of action had been stated in the complaint. The slag had been under the wires for two years, and the court held that the defendant knew or should have known that children were accustomed to play on it. When a company maintains a high-tension line in a place where others may lawfully resort from motives of business, pleasure or curiosity it is bound to take precaution for their safety by insulating the wire or other adequate means. (103 S. E. 352.)

Public Service Commissions and the Fourteenth Amendment.—Affirming that an order of a state public service commission prescribing a schedule or maximum future rates is legislative in character, the United States Supreme Court has declared that the Pennsylvania public service company law—construed by the state Supreme Court as withholding from the courts power to determine the question of confiscation according to their own independent judgment, on an appeal from an order of the commission fixing rates—denies due process of law under the Fourteenth Amendment unless it clearly authorizes some other proceeding in which the order may be challenged as confiscatory; nor does the section of the public service company law relative to injunctions provide such a proceeding. A decree of the Supreme Court of Pennsylvania sustaining an order of the commission has been reversed by the United States Supreme Court for the foregoing reason, and the case—one involving the rates of a water company—remanded. (40 S. C. R. 527.)

Men of the Industry

Changes in Personnel and Position— Biographical Notes

Col. Dudley J. Hard, the newly elected president of the Ohio Electric Light Association, is both a native Ohio central-station man and a soldier. He was born and educated in Wooster, Ohio, where for the last eleven years he has been vice-president of the Wooster Electric Company, which was organized by his father, C. V. Hard, in 1886, when there were only two other electric lighting companies in the state. Colonel Hard has been in the central-station business since his graduation from the University of Wooster in 1893. In 1894 he was elected secretary and treasurer of the Cleveland Light & Power Company, and he still holds that



DUDLEY J. HARD

dual position in addition to his official connection with the Wooster company. When a boy the future central-station executive was much interested in military matters and for about thirty years dating from 1888 he was a member of the Ohio National Guard. During that time he served his country in a military capacity on three occasions, first at Santiago in the Spanish-American War as a lieutenant of the Eighth Ohio Infantry, then on the Mexican border in 1916-17, where he commanded the Ohio cavalry as major of the First Ohio Squadron, and lastly as colonel of the 135th Field Artillery, with which he spent nine months in France. The honor which the Ohio central-station men have bestowed upon Colonel Hard was also conferred upon his father some years ago.

O. M. Booher, who for the past twelve years has been manager of sales for the Indiana Railways & Light Company, Kokomo, Ind., has resigned to become general manager of the Kokomo Brick Company. Mr. Booher was very active in committee work of the Indiana Electric Light Association.

Edward W. Harry has resigned as electrical engineer for the National Tube Company, to become chief electrical engineer with the Pittsburgh Steel Company at Monessen, Pa. Mr. Harry started with the electrical department in 1910 as a lineman and while in this employ took a course in electrical engineering at Carnegie Institute of Technology, being graduated in 1915. While employed in the department he had a varied experience as lineman, armature winder, meterman, draftsman, electrical designer and engineer.

T. D. Ramm has resigned from the St. Paul Gas Light Company, where he was general superintendent of the electrical division, to become connected with the Pennsylvania-Ohio Electric Company, Youngstown, Ohio. Mr. Ramm started with the St. Paul company as a cadet engineer seven years ago and was successively promoted to assistant electrical engineer, electrical engineer, assistant superintendent, superintendent of distribution, assistant to the engineer and general superintendent.

Lloyd Henley, electrical engineer with the California Railroad Commission, has left the commission to take up the work of rate research engineer with the San Joaquin Light & Power Corporation. Mr. Henley was graduated from Stanford University with the class of 1908 and entered the construction department of the Pacific Gas & Electric Company. For a time he was with J. G. White & Company in the construction of the Bakersfield steam plant for the San Joaquin Light & Power Company. He rejoined the Pacific Gas & Electric Company when that company



LLOYD HENLEY

started the Drum-Spaulding project. For a number of years Mr. Henley was foreman of the Drum power house leaving that company to accept a position with the California Railroad Commission in 1918. A short time ago Mr. Henley was made chairman of the committee that is revising the rules for overhead line construction for the State of California.

Obituary

James Mitchell, president of the Alabama Power Company, and one of the pioneers in the electric railway field, died at his home at St. James, Long Island, N. Y., July 22, aged fifty-four. A Canadian by birth, he was educated



JAMES MITCHELL

at the Milton (Mass.) High School and in 1884 joined the Thomson-Houston forces at Lynn, Mass. Here he was kept busy making the apparatus used by Professors Thomson and Rice until advancement came and he had charge of the manufacturing company's first stationary and railway motors. He then entered the railway department and was instrumental in installing electric steel railway systems in a number of cities, besides placing in Brazil the first electric street railway in South America. For seventeen years he was in South America installing street railway and electric systems. After his return to the United States he devoted his attention to the Alabama Power Company. This company under Mr. Mitchell's direction has had a most remarkable growth, having now considerably over 100,000 hp. installed in its various plants. He was one of the early advocates of electric steel production and at Anniston, Ala., he laid the groundwork for a rapidly growing electric steel and ferromanganese industry.

Adrian Onderdonk Schoonmaker, president and treasurer of the A. O. Schoonmaker Company, mica manufacturers, died in New York on June 23. Mr. Schoonmaker was born Aug. 4, 1851, and was graduated from the Brooklyn Polytechnic Institute. He entered the mica insulation business when a young man and at the time of his death had built up a very considerable business.

Trade and Market Conditions

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

Greater Use of Trade Acceptance Strongly Urged

THAT the trade acceptance is coming more and more into use by electrical supply jobbers is fully attested by reports from several sources. Representative jobbers throughout the country are using it as a means of stabilizing not only their own credit standing but also that of their customers, and they are pushing it wherever they see that benefit will result. One of the more significant results is that of converting open accounts, which have acquired a habit of running sixty or seventy-five days or so, to a trade acceptance basis for payment in forty-five days, at the same time permitting discount at the bank.

It is perfectly true that this method of collection has not been sold to all jobbers, and it is very probable that by the old method of open account the jobber is able to keep some business which otherwise he would lose. But there is room to question the value of such accounts. There is no doubt that many jobbers not now using acceptances would take them up if they were thoroughly acquainted with their use.

The National Association of Credit Men only two months ago in convention strongly expressed its approval of the trade acceptance as a desirable credit instrument, thus reaffirming its position on this question as taken in previous years. The banking and currency committee of this association particularly stresses the value of the trade acceptance in the conversion of indifferent and slow debtors to prompt payers and frequently to discounters. That committee believes that as a collection instrument nothing better was ever devised, but believes its purpose is defeated if taken in payment of past-due accounts.

The electrical industry has not come to the front in any particular in the use of this form of credit, but it is learning the game. Certain houses in other lines of business are teaching their salesmen the value of this instrument and these salesmen are consequently much better fitted to assist in converting slow payments into good collections for their own house.

Discounting of trade acceptances is generally confined to the banks in the communities where the paper originates and enjoys a rather limited market. According to one Federal Reserve bank, of nearly $11,000,000 of trade acceptances handled for collection during the period of Jan. 1 to May 31, 1920, $9,500,000 were paid at par, and exchange charges on the remainder amounted to about one-tenth of 1 per cent.

Strong Market Ruling for High-Tension Insulators

ALTHOUGH the production of high-tension insulators is said to be up to normal capacity or nearly so, demand has increased to such an extent that it now far outstrips available supply. Not only is a good volume of domestic orders reported, but the call coming from foreign countries since the war has been steadily increasing and export orders are now an important factor in the business. South American countries, France, Italy and the Scandinavian peninsula offer especially favorable markets for porcelain insulators, and replacements seem to be about an equal factor with new construction work in accounting for the demand.

Manufacturers when questioned regarding stocks of finished goods throw up their hands in despair at the very suggestion of the existence of such a thing. Reports on the raw-material situation, however, are not so uniformly bad, for although this item is undoubtedly causing delay, the use of personal tracers to locate shipments and careful attention to ordering supplies long ahead have guarded against an acute shortage. Little labor trouble has been experienced in this field, although in one or two quarters some shortage of skilled workmen is reported.

With the output of insulators unable to keep pace with demand, delivery dates have been growing longer. Six months is about the very best figure quoted, and delivery dates run all the way up to ten months, depending upon the size and type. Medium-voltage sizes around 35,000 to 45,000 volts seem to be in the best shape as regards deliveries, while the highest voltage types are the worst off in that respect. Suspension insulators in several cases are reported a little easier than the pin type, and although in the former case the metal parts are a factor in production, the metal is not holding up the program so much as porcelain. In spite of long deliveries, an almost entire absence of cancellations is noted.

Prices at present are high, and opinions differ as to whether further increases may be expected. No price change is reported since the advances made a month and a half or more ago. Manufacturers in this line as a whole report their bills are being met fairly promptly and that little trouble is experienced with collections.

Foreign competition seems still to be a negligible quantity in affecting the American market for high-voltage insulators, as the industry abroad has not as yet sufficiently recovered from its period of war apathy.

Transformer Market Continues Active

TRANSFORMER manufacturing plants are busy filling back orders and taking on new business, although some diminution is noted in the volume of inquiries and extent of so-called proposition work, compared with earlier in the year. Not much difference can be seen in the character of buying, both power and distribution transformers being sought in about the usual proportions. The passage of the national water-power act has opened the door to larger sales, sure to be realized more and more as these resources are developed. As yet it is too early for this legislation to exert a substantial effect on orders, but considerable business is looked for from Western sources as projects long imprisoned on paper are released for construction.

An improved material situation as regards the heavier items used in transformer manufacture features present conditions. Manufacturers are less worried today over the supply of copper, magnetic steel and sheet iron than during the past winter. Railroad congestion has given cause for anxiety all through the year, but by strenuous efforts necessary stocks of the foregoing raw material have been accumulated in sufficient amount to permit steady production to be assured for some time. The chief difficulty has come in connection with the supply of such items as long-fiber cotton, shellac, enameled wire for primary coils, porcelain and grain alcohol.

For about six weeks a strike in the Naugatuck Valley of Connecticut interfered with copper deliveries to manufacturers of transformers and much other electrical equipment, but with the failure of this walkout conditions have greatly improved. Difficulties still exist in connection with the cotton supply, these being heightened by the large pur-

chases of this material by the automobile industry. It has become necessary, in some cases at least, to buy shellac abroad before shipment to the United States, in order to forestall complete absorption of imports on arrival. Facilities for local manufacture of enameled wire and porcelain will soon be established in at least one representative transformer-making plant, so that these materials will cause less trouble in future from the shortage standpoint.

Deliveries of distribution transformers now average about eighteen weeks, although occasionally much shorter shipments can be made. On power transformers, classed at 200 kva. and over, shipment can be made in from five to eight months. There are practically no factory stocks in hand of either type. Labor conditions are fairly steady, and prices have been quiet but firm since the last advances, which took place in the late winter and spring. Every effort is being made through quantity production and by pushing the standardization program to hold prices close to present levels, which are still far below the advances attained in many other lines of commodities. If pig-iron advances further this summer, it seems likely that transformer prices may have to undergo another upward readjustment, but there is little certainty at present about this. A bright spot in this branch of the industry is found in the results of rating standardization, which have cut the sale of specials to one-third that of four years ago and reduced the number of standards to about 40 per cent of the old figures.

Graphic-Recording-Meter Market Growing Fast

MANUFACTURERS of graphic recording meters uniformly agree that demand today is probably greater than ever before in that line, and not only have sales for the first half of this year greatly exceeded those of last season but inquiries seem to be steadily increasing. The remarkable favor in which this instrument stands can be traced to the growing tendency of power consumers to check up their costs. According to one of the big producers of recording instruments, hardly a single electric power installation is now made without including a graphic recording meter in the equipment. Reports are about evenly divided as to whether the greatest part of this call comes from central stations or manufacturing plants, but these two classes of buyers between them undoubtedly account for a very large proportion of the orders.

A survey of the field reveals very short stocks in the hands of manufacturers, but this condition is not so alarming as at first appears, in view of the fact that most of these meters are made to order and light stocks are usually the rule. But even so, the available supplies are rather sub-normal and the main factor promoting this condition would seem to be the rapid increase of demand, which has outstripped facilities for adequate production, even though that production at present seems to be proceeding at normal capacity, as judged by the standards of the past. Another consideration, of course, has been the freight muddle, and to some extent supplies of raw material, although this item was in several cases reported to be in pretty fair shape.

Under these conditions, deliveries in this market are considered pretty fair, although some manufacturers were much worse off than others in that respect. From four to six weeks were the best dates quoted, and other estimates ranged as long as ten or even twelve weeks. One of the producers who was among those able to make the quickest deliveries, stated that his shipments were sent only by express. No present labor difficulties are reported, as this phase of manufacturing conditions has presented a favorable aspect since some trouble with labor was experienced in certain quarters last spring. An entire absence of order cancellations is also noted. Prices for graphic recording meters have remained stationary for about two months and in some cases an even longer time, but before that period increases strung along in amounts of from 5 to 10 per cent. Several representative makers think prices are likely to hold firm.

Analysis of Exports of Transformers for the Year 1919

THE value of transformers exported from the United States during 1919 ranked sixth as regards classes of electrical apparatus exported, last year's exports of this product amounting to $3,787,851. The highest monthly value was recorded in March, amounting to $449,077. The average monthly rate of exportation was $315,654. With the exception of August the monthly values of exports were below the average for the second half of the year.

Exports of transformers for the first five months of 1920 amount to $1,482,712, which is at a rate of more than

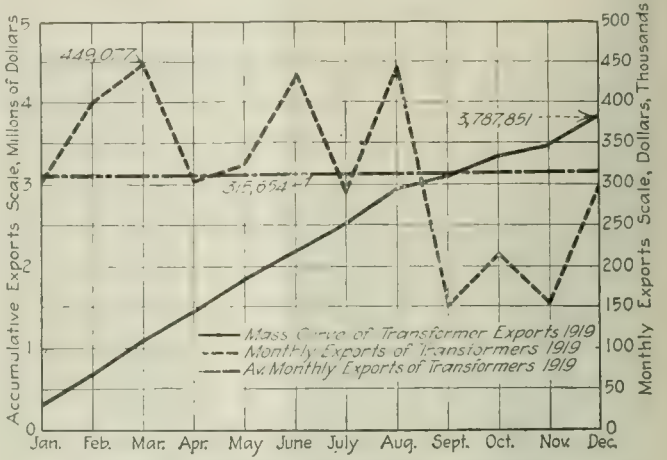


FIG. 1—MONTHLY VARIATIONS OF EXPORTS

$3,550,000 for the year. This is below the actual exports for last year, but, with the exception of the month of April, the monthly rate for this year has been holding up well.

Data compiled by the ELECTRICAL WORLD indicate that 14 per cent of this class of exports were consigned to Brazil, with a total of $538,325. Japan and Australia were second and third, with $366,167 and $272,581 respectively. Fig. 2 indicates the large extent of exports to various foreign countries. France, Italy, Norway, Portugal and Spain imported American transformers valued at $837,629, which is about 22 per cent of the total value of this class of exports to all countries. Fig. 2 also indicates the extensive market in South America for this class of electrical goods. Seven of the countries of that continent imported American transformers valued at $983,998, which is about 26 per cent of the total value of this class of exports to all countries. To

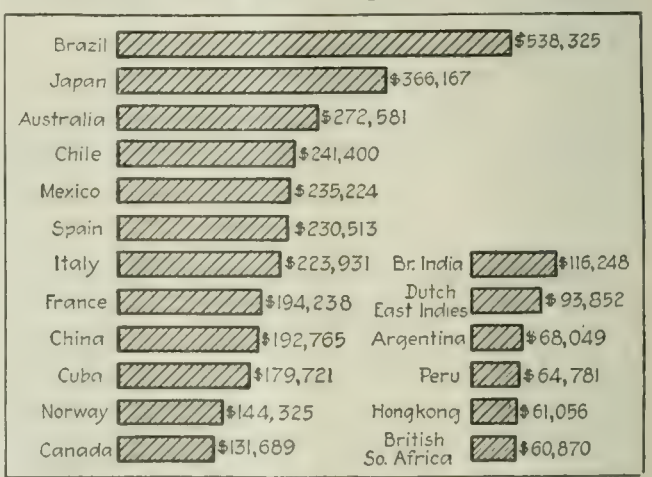


FIG. 2—ANALYSIS OF EXPORTS BY COUNTRIES

Canada, Mexico and Cuba exports of these goods totaled $546,634, about 15 per cent of the total of these exports. Taking into consideration, therefore, only such countries as imported $25,000 or more of this class of American electrical goods, continental American trade accounted for $1,530,632 worth, or about 41 per cent.

The above figures are based on export statistics issued by the Bureau of Domestic and Foreign Commerce for 1919.

Demand for Integral Horsepower Motors Easier

AT LEAST temporarily, the demand for integral horsepower motors appears to have slackened off a little, but the large volume of unfilled orders on factory books insures ample work in this field for many months to come. By and large, the motor business now being booked probably runs 25 per cent above that of a year ago. Prices have remained steady since March, but a further advance is not unlikely if transportation conditions grow worse, unless, of course, the volume of business should fall off materially. Representative deliveries on alternating-current motors are from three to six months, and on direct-current motors about fifteen weeks.

The quotations on single-phase motors show a little improvement in deliveries over last spring. New plants for the manufacture of both fractional and integral-horsepower motors are being established, and it is likely that considerable improvement in deliveries can be realized before the end of the year. Enameled wire is scarce, and while sheet steel can be obtained more readily than in the winter, raw-material conditions are none too satisfactory. Labor costs continue high, but some improvement in the temper of labor seems to be evident, shutdowns in other manufacturing fields exerting a constructive influence upon the workman's disposition to remain more continuously at his post.

Metal Market Situation

PREVAILING conditions in the copper market show the buying activity to be very light. Producers are booking orders here and there at 19 cents for prompt and third-quarter deliveries, while fourth-quarter deliveries are quoted at 19.25 cents. There is little activity in the longer deliveries, partly because it is not known definitely at this time what effect the recent increase in railroad wages will have on freight rates, other than that they will undoubtedly be advanced. It has been estimated, however, that rates will advance sufficiently to add about 1 cent to finished copper in its movement through production.

The outside market is quiet, with some sales reported made at interior points at 18.50 cents f.o.b. shipping point for prompt. But 18.62½ to 18.75 cents is nearer the outside market price. There is no evidence that producers are even considering weakening their position through any recessions in price. They feel a good buying movement in the near future and know their ability to hold on.

On July 21 the official lead price was advanced ½ cent, to 8.50 cents. The outside market, however, is quoting prompt lead from the West up to 9.25 cents New York. Mine output is below normal because of labor shortages, and the spot market is extremely low. At the same time future activity is negligible in the outside market. Scrap lead shows a quarter-cent advance.

Zinc consumers show little interest and several outside lots are finding no buyers.

NEW YORK METAL MARKET PRICES

	July 20	July 27
Copper	£ s d	£ s d
London, standard spot	91 5 0	92 0 0
	Cents per Pound	Cents per Pound
Prime Lake	19 00	18 62½
Electrolytic	19 00	19 00
Casting	18 25	18 00
Wire base	22.50–23.00	22.50–23.00
Lead, trust price	8.00	8.50
Antimony	7 50	7 25
Nickel, ingot	43 00	43 00
Sheet zinc, f.o.b. smelter	12 50	12 50
Zinc, spot	8 25	8 10
Tin	49 75	48 75
Aluminum, 98 to 99 per cent	33.00	33.00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	15 50 to 16 00	15 50 to 16 00
Brass, heavy	9 50 to 9 75	9 25 to 9 50
Brass, light	7 25 to 7 75	7 25 to 7 75
Lead, heavy	7 00 to 7 37½	7 25 to 7 50
Zinc, old scrap	5 00 to 5 50	5 00 to 5 50

THE WEEK
IN TRADE

IN THE Middle West and on the Pacific Coast trade dullness and general summer apathy are slowing up sales of electrical material, while in the East business is also slacking, but a good volume of sales is still reported. In the South the brisk demand for all electrical material continues, with no let-up as a result of the heavy building construction program.

An improved freight situation is everywhere reported except in Atlanta territory, where car shortage is seriously holding up the supply of building material. Reported heavy demand on cars for the movement of wheat is also a factor which has now to be reckoned with. Under the influence of lessened sales and better shipments, stocks seem to be uniformly picking up.

Labor conditions appear pretty steady, although certain electrical workers on the West Coast are demanding higher wages. Collections in general seem to be tightening over the country, but although caution is used with regard to credit, an optimistic feeling prevails as to the future.

A good volume of construction work is under way in the East and at points South, while a large amount of this work is also contemplated for the near future in the Middle West, which has so long been delinquent in that respect. Residence construction in the Northwest district has slackened, seemingly because builders are expecting lower prices to prevail on lumber.

NEW YORK

Jobbers continue to report a quieter market than for some weeks past, with a slight slackening up of sales for all classes of electrical material.

Reports on the transportation situation seem to be about evenly divided as to whether freight deliveries are easing up to an appreciable extent. In several quarters, however, shipments are said to be coming through in much better shape than heretofore.

There are signs of approaching relief in the chaotic condition prevailing in the building material supply situation, according to the Dow reports, and when this relief materializes a greater volume of residence construction may be expected on the part of those who have been postponing building operations awaiting the advent of more favorable conditions.

Collections in the metropolitan district seem to be tightening up, with credit cautiously extended. Prices show no change since the recent withdrawal of quotations on porcelain items and schedule material. Pipe is in as bad shape as ever, but an easing up in the supply of flexible armored conductor seems to be evident. Little real fan weather has been felt as yet, and light sales are responsible for overstocks.

Tape.—Fair stocks of the friction type seem the rule, although here and there some shortage is reported. Good demand is felt at prices of from 52 cents to 60 cents per pound. Rubber tape seems to be in less call, with fairly good stocks and prices ranging all the way from 47 cents to 60 cents a pound, depending upon the quantity.

Rigid Conduit.—No relief in the situation is reported. Irregular receipts of car lots melt at once in the face of an unslackening demand. Poor stocks are on hand, with ½-in. black ranging in price from $92 to $96 per 1,000 ft., and the 1-in. size from about $180 to $200.

Flexible Armored Conductor.—A falling off in demand and improved shipments have eased up the situation, with signs of stocks beginning to show. Quotations in 1,000-ft quantities are ranging around $115, though in one case price was under $100.

Fans.—Some jobbers find themselves overstocked, and others have canceled outstanding orders for the remainder of the season. With the unseasonable weather prevailing stocks have moved very slowly.

Rubber-Covered Wire.—This is in good demand, with plentiful supplies on hand and fairly regular shipments arriving. No. 14 is quoted at from $11.25 to $11.50 per 1,000 ft.

Vacuum Cleaners.—Embargoes are holding up stocks, and those jobbers who go in for this specialty claim they can't obtain enough to meet the present strong demand. One distributer has run out of attachments.

Switches.—Stocks of the snap and push-button types are in good shape with a normal demand prevailing. A good supply of knife switches is also available to meet the fairly steady demand which is felt. Shipments of toggle switches in one case are quoted at from five to six months.

Lamps.—Stocks, which a few weeks ago were decidedly spotty, are now generally well filled up, awaiting an expected heavy fall trade. An average summer demand is experienced.

Flashlight Batteries and Lamps.—No trouble is reported in meeting the usual vacation season demand. Stocks are in fair shape with pretty regular shipments.

Conduit Fittings.—Jobbers seem to have fairly good stocks of fittings, with some few short items owing to raw-material difficulties. Demand is uniformly good, but reports on shipments vary.

Fuses.—Plentiful stocks and a demand which in most cases is said to be normal are evidenced in this line. The call seems to be about evenly divided between the renewable and non-renewable types, with good shipments the rule.

BOSTON

Midsummer dullness in trade was in evidence at the close of last week. While a healthy volume of business is being transacted, the pressure upon jobbing houses has relaxed sufficiently to permit the building up of local stocks beyond recent unsatisfactory levels, except in motors, weatherproof wire and the lighter appliances for table use. Collections show little change over last week. Prices hold firm and deliveries are gradually improving. Building and engineering contracts in New England for the week ended July 22 totaled $5,513,000, compared with $5,135,000 in the same week last year. The total of contracts in 1920 to July 22 is $199,196,000, against $100,874,000 for the same period in 1919. In other words, new building is at present increasing about 7 per cent over last year. Contractors in the electrical field are very busy on numerous "piecemeal" jobs, especially in the industrial field. Labor conditions in the electrical industry are fairly steady in this section for the time being.

Motors.—Famine conditions prevail in the small-motors market. Prices are firm, with a slight recession in demand.

Wire.—Weatherproof wire is reported extremely scarce this week, quoting on a 29-cent base. Rubber-covered wire is in good supply, No. 14 bringing $11 per 1,000 ft. in 5,000-ft. lots. Bare copper wire, on a 24-cent base, is in fair supply.

Non-Metallic Flexible Conduit.—Sales are holding up well, with more satisfactory deliveries than formerly. Prices are steady, the $\frac{3}{8}$-in. size quoting $33.50 per 1,000 ft. in 5,000-ft. lots, and the $\frac{1}{2}$-in., $38.50 in 1,000-ft. lots.

Sockets.—No scarcity is reported this week. Pulls in case lots bring 50 cents each, net; keys, 28 cents, and keyless, 26 cents. New England stocks have been well maintained since the railroad tie-ups of late winter, which resulted in concentrated shipments from local factories to local jobbing houses.

Knife Switches.—A brisk demand is reported, due to many non-spectacular but useful central-station line extensions. Outdoor substation construction is active, calling for much fitting material.

Rigid Conduit.—Stocks are not very satisfactory. In lots of under 2,500 lb. galvanized pipe brings $11.10 per 100 ft. for $\frac{1}{2}$-in., $22.20 for 1-in., $36 for $1\frac{1}{2}$-in., and $48.60 on 2-in. sizes.

Flashlight Batteries.—A shortage in No. 790 dry cells has been remedied. In lots of twelve these bring 28 cents each.

Locust Pins.—These are quoted at $50 per 1,000 in lots of 500, with a fair supply.

Flexible Armored Conductor.—In 1,000-ft. lots this material brings $110 per 1,000 ft., in the No. 14 single-strip. No particular difficulty in obtaining supplies is reported.

Fans.—Stocks are not yet exhausted. The season is continuing relatively dull. In lots of twelve 25 per cent off list is quoted.

Toasters and Percolators.—The market is still very short of these devices.

CHICAGO

Unseasonable weather continues with temperature prevailing about 20 deg. below expectation. This, together with the usual vacation slump, has taken all the life out of the retail trade and is being reflected in a noticeable reduction in calls on jobbers for seasonable goods. Freight is moving more easily and in most lines stocks are getting in better shape than they have been for some months past.

Construction remains quiet. Architects report an enormous amount of work "on the boards," but the greater portion of it is held up awaiting favorable conditions. Permits for the past two weeks aggregate nearly $4,000,000, of which more than half applies on buildings now nearing completion. Residence construction for the period named totals about $400,000.

Rigid Conduit.—More liberal quantities are being received by jobbers and back orders are being materially reduced. Light demand for new construction purposes is enabling stocks to build up to some slight extent. One-half-inch and three-quarter-inch sizes are most in demand and hence hardest to get.

Non-Metallic Flexible Conduit.—Popular sizes for immediate delivery are difficult to obtain, but jobbers are improving their stock conditions every day. Lightened demand by the construction industry accounts for this. Current quotations are $35 per 1,000 ft. for $\frac{3}{8}$-in. in 5,000-ft. lots and $37 for $\frac{1}{2}$-in.

Wire.—A reduction in the placing of new business and more favorable shipping conditions are combining to put stocks in better shape than they have been for a long time. A falling off is noted in calls for wire for maintenance work.

Flexible Armored Conductor.—One hundred and twenty dollars per 1,000 ft. is today's price on No. 14 single strip in short lengths, $110 in coil lengths. These prices show no recent change. Stocks are in fair shape, most sizes being readily obtainable.

Underground Cable.—Former great difficulty experienced in getting goods through from Eastern factories is considerably lessened, and as a result deliveries are becoming more prompt. New demand is off, but jobbers are still busy filling back orders.

Electric Signs.—Relief in freight conditions as regards receipt of raw materials has lessened the problems of the manufacturer, and on ordinary stuff delivery can be made fairly prompt. New business shows a decrease compared with that placed during the spring.

Electrical Toys.—In expectation of heavy demand for Christmas trade jobbers are asking dealers to list their requirements now. Uncertainty as to the volume of business this winter is rendering retailers a little cautious. Jobbers seem in pretty good shape as to supply.

Vacuum Cleaners.—Retail sales are holding up very well, and deliveries for the most part are made from stock. Little deferred payment business is done, cash transactions being in the majority.

Heaters.—Most dealers are anticipating heavy business this fall, owing to the high price of coal, and as a result they are ordering heavily.

ATLANTA

Building permit figures for the twelve principal Southern cities for the month of June, 1920, show an increase in construction value of 25 per cent over the same month of last year, while a tentative report shows an even greater percentage increase in the smaller centers. It is this construction that in large measure accounts for the continued brisk demand for all classes of electrical material. Building permits for Atlanta for the first half of July total $537,000.

Bank clearings have settled to a figure only slightly in excess of a year ago, and all lines of trade are reporting a tightening up in the money market, every effort being made to collect outstanding accounts. Collections are coming in rather slowly from the smaller operators, as well as from small municipalities and central stations, but the large jobbers continue to meet their obligations promptly.

Flexible Armored Conductor.—A price increase of approximately 5 per cent is announced. The demand continues very brisk with few or no satisfactory stocks in the territory. Price, lots of 1,000 ft. to 2,500 ft., $12.20 per 100 ft.

Porcelain.—The situation continues unsatisfactory, though a large shipment of knobs, cleats and tubes and so forth is expected daily. This shipment will serve to fill a large portion of outstanding back orders. A price advance of approximately 10 per cent is to be noted on all items. Quotations are as follows: "Nail-it" knobs, lots of 500 to 4,000, $5.45 per 100; two-wire unglazed cleats, lots of 300 to 1,850, $3.50 per 100; ⅝-in. x 4-in. tubes, standard packages, $1.72.

Rigid Conduit.—The shipment of conduit recently reported was quickly absorbed and the market is again short on this item. Demand continues very brisk with prices steady. The car shortage seems to be causing the principal difficulty in the receipt of shipments.

Flexible Non-Metallic Conduit.—Recent shipments have served largely to clean up all back orders, though no stocks are at present in the territory. Shipments now rolling, however, will permit of a fair accumulation in local warehouses. Prices, 1,000 ft. to 2,500 ft., ⅜-in., $4.62 per 100 ft.; ½-in., $4.24 per 100 ft.

Wood Poles.—The car shortage is preventing delivery of badly needed supplies, producers reporting adequate stocks on hand which they are unable to move. The demand is insistent, particularly from small distributing systems which have undertaken to rebuild lines that have been allowed to get in bad condition. Prices, f.o.b. Atlanta, Western red cedar, 30-ft., $12; 35-ft., $14.50.

Cross-Arms.—Good supplies of fir arms in both standard and N. E. L. A. sizes are to be had from jobbers' stocks, and pins and glass insulators are also on hand in good quantities. The demand is brisk and stocks are moving rapidly despite the difficulty in obtaining poles. Prices, N. E. L. A. arms, four-pin, 5-ft., $1.68; standard arms, four-pin, 4-ft., 99 cents; two-pin, 3-ft., 74 cents.

Schedule Material.—With the exception of rosettes, fairly satisfactory stocks are reported, there being a plentiful supply of both key and pull-chain sockets. The demand is holding up very well. Prices, key sockets, standard packages, 39 cents; pull-chain sockets, 58 cents; rosettes, combination one-piece, 10 cents.

SEATTLE—PORTLAND

Vacation season trade slackness, uncertain conditions and a general feeling of apathy characterize the situation in the electrical industry as far as the Puget Sound district is concerned. Sales volumes are still at a low ebb—perhaps a trifle lighter than for the past two weeks from the jobbers' standpoint. Retail sales of small appliances, however, are being well sustained. Contractor-dealers report further slowing up due to decreasing residence construction. The recent drop in lumber prices noted in Puget Sound cities has not stimulated building. Apparently prospective home builders assume that this drop indicates further decreases. However, lumbermen say this assumption is incorrect as relief from the car shortage will result in steadying the lumber market. Jobbers' stocks are improving gradually, owing to better shipments and lighter demand, though there is a shortage along some lines still.

Reports from the Spokane field state that wholesale business is fair and that a good number of sales recently has stimulated retail trade. Small motors, domestic appliances and fixtures are moving exceptionally well. House-wiring devices and schedule materials are also showing a fair movement. Collections are still good, but in the past two weeks they have been slowing up considerably.

Manufacturers and jobbers in Portland territory report that business is gradually picking up. Supplies are being received in greater quantity owing both to the fact that manufacturers are catching up somewhat with their orders and to improved railroad transportation. Oregon contractors, especially those in Portland, report that business is good considering the time of year. Prospects for future business at this time are looking fine. Retail trade is improving materially from week to week. Jobbers report that collections are improving somewhat, but contractors and retailers find them still very poor.

Washing Machines.—Seattle jobbers, generally speaking, report that demand for washing machines is not only holding up, but is even showing a noticeable increase. Shipments are coming through comparatively well but demand is in excess of available supply.

Motors.—Although the demand for fractional sizes is dropping off a trifle, it is still impossible to obtain anything like an early delivery.

Sockets.—Recent improvement in stocks is noted. With residence construction decreasing gradually, sales are dropping off.

Safety Switches.—Poor demand in Puget Sound territory has enabled fair stocks to accumulate. Shipments are improving and prices show no recent change.

SAN FRANCISCO

A very conservative policy adopted by the banks has created certain rumors of forthcoming financial changes, but as a matter of fact, this policy is far-sighted and will lessen the effect of any financial uncertainty. Particular attention is being paid by dealers to such financing assistance as the Morris plan, and it looks as if they have decided that it is important for them to give easy terms in competition with department stores.

The threatened power shortage has become acute in the Willows district of the Sacramento Valley. Furthermore, it is stated that some water from Lake Spaulding is being diverted through creek beds to the orchards on the slopes of the Sierras.

Heating Appliances.—The market for irons is slow on account of new prices, although there is no sign of any drop. On the other hand, the new prices of hollow ware have not affected the call, which is very heavy and which has left stocks bare. Holiday supplies will not arrive until October.

Ranges.—Power company officials state that they are amazed at the strong call for electric ranges despite the recent increase in price and the fact that no regular campaigning is being done. These orders are coming in through widely scattered dealers. Stocks, with the exception of automatic ranges, are rather poor, especially in the larger cabinet styles.

Motors.—The motor situation is growing worse, and delivery dates are being extended until they cover the greater part of a year. With another dry year the situation will become very serious.

Washing Machines.—Right through the summer season heavy sales continue with good stocks now to back them up.

Telephone Material.—Because of raw-material difficulties and the flooding of factories by orders, deliveries are very poor, not only of the sets themselves, but of such primary equipment as cable switchboards.

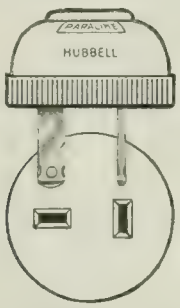
Tools.—Coast stocks of small linemen's tools are still shot to pieces because of the inability of factories to procure fine tool steel. Heavy construction tools are better off.

New Apparatus & Appliances

A Record of Latest Developments
and Improvements in Manufacturers' Products
Used in the Electrical Field

Attachment Plug with Rotatable Blades

By turning the blades the new attachment plug manufactured jointly by Harvey Hubbell, Inc., and the Benjamin Electric Manufacturing Company



SLOT COMBINATIONS FORMED BY TURNING BLADES 90 DEG.

may be adapted to fit slot receptacles whose slots are parallel, in line or at right angles to each other, the manufacturers say. The blades of the cap can be turned through 90 deg. to fit these combinations of slots. The product of the Hubbell company will be marketed under the registered trademark of "Paraline."

Industrial Lighting Unit

A new lighting unit designed both to distribute light over a wide area without glare and to concentrate it for close work on benches, machines, etc., in manufacturing establishments has been developed by the Perfection Sales Company, 329 East Twenty-second Street,



GLARE IS ELIMINATED

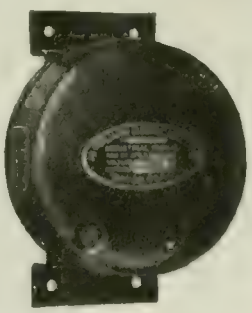
New York City. The unit consists of two shades, an upper opaque one and a lower translucent shade. The lower shade sends the light directly downward to the work. The upper shade deflects the light not only in a downward direction but also horizontally.

Anti-Rust Compound

For protecting steel and iron parts from rust during transportation, storage, etc., the Conversion Products Corporation, 149 Broadway, New York City, has developed a compound called "Stazon." It has a petroleum base and, according to tests, will not flow under temperatures around 200 deg. Fahr. Insulating properties are similar to petroleum greases and the compound acts also as a lubricant. It is especially adaptable to protecting bearings of armatures, shafting and bright steel parts from atmospheric conditions.

Heavy-Duty Buzzers

For use where a signal with a distinct but not necessarily loud tone is needed the Benjamin Electric Manu-



INDUSTRIAL SIGNALS FOR HEAVY DUTY

facturing Company, Chicago, has developed two types of heavy-duty buzzers, for both direct and alternating currents. Sturdiness of construction especially is claimed.

Notes on Recent Appliances

Time Switch

A high-potential oil-break electrically wound time switch, type T, has been developed by the Albert & J. M. Anderson Manufacturing Company, Boston, Mass.

Pipe Fittings

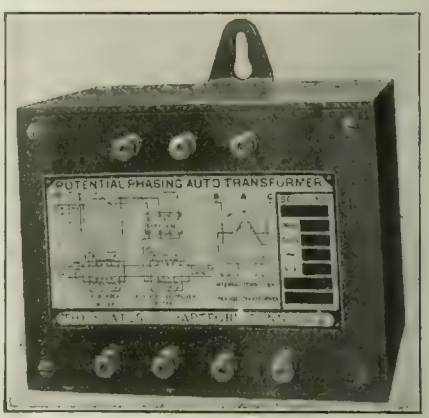
Threadless pipe fittings for switchboard construction are being marketed by the McIntire Corporation, 35 Vesey Street, Newark, N. J.

Wireless Receiver

A short-wave regenerative receiver has been developed by A. H. Grebe & Company, Inc., Richmond Hill, N. Y.

Phasing Auto-Transformer for Power-Factor Measurements

A special phasing transformer designed to simplify power-factor measurements is being placed on the market by the States Company, Hartford, Conn. It obviates the use of a special constant in interpreting meter registrations, the manufacturer says, and does away with the necessity for readjusting a meter for direct registration at a voltage below the normal voltage of the circuit. The transformer supplies 90-deg. lagging potential at normal volt-

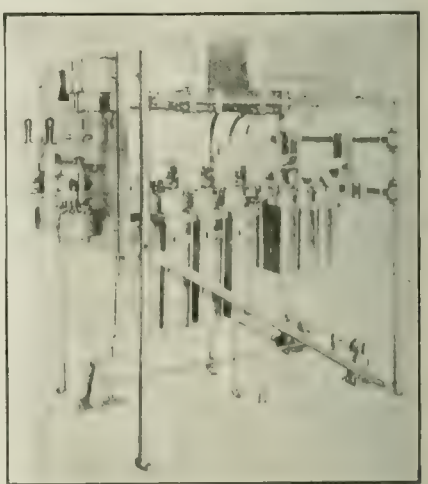


ORDINARY METER USED IN TAKING REGISTRATIONS

age to the reactive volt-ampere-hour meter. An ordinary stock meter may thus be used and its registration taken directly.

Standard Unit Induction Motor Panels

For use with either wound or squirrel-cage motors, operating on three-wire non-grounded systems, the General Electric Company has perfected a line of standard unit induction-motor panels. These units are designed to give special protection to the motor-starting devices and switching parts



ASSURES PROTECTION AGAINST IMPROPER STARTING

from abnormal electrical or load conditions or from damage due to carelessness. Time-limit relays and under-voltage devices are incorporated.

MANUFACTURERS' ACTIVITIES

Record of Changes Affecting Sales and Distribution Together with Trade Personals and Notes on Foreign Trade, Jobbers' News and New Trade Literature

THE ROLLER-SMITH COMPANY, 233 Broadway, New York City, announces certain recent changes in its sales organization as follows: G. L. Crosby, previously sales manager, is now general sales manager at New York City. M. Frankel, previously assistant sales manager, is now Western sales manager at Chicago; W. J. Shire, previously a sales engineer, is now Eastern sales manager at New York City; C. G. Kahant, previously a sales engineer, is now export manager and district sales manager at New York City. F. R. Ryan, J. E. Wood and H. D. Baker remain district sales managers respectively of the Chicago, Cleveland and Detroit territories. In addition to the above C. M. Hunt is a sales engineer in the New York office, and M. B. Mathley is a sales engineer in the Chicago office.

THE STANDARD ELECTRIC MANUFACTURING COMPANY, 216 North Clinton Street, Chicago, has awarded contract for the erection of a five-story factory, 82 ft. x 150 ft., at 925-937 Wrightwood Avenue, to cost about $200,000.

THE M. S. WRIGHT COMPANY, Worcester, Mass., manufacturer of "Sweeper Vac" vacuum cleaners, has increased its capital stock by $750,000. Of this amount $522,400 has been issued, the proceeds being used in the purchase of the property formerly owned by the Mills Woven Cartridge Belt Company, now occupied by the M. S. Wright Company.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., has taken over the plant of the Scranton (Pa.) Textile Company for the establishment of a new plant.

THE ALPHADUCT COMPANY, 136 Cator Avenue, Jersey City, N. J., has filed plans for an extension to its plant at 33-35 New Street.

THE BENJAMIN ELECTRIC MANUFACTURING COMPANY, Chicago, held its annual outing at the Forest Preserves, Desplaines, Ill., on June 12, which was attended by more than 1,000 employees, including factory men, office workers, heads of departments and executives of the company.

THE MERMAID DISHWASHER COMPANY, recently organized to take over the property and holdings of the Wolcott Manufacturing Company, Hartford, Conn., effective June 30, has established a plant in Middletown, Conn., where it will manufacture the Mermaid dishwashers. Frank E. Wolcott is president and general manager.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., is planning to erect a one-story building, 35 ft. x 218 ft., on Grand Street, near Garrison Avenue, Maspeth, L. I., to cost about $18,000.

THE ELECTRIC VACUUM CLEANER COMPANY, Cleveland, Ohio, has awarded contract for the erection of a building, 80 ft. x 80 ft., to be used as a plating shop.

THE DELTA-STAR ELECTRIC COMPANY, 2,437 Fulton Street, Chicago, is having plans prepared for the erection of an addition to its plant, one and two stories, 100 ft. x 110 ft., to cost about $40,000.

WILLIS H. GILBERT is now established at 710 Conway Building, Chicago, Ill. Mr. Gilbert is producing and selling Southern white cedar poles. He has opened distributing points at Atlanta, Washington, Birmingham, Cleveland, New Orleans and other points throughout the South and East.

THE PRICE ELECTRICAL COMPANY, Pittsburgh, Pa., has acquired a three-story building, 40 ft. x 113 ft., at 428-30 Penn Avenue, for its local works.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, East Pittsburgh, Pa., is making preparations for the erection of a new one-story shop, 100 ft. x 112 ft., to be equipped for high-power electric machine service at North Trafford.



BENJAMIN ELECTRIC'S OUTING ATTRACTS MORE THAN A THOUSAND

THE CALIFORNIA ENGINEERING COMPANY, consulting civil, mechanical, electrical, hydraulic and marine engineer, announces the opening of its offices at 131 Leidesdorff Street, San Francisco, Cal. Paul B. McKee is president of the company; Paul R. Parker, vice-president and chief engineer, and Byron H. Hurd secretary.

THE NORTH EAST ELECTRIC COMPANY, 348 Whitney Street, Rochester, N. Y., manufacturer of electrical products, has filed notice of increase in capital stock from $3,000,000 to $6,000,000.

S. F. BOWSER & COMPANY, INC., Fort Wayne, Ind., held its annual sales convention June 28 to July 2; it was the largest convention ever held by the company.

THE BURHAUS-MOORE ELECTRIC COMPANY, 29 Congress Street, Troy, N. Y., has been organized by Mr. Burhaus and J. W. Moore to do an electrical and mechanical engineering business, as well as contracting, and to deal in motors, etc. The company will make a specialty of mill work.

THE FEDERAL ELECTRIC COMPANY'S EMPLOYEE MANAGEMENT.—In an address delivered by John F. Gilchrist, president of the Federal Electric Company, on June 26, at a housewarming at the company's new plant, Eighty-seventh and State Streets, Chicago, an announcement was made that plans were in contemplation under which the employees would have a voice in the management of the company. Approximately 40 per cent of the employees are already stockholders. More than a thousand persons attended the housewarming.

THE GATE COIL COMPANY, Boston, Mass., has acquired property and a factory on Willard Avenue, Providence, which is to be remodeled for the manufacture of electric coil-winding machinery. The company is a subsidiary of the Universal Winding Company, Providence, R. I., and is capitalized at $100,000. Robert A. Leeson, 95 South Street, Boston, is president, and Frank N. French is treasurer.

THE HERMAN ANDRAE ELECTRICAL COMPANY, Milwaukee, Wis., announces the appointment of George H. J. Andrae as assistant to the president of the company. Mr. Andrae is a graduate of the University of Wisconsin and of the engineering course of the Westinghouse Electric & Manufacturing Company. Since his discharge from the Army he has been industrial heating specialist for the Westinghouse Electric & Manufacturing Company in New England.

THE ALLENTOWN STORAGE BATTERY COMPANY, Allentown Pa., which has been established for three years, has recently filed articles of incorporation with a capital stock of $100,000. The company does a general jobbing business and operates twelve battery and five service stations. George D. Fisher is president and William T. Kedward is manager.

THE PACENT ELECTRIC COMPANY, 150 Nassau Street, New York City, has established an advisory and consultation service for electrical dealers and jobbers who handle wireless equipment.

THE NATIONAL SPECIALTIES COMPANY, Lightner Building, Detroit, Mich., has established a branch office in the Marion Building, 1243 West Third Street, Cleveland, Ohio, where a full line of Tungsol tungsten and nitrogen lamps, carbon and miniature lamps and Atlas four-in-one fuses will be carried. F. C. Hawkins, formerly with the Westinghouse Lamp Company in Detroit, will be in charge.

THE STRITE AUTOMATIC TOASTER COMPANY, Plymouth Building, Minneapolis, Minn., has established branch offices in leading cities for the distribution of its automatic toaster for use in restraurants and hotels. Hector C. Adams, Inc., eighth floor, Grand Central Palace Building, New York City, has charge of the distribution in the Atlantic Coast States. The company has a branch office at 166 North La Salle Street, Chicago, and the Pacific Coast territory is taken care of by two of the leading jobbers in that section of the country.

CLAIMS AGAINST ELECTRIC MACHINERY COMPANY.—The Minneapolis (Minn.) Trust Company, receiver for the Electric Machinery Company, is circulating forms to be filled in by all creditors of that company having claims against it. These forms are to be filed by thirty days from July 12.

THE COLUMBUS MANUFACTURERS AND JOBBERS' ASSOCIATION has appointed Oscar Avery of the Avery-Loeb Electric Company, Columbus, Ohio, as chairman of the community conference.

THE BALSA REFRIGERATOR CORPORATION has just moved from 149 West Thirty-sixth Street to 50 East Forty-second Street, New York City.

THE ELECTRIC SALES COMPANY, Ranger, Tex., has recently been organized to handle the sale of electric lighting plants and electrical apparatus in the Southwest territory and in parts of Mexico. It will be prepared to act as the distributer of electrical material not already represented. Offices will be established at Ranger, Pecos and El Paso, Tex. The address of the temporary office at present is care Brooks-Turner Oil Company, Marston Building, Ranger, Tex.

RUSSELL A. GRIFFIN, general sales manager of the National Pole Company, died of pneumonia July 14 at his home. He was for many years connected with the American Telephone & Telegraph Company and later with the Western Electric Company, before going into the pole business.

ROBERT M. HAMES, export manager, Bryant Electric Manufacturing Company, Bridgeport, Conn., has been elected president of a newly formed Export Managers' Club, which has for one of its objects the obtaining and increasing of foreign trade for Bridgeport industries.

THE C. S. BIGSBY COMPANY, 190 Boylston Street, Boston, Mass., distributer of the New Premier electric vacuum cleaner, has established a branch office at 27 Eddy Street, Providence, R. I., in charge of C. C. Bruler.

Supply Jobbers' Notes

THE MILNER-FLOWER ELECTRIC COMPANY, Buffalo, N. Y., has established a branch house at Ithaca, N. Y.

THE ROCHESTER ELECTRICAL SUPPLY COMPANY, 100 St. Paul Street, Rochester, N. Y., has filed notice of increase in capital stock from $100,000 to $250,000.

Foreign Trade Notes

GERMAN ELECTRIC MANUFACTURING INDUSTRY'S NEW PRICE SCALE.—A notice given out by one of the largest electric manufacturing concerns in Germany states that the development of prices in the last few months has been such that the premiums added to the prices asked in pre-war times have reached almost 1,000 per cent. It is taken for granted that prices will never again be so low as they were in times of peace. The firms composing the price-fixing board of the Zentralverband der Deutschen Elektrotechnischen Industrie have therefore decided to increase the basic prices and reduce the premiums accordingly. After thorough investigation and careful calculations, the price-fixing board has concluded to fix the basic prices at three times what they were before the war. These revised price scales were put in force on Jan. 1, 1920. An exception is made in prices for machinery and motors where substitute metals are employed and for machinery wrapped in copper and aluminum. For the last mentioned the basic prices have been only doubled, as they have been increased once before.

TELEGRAPHS AND TELEPHONES DECLARED MONOPOLIES OF STATE IN COSTA RICA.—The provisional government of Costa Rica has issued a decree declaring that the wireless telegraphs and telephones are state monopolies. A translation of the decree forwarded by the United States consul among other provisions states that permissions granted for wireless installations now established in the country may be revoked at any time and the respective plants may pass into the power of the state, with proper indemnification. Furthermore, the decree limits the establishment, management and exploitation of the enterprise of wireless telegraphy and telephony for international service to persons of Costa Rican origin, singly or in corporations, under the supervision and protection of the state.

IMPORTATION OF ELECTRICAL GOODS INTO POLAND WITHOUT A LICENSE.—The most recent regulations in regard to the importation of electrical goods into Poland allow all wiring and installation material, excepting candelabra, lamp globes, incandescent carbon and electric lamps, to be imported without a license, but they are subject to customs duties.

ELECTROTECHNICAL INDUSTRIES IN POLAND.—According to the Journal of the American-Poland Chamber of Commerce and Industry, electrotechnical industries are being developed on a large scale in Poland. Many electric power houses have been built and there is a marked tendency to install electricity even in the smallest towns. The demand for electric machines and apparatus, lamps, motors and installation material is very great.

THE WESTINGHOUSE COOPER HEWITT COMPANY, LTD., 11 Rue du Pont-Suresnes, Seine (Paris), France, is prepared to undertake the representation in Europe of electric washing machines. It announces that it can offer the resources of its sales organizations throughout Europe, with centres at London, Paris, Milan and Berlin, and also the facilities of its factories at London and Paris.

SMALL ELECTRIC LOCOMOTIVES IN COAL MINES IN ENGLAND.—The use of small electric locomotives in coal mines to displace pit ponies has been sanctioned by the British Home Office. These locomotives, which heretofore have been employed in iron mines as feeders from the faces to the main roads, are designed to haul a load of 10 to 15 tons on the level, or about 3 tons up a gradient of one in thirty.

THE COLEMAN LAMP COMPANY, Wichita, Kan., is erecting a plant at Queen Street East and the Don Roadway, Toronto, Ont., for the manufacture of portable lamps.

THE SHADE MANUFACTURING COMPANY, LTD., Edmonton, Alta., is planning to establish a plant on Owen Sound, Ont., for the manufacture of electric washing machines.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An engineer in Italy (No. 33,258) desires to purchase machinery and motors for the equipment of a factory for tannic acid and other acids.

An electrical engineer in Brazil (No. 33,251) desires to purchase an agency for the sale of domestic electrically operated pumps of from ½-in. to 1-in. suction, capable of elevating water from 3 m. to 30 m., utilizing a 220-volt motor.

A commercial agent in Bulgaria (No. 33,254) desires to secure an agency for the sale of material for electric installations, lamps, electric wire, etc.

Agencies are desired by a merchant in France (No. 33,288) for the sale of portable electric tools, vacuum cleaners, washing machines, electrical appliances and machinery.

Trade Publications

ELECTRIC TOOLS, CARBON BRUSHES, ETC.—Gilfillian Brothers Smelting & Refining Company, Los Angeles, Cal., is circulating catalog No. 7 on its electric tools, carbon brushes and ignition parts.

ELECTRIC FURNACES.—The Electric Heating Apparatus Company, 123-125 Sussex Avenue, Newark, N. J., has issued catalog E, covering its electric "Hevi-Duty" furnaces, muffle, tube and crucible types.

FARM-LIGHTING EQUIPMENT.—The Benjamin Electric Manufacturing Company, Chicago, is circulating a small booklet, entitled "Pioneering in Correct Farm Lighting."

ELECTRIC FURNACES.—The Electric Furnace Company, Alliance, Ohio, is circulating a four-page folder, entitled "The Crisis in Fuel Oil—a Solution of the Problem," in which it describes the resistance type of Bailey electric furnaces for the melting of metals and the heating, heat treating and annealing of steel and brass, etc.

BRUSHES FOR ELECTRICAL MACHINERY.—The Morganite Brush Company, 519 West Thirty-eighth Street, New York City, has issued bulletin M.B.C. No. 1, in which it describes its different types of Morganite brushes for electrical machinery.

AUTOMATIC ADVERTISING SERVICE.—The Automatic Illuminated Advertising Corporation, 824 West North Avenue, Baltimore, Md., has published an illustrated booklet covering its automatic "Balopticon" screen service for the advertiser, educator and lecturer.

TRANSFORMERS.—Miniature catalog 4-A-1, giving a complete list of distribution transformers with prices, has been published by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

MACHINE-TOOL CONTROL.—The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has issued a forty-eight page book, entitled "Machine Tool Control—C-H Controller."

RADIUM LUMINOUS MATERIAL.—"Undark" is the title of the booklet issued by the Radium Luminous Material Company, New York City, covering the use of radium for illuminating purposes.

OIL SEPARATOR.—Bulletin No. 1130, describing its Bundy oil separator, is being circulated by the Griscom-Russell Company, 90 West Street, New York City.

MOTORS.—The Triumph Electric Company, Cincinnati, Ohio, has issued bulletin No. 2007 on the Triumph 40-deg. polyphase induction motor.

MOLDING MACHINES.—Catalog 10, issued by the William H. Nicholls Company, Inc., 2-10 College Place, Brooklyn, N. Y., describes and illustrates its molding machines.

ARC WELDING.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is distributing reprint No. 85, entitled "Analysis of Arc Welding Principles and Processes."

WOOD PRESERVER.—The C-A-Wood Preserver Company, St. Louis, Mo., is getting out a series of letters, which will be continued, on the preservation of timber, poles, etc.

ELECTRIC WATER HEATER.—The Aetna Electric Appliance Company, 40 Court Street, Boston, has issued a small booklet describing its "Hot Vent" electric water heaters.

BALL BEARINGS.—The Fafnir Bearing Company, New Britain, Conn., has published booklet No. 20 covering its ball bearings for electrically driven and other machines.

PANEL BOARDS AND CABINETS.—The Trumbull Electric Manufacturing Company, Plainville, Conn., has issued its panelboard catalog, covered by bulletins 1-2-3.

TUMBLERS.—The Whiting Foundry Equipment Company, Harvey, Ill., has issued catalog No. 153 entitled "Tumbling Mills," in which it covers its different types of tumblers for foundries.

VENTILATING FANS.—Catalog No. 721 issued by the Buffalo Forge Company, Buffalo, N. Y., describes its motor-driven fans for dye houses and bleacheries.

BATTERY STATION EQUIPMENT.—The Service Products Company, Springfield, Ohio, is circulating a booklet entitled "Automotive Service Station Equipment," in which it describes its battery service station equipment.

CONTROLLERS.—The National Electric Controller Company, Chicago, is distributing price list No. 10, descriptive of National controllers, etc.

CONDULETS.—Crouse-Hinds Company, Syracuse, N. Y., is circulating bulletin No. 1000N, on "Condulets, Mogul Obround Series."

New Incorporations

THE NATRONA (PA.) LIGHT & POWER COMPANY has been incorporated with a capital stock of $75,000 to operate an electric light and power plant in Natrona.

THE SEQUOYAH HYDRO-ELECTRIC POWER COMPANY, Muskegee, Okla., has been incorporated with a capital stock of $10,000 by H. C. House, R. S. Cate, both of Muskegee, and F. L. House, Gore, Okla.

THE COOPER STORAGE BATTERY COMPANY, Cincinnati, Ohio, has been incorporated with a capital stock of $10,000 to manufacture storage batteries of all kinds. The incorporators are I. J. Cooper, J. D. Cloud, A. H. Brendel, H. H. Brenner and L. E. Tulley.

THE ELECTRIC SUPPLY CORPORATION, Boston, Mass., and Manchester, N. H., has recently been organized and incorporated with a capital of $100,000, to manufacture electrical goods, etc. The promoters of the new company are Earle T. Carbee, of Hoskett, N. H.; Charles K. Marston, of London, N. H.; S. R. Atwood, of New Boston, N. H., and George M. Faulkner, of Brookline, Mass.

THE MEELEY MAGNETO & PARTS COMPANY, Philadelphia, Pa., has been incorporated by W. F. Monahan, Michael J. Trochler and Raymond M. Waters. The company is capitalized at $100,000 and proposes to manufacture magnetos and ignition equipment for automobile service.

THE HERCULES MANUFACTURING COMPANY, Indianapolis, Ind., has been chartered with a capital stock of $400,000 by Jackson Carter, E. M. McDaniel and W. L. Taylor. The company proposes to manufacture electrical machinery.

THE CANNON ELECTRIC DEVELOPMENT COMPANY, Los Angeles, Cal., has been incorporated by James H. Cannon, 4034 Homer Street; John F. Torrey and Byron L. Marvel. The company is capitalized at $20,000 and proposes to manufacture electric apparatus and electric equipment.

New England States

BOSTON, MASS. Contract will soon be awarded by the Workingmen's Co-operative Bank, 101 Tremont Street, for the construction of a bank and office building to cost about $150,000. An electric lighting system will be installed. T. M. James, 3 Park Street, is architect.

GLOUCESTER, MASS. The Department of Utilities of Massachusetts has authorized the Gloucester Electric Company to issue 523 shares of capital stock at $110 a share, the proceeds to be used for extensions and improvements to its plant.

WATERTOWN, MASS. — Contract has been awarded to the Hugh Nawn Construction Company, 82 Savin Street, Roxbury, by the Walker & Pratt Manufacturing Company, 31 Union Street, Boston, for the construction of a stove factory to cost about $200,000. Electric light and power equipment will be installed.

GLASTONBURY, CONN. — The Central Connecticut Power & Light Company is endeavoring to interest the people of Colchester, Hebron and Neipsic Avenues to form a fire district for street lighting.

NORWALK, CONN. — Plans are under way by Westcott & Mapes, Inc., 207 Orange Street, New Haven, for the construction of a plant in the Second District of Norwalk. The first unit to be erected will be used as a rotary substation to cost about $50,000. Equipment includes two 300-kw. rotary converters with transformers, switchboard, etc.

Middle Atlantic States

ALBANY, N. Y.—The Adirondack Power & Lighting Company of Glen Falls will soon receive bids for the erection of a hydro-electric plant on the Mohawk River near Albany. The General Electric Company, it is reported, is interested in the project. Sargent & Lundy, 72 West Adams Street, Chicago, Ill., are structural and mechanical engineers.

MOUNT VERNON, N. Y.—The City Council has contracted with the Westchester Lighting Company to install and maintain an ornamental lighting system on West Third Street between Fourth and Fifth Avenues for a period of three years. Ornamental standards mounted with four 100-watt lamps will be used.

OLEAN, N. Y.—Plans are under way for the construction of an addition to the power house of the Olean Electric Light & Power Company, to cost about $100,000. Day & Zimmerman, 611 Chestnut Street, Philadelphia, Pa., are architects.

UTICA, N. Y.—Arrangements have been made by the Utica Gas & Electric Company for an issue of $1,700,000 in bonds, part of which will be used for improvements to its plant and system.

SECAUCUS, N. J.—Bids will soon be received by the Boulevard Commissions of Hudson County, Jersey City, for the installation of a motor electric power plant in the local power house, to cost about $30,000.

BETHLEHEM, PA. — The Chamber of Commerce contemplates the erection of a ten-story hotel in Bethlehem to cost about $500,000. Electric light equipment will be required. Verus T. Ritter, North American Building, is architect.

PHILADELPHIA, PA.—The Philadelphia & Reading Railroad contemplates the erection of two electric substations.

SCRANTON, PA. — Contract has been awarded to E. A. Fuller Company, Dickson Avenue, by the Linder Brothers for the construction of a garment factory to cost about $160,000. Electric light equipment and 100 electric motors of ½ hp. for sewing machines will be installed.

SCRANTON, PA.—Fred Nelson, architect, Connell Building, is preparing plans for the erection of a handkerchief factory, owner's name withheld, to cost about $100,000. Electric light and power equipment will be required.

BALTIMORE, MD. — Plans are under way by the Consolidated Gas, Electric Light & Power Company, for the erection of a new power plant at Dundalk.

BALTIMORE, MD. — The Miller Safe Company, Fremont Avenue and Frisco Street, will soon award the contract for the erection of the initial unit of its proposed new plant, to include power house, machine shop, etc., at a cost of about $400,000, including equipment.

WASHINGTON, D. C. — The following appropriations have been made by Congress: Engineer department, for maintenance and repair of searchlights, electric light and power equipment for seacoast

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

fortifications, and for tools, electrical and other supplies to be used in their operation, including purchase of reserve lights, $60,000; for the installation and replacement of electric light and power plants at seacoast fortifications and purchase and installation of searchlights for seacoast defense in the United States, including searchlights for anti-aircraft defenses and accessories therefor, for salaries of electrical experts, etc., $566,250; purchase and installation of searchlights for the defense of the most important harbors in the Philippine Islands, $2,000, and in the Hawaiian Islands, $50,000; maintenance and repair of searchlights, electric light and power equipment for seacoast fortifications, tools, etc., in the Philippine Islands, $25,000, and in the Hawaiian Islands, $7,000. Chief of Coast Artillery, for the construction of fire control stations and accessories, including not to exceed $48,755 for lands and rights-of-way, purchase and installation of necessary lines and means of electrical communication, including telephones, dial and other telegraphs, wiring and all special instruments, apparatus and materials, coast-signal apparatus, subaqueous, sound and flash ranging apparatus, including their development, salaries of electrical experts, etc., $770,000. Chief Signal Officer, for operation and maintenance of fire control installations at seacoast defenses, $165,000.

North Central States

DETROIT, MICH.—Plans have been filed by the Detroit Tool Company, 1487 St. Antoine Street, for the construction of a two-story addition to include a power department.

DETROIT, MICH.—The Michigan Creamery Company, care of Samuel Raboniwitch, Ford Building, has plans well under way for the construction of a creamery plant to include a steam-power plant. Electric lighting and miscellaneous power equipment will be required. Thos. A. Hyland, 307 Moffat Building, is architect.

CINCINNATI, OHIO.—Contract has been awarded to the Foundation Company, Front and Rose Streets, by the Union Gas & Electric Company for remodeling a warehouse into an electric substation, to cost about $40,000.

GEORGETOWN, OHIO. — Contract will soon be awarded for the installation of an electric lighting plant in Georgetown. E. Young is clerk.

WARREN, OHIO. — The Warren Hotel Company, care of F. E. Robbinson, Guardian Building, Cleveland, is having plans prepared by Moulthrop & Nichols, architects, 5716 Euclid Avenue, Cleveland, for the erection of a hotel to cost about $1,000,000. Electric light and elevator equipment will be installed.

RICHMOND, IND.—An appropriation of $100,000 has been ordered by the City Council as a portion of the amount to be expended for additional equipment for the municipal electric light and power plant.

WASHINGTON, IND.—Bids have been received by the City Council for the construction and operation of a municipal electric light plant to be erected at East Side Park. A bond issue of $83,495.95 for the new plant has been approved.

BREESE, ILL.—The erection of an electric distribution line from Breese to Aviston, including necessary transformer stations, poles and wires, is contemplated. Fuller & Beard, Chemical Building, St. Louis, Mo., are engineers.

ROSCOE, ILL.—Funds to the amount of $4,500 are being raised by the citizens of Roscoe for the erection and equipping of an electric light plant. The Beloit Water, Gas & Electric Company will erect a line from Rockton to supply the power.

KEWANEE, ILL.—The City Council has approved the plan now before the Chamber of Commerce for the installation of a modern street-lighting system in the business section of Kewanee.

ROCK ISLAND, ILL.—An appropriation of $20,000 has been made for the maintenance and operation of a power plant at the Rock Island Arsenal.

AMBERG, WIS. — The development of water power at the Pike River dam for the purpose of furnishing light in Amberg is contemplated.

FLORENCE, WIS.—Bids will be received by C. R. Johnson, secretary of the committee on waterworks improvements, until Aug. 15 for furnishing, f.o.b. Florence, three centrifugal motor-driven pumps, rating from 100 gal. to 500 gal. per minute; two operating panels equipped with automatic controller, meter, etc.; one electric siren and one small air compressor. Further information may be obtained on application to W. G. Kirchoffer, engineer, 31 Vroman Block, Madison.

VESPER, WIS.—The Wood County Rural Electric Company, recently incorporated with a capital stock of $100,000, contemplates the erection and operation of electric light, heating and power systems in Wood and Portage Counties.

CARTHAGE, MO.—A second election has been held and bonds to the amount of $100,000 have been voted for improvements and extensions to the electric light plant and waterworks.

MARSHALL, MO.—Bonds to the amount of $90,000 have been voted for the installation of an electric light and water plant.

ST. LOUIS, MO.—Plans are under way for the establishment of a municipal electric lighting system to cost about $1,000,000.

GRAND FORKS, N. D.—Contract has been awarded to the Fegles Construction Company, Minneapolis, Minn., by the Industrial Commission of North Dakota, for the erection of a power plant, reservoir and filter plant. C. L. Pillsbury, Metropolitan Life Building, Minneapolis, Minn., is engineer.

CLATONIA, NEB. — The local electric power plant of H. W. Steinmeyer is reported to have been partially destroyed by fire, causing a loss of about $15,000.

Southern States

ALBEMARLE, N. C. — The Southern Power Company of Charlotte contemplates rebuilding its power station recently destroyed by fire.

BLADENBORO, N. C. — Bonds to the amount of $10,000 have been voted for improvements to the lighting system, streets, etc., in the town.

BAMBERG, S. C. — At a recent local meeting, bonds to the amount of $15,000 were voted for repairs to and the enlargement of the municipal electric light plant.

UNION, S. C.—Bonds to the amount of $30,000 have been voted for improvements to the municipal electric light system.

WOODBURY, GA.—Improvements to the electric light and water systems to cost about $35,000 are contemplated. S. P. Wilburn is city clerk.

HOMESTEAD, FLA.—The city officials are considering the installation of an electric light system to cost about $15,000.

PIGGOT, ARK.—The Myers Stave & Manufacturing Company, J. R. Myers manager, contemplates the construction of a plant including a main factory and a power house, 40 ft. x 60 ft., to cost about $400,000.

NEW ORLEANS, LA. — Contract will soon be awarded by the Arabi Packing Company for the construction of a packing plant to include a power house, 57 ft. x 67 ft., to cost about $400,000. Packer's Architectural Engineering Company, 431 South Dearborn Street, Chicago, Ill., are architects.

COLLINSVILLE, OKLA.—The erection of a dam on the Caney River, with a new intake pumping station and the installation of a 5-stroke [illegible] boiler, is contemplated by the city officials. The cost is estimated at about $120,000.

ERICK, OKLA.—Improvements to include the installation of a sewer system and additions to the electric light and water plant are contemplated at a cost of about $120,000.

DALLAS, TEX.—Application has been made to the City Commission by the Dallas Power & Light Company for permission to issue $700,000 in bonds for improvements to its plant.

EDINBURG, TEX. — The Edinburg Commercial Club is interested in plans for a local electric light plant. Marvin W. Harms is secretary.

MARBLE FALLS, TEX.—The Syndicate Power Company has been reorganized by Col. C. H. Alexander of Dallas to carry out the deferred construction of a large dam across the Colorado River, partly finished, and the installation of a hydro-electric plant to develop 100,000 hp. The cost of the project is estimated at about $8,000,000, including the erection of electric transmission lines to San Antonio, Austin and other towns within a radius of 150 miles.

Pacific and Mountain States

BEND, ORE.—Announcement has been made by Charles A. Brown, president of the Bend Water, Light & Power Company, that the development of power on Tumalo Creek will be started definitely this summer or early fall. The cost of the project is estimated in excess of $250,000.

ENTERPRISE, ORE. — The Enterprise Electric Company will have work started soon on the construction of a hydro-electric plant above Wallowa Lake. The first unit to be installed will consist of one Henry impulse turbine operating under a head of about 800 ft. and one 800-kw., 514-r.p.m., 6,600-volt, 60-cycle, three-phase generator.

BONIFAY, CAL.—The extension of the electric lighting system in Bonifay is under consideration.

BURBANK, CAL.—At a recent election bonds were voted for improvements to the electric light and power plants.

LA MANDA PARK, CAL.—The Board of Trade will start a campaign soon for the purpose of securing a lighting system for this place.

LOMPOC, CAL.—The Board of Supervisors has awarded contract for installing the Los Alamos street-lighting system to the Midland Counties Public Service Company of San Luis Obispo.

LONG BEACH, CAL.—The installation of an electric street-lighting system on a portion of Fourth Street is contemplated. W. C. Waughop is city clerk.

MOORPARK, CAL.—At a meeting held recently, the proposal to establish a lighting district in Moorpark was carried.

WORLEY, IDAHO.—Bids will be received by the Board of Trustees until Aug. 7 for the erection of an electric distribution line in Worley and a transmission line from that village to Plummer, also for furnishing all materials required in the construction of both lines.

WINSLOW, ARIZ.—A certificate of convenience and necessity to construct and operate a plant in Winslow has been granted to the Arizona Electric Company.

BRIDGER, MONT. — Surveys are being made by the Montana Power Company of Butte for the extension of the high-tension transmission line from Bridger to Bearcreek and Washoe.

SANTA FE, N. M.—The installation of new ornamental lamp standards for the street-lighting system is under consideration. W. G. Turley is city engineer.

Canada

TRAIL, B. C.—Work is well under way on the construction of an extensive water system for the Consolidated Mining & Smelting Company of Canada. In the main pumping station located on the Columbia River there will be installed three 200-hp., 550-volt motors direct-connected to three three-stage centrifugal pumps, the latter operating against a head of 337 ft. and rating 1,500 r.p.m. Water will be pumped through a reservoir to a relay station to be equipped with two pumps similar to those in the main pump house. The company is also making additions to its copper plant, necessitating the installation of a 1,200-kva. synchronous motor-generator set.

LIVERPOOL, N. S.—Plans are under way for the construction of a local power plant to cost about $30,000. Smart & Burnett, 10 Cathcart Street, Montreal, Que., are engineers.

KENORA, ONT.—The Lake of the Woods Pulp Mill Company contemplates the development of water power at Kenora. The cost of the project is estimated at about $1,000,000.

SAN JOACHIM, ONT. — The Rochester Telephone Company contemplates rebuilding and altering its system completely, at a cost of about $15,000. Plans include the installation of new equipment, changing lines and making extensions. F. A. Trepanier of San Joachim is engineer.

TORONTO, ONT. — The Grinnell Company, Ltd., has awarded contract to the Anglin-Norcross Company, Ltd., for the construction of a foundry building 100 ft. x 150 ft. Electric light equipment and motors will be installed.

TORONTO, ONT.—General contract has been awarded to Witchall & Son, 156 St. Helens Avenue, by the Toronto Electrical Commissioners, Duncan and Nelson Streets, for the erection of a hydro substation.

CHELSEA, QUE.—Gilmour & Hughson of Hull contemplates the development of water power in Chelsea. The Royal Securities Company of Montreal is interested.

MONTREAL, QUE. — Plans are under way for the construction of a ten-story hotel, to cost about $8,000,000, for the United Hotel Company. Two floors will be utilized for the accommodation of power, heating and ventilation equipment, also for laundry, kitchen, etc. Ross & Macdonald, Belmont Street, are architects.

SASKATOON, SASK.—Extensions to the electric light and power plant, to cost about $27,300, are contemplated. A. Leslie is city clerk.

Record of Electrical Patents

Notes on United States Patents

(Issued July 6, 1920)

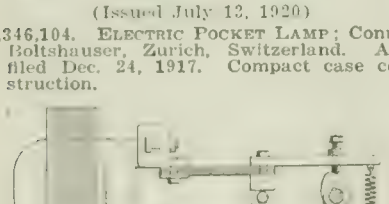
1,344,961. ELECTRIC METAL-WORKING APPARATUS; Wolcott Remington, Lynn, Mass. App. filed Oct. 4, 1919. For heating blanks fed into machine.

1,345,351. JOURNALED CABLE CLAMP; Edwin L. Crosby and Oliver J. Marshick Detroit, Mich. App. filed Oct. 31, 1919. To be used for lessening bending strain on flexible cables of rotatable electric furnace.

1,345,768. ELECTRICAL APPLIANCES; Harold P. Hastings and John J. Dossert, Syracuse, N. Y. App. filed June 24, 1918. Socket outlet applied to conduit.

(Issued July 13, 1920)

1,346,104. ELECTRIC POCKET LAMP; Conrad Boltshauser, Zurich, Switzerland. App. filed Dec. 24, 1917. Compact case construction.



1,344,961. Electric Metal Working Apparatus

1,346,198. DRUM FOR REELING FOR DYNAMO-ELECTRIC MACHINES; Edward F. Andrew, Chicago, Ill. App. filed March 28, 1919. Mounted on plate or frame.

1,346,161. ARC-WELDING GENERATOR; Alan M. Bennett, Westfield, N. J. App. filed March 9, 1918. Produces the desired current when striking arc and during welding.

1,346,181. AUTOMATIC REGULATOR; Henry R. Davies, Toledo, Ohio. App. filed May 13, 1918. Constant voltage from variable-speed generator.

1,346,213. CONTINUOUS-CURRENT DYNAMO; Fritz Kesselring, Neuhausen, Switzerland. App. filed July 17, 1916. Constant voltage at variable speed.

1,346,353. HEAT AND VAPOR BATH CABINET; Oscar B. Ullman, Eugene B. Simmonds, and Arthur E. Atkinson, Muncie, Ind. App. filed Sept. 16, 1918. Electrically heated.

1,346,355. ELECTRIC CIGAR LIGHTER; Charles F. Cinco, Meriden, Conn. App. filed March 3, 1919. Used on automobiles.

1,346,418. CURRENT-REGULATING PLUG AND SOCKET SWITCH; Antonio Papini, Philadelphia, Pa. App. filed Aug. 15, 1919. Rheostat in socket.

1,346,471. AIR-DIFFUSION MACHINE; Vern Slater, Iowa City, Iowa. App. filed Jan. 3, 1919. Delivers electrically heated air.

1,346,476. STRING MESSAGE HOLDER FOR WIRELESS OR OTHER TELEGRAPH MECHANISM; Montraville M. Wood, Berwyn, Ill. App. filed April 4, 1919. Knots on string close contacts.

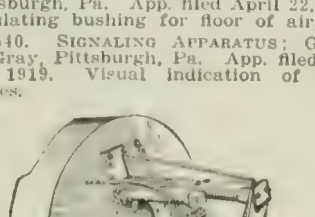
1,346,493. ILLUMINATED SIGN; William P. Hammond, Passaic, N. J. App. filed April 30, 1915. Any desired design may be shown.

1,346,522. AUXILIARY SPARK GAP; Harvey P. Altman, Findlay, Ohio. App. filed March 30, 1918. Attached to plug to increase spark.

1,346,525. BINDING POST; Frank G. Beetem, Washington, D. C. App. filed Feb. 6, 1919. Cannot rotate in its support.

1,346,539. FAIR LEAD; George F. Gray, Pittsburgh, Pa. App. filed April 22, 1919. Insulating bushing for floor of airplane.

1,346,540. SIGNALING APPARATUS; George F. Gray, Pittsburgh, Pa. App. filed May 20, 1919. Visual indication of radio waves.



1,345,351. Journaled Cable Clamp

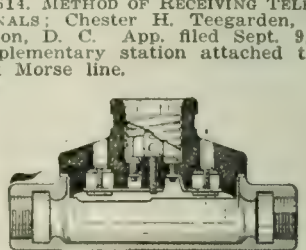
1,346,544. MAGNETIC ORE SEPARATOR; August F. Jobke, Pittsburgh, Pa. App. filed April 24, 1918. Specially shaped electrodes.

1,346,592. FIELD-COIL TESTING DEVICE; Jasper F. Cullin, Detroit, Mich. App. filed Jan. 26, 1920. For determining condition of insulation.

1,346,598. STARTER FOR INTERNAL-COMBUSTION ENGINES; Frank E. Fisher, Detroit, Mich. App. filed Feb. 24, 1919. For use on a Ford automobile.

1,346,606. ELECTRICAL APPARATUS; Christian M. Petersen and Oscar J. Boden, San Francisco, Cal. App. filed June 4, 1919. For energizing magnets.

1,346,614. METHOD OF RECEIVING TELEGRAPH SIGNALS; Chester H. Teegarden, Washington, D. C. App. filed Sept. 9, 1918. Supplementary station attached to simplex Morse line.



1,345,768. Electrical Appliances

1,346,631. ELECTRIC RIVETING MACHINE; Paul M. Benedict, New Haven, Conn. App. filed March 6, 1916. Rivet clinched while heated electrically.

1,346,659. ADJUSTABLE LAMP SUPPORT; Max Kossmann, Brooklyn, N. Y. App. filed Dec. 27, 1919. Supports lamp and cord.

1,346,693. MEANS FOR POSITIVELY INDICATING THE CONDITION OF STEEL DURING HEAT TREATMENT; Charles O. Bastian, London, England. App. filed May 10, 1920. Indicates point of critical temperature.

1,346,694. ELECTRICAL CONDENSER; Ernest A. Bayles and Harold Higham, Helsby, England. App. filed Feb. 23, 1915. For higher voltages.

1,346,698. ELECTRICAL FIRE-LIGHTING ATTACHMENT FOR STOVES; Tito L. Brunelli, Clearfield, Pa. App. filed Dec. 16, 1919. Power derived from house wires.

1,346,741. ELECTRICAL SUPERHEATER; Shady D. Colvin, Myrtis, La. App. filed July 19, 1919. For electrically superheating steam or water.

1,346,793. ELECTRIC HEATER; William O. Bunnell and Quincy A. Gates, Wilkes-Barre, Pa. App. filed March 27, 1916. To furnish various degrees of heat.

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The Engineer's Police Duty

HESITANCY of bankers and bonding houses to advance money for hydro-electric developments is often due more to misgivings caused by past misrepresentations than to the rate of return which is offered them. To facilitate legitimate developments it is the duty of the engineering fraternity as a whole to expose unsound projects. The industry cannot wait for some one else to do its policing.

Coal Regulation

THE coal producers of the country are playing a fast and loose game with consumers which can have but one ending. At present the game is all their way. Fortune favors them, and if one wants coal he must pay the price or go without. But from a public policy angle such an attitude is nothing short of suicidal. Coal production is not an amusement resort attraction, depending upon claptrap and chicanery for existence. It is a vital business dealing with an important and basic product which is essential to almost every other business in existence. For that reason producers cannot lightly regard adverse public sentiment, and this is fast building against them, owing to the unconscionably high prices for coal now prevailing. Unheeded, this sentiment will cause the game to be abruptly ended, and coal producers will find themselves bag and baggage in the hands of a regulating commission. All industry, and particularly public utilities, will demand it. This, of course, is the last thing the National Coal Association wants, but the road on which it is now traveling leads that way.

Strikes and Public Utilities

FIFTEEN hundred and sixty-four of the bodies making up the United States Chamber of Commerce have voted for and only ninety-seven against a declaration of principle averring that strikes of employees of public service corporations should be prohibited by law. By an equally emphatic vote the creation of tribunals to adjudicate labor disputes affecting such corporations, the decisions of these tribunals to be final and binding, has been indorsed. In making these declarations the Chamber of Commerce is merely registering what has long been the conviction of business circles—a conviction shared very generally by the people at large, whose "lives, health, security, comfort and well-being" are threatened and interfered with every time such a strike takes place. It is the good fortune of electric light and power companies that their interest in this particular phase of the activities of the Chamber of Commerce is that of good citizenship rather than that of participants in such struggles. For, thanks to the loyalty, high intelligence and public spirit of their employees, strikes are almost unheard-of happenings with them and the better way of negotiation and mutual concession has been long an accomplished fact.

"Foolproof" Electrical Apparatus

THE electrical engineer of a well-known automobile company makes the statement that owing to ignorance and incompetency the labor of keeping electrical equipment in first-class shape has increased fourfold. Obviously, then, the remedy lies in making all electrical apparatus as nearly "foolproof" as possible. To do this requires simplification of control and the use of automatic devices with push-buttons for starting and stopping motors and for closing switches of all types where power in any quantity is involved. Educational propaganda may also help, but its efficacy is dubious if labor is too ignorant to learn or cares little for consequences. "Foolproof" apparatus is the surest solution of the problem involved.

Insulators for Higher Voltages

FROM a Western viewpoint the question of going to higher transmission voltages is not an abstract proposition. With one large company having already ordered transformers wound for 220 kv. and others installing lines to operate at voltages above 150 kv., there is an immediate need for intensive study of the insulation requirements of such lines. Studies of the results to be obtained from the use of shields have been made by independent investigators, who have arrived at the conclusion that strings of suspension insulators shielded by metal plates or antennas may have the electric stress so distributed that no unit in a 220-kv. string will have greater unit duty than the same string used unshielded on a 150-kv. line. The particular type of shielding is of comparatively small importance, but the fact that a solution of this pressing problem is at hand is of intense interest to transmission engineers.

Rural Service Needs Study

HOW the rural line extension shall be handled has become an exceedingly pressing question, particularly in the Middle Western States, where the agricultural industry dominates the field, and where, unlike the Eastern States, industrial applications have not completely absorbed available central-station capacity. The farmer is not only demanding service but in many localities is able and willing to pay any reasonable price to get it. Present methods are very much confused because of the rapidity and magnitude of the development, but there are several tendencies that should receive the close study of central-station managers if serious errors are to be avoided. One of these tendencies is the character of construction. There is a tendency in some quarters to resort to extremely light construction or questionable engineering practices

on the assumption that first cost must be at the lowest possible level. While low first cost is essential, it must not be attained at the expense of safety and the imposition of heavy future maintenance charges that will be many times the fixed charges on the extra cost required to put up substantial construction. A tendency toward the creation of mutual organization or rural utilities that will operate and maintain their own distribution lines is observed. The experience of the rural telephone companies can be profitably studied in this connection. Rural companies cannot be expected to have an adequate working knowledge of the systems they attempt to operate, nor can they afford to employ a staff that has the necessary qualifications. From the trend in some localities it appears that the problem may be solved by an arrangement whereby the farmer makes the necessary investment, turning the lines over to the utility for future operation and maintenance and paying a fixed charge in addition to the energy charge that will be sufficient to cover depreciation and the maintenance and operating charges that may be in excess of the similar charges for city or town service.

The question of rates has perhaps so far received the most attention, but for the moment it would appear that the questions of character of construction and methods of financing and operating lines are of first importance, for on the answer to these questions depends the answer to the question of rates, which it is admitted must be sufficient to cover the cost of service and afford a reasonable profit. Present light and power rate schedules have been largely built up on city and town service conditions. Some have already made the error of attempting to establish rural service rates on that basis and are finding that the rates so fixed do not fit at all.

It appears now that the rural distribution line is a development that cannot be denied. Whether or not that development will be retarded and agricultural development hindered depends on the thoroughness of central-station men in working out the development problems with the various state commissions and prospective rural consumers. Several state commissions with the assistance of the utilities of their states are already earnestly at work on the problem, and it may be in order to suggest that the National Electric Light Association can very profitably take hold of the subject from a national viewpoint.

Isolated-Plant and Central-Station Costs

ONE striking result of war-time conditions has been the great increase of industrial service on the part of central stations and a very formidable concurrent increase in the price of fuel. Now, as fuel goes up highly efficient power plants gain increasing advantage, and hence central stations are more than ever able now to take over isolated plants which previously were operating at figures nearer to a real competitive basis. The central stations, with some loss of industrial patronage owing to the shutdown of war-time plants, are well equipped to take care of their customers and to take on the additional load to be furnished by the larger class of isolated plants. The central station of course has also to pay more for its coal than it used to, but utilizes it at much higher efficiency than is feasible in the isolated plant. The data available seem to indicate that, with fuel prices anywhere near the present level, nothing short of a superefficient isolated plant can be economically operated where central-station power is available at the usual rates.

Feat in Reducing Costs

IN THESE days, when the cost of everything is climbing inconceivable grades on high gear, it is almost astounding to find that by careful organization and the introduction of labor-saving schemes the Commonwealth Edison Company has been able to keep its service installation costs for the last year actually below prewar figures. D. W. Roper's account of the way in which this remarkable feat was accomplished is worth careful consideration as showing how many loose ends can be pulled up in construction work and how straightforward a proposition services actually become when the working plans are carefully made. Among the many details which Mr. Roper reports some stand out conspicuously. First, the elimination of a very large proportion of rush orders is a gain of no small magnitude. Rush work is notoriously expensive, and when it involves disturbance of the regular schedule as well as extra costs in transportation it becomes singularly burdensome. Of course, now and then it has to be undertaken, but where the general installation work is carried on in an orderly manner the average time required for completion comes down quite nearly to the basis of a rush order. Beyond this the change in practice most conspicuous is the service of the work dispatcher in routing and handling the construction parties. The plan of campaign is worked out in advance. The routes for the several gangs are laid out so that each will start at the furthest point from headquarters and work back through the day. More than this, the men report in the morning at the job set for the beginning of their day's work, a provision which impresses us as being one of the most important in the whole schedule of economics. So much for the principal features of the human side of the task.

Next in importance comes the introduction of standardized methods in working out the details of an installation, that particular type of service being selected for general use which proved to make the easiest and most straightforward job. This being done, the equipment, tools and material could also be standardized so that each regular crew would have a uniform equipment containing everything necessary to carry on the work, without the casual additions that are likely to come when the exact method of procedure is left to be determined on the work. This entire equipment was packed in a uniform type of construction wagon, each article going into a space just fitted for its reception. This precaution insures the greatest possible ease in getting at anything which is required and eliminates grubbing around in the bottom of a wagon for an article thrown into it without any plan. On the average, the standard equipment of stock and tools is five hundred pounds lighter than the miscellaneous collection which used to clog the wagons, and this again facilitates getting promptly on the job. Gradually, too, various ingenious details of construction have been worked out and made a regular part of the program to save time and cut down waste of material. The complete list of equipment which Mr. Roper tabulates speaks volumes for the thoroughness with which the whole

operation is planned, and finally the clerical routine of reporting and executing orders has been simplified so that the foreman can attend strictly to his business without scribbling in the field a lot of entries for which there is no absolute need when proper provision is made at the office for reporting the essentials. The result of this admirably planned campaign of installation has been, as already said, actually to bring the costs of this item below pre-war figures and so to recoup in part the heavy expenses which have been loaded upon public utilities by increases of prices which no foresight or skill can escape.

Protection of Transmission Systems

HIGH-VOLTAGE transmission systems are subject to various troub'es, all of which have to be considered by designers and operating engineers, while some of them have to be specially protected against. There are insulator breakdowns due to insufficient factor of safety in the insulators, power losses by corona, groundings of the lines by casual storm damage, poor voltage regulation, harmonics, short-circuit impacts on generators, losses of synchronism, overvoltages due to lightning and arcing grounds. In this number we print a contribution by Prof. Emil Alm which is particularly directed to protection against lightning surges and arcing grounds, with especial reference to the 100-kv. Untra-Värtan transmission system in Sweden.

In order to discharge the steadily increasing atmospheric accumulations of electricity on the lines, the neutral points of the three-phase transformers are permanently grounded. On the other hand, in order to limit short-circuit currents due to accidental grounds, neutral-point resistances to ground are inserted. Consideration is given to the proportioning of these resistances, so as to produce the best compromise between prompt discharge through a low-resistance path, and checking short-circuit currents by increasing the resistance.

It is claimed that there is a distinct advantage in the substitution of inductance for resistance in the neutral-to-ground paths, particularly in suppressing arcing grounds. This is an interesting point, on which experimental information, as well as practical experience, would be welcome. In the system described by the article. however, we understand that these neutral-to-ground impedances are conductive and not inductive. The high-tension busbars appear to be of stout iron pipe, instead of the usual copper.

The effects of the surge reflections as they enter from the line and develop in the protective devices are estimated in some detail. This method of computation is somewhat novel, but it is likely to receive much development in the future. In the radio art these oscillations are fostered and encouraged for the purpose of obtaining from them the communication of intelligence which they bear. In the power-transmission art these oscillations are suppressed and discouraged as much as possible, on account of their possibilities for danger. Means should be found for recording, oscillographically and automatically, the surges which come into a power house from the incoming lines, so that their properties may be studied and understood at leisure. The most troublesome oscillations arrive so swiftly and suddenly that the ordinary oscillograph is incapable of recording them properly.

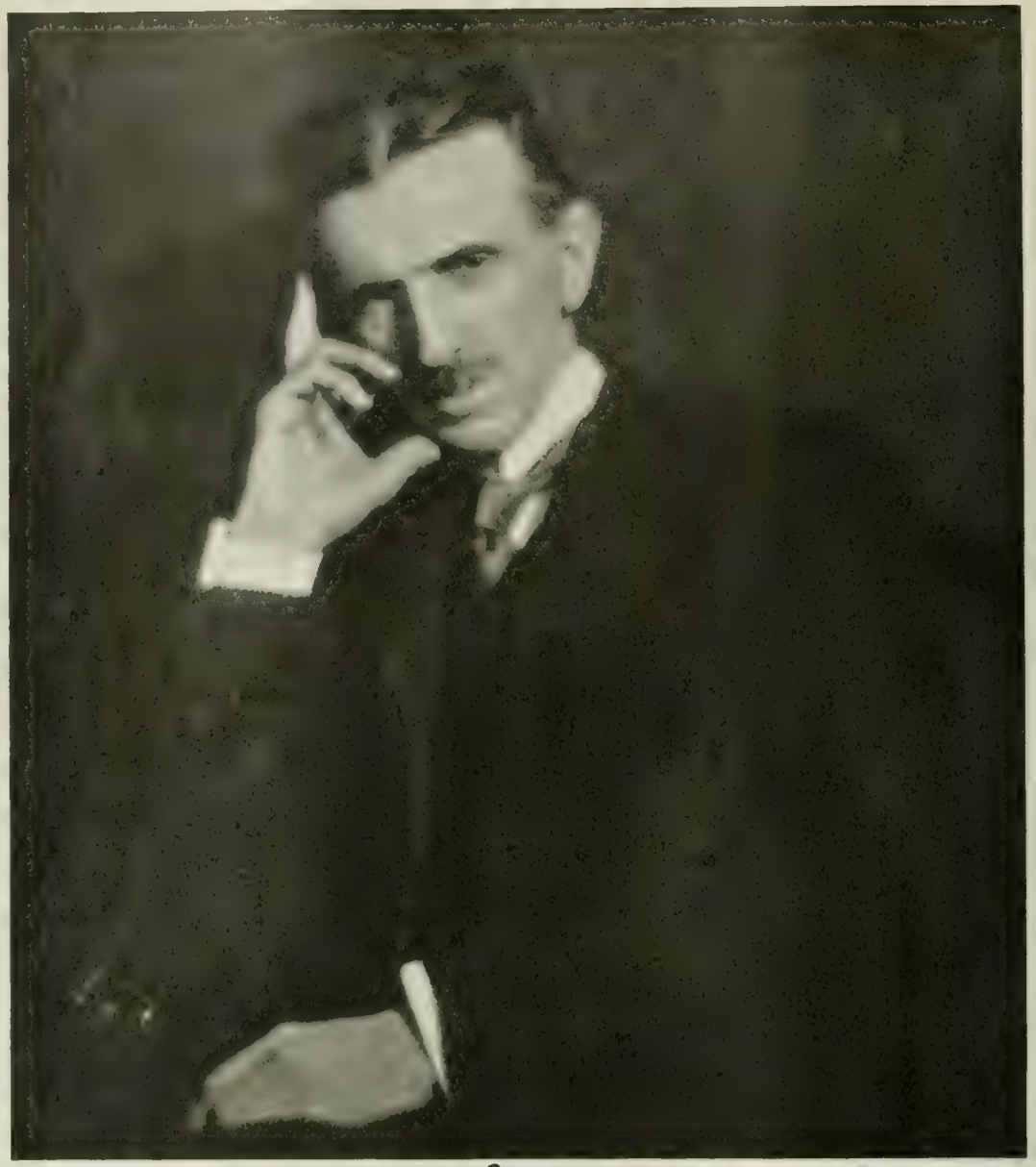
Difficulties of Waterwheel Regulation

AS BITTER experience has taught, speed regulation in hydro-electric plants is no joke, especially when big machines are operated in parallel. The fundamental difficulty is the sluggishness and immense inertia of the moving fluid, more particularly in the case of rather low-head installations, resulting in a time constant of regulation which is often inconveniently large. In the current issue C. F. Mosher discusses in an illuminating manner some of the general problems of regulation as they present themselves in practice. In these days of sensitive relay governors a wheel at constant or slowly changing load can be held at constant speed very closely. It can even be set to hold speed quite accurately from no load to full load, as regards gradual change. But the more nearly it does this the more delicate must be the setting and the greater the danger of trouble in case of a quick change of load. If the governor is sluggish, the risk of pressure changes is reduced at the expense of varying speed; if it be quick-acting, it will hold speed better, but the stresses may become disastrously high, and when generators are operating in parallel there may be instability and hunting. In these respects one finds himself between the devil and the deep sea.

As Mr. Mosher indicates, too c'ose inherent regulation is risky; but the main difficulty resides in dealing with rather rapid changes of load, especially with turbines at moderate heads. With impulse wheels under high head using the deflecting type of regulation, a well-balanced nozzle will act very promptly; but it should be noted that this system is very wasteful of water, and the use of needle valves or their equivalent brings again grave stresses requiring very complete provisions for relief. With ordinary turbines the greatest freedom of action comes with an open-flume setting, which as a general proposition is impracticable, and difficulties increase with the length of the penstock and draft tube.

Good as modern waterwheel governors are, there is still room for improvement in the matter of adjustment to the actual load conditions of the system. Two things in particular have to be taken into account—first, the range and time relations of ordinary changes of load; second, the effect of violent changes such as may be produced by a short circuit or open circuit. The former class can be well taken care of by adjustment allowing a moderate speed variation with respect to the time constant of the hydraulic system; the latter demands emergency measures both electrical and mechanical. This combination cannot easily be worked out *à priori*. Still again the operation of hydro-electric and steam plants in parallel brings a new set of problems, fortunately often simplified by the cushioning effect of a long connecting line.

In the long run security from grave difficulties in governing comes not only from good design and adjustment but from the increase of interconnection, giving steadier load conditions and allowing a unit in trouble to drop out of the system without producing serious load changes. It is the violent change that brings danger; for the rest a moderate variation in speed, if gradual, produces little disturbance in service, and on the whole a governor too sensitive is more to be feared than one which has more deliberate operating characteristics.



Nikola Tesla

Inventor of the alternating-current motor, pioneer in high-frequency investigation and discoverer of numerous fundamental principles in electricity

ALMOST a third of a century has passed since Nikola Tesla announced his discovery of the alternating-current motor, but the principles then enunciated by him will be found in force today wherever alternating current is used. Little things frequently lead to important consequences, and the way in which Tesla was led to his discovery is an exemplification of this trite observation. He was a student in Gratz, in Austria, when he became annoyed by the sparking of a small laboratory generator, and the idea came to him that a commutatorless dynamo might be possible. This thought grew upon him, but not until four years later did he make any progress toward its realization. Then the solution suddenly came to him during a moment of recreation. In Europe it was impossible to interest capital in his discovery, so in 1884 he came to America, where his fame had preceded him. His first employment was with Edison.

He was able later on to attract capital, and in 1887 he organized a company to further his cherished plans, on which he worked nineteen hours a day. The next year, upon the issuance of the patents, he announced the discovery which was destined to have such a profound effect upon the rapid expansion of the use and application of electrical energy.

Next to this work in polyphase power transmission his researches in the field of high-frequency oscillations are probably of greatest importance. His discoveries in this field include among others the oscillation transformer, the electrical oscillator and the Tesla tube. Work on these lines led quite naturally to his investigations in the field of radio power transmission. In addition he has made various other scientific investigations, especially in the fields of low-weight, high-powered prime movers and atmospheric nitrogen production.

Mr Tesla was born of Serbian parents at Smiljan, Lika, in Austria-Hungary, in 1857. He studied engineering at Grätz, Prague and Budapest. In 1917, on the twenty-ninth anniversary of the reading of his paper before the American Institute of Electrical Engineers, announcing his discovery in polyphase transmission, he received the Edison medal for "early original work in polyphase and high-frequency electric currents."

Service Work for 1919 Below Pre-War Cost

In Spite of Increased Wages and the Inroads of War and Industry on the Ranks of Trained Workers, Careful Engineering Has Succeeded in Reducing Unit Costs —Important Factors That Have Played a Part in Bringing This About

By D. W. ROPER

Superintendent of Street Department Commonwealth Edison Company

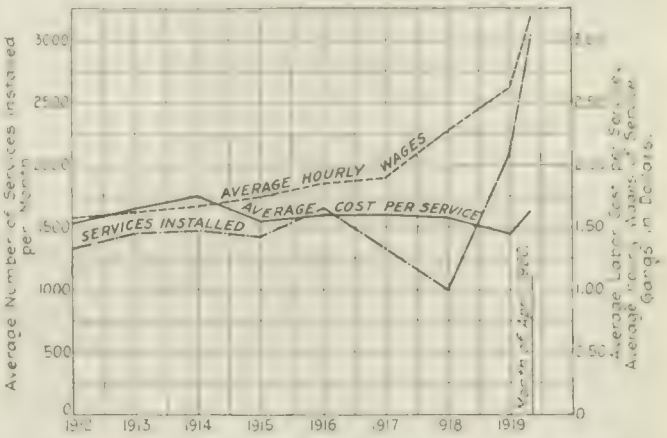
THAT the street department of the Commonwealth Edison Company of Chicago has been able to make a reduction in overhead service costs, as shown in the accompanying curves, in spite of the increased costs of labor, has been due to the carefulness with which efficient working methods have been carried out. At first glance it may appear that the increasing number of services installed per year is a large factor in reducing the cost per service. This, however, is not the case, as may be observed by studying the dip of the "service installed" curve in 1917. It is a fact that the number of services installed does have some effect on the cost per service, but, as shown by the data making up these curves, it is a very small factor. There are other factors which are more potent and the net result is achieved only by the combined effect of all.

Some of the important factors that have helped to effect this reduction can be briefly summarized as follows:

1. Eliminating rush orders.

2. Scheduling services. More than 80 per cent are installed within three days of the time the order reaches the street department.

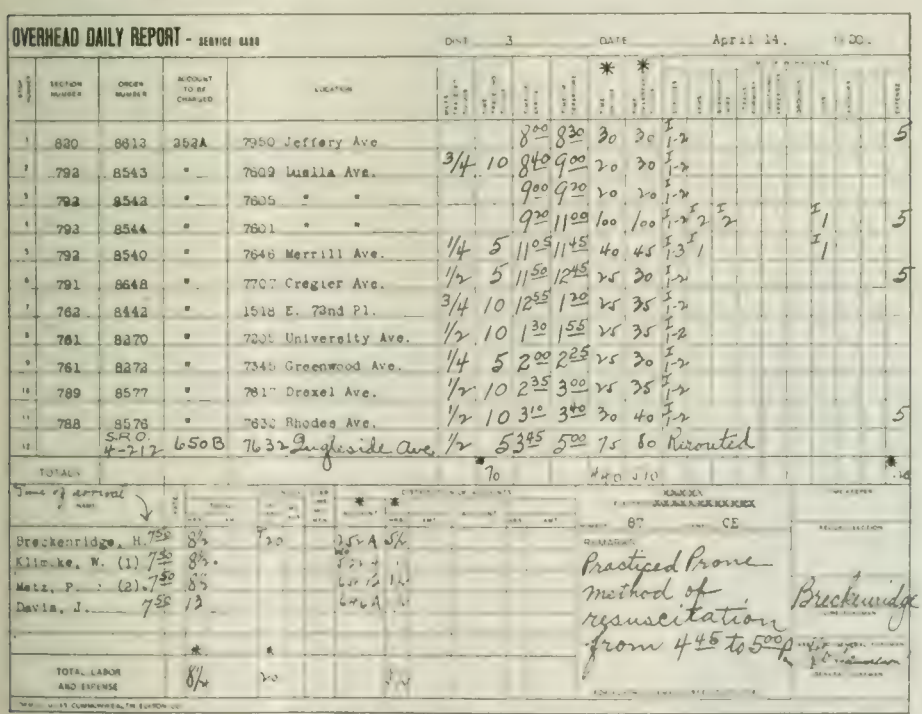
3. Standardization of the overhead-line equipment.



AVERAGE LABOR COST PER SERVICE OVER EIGHT-YEAR PERIOD

During the period shown the average wages of the gang have increased from $1.56 to $3.20 per hour, an increase of 105 per cent. Had the average labor cost of service installations increased in the same ratio, the labor cost per service would have been $3.12 in place of $1.56. During April 3,033 services were installed, on which the saving at $1.52 per service amounts to $4,730. In April there were twenty-six working days so that the average daily saving during the month of April due to the methods herein described was $182 per day.

4. Improved form of wagon for service and petty repair work. Some of the boys call it a "kitchen cabinet on wheels."



OVERHEAD DAILY REPORT - SERVICE CARD

DIST. 3 DATE April 14, 1920.

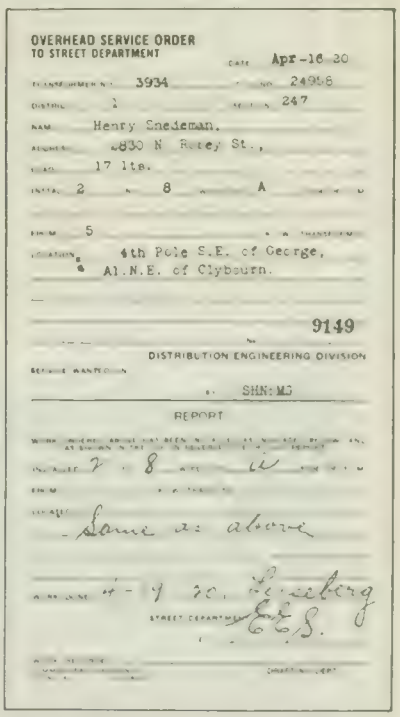
	SECTION NUMBER	ORDER NUMBER	ACCOUNT TO BE CHARGED	LOCATION	*	*											
1	820	8613	262A	7950 Jeffery Ave			8 00	8 30	30	30	I-2						5
2	792	8543	"	7809 Luella Ave.	3/4	10	8 40	9 00	20	30	I-2						
3	792	8542	"	7805 " "			9 00	9 20	20	20	I-2						
4	793	8544	"	7801 " "			9 20	11 00	100	100	I-2	I-2	I-2		I		5
5	792	8540	"	7646 Merrill Ave.	1/4	5	11 05	11 45	40	45	I-3	I			I		
6	791	8648	"	7707 Cregier Ave.	1/2	5	11 50	12 45	45	30	I-2						5
7	762	8442	"	1518 E. 73rd Pl.	3/4	10	12 55	1 20	25	35	I-2						
8	761	8370	"	7201 University Ave.	1/2	10	1 30	1 55	25	35	I-2						
9	761	8373	"	7345 Greenwood Ave.	1/4	5	2 00	2 25	25	30	I-2						
10	789	8577	"	7817 Drexel Ave.	1/2	10	2 35	3 00	25	35	I-2						
11	788	8576	"	7832 Rhodes Ave.	1/2	10	3 10	3 40	30	40	I-2						5
12		S.R.O. 4-717	650B	7632 Eugleside Ave.	1/2	5	3 45	5 00	75	80	Rerouted						
	TOTALS					70			440	510							

Time of arrival

Breckenridge, H.	7 55	8 1/2	7 20	35 A	S/K
Klimke, W. (1)	7 30	8 1/2			
Metz, P. (2)	7 30	8 1/2			
Davis, J.	7 55	12			
TOTAL LABOR AND EXPENSE		8 1/2	7 20		

87 CE

REMARKS: Practiced Prone method of resuscitation from 4 45 to 5 00 p.m. Breckenridge



OVERHEAD SERVICE ORDER TO STREET DEPARTMENT

DATE Apr-16 20

No. 24956

DISTRICT 1 No. 247

NAME Henry Snedeman.

ADDRESS 4830 N Ravey St.,

No. of Lts. 17 lts.

INSTR. 2 8 A

FROM 5

LOCATION 4th Pole S.E. of George, Al.N.E. of Clybourn.

No. 9149

DISTRIBUTION ENGINEERING DIVISION

SERVICE WANTED SHN:MJ

REPORT

Same as above

4-9 20. Lewberg

STREET DEPARTMENT E & S.

AT LEFT, OVERHEAD DAILY SERVICE REPORT OF SERVICE GANGS.

Typewritten entries are made in the office the day previous to issuing to foreman. Additional items of work given over the telephone are written in by the foreman, who also fills out the various columns giving details regarding work done and other items. All columns marked with an asterisk (*), showing the distribution of time to the various accounts and other items, are filled out in the street department office, and the extensions are figured and entered by the timekeeping department. The following abbreviations are used: "I" means installation; "R" means removal; "X" means replacement, and "M" means relocation of equipment.

AT RIGHT, OVERHEAD SERVICE ORDER TO STREET DEPARTMENT

For the overhead service order the typewritten entries are made in the office. Three copies of the order are sent to the street department; one is retained in the general office for their follow-up record, and two are sent to the district office; one copy is used for office record and one issued to the foreman, who enters in pencil his report of work done. On the back of the report he makes only a simple pencil sketch showing the location of the work done by the gang. Occasionally the service gangs install one or two spans of line wire which are also indicated on the back of this report and later entered on the permanent record by the engineering department.

SPECIAL ATTENTION

NAME OF CUSTOMER Van Buren Wet Wash Co.

ADDRESS 3521-27 Harrison St.

DATE SERVICE IS PROMISED Saturday, April 17, 1920.

AGREEMENT BY J.W. Ferguson.

POSSIBILITY OF ACCOMPLISHMENT VERIFIED BY J.F.Rice.
HEAD OF DEPT. OR FOREMAN

APPROVED BY J.W.Ferguson.

DATE April 16, 1920.

FORM C 111 COMMONWEALTH EDISON CO

SPECIAL ATTENTION SLIP

The original of this slip when issued is attached to the order sent to the engineering department. Typewritten copies are made there and attached to the installation orders sent to the several divisions of the street department so that all parties handling the job in the office or in the field know that it must receive special attention.

5. Standard wagon stock replenished from day to day. This standard stock takes care of all ordinary jobs. If some job requires special material, it is ordered by the office and placed in a locker during the afternoon. The driver puts on his wagon before starting the next morning all the material in that locker.

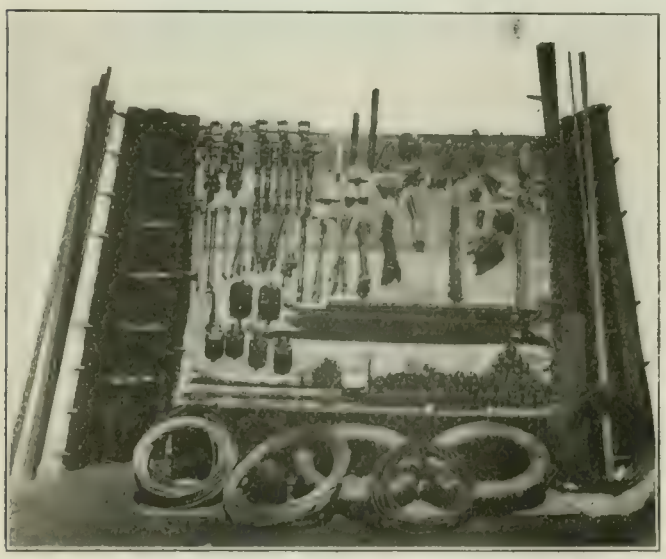
6. A typewritten form of order which eliminates most of the clerical work formerly requested of the foreman and simplifies the reporting.

7. Routing of services by the office so as to reduce traveling time.

8. Proper charging of time with careful supervision by office to insure accuracy.

9. Daily analysis of service costs of each gang to detect and eliminate cause of loss of time or other items increasing the cost.

Of course, the full effect of all of these causes for reduced cost was not realized overnight. Each is an achievement resulting from considerable earnest work by the street department employees. However, the whole movement started ten years ago when the then existing Western District, Northern District and Southern District offices were abolished and replaced by a department organization. This was in the year 1910.



STANDARD STOCK OF MATERIALS FOR OVERHEAD SERVICE TRUCKS

Foreman calls work dispatcher on telephone in afternoon and states what material has been used during the day. Work dispatcher arranges to have this material placed in foreman's locker during afternoon and also arranges for placing in same locker any special material required for jobs on next day's orders.

At that time it developed that each district had its own standards of equipment, its own standards of material and its own standard methods. Conditions were so radically different in these three districts that it was difficult to transfer either material, individual men or crews from one district to another. A program of construction was therefore started.

The standardization of service construction details made it necessary to standardize all other details of line construction. Standard drawings showing all such details have been prepared by the engineering department and index numbers have been assigned to them. Each foreman has a complete set of these prints so that the type of construction desired is indicated by giving the print number. The benefits from uniformity of design and construction are now making themselves evident in reduced costs. Briefly, that is the history of the development. Perhaps it would be well also to discuss more in detail the nine principal causes for the reduction in cost.

TABLE I—LIST OF TOOLS AND RUBBER GOODS CARRIED ON OVERHEAD SERVICE TRUCKS

Quantity	Size	Article	Quantity	Size	Article
1	1⅛x8 in.	Digging bar	1	.....	Drill handle
4	100 lb.	Canvas coal bags	1	.....	First aid kit
1	⅞x8 in.	Auger bit	1	8 ft.	Alley arm ladder
2	¾x8 in.	Auger bit	1	36 ft.	Extension ladder (three-piece)
1	1⅛x8 in.	Auger bit			
2	1⅛x16 in.	Car bit	1	10 ft.	Butt ladder
1	⅞ in.	Wood bit	1	2½ in.	Solder ladle
1	⅝ in.	Wood bit	1	No. 6786	Flash light
1		Screwdriver bit	1	100 ft.	Tape line
1pair	4 in.	Double-sheave wood blocks	4	.....	Clothespin blanket fasteners
1 pair	3 in.	Double-sheave wood blocks	1	No. 90	Coffee pot
			1	No. 5	Solder pot
1 pair	6 in.	Double-sheave wood blocks	1	4½x10 in.	Leather pouch
			1	No. 1	Burring brace reamer
1	6 in.	Snatch block			
1	8 in.	Ratchet brace	1	..	Transformer riser
1	12 in.	Ratchet brace	1	⅜x11 in.	Steel ramrod
			250 ft.	⅜ in.	Manila rope
1	No. 5	Stencil brush	200 ft.	½ in.	Manila rope
3	No. 6	Sash brushes	150 ft.	¾ in.	Manila rope
1	2 gal.	Safety can	50 ft.	1 in.	Manila rope
1	No. 2	Framing chisel	1	16 in.	Hand saw
1	8 in.	Cold chisel	1	26 in.	Hand saw
4		Miners' cups	1	.....	Hack saw
4	No. 1604-20	Haven clamps	1	Large	Furnace shield
1	No. 2	Bolt cutters	1	No. 2	Shovel
1	¾R ¾x1½ in.	Pipe die	1	No. 1	Reed-pipe stock
6	¾x4 in.	Star drills	1	.....	Sharpening stone
1	.....	Short bull-point drill	1 set	3 in.	Brass stencils, A-Z
			1 set	3 in.	Brass stencils, 0-9
2	½ in.	Bolt expanders	1	.....	Pipe vise
1	7 in.	Auger bit file	2	No. 3109-10	Lag wrenches
1	12 in.	Bastard flat file	2	14 in.	Stillson wrenches
2		Gasoline furnaces	2 pair		Westcott wrenches
1	No. 02	Funnel	1 pair	No. 260	Rubber knee boots
1 pair	..	Safety goggles	3 pair	No. 264	Rubber sporting length boots
2 pair	.	Horsehide over gloves	2		Rubber blankets
1	10 lb.	Sledge hammer	1		Brown motor coat
1	3½ lb.	Double-faced hammer	3		Lineman's rubber coats
1		Bull-point handle	2 pair	....	Rubber gloves
1	No. 21	Aluminum holder	4½ in. x 3 ft.		Rubber hose

VERY FEW RUSH ORDERS NOW

The matter of eliminating rush orders was simply handled by a general company order which made it impossible for any clerk who wanted to rush a job to mark "Rush" across the ticket in red letters. The authority for issuing rush orders has now been limited to the general contract agent and to a very few other officials in the company. Eliminating rush orders, of course, has been generally beneficial, since the handling of any jobs outside of the regular routine always tended to slow up work in general. The following formula has been evolved for determining how many days it will take to install a service:

2 X (days required to do job with one gang) + 2.

The natural result of the working of this formula is that it is now possible to schedule services. More than 80 per cent of the services are installed within three

days of the time when the order reaches the street department. The majority of those which do not come within the 80 per cent are services in outlying districts to which it is impracticable to send a crew of men until sufficient work has accumulated to occupy them for at least one-half day, or services which have been delayed by bad weather.

An important part of this scheduling of services and an interesting part has to do with the routing and handling of the men in the field. For the purpose of handling this work the street department divides the city into the Northern, Western and Southern districts, each of which has a separate office. At each of these offices a work dispatcher is stationed who receives the orders for services and who can then locate them on a map of the city by means of specially colored loca-

TABLE II—STANDARD STOCK OF MATERIAL FOR SERVICE TRUCKS

Quantity	Item	Quantity	Item
2	Four-pin alley arms	16	50-amp fuses
3	Six-pin alley arms	3	Ground rods
5	Six-pin cross arms	6	Ground-rod caps
1	Eight-pin cross arms	8	Ground-rod rivets
1	Eight-pin transformer arm	4	Guy clamps
1	42-in. transformer arm	4	Guy plates, S print No. 371
10	⅝x12 in. through bolts	4	Guy plates, S print No. 372
10	⅝x14 in. through bolts	12	½-in. strain balls
6	⅝x16 in. through bolts	6	¾-in. strain balls
4	⅝x18 in. through bolts	18	Porcelain primary insulators
2	⅝x20 in. through bolts	36	D.G D.P. glass secondary insulators
2	⅝x22 in. through bolts		
1	⅝x24 in. through bolts	24	Transposition insulators
10	⅝x16 in. double-arm bolts	2 gal.	Kerosene
10	⅝x18 in. double-arm bolts	100 ft.	¾-in. molding
6	⅝x20 in. double-arm bolts	20 ft	1¼-in. molding
4	⅝x22 in. double-arm bolts	3 lb	Tenpenny nails
2	⅝x24 in. double-arm bolts	5 cans	Soldering paste
75	½x2½ in. lag bolts	½ gal	P. & B. paint
25	½x4 in. lag bolts	1 lb	White lead
25	½x2½ in. carriage bolts	8	Locust pins
6	½x5½ in. eye bolts	6	Steel pins
24	½x4 in. machine bolts	15	Pole steps
4	½x1½ in. machine bolts	10 lb.	Salt
18	½x4½ in. machine bolts	2 gross	Sorted screws
6	½x5 in. machine bolts	8 lb	Bar solder
60	½x1½ in. expansion bolts	75	2-in. staples, three sizes
18	½x2½ in. expansion bolts	100	3-in. staples
1	7-ft. alley arm brace	5 lb.	Friction tape
2	5-ft. alley arm brace	1 lb	Rubber tape
3	30½-in. knee braces	3 lb.	½-in. round washers
24	24-in. cross-arm braces	2 lb.	⅝-in. round washers
6	24-in. alley side-arm braces	10 lb	2x2 in. square washers
2	48-in. vertical braces	8	Thimbles for ½-in. guy wire
9	Two-point brackets	6	Thimbles for ⅝-in. guy wire
9	Three-point brackets	600 ft.	½-in. guy wire
1	Two-point special bracket	150 ft.	⅝-in. guy wire
1	Three-point special bracket	1 coil	No. 6 weatherproof wire
4	25-amp. cutouts	1 coil	No. 8 weatherproof wire
2	50-amp. cutouts	50 lb.	No. 4 weatherproof wire
8	⅜-in. eyelets	30 lb.	No. 2 weatherproof wire
24	25-amp. fuses	10 lb.	No. 0 weatherproof wire

tion tacks. When all of the services for a given day are posted the work dispatcher lays out the route for his several gangs by running various colored strings around the tacks in such a manner that each crew will start work at a point farthest from headquarters and so will work back toward the headquarters as it progresses from job to job during the day. The men, instead of reporting at the company's district quarters in the morning, report at the location for the first job and hence lose no time in traveling to their work. The foreman, on calling up by telephone, is notified late in the afternoon of each day of the location of the first job for the following day and informs his men accordingly. The driver, by consulting a chart with which he is provided, can readily determine the time at which he must leave the district headquarters in order to arrive on the job on time. He must get to the barn sufficiently in advance of that time to permit of loading on his wagon the material which has been placed in his locker the previous afternoon. The linemen work eight and one-half hours, and the driver, who is also a groundman, works eight and one-half hours plus the time it takes him to drive the wagon from headquarters to

Mr. [illegible], Jr.
General Foreman, District #1. Date April 10th, 1920.

Summary of Average Costs Week Ending April 10th, 1920.

Foreman	Cost of gang per hour	Number of Services Daily and Average Cost. Mon.		Tues.		Wed.		Thurs		Fri.		Sat.		Total	
Jones	$3.01	1	1.51	12	1.21	13	1.45	1	1.50	7	1.72	4	1.[illegible]	38	1.49
Johnson	3.01	4	1.50	3	2.00	7	2.15	-		11	1.50	3	2.00	28	1.77
Brown	3.06	-		13	1.50	15	1.55	9	1.52	1	1.37	7	1.[illegible]	45	1.59
Smith	[illegible].11	3	[illegible].0[illegible]	13	1.55	-		-		7	1.3[illegible]	1	3.10	24	1.49
Perkins	3.47	1	[illegible].9[illegible]	10	1.20	15	1.59	2	1.80	2	1.71	8	1.48	40	1.[illegible]
Totals	3.17	11	1.60	51	1.41	50	1.62	12	1.56	28	1.53	23	1.86	175	1.57

Lowest District Standing:
No. of Services 227 ; Average Cost 1.47

WEEKLY SUMMARY OF AVERAGE SERVICE COSTS

This summary is made up each week for each district and gives the general foreman the necessary information to enable him to locate and correct any tendency toward higher service installation costs.

the first job and from the last job back to district headquarters at night.

The question of standardizing line equipment was one which was solved in a rather unusual way. When the three districts were consolidated each general foreman felt that his own type of service construction was best. In order to arrive at a company standard the three general foremen were requested to bring their crews and to erect in a lot selected for the purpose services according to the standards which they were then using or which they thought should obtain. Then each man was requested to point out why he thought his type of service was better than that used by the other crews. It developed that the rival claims of the various foremen centered around the type of construction which would permit several services to be run off the insulators without attaching several layers of wire over each other. A compromise solution of the problem was reached by a suggestion that the company adopt as a standard insulator the ordinary glass triple-groove telephone transposition-type insu-



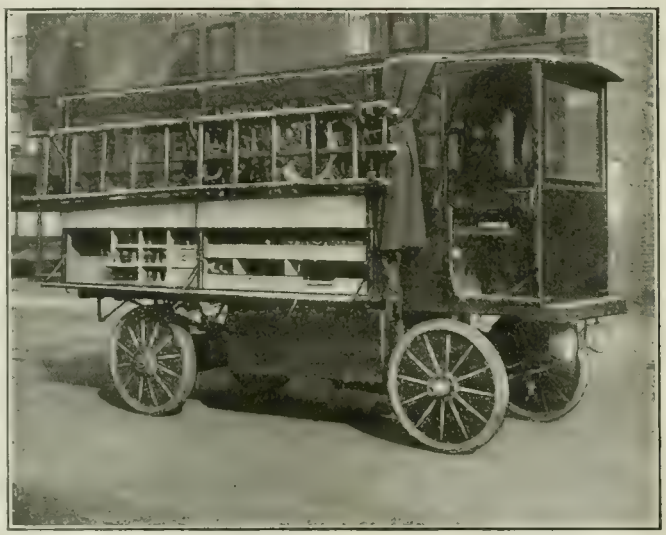
STANDARD STOCK OF WAGON TOOLS AND PROTECTIVE APPLIANCES FOR OVERHEAD SERVICE TRUCKS

In addition to the tools shown on the list and in this photograph, each lineman has his own supply of lineman's tools carried in his belt.

lator. This is now used for all services and makes it possible to run a number of services from any pole without tangling them.

While this insulator incident is only a detail in the standardizing process, it illustrates the methods which have been employed to reach a standard commonly accepted by all supervisory and field employees. The same treatment has been applied to all overhead-line equipment. A more detailed article on the standardization of pole-top equipment was published in the ELECTRICAL WORLD of April 27, 1918, the author of which was H. E. Wulfing.

Improvements in the wagons which haul service crews and their equipments have been worked out on the theory that a compartment should be built for everything in such a way that materials and tools cannot be put in the wrong place, because they will not fit any compartment but the one in which they belong. The wagons are truly a marked departure from the earlier wagons used by line crews, which were famous for the fact that it was usually necessary to "excavate" in the vicinity of the wagon bed when any particular piece of apparatus or any tool was needed.



OVERHEAD SERVICE TRUCK WITH STANDARD STOCK OF TOOLS AND MATERIAL

Lids or doors to the compartments can be fastened with padlocks. Space is provided for safe-keeping of linemen's personal tools over night.

It is an interesting sidelight on the standardization of the stock and tools that the standard stock is 500 lb. (226 kg.) lighter on an average than the stock which was carried in the wagons before standardization was effective. This figure was arrived at by running the wagons over a scale on the day before the standard stocks were placed in them for the first time and running the same trucks over the scale the day following. The reason for the saving in weight is quite easy to understand when it is remembered that nearly every construction man is in the habit of picking up something that he thinks he may need and carrying it around in the wagon for perhaps a year before he really does need it. The list of tools and the standard wagon stock of materials which are reproduced herewith show in detail what the wagon carries, and the photographs will assist the reader by showing how these stocks and tools are placed in the wagons.

Samples of the typewritten order form which eliminates the clerical work formerly required of the foremen are reproduced. On this report blank the foreman fills in absolutely nothing that can be filled in for him in the office. He makes notations which indicate the amount of work done, the time at which each job was begun and the time at which it was finished. He makes no attempt to divide the time among the various kinds of work which he lists. These divisions are made by men in the office who are experienced in such work. For all practical purposes this is just as accurate as if the foreman were to charge each part of each job with the hours and minutes devoted to it, because in the reports to the timekeeper half hour units are used.

The foregoing paragraphs describe briefly the system which makes it possible for the service crews of the street department to operate efficiently. There are, however, a number of other points which deserve special comment. One which certainly should not be forgotten is the personnel of the service crews themselves. The standard service crew consists of four men, including a foreman, a driver who acts as a groundman, a first-class lineman and a second-class lineman. These crews install a typical service and move to one location from another in about twenty-five minutes. They benefit because the system which has been developed for doing the work actually reduces the necessary effort on their part. There is no hurry and no excitement about the way in which the work is tackled. There is no element of "rawhiding." Their efficient operation can be attributed to the elimination of useless work, to doing things the easy way with the proper equipment, all efforts being intelligently directed and thoughtfully applied.

Many "kinks" have become standard practice with the service crew. Several have been worked out in the method of soldering. For instance, the soldering pot has an offset bale so that it can be lifted under line wires easily to catch the solder which is being ladled over the joint. The hook with which this pot is lifted has a corkscrew end, so that it is impossible for the lineman to let the pot fall off the hook even if it is bumped against something. At the end of the service line which is attached to the building pigtail splices are employed because it is easy to get the end of these splices into a ladle full of solder and because it would be difficult to hold the pot of solder in such a position that the molten metal could be ladled over any other kind of a joint in this location.

There are other kinks in handling material and tools. The linemen carry brackets, insulators, hammers, chisels, brick drills, etc., in canvas bags which are of the same type as those used by coal companies for handling coal a bushel at a time. This type of bag was selected because of its rugged strength and because it was not thought advisable to make up a special bag for the lineman to use. Convenient receptacles for carrying soldering acid and paint to use on the outside of taped joints are provided with hooks and arranged so that they can be swung from the belts of the linemen. All these things contribute their quota to efficiency.

THE *engineer is more than ever needed as a guide in national affairs. That man is not wise who does not consult the expert in matters demanding special information not possessed by himself. An engineer should also be an example of a broad-minded citizen, interesting himself in all such activities as conduce to the welfare of his country and its people and the world.* —ELIHU THOMSON.

Protection of Transmission Systems—I

Comprehensive Analysis of Abnormal Voltages on Transmission Systems and Methods Adopted by a Company in Sweden to Protect the Station Apparatus from Insulation Breakdown

By PROF. EMIL ALM

WHILE the nature of overvoltages is far from fully understood, it is certain that their causes may be found in atmospheric discharges as well as disturbances internal to the system, such as switching, grounds, short circuits, etc. The overvoltage phenomena, whether they are due to internal or external causes, appear generally first as traveling waves, but change later into oscillations between the capacity and inductance of the system. In certain cases, especially with overvoltages from internal causes, resonance is liable to be set up, resulting in a considerable increase in the voltage stresses.

In planning the overvoltage protection for the Untra (Sweden) power station, these points have received due consideration and have resulted in the adoption of the system shown in Fig. 1. The principles which led to the selection, rather than a description of the installation, are treated in what follows here.

The Untra power station is designed for five water-wheel-driven generating units, each having a capacity of 7,300 kw. at 0.80 power factor, 6,800 volts, 25 cycles. Four of these units are now installed. The transmission voltage is approximately 100,000 volts, and the generator voltage is transformed up to this value by means of three-phase transformers, each of the same capacity as the generators and thus forming units with these so that the paralleling may be done on the high-tension side. There are for this reason two sets of busbars, which may be considered as part of the transmission lines. A low-tension bus is provided for transfer of a reserve unit and other auxiliary purposes. In the receiving station at Vartan the voltage is transformed down to 6,300-6,000, and the high-voltage arrangements in the two stations are practically identical. A complete system of connections for the entire installation, showing the various protective arrangements adopted, is given in Fig. 1.

Voltages Arising from Atmospheric Disturbances

Gradual Charging.—To provide a discharge path for the gradually accumulated static charges on the transmission line, the transformers at Untra, with their low-tension windings delta-connected, have the high-tension windings star-connected with the neutral point grounded. In order, furthermore, that a ground on the line shall not cause a direct short circuit of the grounded phase, a resistance is inserted in the neutral connection. For the sake of safety it was also considered advisable to make such provisions that a disconnected transformer unit would not be subjected to voltages through its neutral connection in case of a ground. As at Untra no space could be found for a common neutral bus to which the respective transformers could be connected by means of switches, each transformer had to be provided with its own resistance. For taking care of the static charges it is evidently immaterial whether resistances or inductances are used, and their sizes can be varied between very wide limits. For the correct functioning of certain relays the resistances used were, however, so dimensioned that the short-circuit current at normal voltage would be about 10 amp., whether two, three, four or five transformers were in operation. They were made in two parts for 20 and 30 per cent respectively of the full current to ground.

Lightning Charges.—A thunderstorm cloud can, by static induction, charge a grounded transmission circuit

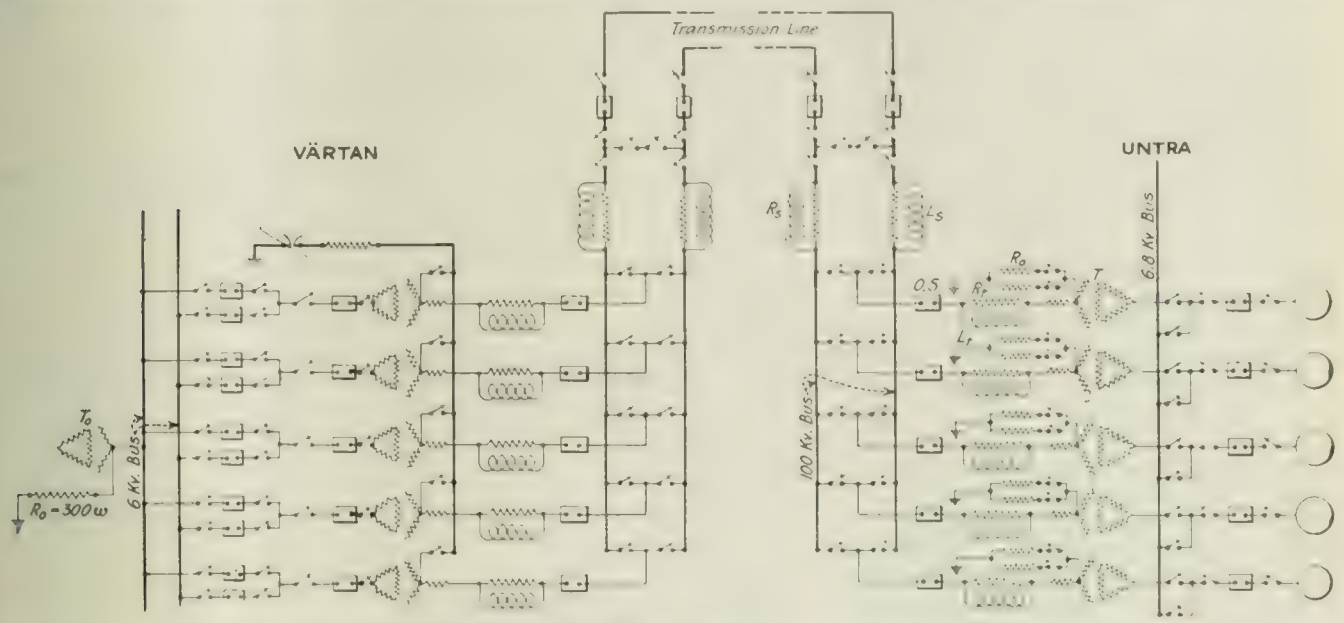


FIG. 1— CONNECTION SCHEME FOR PLANT AND TRANSMISSION SYSTEM AT UNTRA, SWEDEN

Abbreviations: *OS* = oil circuit breaker; *T* = transformer; L_l = transformer inductance coil; R_l = shunt resistance for same; L_s = line inductance coil; R_s = shunt resistance for same; R_0 = neutral resistance; T_l = transformer neutral resistance. The generating station is connected to Värtan over 100-kw. transmission lines.

with a quantity of electricity which, when the cloud discharges, raises the potential of the circuit to a value which depends on the height of the wires above ground and which may amount to about 20,000 volts for each meter in height above the ground. As the average height of the Untra line is about 10 m., we can therefore expect a voltage rise above normal of about 200,000 volts, which corresponds to an alternating-current sinusoidal voltage with an effective value of 140,000 volts. Adding to this the normal voltage to ground (60,000), we find that the total voltage stress to ground due to a lightning discharge may reach an effective value of 200,000 volts. With one of the phases grounded, the total potential to ground would therefore be about 240,000 effective volts.

After the lightning discharge, the above-mentioned static charge will divide into two equal traveling waves, each of one-half its amplitude, going in opposite directions. On account of the distribution of the charge before the lightning stroke, the wave front has a comparatively small slope and is therefore not very dangerous for the insulation between adjacent turns or layers of windings. The only danger is that its amplitude may cause a puncture to ground. On the other hand, when the charge is set free—that is, at the lightning stroke—if a flash-over occurs on an insulator string,

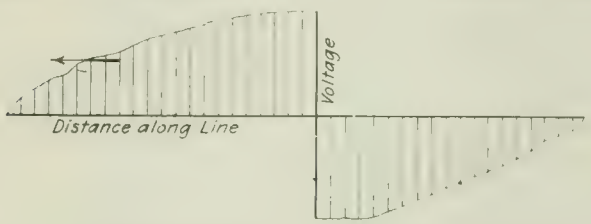


FIG. 2 — VOLTAGE DISTRIBUTION ON THE LINE FOLLOWING AN INSULATOR FLASH-OVER

then the charging wave will be followed by a discharge wave with a steep front, which is considerably more dangerous for the transformer windings. The voltage jump will then be equal to the entire flash-over voltage of the insulator string (Fig. 2). If with such grounds an arc is formed, other difficulties are very liable to occur, such as destroyed insulators, burned-off wires, etc.

To avoid the risks which are connected with an insulator flash-over there are two remedies which can be used: First, the flash-over voltage of the insulator string may be made so high that an induced charge from a lightning stroke is unable to cause a flash-over; second, the statically induced voltage may be limited by means of ground wires. Both of these protective arrangements are used in the Untra installation. The insulator strings have a minimum flash-over voltage value of about 250,000 when wet and somewhat higher when dry, and the ground wire, which is installed above the transmission wires, is expected to reduce the overvoltages about 40 or 50 per cent.

Protection Against Grounding Phenomena

Experience has shown that even with the best precautions it is impossible absolutely to prevent grounds, which may be caused by blown-down branches of trees, etc. On networks with relatively high currents to grounds it has been proved that such arcing grounds may be quite disastrous if suitable precautions are not taken. If the ground current be of such strength that the arc will not go out but an intermittent grounding takes place, and if there be no suitable ground connection, then the system will be charged between each reformation of the arc to a constant potential with a value up to two and a half or three times the maximum value of the normal voltage to neutral and with alternating positive and negative signs. Partly on account of this rise in the voltage to ground, but chiefly on account of the high value of the voltage impacts to which the transformer windings are hereby exposed, it becomes necessary to make arrangements which will prevent these dangerous phenomena from occurring. The most effective method is to provide for a discharge of these voltages before they have been able to do any damage, and this was done by a suitable dimensioning of the neutral resistances of the Untra transformers. Either non-inductive resistances or inductances may be used for grounding.

Calculation of Neutral Grounding Resistance

In this case we obtain a discharge with C in series with an inductance L_k over a resistance R_o, where:

C = capacity of all of the lines to ground = $3K''$ for a single line and $6K''$ for a double line, K'' being the partial capacity for each phase to ground.

L_k = the leakage inductance of the transformer divided by the number of phases, if, as with the Untra installation, the transformers are Δ-Y connected.

R_o = the resistance in the neutral ground connection.

In general, the inductance L_k is so small in proportion to C and R_o that its influence may be neglected, and we then only have a condenser which is discharged through an ohmic resistance. The potential diminishes then in accordance with the law:

$$v = Ve^{-\frac{t}{R_oC}}$$

Besides the wattless ground current through the air,

$$I_j = E_f\omega C,$$

an energy current flows through the resistance and is equal to:

$$I_r = E_f/R_o,$$

where E_f = the effective value of the voltage (to neutral).

Both these currents will now pass through the arcing ground, so that the current of the arc becomes:

$$I_b = \sqrt{I_j^2 + I_r^2}$$

With a too high value of R_o the result will be that V will not have time to fall off sufficiently before the voltage of the faulty phase again causes a flash-over. If R_o is made too small, the discharge will be good, but the total current I_t will be more than necessarily higher than I_j, thereby decreasing the ability of the arc to extinguish itself. It seems to be most satisfactory to dimension R_o so that, approximately,

$$I_r = 40 \text{ to } 100 \text{ per cent of } I_f$$

or that

$$R_o = (2.5 \text{ to } 1)\frac{1}{\omega C} \text{ ohm.}$$

For the Untra installation calculations give $K'' = 0.656$ m.f. For a single line we thus get $C = 1.97$ m.f., and for both lines $C = 3.94$ m.f. According to the above formula, the value of R_o will thus be:

For single line: R_o = 8,000 to 3,200 ohms.
For both lines R_o = 4,000 to 1,600 ohms.

As already mentioned, the neutral resistance was proportioned for 10 amp. and has thus a resistance of 5,600 ohms, which may be considered as satisfactorily meeting the requirements connected with the discharge problem, especially as besides this the automatic overload circuit breakers will be set so that the faulty line can quickly be disconnected.

Considerations Concerning the Use of Inductance in Neutral

By using a non-inductive ground resistance, as explained above, the danger of the excess voltages due to grounds is removed, but when the current to ground is of a sufficiently high value the arc will continue to burn and thereby cause damage to insulator strings, the burning off of wires, etc. If, on the other hand, an inductance is used, then the charging current of the line will still be vectorially combined with the ground current through the inductance in order to give the resulting current in the arcing ground. As now the two components are opposing each other, the arc current will be equal to the arithmetic difference between the two components, and if they are of equal value, then the arc current will be zero; that is, the arc cannot exist but will immediately be extinguished. The condition for this is therefore:

$$I_l = I_l \text{ or } E_f \omega C = E_f \omega L_o,$$

and

$$\omega^2 L_o C = 1.$$

The inductance of the neutral ground must therefore (at the frequency of the system) be in resonance with the sum of the partial capacities of the system to ground. With the previously given values for C, the reactance ωL_o with both lines connected should therefore be:

$$X_o = \omega L_o = 1{,}600 \text{ ohms.}$$

With $E_f = 56{,}000$ volts, we get

$$I_l = 35 \text{ amp.}$$

In order that the circuit-breaker relays shall operate satisfactorily, the current in the grounded phase must not drop to zero, and as experience has demonstrated that the arc will go out even when the current in it is from 5 amp. to 6 amp., it was decided that the current through the inductance of the neutral ground could be about 30 amp.

The discharge of the constant potential caused by the first breaking of the arc takes place through a dampened sinusoidal oscillation down to zero, and if the coil were dimensioned for the entire normal arc current, then this oscillation would have the same frequency as the system. In the case here noted, with a somewhat higher inductance, the frequency of the oscillation will be somewhat lower than the frequency of the system. From this it follows directly that the voltage of the faulty phase will rise according to the same law as the discharge just mentioned, or ordinarily so slowly that an arc will not be formed unless the insulation is so weakened that it cannot withstand the normal voltage, in which case the line in question must be disconnected.

Inductances give, without doubt, a more satisfactory solution of the protective arrangements against the disturbances caused by grounds than non-inductive resistances. With both arrangements it is possible to prevent the traveling waves with abnormally steep fronts caused by oscillatory grounds. The inductances, however, have the added advantage that the current flowing through the temporary ground will not cause any arcing. If the cause of the disturbance is removed, then the line will be immediately operative and need not be disconnected. With a non-inductive resistance for about 10 amp., the current through the fault with one line will be about 20 amp. and with both lines about 40 amp., and it is very doubtful if even at the lower current the arc will go out. In such a case it would be necessary immediately to disconnect the faulty line, even if the fault were only transient.

Why Resistance Was Used in Neutral

On the other hand, one must always be prepared for grounds of a permanent nature, and arrangements must naturally in any case be made so that the line can be disconnected if necessary. If this switching arrangement is automatic, as planned for the Untra installation, then this will, of course, somewhat diminish the advantages of the inductance neutral grounds. There are furthermore other overvoltages which will be dealt with later for which the non-inductive resistance has a decided advantage over the inductance. Finally, all the insulator strings are equipped with a kind of horn, primarily intended for improving the potential distribution of the insulators, but also useful as a spark gap, whereby an eventual arc is carried away from the line wire and the insulator. What kind of operating disturbances it would be especially desirous to guard against could not be decided beforehand. It would undoubtedly be safest to make all the permanent ground connections non-inductive and, in addition, as a protection against traveling waves treated later on, install non-inductive resistances in series with spark gaps, the gap being set for somewhat higher potential than the line to neutral voltage. As yet it may be assumed that non-inductive neutral ground resistances give a more varied means for protecting against operating disturbances than inductances, the result being that the resistances were used in the case in question.

Provision Against Voltage Rise Caused by Grounds and Switching

As it can always be assumed that the line is at least partly loaded and as it is rather improbable that a disturbance will occur simultaneously on the same phase of both lines, we need not expect that any voltage rise will occur with values as high as four times normal. The transformer and lines are nevertheless insulated for such a voltage rise, and as a further protection we have the non-inductive neutral ground resistances at Untra. Besides this there is provided at Vartan a non-inductive resistance for 5 amp. at normal phase voltage. This resistance is through a spark gap connected between the neutral transformer bus and ground. Primarily this resistance is intended as a protection against traveling waves. When a ground occurs the former resistances will immediately act as a load, and if the normal phase voltage is exceeded, then the spark gap at Vartan will arc over and thus still another non-inductive load is caused, which prevents the neutral voltage rise from developing any further.

In an early issue this discussion will be completed by the consideration of traveling waves, generator voltage harmonics and the passage of overvoltages into the low-tension system.

This paper was translated and condensed by Eric Lof from a lecture delivered by Professor Alm before the Electro-Technical Society in Stockholm, Sweden.

Regulating Hydro-Electric Prime Movers

Ability to Hold Constant Speed, Inherent Regulation and Momentary Changes of Speed Are Discussed in Detail—Conditions Upon Which Speed Changes Are Based

By C. F. MOSHER
Superintendent of Power Plants Turners Falls (Mass.) Power & Electric Company

THE problem of speed regulation with waterwheel-driven generator sets is inherently more difficult of solution than is the same problem for steam-turbine-driven sets. This is due to two fundamental reasons that follow:

First—The inertia of the rotating parts (or flywheel effect) for the waterwheel-driven machine is usually much less than for the steam-turbine-driven outfit, and a large flywheel effect per unit of capacity is always helpful toward better speed control. A modern single-runner waterwheel-driven generator set of 7,500-kw. capacity, running at 100 r.p.m., with an operating head of 60 ft. (18 m.), will have a flywheel effect of approximately 11,000,000 ft.-lb. per second (1,518,000 kg.-m.), whereas a steam-turbine unit of the same capacity operating at 1,800 r.p.m. will have a flywheel effect of about 60,000,000 ft.-lb. (8,280,000 kg.-m.) per second.

Second—The very "nature of the beasts and the stuff they feed on," the weights of feed, size of inlets, passages involved, etc., render the problem much more complex in the case of the waterwheel.

Why Speed Regulation of Hydro Units Is Difficult

Consider again a 7,500-kw. waterwheel-driven set operating at 100 r.p.m. under a 60-ft. (18-m.) head. Such a machine will have a supply pipe or penstock of about 380 sq.ft. (55 sq.m.) section and will pass at full load about 117,500 lb. (53,200 kg.) of water per second—a heavy, inelastic, practically incompressible fluid in usually quite a long column, which may not be started, stopped or have its velocity changed too abruptly with impunity, no matter what may be the load requirements. On the other hand, a steam turbine of 7,500 kw. rating, running at 1,800 r.p.m. at 250 lb. (17.5 kg.) pressure, with 150 deg. superheat at the throttle, will be supplied through a 10-in. or 12-in. (25-cm. or 30-cm.) diameter pipe having a cross-sectional area of perhaps 0.75 sq.ft. (0.069 sq.m..), or 0.002 of that required for the waterwheel set. It will pass approximately 27 lb. (12.2 kg.) per second of steam—a light, highly elastic medium whose flow may be started, stopped or have its velocity changed as rapidly as may be desired to accomplish a given result, without any distress to equipment. This weight passed by the steam turbine is about 0.00023 of the weight passed by the waterwheel. The foregoing is a crude endeavor to explain simply some of the differences in the problems of speed regulation for the two types of prime movers, and perhaps will account for the more complicated speed-control devices usually present in the hydro-electric installation.

There are three main points to have clearly in mind when discussing speed-regulating devices, as follows:

(1) Ability to hold a constant, predetermined or normal speed at no load or at any constant unchanging load.

(2) Inherent regulation, usually expressed in terms of percentage of normal speed, and meaning the drop in speed from no-load to full-load conditions without manual adjustment. As a rule a prime mover can be arranged with a relay-type governor so as to have the same speed at full load as at no load without manual adjustment, but such a condition usually, and in the case of two prime movers operating alternators in parallel, would most certainly result in a condition of unstable equilibrium; so it is the usual practice to adjust all governors for an inherent regulation of from 2 to 3 per cent. Few regulate more closely and a great many not so closely.

(3) Momentary changes of speed due to changes of lead, occurring either gradually or suddenly, usually expressed in percentage of normal speed for a certain percentage of load change on or off, and the time required, in seconds, for restoration of normal speed at the new load.

A modern well-designed and constructed hydro-electric installation may be and frequently is installed so that it will satisfy the first two points above quite as well as any steam-turbine installation; but to satisfy the third point as well is a practical impossibility and always will be, because the designer is confronted by unchanging natural laws.

To operate the gates of the 7,500-kw. waterwheel above mentioned requires for full stroke in one second 125,000 ft.-lb. (17,250 kg.-m.) of energy, or approximately 230 hp. It is entirely feasible to construct speed gates and operating mechanism to close them much faster than this, but it is entirely impracticable to construct penstocks of the required dimensions to withstand the resultant shocks without rupture.

Tests for Rapid Load Change

A test has been made on a 7,500-kw. machine of a type and under conditions similar to the one referred to, in which full load was thrown off and the gates closed in just over two seconds, and yet there was a momentary pressure rise in the wheel case of about 78 per cent. The momentary rise in speed on this test was from 18 to 20 per cent. This same machine shows on test an inherent speed regulation of 3 per cent. The test for inherent regulation was made under low-head conditions, and it is probable that at normal head the regulation would be reduced to about 2.5 per cent. It is a point easily controlled by adjustment, if necessary.

On these units the governors are guaranteed to work in parallel with each other and with other governors on the system being so arranged that the drop in speed from no load to full load may be adjusted from zero to 3 per cent. When properly adjusted the governors maintain approximately equal load on all generators. Each governor is designed to be sensitive within 0.25 per cent; *i.e.*, for a change in speed of 0.25 per cent the governor will immediately move the gates, and for slow changes of load will keep the speed within 0.25 per cent of normal. Each governor is provided with adjustment to allow of complete gate movement within one second, provided such fast operation becomes desirable.

The governors are guaranteed to control the speed of the main units in accordance with the following percentage table of speeds and load changes:

Load Changes	Speed Change On	Speed Change Off
5	1.10	1.0%
10	2.10	1.8
25	5.50	4.5
50	10.00	8.5
100	18.00	16.5

The maximum rise in head measured one-half way around the scroll is guaranteed not to exceed 50 ft. (15 m.) when full load is instantly thrown off the generator at normal speed and head.

Conditions.—The above speed changes are based on the following conditions:

(1) Normal effective head on waterwheel, 60 ft. (18 m.); normal speed, 100 r.p.m.

(2) The WR^2 of the combined unit to be not less than 7,000,000 ft.-lb.

(3) The concrete penstock from headgates to center line of the unit not to exceed 90 ft. (27 m.) in length and to be not less than 380 sq.ft. (34.9 sq.m.) in section up to the scroll case.

(4) Length and shape of draft tube in accordance with specified design, the design of the entire setting including penstock and scroll case being subject to governor builder's approval.

One other risk involved in a too quickly closing gate mechanism is the possibility in an installation with a long draft tube of having the column of tailwater suddenly part company with the wheel and a little later surge back with a tremendous blow and wreck it.

In general, the nearer an installation approaches that of an open flume setting without draft tube the more quickly may the gates be safely operated; but such a type of setting is cumbersome, expensive and for most developments inefficient and inadvisable, so that speed regulation for sudden load changes in most installations is made as fast as the hydraulic conditions will allow.

It is often necessary in connection with long penstocks to install surge tanks to relieve shocks due to quick gate movements, and sometimes relief valves are also provided. In high-head plants using the Pelton type of wheel it is usually the practice to divert the nozzle from the wheel as a means of speed and power control, rather than to stop the flow of water.

Waterwheel governor design has settled down to one rather generally accepted type known as the "hydraulic relay compensated type," using a flyball governor, either belted or mechanically connected to the waterwheel shaft as a primary control and through a pilot valve, with restoring and compensating mechanism, and a relay valve controlling the flow of a fluid under pressure to one or more servo-motor cylinders that are suitably connected to and operate the speed gates through a combination of links and levers. The operating fluid has usually been a mineral oil, and in earlier designs each governor had its own individual pump, pressure tank and vacuum tank. The pump was continuously discharging oil into the pressure tank, which was partially filled with air to give elasticity and quick action, and the servo-motor cylinders discharged into the so-called vacuum tank, whence the oil was picked up as it came over by the pump. This was a closed system and was comparatively simple, but the oil was expensive, short-lived and gave off considerable carbon deposit.

In the last few years this system has been improved upon by substituting a discharge tank under atmospheric pressure for the vacuum tank and installing a pressure-operated unloading or by-pass device on the pump. In multiple installations a central pumping system has been installed, the pumps being motor-driven with automatic pressure-controlled starting and stopping devices. Both of these arrangements represent an improvement, and, owing to the relief of the oil, which is somewhat warm from the vaporizing effects of the low pressure in the vacuum tank, the oil appears to have a much longer life than previously and a reduced carbon deposit. In recent years and in larger installations it has become quite common practice to use water under pressure as the operating fluid, introducing 1.5 to 3 per cent of soluble oil. The function of the oil is primarily to prevent corrosion of the working parts of the system with which it comes in contact. This has in most cases worked out very well.

The foregoing is abstracted from a paper read before the System Operators of New England, Worcester meeting.

Writing Specifications for Lubricating Oils and Greases

General Properties of Oils Which Have a Bearing on Specifications—Typical Specifications for Turbine, Dynamo and Other Oils

BY A. A. POTTER* AND A. J. MACK†

IN WRITING a specification it should be the object to insure a satisfactory product, but in the case of lubricants the specification must be so worded that it will apply not only to oils from the Pennsylvania fields but also to those from the mid-continent and the Southwestern fields. In special cases specifications applying to one particular field are justified, but for most purposes a suitable oil can be manufactured from crude products with asphalt as well as with paraffine bases.

Lubricants may be classified, as to their use, into steam cylinder oils, engine or machine oils, automobile oils, truck and tractor oils, turbine oils, air-compressor oils, dynamo oils, ice-machine oils, greases, transmission oils, lubricants for gears, chains and wire ropes.

Important properties to the user of lubricating oils are those pertaining to viscosity, pour test, flash point, carbon residue, emulsion, freedom from soap, tar, rosin, moisture, acid, alkali, suspended matter or animal oils. The specific gravity is not included in the specifications as it is of value only in determining the source of oil. The crude oils coming from different localities differ as to their specific gravities, but the specific gravity is not an indication of the quality or of the suitability of the oil for a given purpose.

"Viscosity" indicates the fluidity of an oil and refers to the time required for a definite volume of the oil to flow, under an arbitrary head through a standard orifice at constant temperature. The viscosity of an oil is of prime importance in a specification, but should be taken as nearly as possible at the working temperature of the engine or machine. As these temperatures vary greatly, viscosities are usually given in seconds at 100 deg. Fahr. and 210 deg. Fahr. Viscosities refer to the Saybolt standard universal vis-

*Dean division of engineering and director of engineering experiment station Kansas State Agricultural College.

†Instructor in steam and gas engineering Kansas State Agricultural College.

cosimeter. The "pour test," often also referred to as the "cold or chill test," is the lowest temperature at which the oil will pour. This property is particularly important in connection with oils which must be operated in an atmosphere of low temperature. The "flash point" is the lowest temperature at which the oil forms an inflammable vapor. The temperature at which the body of the oil catches fire is known as the fire point. Flash-point tests refer to the Cleveland open cup. The "carbon residue" is that which remains after the complete distillation of an oil. "Emulsion" is the property of an oil which refers to its separation from water. Thus a non-emulsifying oil when mixed with water will clearly separate.

Lubricants for most purposes should be straight mineral oils. Steam cylinder oil for engines operating on wet steam is usually compounded with acidless tallow or with other animal oil to cause the lubricant to adhere better to the cylinder walls when in contact with moisture. No compound should be used in oils intended for engines operating on superheated steam.

The presence of acids in oils indicates improper refining, but acidity is also developed when the oil is in use.

Engine or machine oils are those designed for lubricating bearings of engines and of machinery, but are not to be used for lubricating the internal parts of an engine which come in contact with a gas or a vapor. It is usually not necessary that engine oils withstand great temperature changes. Engine oils for slow-speed machinery should have a higher viscosity than those designed for high-speed machinery. A flash point of 300 deg. or 350 deg. Fahr. is sufficient, and the pour test, except when used in an atmosphere of very low temperatures, can be taken as 35 deg. Fahr. Engine oils should be straight mineral oils, well refined, filtered and non-emulsifying. They should be free from moisture, soap, rosin, acid, alkali, tar and suspended matter. The viscosities for different grades are given in the table.

Turbine oils are designed to lubricate the bearings of steam turbines. Turbines require no internal lubrication. As turbine oils are usually circulated over and over again, it is important that they be non-emulsifying when coming in contact with water. A turbine oil should be a straight mineral oil, filtered and well refined. It should be non-emulsifying and free from acid, alkali, tar and suspended matter. The viscosity of turbine oils at 100 deg. Fahr. should be from 140 to 240 seconds and at 210 deg. Fahr. 38 to 45 seconds. The flash point, minimum, should be 370 deg. Fahr. and the pour test not more than 25 deg. Fahr.

ENGINE OR TURBINE OIL MAY BE USED FOR MOTOR BEARINGS

A good engine or turbine oil should give satisfaction when used for lubricating the bearings of electrical motors and generators. Special dynamo oils are available which should meet the following requirements: A dynamo oil should be a straight mineral oil, well refined, filtered and non-emulsifying. It must be free from soap, acid, alkali, tar and resinous matter. The viscosity at 100 deg. Fahr. should be 140 to 200 seconds, and at 210 deg. Fahr. 38 to 45 seconds. The minimum flash point should be 370 deg. Fahr. and the pour test not higher than 25 deg. Fahr.

A steam-cylinder oil must be suitable to lubricate the walls of the cylinder under operating conditions. Steam engines operating with saturated steam use a mineral oil compounded with tallow in order that the oil when it comes in contact with water shall saponify and adhere to the cylinder walls. The amount of compounding depends upon the quality of the steam used. The drier the steam the less animal compounding should be used. Engines operating with superheated steam should use a straight mineral oil without compounding. The amount of compounding allowed for the various grades is indicated in the table accompanying this article.

Steam-engine cylinder oils must be free from dirt or sediment of any kind after standing, must feed freely through lubricators, and must not show more than $\frac{1}{10}$ per cent of acid when digested with boiling alcohol. The other specifications for three grades of steam-engine cylinder oil are given in the table. The flash point depends upon the temperature of the steam. With saturated steam a flash point of about 450 deg. Fahr. is sufficient. Oils used in connection with superheated steam should have higher flash points, depending upon the temperature of the superheated steam.

Cup grease should be a compound of mineral oils and greases. It should contain sufficient soap to form a semi-solid mass at temperatures below 150 deg. Fahr. It should be smooth, free from lumpy particles, dirt or other foreign matter. It must contain nothing which would tend to corrode or injure bearings and must not be rancid.

SPECIFICATIONS FOR LUBRICANTS

Kind of Oil	Viscosity in Seconds — At 100 Deg. F.	Viscosity in Seconds — At 210 Deg. F.	Flash Point, Deg. F. (Minimum)	Pour Test, Deg. F. (Maximum)	Acidless Tallow —per Cent.
Dynamo oil	140 to 200	38 to 45	370	25	0
Engine oil, high speed	140 to 200	35 to 45	350	35	0
Engine oil, slow speed	180 to 300	40 to 55	350	35	0
Steam cylinder oil, dry steam		135 to 165	450	50	5
Steam cylinder oil, wet steam		120 to 160	450	50	5 to 10
Steam cylinder oil, superheated steam		150 to 250	*	50	0
Transmission gear oil		170 to 215	300	50	0
Turbine oil	140 to 240	38 to 45	70	25	0

* Depends upon steam temperature.

Transmission oil should be suitable for gears of motor vehicles, trucks, tractors, and for other purposes where a heavy gear oil is required. Transmission oil should be a petroleum product, free from vegetable or animal oils, residue or fats of any kind. It should also be free from fillers such as talc, resin, tar or other foreign materials. It should contain nothing to injure or corrode the bearings or other metallic surfaces. Transmission oil should have a viscosity at 210 deg. Fahr. from 170 to 215 seconds, a minimum flash point of 300 deg. Fahr. and a maximum pour test of 50 deg. Fahr.

A lubricant for gears, chains and wire ropes should be a petroleum product, free from vegetable or animal oils, residues or fats of any kind. It must not contain fillers such as talc, rosin, tar or other materials foreign to the original product. When applied to a plate of polished steel, the lubricant must protect the steel against the action of chemical vapors, salt or fresh water and against water containing 10 per cent of sulphuric acid. The lubricant when applied to a wire rope should not peel, crack or chip the rope after exposure to weather for a period of sixty days, as a minimum requirement.



HOW SHALL LINES SERVING SUCH TERRITORIES AS THIS BE FINANCED?

Managing Electric Service for Farmers

Experience Which Has Come from Six Years of Business Management of Rural Customers Is Reviewed, and Practical Solutions of Common Contractual and Engineering Problems Are Suggested—Twenty-two Points in Operation

By A. W. JONES

Secretary-Manager Peterson (Iowa) Power & Milling Company

IN 1913 the first transmission line of the Peterson (Iowa) Power & Milling Company was built to connect up a town 10 miles (16 km.) distant. On this line the company first tried out a plan for supplying farmers with electric service. Six farm customers were connected to this line and were taken under contracts very much the same except for price as the company's contracts for today. This would seem to indicate that if the company's farm policy is faulty we have failed to find it out in six years of practice, during which time we have built transmission lines to serve fourteen towns and on these and other farm lines in four counties we have hundreds of farm customers.

From knowledge of general farm conditions throughout Iowa and our experience in giving electric service to the farmers for six years, I know that they can well afford such installations as are necessary to make available central-station service, and the cost of the service after the installation is made is not burdensome. The added improvement and convenience meet the general requirements for more economical operation and better conditions on the farm. After a few months' experience with electricity for light and power it is considered a necessity and is highly recommended by almost every patron. Electric service for the farmer is a mutual business, and any inequitable arrangement either in the rates for service or the regulations imposed by the central station for the installation or the use of equipment will not work out to the advantage of either the producer or the customer.

A reasonably high minimum charge is necessary where farm customers are metered individually on the low side of the transformer. This regulation is necessary to offset line and transformer losses, and it obligates the consumer to use a liberal amount of energy. In justice to the consumer the kilowatt-hour rate must be low enough to make it practicable for him to use a good share of this service for power. These two conditions must be met if the company and the customer are to be satisfied.

If the representative of the power company negotiating for farm-line extensions bears a good business reputation, it is easy to get the farmer to sign a contract detrimental to his own interest, as the subject of electricity is decidedly foreign to him. He commonly admits that he knows nothing about it and is leaving the whole matter to the company. This is all the more reason why the power company, in building business for the future, should be extremely careful in making long-term contracts.

On our main transmission lines we charge a stipulated price for connection on the line, and the farmer pays for all the equipment leading from the transmission line, which is owned and maintained by the farmers. The meters are owned jointly by the power company and the farmer. Our reason for this is that the meters are read infrequently, and in case a meter becomes inaccurate it is much easier to reach an equitable settlement when the equipment belongs to both parties and the blame for not taking proper care of the equipment cannot be placed wholly upon either party.

We limit farm installations to 5-kva. transformers on the theory that all of the continuous power required on a farm can be done with a 5-hp. motor. Such work as

running a large corn sheller, shredding corn, filling silos or threshing grain requires the use of a motor for such a few hours in a year that the farmer is not warranted in making the costly installation and buying a high-priced motor for these few days' work, nor can the power company afford to take the losses in order to sell this additional energy, which, compared to a year's business, is small.

I am convinced that a low minimum charge and high-priced energy is ruinous business. In almost every case it is very unsatisfactory to both the producer and the consumer. The power company, while getting a high rate for energy, sells such a small amount that the percentage of loss is high enough to make the net receipts for such service entirely too low. At the same time the farmer cannot afford to use the service for anything but lighting and fractional-horsepower motors, and he too is dissatisfied because his ordinary power requirements are not taken care of, as he had anticipated they would be.

Approximately two-thirds of the energy used by the farm customers is for day load. Every farmer who is enterprising enough to make an electric installation has plenty of work that can be done profitably by electricity. Obligate the customer under the minimum charge to install motors in order to use up his allowance under the minimum charge and he will soon use much in excess of this fixed amount, which makes it possible to give a comparatively low rate.

Answers to Practical Questions

In making proposals to farmers who contemplate building a new line a number of practical questions must be taken into consideration. Briefly, our experience has been as follows:

(1) At present prices a single-phase, 2,300-volt line with thirty-six 25-ft. (8-m.) poles per mile (1.6 km.) costs about $600. The same line using No. 6 copper, 6,600-volt, will cost $650. A single-phase line operating at 6,600 volts with No. 6 copper on twenty-eight 30-ft. (9-m.) poles per mile costs $675.

(2) We have the farmers sign a joint construction contract, specifying the price per mile for building the line and making the contract binding upon them when enough signers are obtained so that the cost will not exceed an agreed amount, say around $250 to $300 apiece. This allows the power company to carry the extension as far as it can, or cares to, and stop when it wishes.

(3) I prefer No. 6 copper-wire 6,600-volt main lines with No. 8 copper spurs. This voltage is easy to reduce and lightning protection is inexpensive, yet the line will carry a good load, which it will need to do if in a good section of country.

(4) Our terms of payment for line construction are 50 per cent when the contract is signed and the balance when the line is energized.

(5) The construction contract is signed jointly as a copartnership by all the farmers on a proposed line, but the clause limiting the cost to each signer to a specified amount protects each customer and removes the ordinary copartnership objection as to liability.

(6) We own only the main lines. The farmers pay for all the farm lines and turn the mains over to us. It is well to own the main feeders because that gives the central station a good hold on the business.

(7) We supervise and keep up all the farm lines, assuming no responsibility beyond the sections of line we own. We charge the cost of supervision and maintenance of farmers' lines to the various copartnerships, prorate the charge and collect each year from the individual customers.

(8) We assume responsibility for the lines we own only.

(9) The central station must give good service, as a farmer will want some assurance that after he has spent $600 to $800 for an electric installation he will get service that will meet his requirements. He is entitled to this.

(10) Our present contracts for 3-kw. installations are being made at $50 a year for 425 kw.-hr. used within the year and 8 cents per kilowatt-hour for energy in excess of this amount, or $60 for 525 kw.-hr. and 8 cents per kilowatt-hour for excess when a 5-kva. transformer is used.

(11) Most of our contracts run for twenty years.

(12) Customers are obligated to pay for service during the full life of the contract unless this obligation is met by their successors.

(13) We read meters once each year, but they should be checked up two or three times a year.

(14) Customers with a $50 minimum pay $12.50 per quarter in advance, and customers with the $60 minimum pay $15 per quarter in advance; and all pay for energy used in excess of the amount covered by the minimum charge at the end of each year.

(15) Coal clauses I consider a good arrangement, especially if all-steam power is used.

(16) Transformers on which the power company takes the loss should meet its approval; also, all energy-consuming devices should be installed subject to the approval of the power company.

(17) Each customer should own the transformer and substation equipment used for his own service.

(18) We limit transformers to 5 kva. rating, and we find that 95 per cent of our farm installations are 3-kva. transformers. Rightly arranged, a 3-hp. motor will do all the work required on almost any farm.

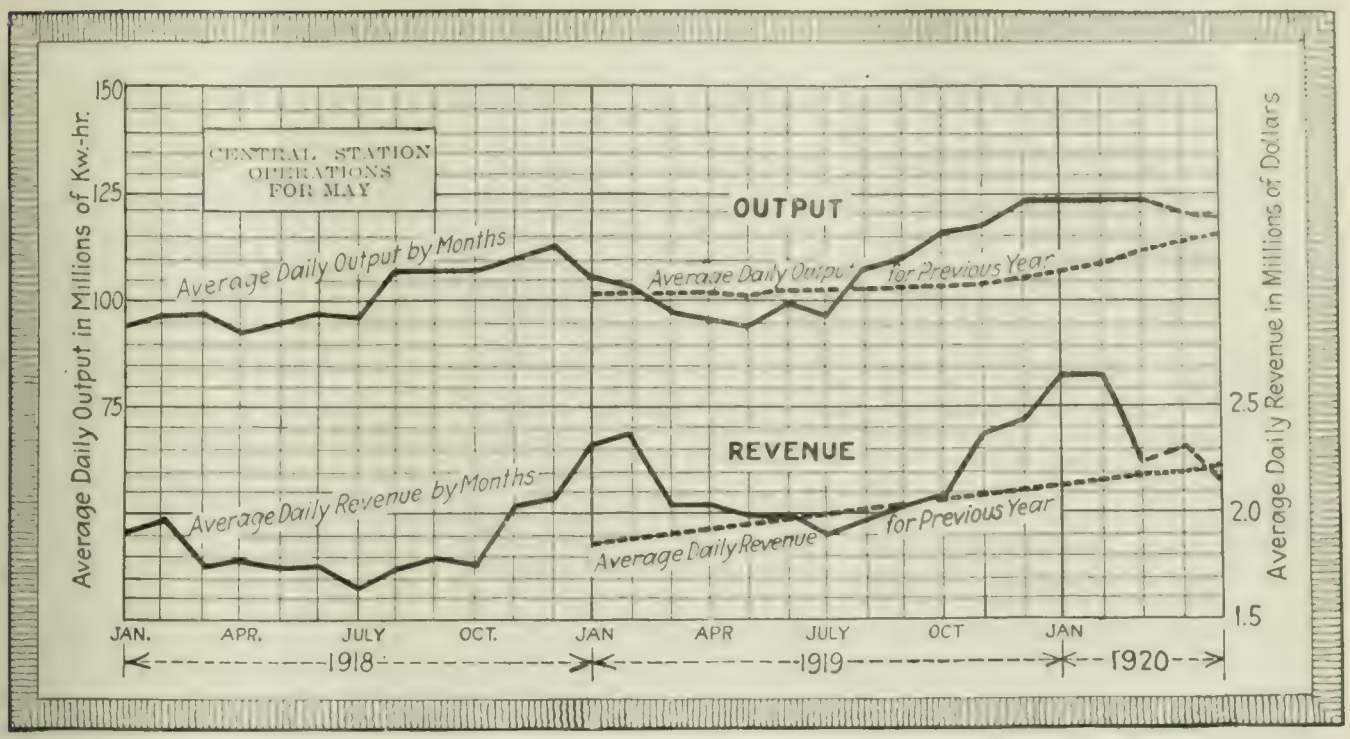
(19) A clause permitting future reasonable additions to the contract affords a good place to provide for something you may overlook.

(20) Keep within your jurisdiction questions of further extensions.

(21) The only farm equipment that gives trouble of any consequence is the transformer fuses. Sometimes during a severe electric storm many fuses on the farm installations will burn out, and with many customers out of service and bad roads this is a source of much trouble. We have overcome this difficulty by the use of a substation equipment of our own design, which, in addition to horn-gap lightning arresters and choke coils, has a removable fused switch blade. Using a 12-ft. (3.6-m.) light-weight weatherproof pole with a special spring finger on the end, the customer can stand on wet ground with safety and remove the switch blade, re-fuse it and replace it in less than five minutes. Since the installation of these fused switches two years ago we have heard nothing from farm customers about fuses. With hundreds of customers this is an important question.

(22) We write liability insurance for our farm customers by an indorsement on our policy, and charge each customer enough to pay this cost. The minimum premium for such an indorsement is $100 per year. The cost to farm customers for this is $1 per year.

Transportation Demoralization Curtails Output



RETURNS received by the ELECTRICAL WORLD for May indicate that with the exception of the Mountain and Pacific States, central station operations throughout the country were the lowest of the present year. Labor troubles and congestion in transportation lines resulted in a wide-spread curtailment in production and a consequent lessened demand for electrical energy. These decreased industrial requirements, in conjunction with the lowered demands for lighting purposes, resulted in a drop of about 2,600,000 kw.-hr. in the average daily output.

The situation in virtually every industrial section of the country appears to have been similar. Diminishing supplies of raw material and the accumulation of finished products due to the thoroughly demoralized railroad situation are reflected very clearly in the central-station returns from the industrial sections, as are also the almost incessant demands of labor.

The labor situation was probably most acute in the New England States, where over 2,000,000 spindles were idle for a portion of the month in one district alone and only a few communities reported no labor troubles. Shortage of raw materials and accumulation of finished products were also reported by every portion of this section. Taken together with the increased demand for lighting purposes, these adverse conditions resulted in a decreased average daily energy demand in New England of about 180,000 kw.-hr. under that of April.

The transportation tie-up continued to dominate the iron and steel industry. At the end of the month pig-iron and crude-steel production was rated at about 50 per cent capacity in the eastern districts and at a much lower percentage in finished steel products. Labor troubles seriously affected the operations of the numerous shipyards along the Delaware River, causing in many cases complete shutdowns. These decreased activities in the Atlantic States during May, augmented by curtailment in production in other lines of industry in that section, are reflected in a 7 per cent drop in energy use under that for April.

A survey covering May shows that shipping facilities in the North Central States were only about 50 per cent of normal. In the Detroit district alone curtailment representing the working capacity of about 50,000 men was found necessary partly because of lack of raw material with which to maintain production. Central-station operations in this section, however, were only slightly decreased for the month as a whole.

The large gains made by the central-station industry in the South Central States during the past twelve months is most strikingly presented by the May returns

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE MONTHS

	Revenue from the Sale of Energy				Kw.-Hr. Output		
	Percentage of Installed Capacities Represented	1919 Thousands	1918 Thousands	Per Cent Increase	Percentage of Installed Capacities Represented	1919 Thousands	1918 Thousands	Per Cent Increase
June	47	28,175	24,701	14 1	47	1,399,951	1,367,908	2 3
July	44	25,794	22,568	14.1	44	1,309,301	1,281,874	2 0
Aug.	54	32,756	29,006	13 0	54	1,801,836	1,793,706	0 5
Sept.	53	32,344	28,336	14.0	53	1,761,582	1,695,862	4 3
Oct.	55	35,492	30,077	18 0	60	2,175,636	1,987,004	9 0
Nov.	53	37,439	31,927	17.2	58	2,055,428	1,895,693	8 2
Dec.	59	44,125	37,978	16.0	65	2,509,571	2,270,833	10 0
		1920	1919			1920	1919	
Jan.	57	46,614	39,002	19 8	67	2,581,096	2,186,732	18
Feb.	63	45,881	37,502	22.1	69	2,494,764	1,986,493	25 3
Mar.	[illegible]	46,155	36,840	25 0	70	2,698,890	2,103,587	[illegible]
Apr.	65	45,017	[illegible]	24 7	70	2,561,101	2,061,727	24 1
May	65	43,494	[illegible]	23 7	70	2,590,117	2,132,330	21 5
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

total installed capacity of all central stations.

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

	Month	Percentage of Installed Capacities Represented	New England States			Percentage of Installed Capacities Represented	Atlantic States			Percentage of Installed Capacities Represented	North Central States			Percentage of Installed Capacities Represented	South Central States			Percentage of Installed Capacities Represented	Pacific and Mountain States		
			1919 Thousands	1918 Thousands	Per Cent Increase		1919 Thousands	1918 Thousands	Per Cent Increase		1919 Thousands	1918 Thousands	Per Cent Increase		1919 Thousands	1918 Thousands	Per Cent Increase		1919 Thousands	1918 Thousands	Per Cent Increase
REVENUE	June	71	3,317	2,904	14 1	43	10,605	9,537	12 0	39	7,158	6,166	16.0	40	1,599	1,338	19.5	63	5,496	4,767	15.2
	July	70	3,406	2,995	13.7	40	9,320	8,375	12 0	39	7,240	6,121	18.1	38	1,614	1,321	21 9	49	4,214	3,756	12.1
	Aug	74	4,225	3,693	14.4	57	12,174	10,995	11.1	47	9,295	7,924	15.8	39	1,647	1,385	18 4	61	5,415	5,009	8 5
	Sept	73	4,019	3,536	13 6	53	11,429	10,069	13.5	46	9,671	8,278	16.6	38	1,724	1,488	16 0	63	5,501	4,965	10.9
	Oct	72	4,127	3,453	19 1	53	12,684	10,822	16 9	52	11,401	9,484	20 2	38	1,840	1,519	21.1	62	5,440	4,799	13.9
	Nov	71	4,432	3,800	16.2	56	14,738	12,761	15.7	44	10,541	8,689	21 2	39	2,063	1,694	21.8	63	5,665	4,983	13.9
	Dec	73	4,908	4,254	15.1	57	15,926	13,806	15.8	49	11,660	9,833	18.3	44	2,496	2,070	20.0	77	9,135	8,015	14.2
			1920	1919			1920	1919			1920	1919			1920	1919			1920	1919	
	Jan	78	5,635	4,718	19 8	59	17,659	14,625	20 9	51	12,885	10,799	19.6	53	3,047	2,538	19.9	75	7,388	6,322	16.1
	Feb	82	5,354	4,368	22.1	61	17,245	14,343	20.4	55	13,191	10,403	26.0	53	2,949	2,360	24.7	79	7,142	6,028	18.3
	Mar	82	5,136	4,044	27 0	63	17,696	14,299	23 7	57	13,270	10,469	26 5	54	2,910	2,287	27 8	79	7,143	5,741	24 2
	April	82	5,087	3,943	29 0	63	17,138	13,945	22 9	57	12,690	10,042	26 9	54	2,952	2,181	35 2	79	7,150	6,004	19 1
	May	82	4,885	3,750	30.0	63	16,173	13,274	21 8	57	12,499	9,869	26.8	54	2,874	2,139	34.5	79	7,063	6,148	14.7
KW.-HR. OUTPUT			1919	1918			1919	1918			1919	1918			1919	1918			1919	1918	
	June	71	127,260	119,217	6 7	43	408,335	419,060	2 5	39	364,552	336,902	8.0	40	53,990	49,520	8.1	63	445,814	443,209	0.5
	July	70	141,551	130,393	8 2	40	373,105	378,053	1 5	39	371,425	355,664	4 5	38	56,945	52,501	8 1	49	366,275	365,263	0.1
	Aug	74	161,431	153,266	5 1	57	640,616	662,120	3 2	47	496,745	460,360	8 0	39	58,991	53,231	10.2	61	444,026	464,729	−4.2
	Sept	73	153,837	146,209	4 5	53	610,254	610,179	0.1	46	515,519	463,929	11 5	38	58,316	54,838	6 3	63	423,656	420,707	0.5
	Oct	72	162,859	142,326	14 4	53	694,584	659,859	5 3	67	815,284	709,665	15.3	38	67,155	56,742	18.5	62	435,754	418,412	4.1
	Nov	71	153,171	140,240	9 2	56	724,667	707,347	2 4	60	686,486	597,855	14.9	39	68,352	59,507	14.7	63	422,812	390,744	8.2
	Dec	73	180,493	152,304	18.0	58	803,165	733,222	8.9	67	825,313	713,959	15.8	44	88,658	73,728	20.1	77	611,942	597,620	2.5
			1920	1919			1920	1919			1920	1919			1920	1919			1920	1919	
	Jan	78	207,158	159,773	29.8	60	853,057	717,303	19.2	69	841,841	731,758	15.2	56	140,736	117,677	19.9	75	538,304	460,221	16.2
	Feb	82	187,264	148,103	26 2	62	809,865	672,836	20.1	73	858,939	663,523	29.4	56	130,473	98,098	33.0	79	508,223	403,933	26.1
	Mar	82	198,603	148,512	33.7	64	897,327	711,828	26 0	74	913,659	711,761	28.1	56	137,306	102,545	33.6	79	551,995	428,941	28.6
	April	82	187,174	144,922	29 1	64	846,943	673,791	25 8	74	857,467	687,751	22 8	56	135,140	99,877	35 2	79	534,377	455,386	17.5
	May	82	188,216	147,883	28.0	64	813,608	679,173	20.0	74	880,570	710,787	24.0	56	138,534	98,799	40.2	79	569,189	495,688	14.4

from that section. In May 1919 the production of electrical energy in that section was about 3,800,000 kw.-hr. less than that produced in the New England States during the same month. In May of this year, however, central-station operations in the South Central States were 247,300,000 kw.-hr., against 229,300,000 kw.-hr. in New England. The industrial load in this section is increasing very rapidly, which accounts in a large part for this 71.4 per cent increase in energy production in the short period of a year.

Metal production showed a slight increase in the Mountain States over April. Numerous strikes in this section were still under way, and the poor transportation conditions hindered greatly the full operation of smelters and mills. Continued industrial prosperity on the Pacific Coast was sufficient, however, to overcome the sub-normal power demands of the Mountain States, resulting in an aggregate gain for the entire section of about 200,000 kw.-hr. in the average daily consumption over that of April. The stability of the central-station industry in this section is indicated by the fact that at no time during the present year have the monthly operations shown a decrease over the preceding month

Brass Furnace Highly Developed

THE evolution of the electric brass furnace has now proceeded to such a point that fundamental improvements in design are henceforth likely to be rather slow to materialize, according to H. M. St. John. There will, of course, be constant progress in the development of refinements in mechanical and electrical design calculated to make the furnaces more reliable, more durable and more nearly foolproof than they are at present. One of the most fertile fields for such improvement is in the development of refractories more exactly suited to the requirements of electric furnace operation.

Readers' Views and Comments

Improvements Needed in High-Voltage Air-Break Switches

To the Editor of the ELECTRICAL WORLD:

SIR: Air-break switches for the higher voltages, customarily known as horn-gap switches, were originally designed as a commercial product to furnish an economical means of sectionalizing transmission systems and disconnecting customers' substations. They were generally mounted on poles or other suitable structures and controlled from the ground. It was not intended that these switches should break any loads, neither were they to be used at points where the charging current would be excessive. Auxiliary arcing horns were added perhaps as an afterthought in order to protect the main contacts from the burning to which they would undoubtedly be subject under certain conditions.

With the general acceptance of the practicability of outdoor construction other very important uses have been found for horn-gap switches. Owing to the fact that improvements on the switches have not kept pace with improved methods of power transmission, the operating engineer has found himself confronted with a singularly vexatious problem. Outdoor transformer banks and switching stations were heretofore more or less of an experiment. Today, however, outdoor construction is recognized to be both practical and economical. Systems are of larger capacity and extend over considerably greater areas. The operating man

finds by comparison that the same reliance cannot be placed in his line-sectionalizing switches that experience has convinced him he is justified in placing in other line material and equipment. Operating conditions on most systems are such that the horn-gap switches are doing service for which they were originally not intended. Every operating engineer has had this forcibly brought home to him at one time or another.

After this vague criticism it is well to cite specific reasons why present switches are insufficient to meet the requirements of present operating conditions. The most serious handicap to the extensive use of these switches is their lack of rupturing capacity. Nearly all types depend almost entirely upon a modified horn-gap action rather than a positive action of actually pulling the arc up the horns, which is, of course, only possible where the movable contact travels upward in a vertical plane. A defect in the design of some switches is subjecting the operating insulators to torsional or tensional strains that tend to pull the insulator sections apart or loose on the pin. Pin-type insulators are not designed to withstand the heavy torsional or tensional strains. The protection of all operating parts and particularly the main contact against the weather and possibility of freezing is the feature of design which must be carefully worked out. Some of the horizontally operated switches now on the market are well protected against the weather.

Considerable thought has been given to the design of the main contact of the switches, but this study has not as yet, in the writer's opinion, produced a dependable contact. I believe any of the contacts now in use on horn-gap switches would operate successfully under ideal conditions, but it must be remembered that the switches are never used under ideal conditions. They are installed on top of a pole or substation structure and seldom if ever inspected or adjusted. A dependable contact would be one that could be effectively protected against the weather and self-adjusting, so that its carrying capacity would not be reduced by unexpected strains on the switch. The contact should not be one that must be held closed against tension, because such a contact would have a natural tendency to work open.

In redesigning horn-gap switches to meet the present-day operating conditions, serious consideration should be given to the feasibility of making more of the parts interchangeable. Also it should be possible to make replacements of parts quickly. It should be possible to change an insulator almost as quickly as a line insulator can be changed. Owing to the tremendous expansion of transmission systems the energies of the manufacturer have been concentrated upon production rather than on development, but we look forward to air-break switches which will meet our present requirements. Experience suggests that the following features be considered in the design.

The general type of switch is most important. The vertical-break switch has many advantages over a switch of the horizontal-break type, provided the vertical-break switch is so designed that the arc is lifted up the horns just as rapidly as the switch arm is raised in opening. Also the switch should provide a larger gap between the tops of the horns than has been the general practice. This is not only important in breaking heavy energy loads, but it is necessary when breaking low-power-factor loads or charging currents such as sectionalizing switches are called upon to handle. A switch designed in this way would prevent the possibility of an arc from one switch striking the horns of an adjacent switch, thus causing a short circuit.

The switches must, of course, be absolutely weather-proof. The main contacts, as well as all other parts of the switch and the operating mechanism, must be protected against sleet and ice. All of the live iron and steel parts should be galvanized. All bearings should be brass-bushed or babbitted and provided with grease reservoirs for lubrication. In no part of the switch should two iron or steel parts between which there is any motion come in contact. They should be spaced apart with brass rings or plates, so as to prevent any possibility of their rusting together. The main contact of the switch should be protected against the weather by a sleet hood which entirely covers it at all times, whether the switch is opened or closed. It should also be protected against burning by auxiliary arcing horns. The contact should be a self-adjusting type which aligns itself with a contact blade. It must be of such design that unexpected strains on the terminals of the switch or a warping of the structure upon which it is mounted will not cause poor contact or burning.

All torsional or twisting strains on the insulators must be avoided, as such strains would loosen them between sections or on the pin. All strains on the porcelain or between the porcelain and the pin must be in compression. The insulators should be secured to the pins in a manner permitting their easy removal, but the insulators must be securely locked to the pins. All of the insulators on the switch should be interchangeable for any position on the switch; that is, all of the parts which are permanently attached to the insulator should be duplicates, so that a single insulator could be held as a spare for any position on the switch. The insulator pins should be either forged steel or malleable iron. The terminals should be heavy cast brass or copper. The switch must be easy to install and of such design that when adjustments are once made they will remain permanent.

Wheeling Electric Company, Wheeling, W. Va. FRANK HOWARD, General Superintendent.

The Oersted Centenary

To the Editor of the ELECTRICAL WORLD:

SIR: In your issue for June 19, in an editorial note entitled "A Notable Centennial," you advocate the commemoration of the hundredth anniversary of Oersted's discovery of the phenomenon of electromagnetism. To the name of the celebrated Danish scientist you appropriately join that of the renowned Frenchman Ampère, who at once perfected the discovery made by Oersted. Following the discoveries of Franklin, Volta, Cavendish and a host of others, they opened the way to the wonderful development of modern electricity of which the present age is justly proud.

We view with satisfaction your endeavors to have the importance of Oersted's discovery duly recognized and to procure for permanent record reflections from experience and study bearing upon the influence of the early work of Oersted and Ampère. We shall highly appreciate any contributions to this end as well as any information regarding inventions, from whatever source it may be obtained. We are at all times prepared gladly to assist inventors in scientific research and in the practical application of discoveries.

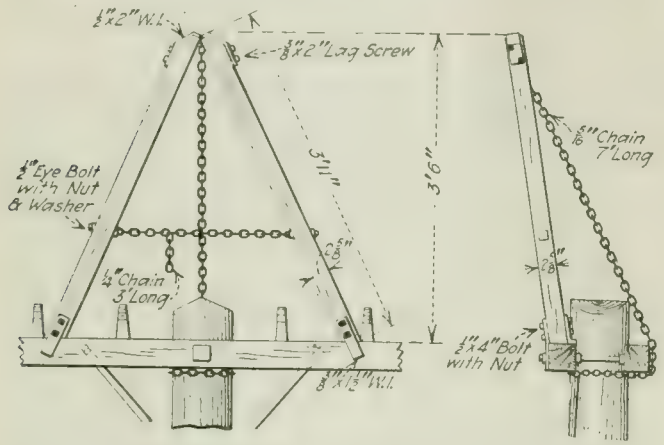
GODFREY A. P. V. WINTER BAUMGARTEN,
Rome, Italy. International Inventions Institute.

Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Pole-Top Hoist Which Saves Time in Raising Transformers

A QUICKLY set-up crane for hoisting transformers to pole tops, in use by the Southern California Edison Company for some time, has proved to be a real time saver. The crane consists of two 2⅝-in. (6.5-cm.) side members as shown, held together by a short length of chain. The hoist is placed with the legs resting on



HOIST IS QUICKLY ATTACHED BY PASSING CHAIN AROUND POST

one cross-arm and inclined from the vertical to allow clearance when hoisting the transformers. The chain holding the crane erect is provided with a hook so that attachment may be made quickly, after which the tackle is swung from the apex ready to raise the transformer. As so many transformers are placed for distribution service, a loss of only a comparatively small amount of time on each job would give a large total during a month's period. Consequently this hoist has proved very valuable.

W. R. BATTEY,
Chief Electrical Designer.
Southern California Edison Company,
Los Angeles, Cal.

Gritty Brushes Cure High Mica on Engine-Type Generators

ALTHOUGH hard brushes were employed in several engine-driven generators which came to the writer's attention, black spots and other indications of high mica continued to exist in spite of efforts to prevent it. Finally the substitution of a brush with specifically gritty qualities stopped the trouble completely.

When the trouble first developed the commutators were turned, but the trouble came back in a different place, which proved that it was not due to shaft throw or to local causes in the commutator. Though all of these machines were equipped with hard brushes, it was finally concluded that this trouble was due to lack of ability on the part of the brushes to wear down the mica as fast as the copper. This did not seem very reasonable because this grade of brush was very hard. However, substituting another grade of carbon known to have gritty qualities cured the trouble in every case. Consultation later with the brush maker developed the fact that the original brush had no abrasive qualities whatever.

In many cases of this kind a common carbon brush will be found to give good results and for obstinate cases, undercutting the mica will surely cure the trouble. Whenever these gritty brushes are used it is advisable to put on one graphite brush per stud, staggering across the face of the commutator, for lubrication purposes.

Cleveland, Ohio. JAMES DIXON.

How to Make Moisture Tests and Evaporation Tests on Oil

AS 0.01 per cent of water in insulation oils seriously impairs the dielectric strength, a simple method for testing for water in oil is very useful. Since water is of no value as a lubricant, it has no place in lubricating oils, especially where they are purchased by weight. The two simple tests described here are a qualitative test for the presence of any water in oil and a quantitative test for determining how much water is present. In the qualitative test, a small amount of anhydrous copper sulphate (blue vitriol gently heated until it has turned white) is shaken in a bottle containing oil. If there is a trace of water present the white anhydrous copper sulphate turns blue, owing to the formation of crystallized copper sulphate.

In the quantitative test a measured quantity of oil is diluted with an equal volume of benzine in a graduated tube and the mixture is whirled vigorously with a circular motion until the layer of water which separates does not increase in volume. The graduated tube with fine divisions allows the volume of the separated water to be accurately read and the percentage to be computed. As water is somewhat soluble in benzine it is advisable first to shake the benzine vigorously with water and then separate the two by whirling in a circular motion in order to saturate the benzine with water.

The value of an evaporation test is to determine the loss of oil for compressors, turbines, transformers, etc., in operation, and to make specifications for lubricants, as the flash point is somewhat proportionate to amount of oil that will evaporize at a specified temperature.

Kind of Oil	Temperature Deg. F.	Time Hours	Loss not to Exceed Per Cent
Cylinder	400	24	2
Engine	212	4	½ to ¾
Transformer	212	5	¼
Spindle	150	8	4

To make the evaporation test a small quantity of oil is placed in a shallow evaporating dish, accurately

weighed and heated in an air bath or drying oven. At the end of the required time the dish is cooled, reweighed, and the percentage of loss is computed. As a rule for comparing one oil with another, if the working temperature is known the test may be conducted at this temperature for eight hours and the desired information obtained. If it is desired only to know if oil of about the proper kind is being used on certain apparatus, the test may be made in accordance with the accompanying table, which gives the temperature, time and the maximum allowable loss. In making an evaporation test the size and kind of dish, the means of heating and the barometric pressure will make some difference in the result.

C. D. BASLER.

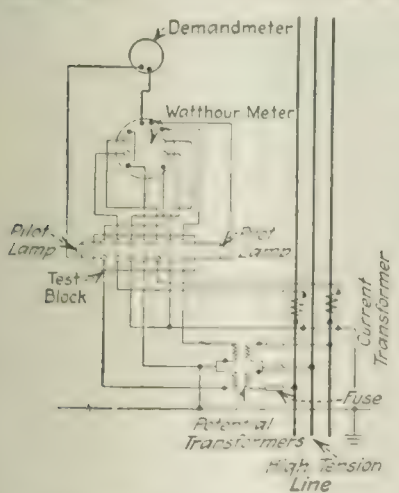
Consumers' Power Company,
Jackson, Mich.

Pilot Lamps Denote Failure of Potential on High-Tension Meters

FOR periodically testing the integrity of potential circuits of high-tension meters, potential transformers and fuses two pilot lamps are installed on the meter-test blocks of the Northern Ohio Traction & Light Company, Akron, Ohio. The location of these lamps and the arrangement of circuits are shown in the accompanying diagram.

In explanation of the sketch, all seven posts of the test block are normally closed. The two outside posts when closed short-circuit the pilot or indicating lamps, which are 10-watt, 110 volts or 125 volts. These two end posts are provided with spring contacts which when released cut the indicating lamps in series with the potential circuit of the watt-power meter. The lamps will not indicate unless the potential circuit in the meter and the potential transformers and fuses are intact. The construction of the test-block cover is such that it cannot be screwed in place until the binding posts have been returned.

The connection of the demand meter on three-wire, three-phase construction, as shown in the sketch, is such that failure of the potential ahead of the test block on either side will affect the graphic record and in most cases afford a definite time basis for correcting loss of registration due to failure of potential between tests. Isolating the billing meters on separate instrument transformers has made simple the use of this method of insuring proper potential conditions. Therefore, although the expense is greater, this scheme has been adopted as standard for construction on services to primary customers. No relays or indicating instruments are placed on the same transformers with billing meters. Primary meter houses, where necessary to isolate from other switchboard construction, are built by the customer from specifications furnished by the company. These specifications provide for clearness, ventilating shutters, etc. Brick and hollow tiles are used, the hollow tiles minimizing extremes of temperature.



PILOT LAMPS SHOW FAILURE OF POTENTIAL TRANSFORMER, FUSES OR METER POTENTIAL CIRCUIT

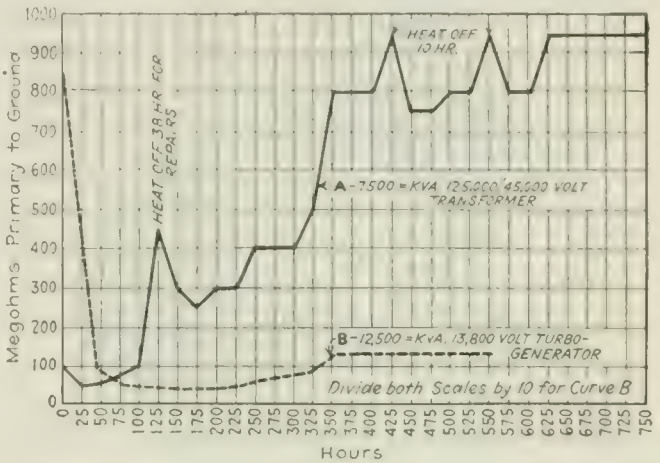
Tests of potential are made weekly on all primary metering outfits, 48 in number, over 42 miles, in about twelve working hours, by tester using motor cycle.

Northern Ohio Traction & Light Co., Akron, Ohio.

S. C. HENTON, Superintendent of Meters.

Proper Use of Megger in Drying Out Transformers and Generators

IN USING a megger when drying out electrical equipment the resistance readings must become constant before the drying is stopped. While the megger readings are affected by the voltage for which apparatus is insulated, it must be borne in mind that the form of curve given by readings taken at frequent intervals during the drying-out process, and not the numerical values of the readings, is the guide as to the progress.



FINAL SHAPE OF CURVES AND NOT INDIVIDUAL READINGS DETERMINE ACTUAL CONTENT OF INSULATION

Generally the curve will fall more or less rapidly as the apparatus warms up at the beginning and then rise slowly until the moisture has evaporated, when the curve will become constant. It must not be assumed that individual readings may be taken as a positive indication of the condition of the insulation at any given time.

Curve *A* is a typical curve taken during the drying out of a 12,500-kva., 13,800-volt turbo-generator that was delivered in December, erected during the winter and dried out in April after being subjected to extreme winter temperatures and moisture-laden atmosphere. The original reading was high, but in four hours it dropped to less than 10 per cent of starting value, continuing to drop thereafter for several hours to 5 per cent and never rising to more than 20 per cent of the original value even at the end of the run with the generator completely dried out. The slowly rising curve indicates the gradual elimination of moisture, the curve becoming flat when the moisture was completely eliminated.

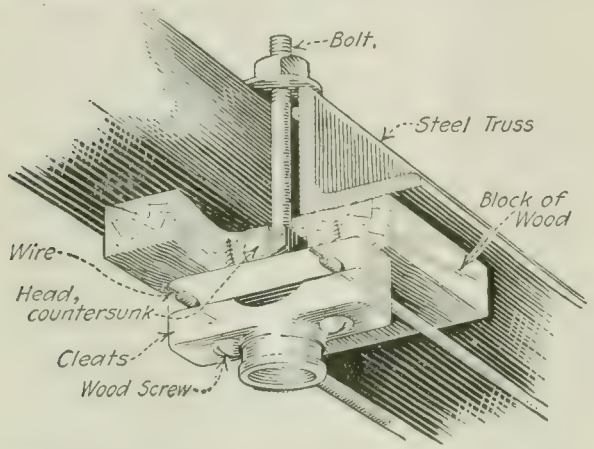
Curve *B* is that taken during the dry-out of a 125-kv. transformer. In this case trouble with the drying apparatus was encountered, resulting in marked rises in megger readings on the resumption of drying out until the transformer windings warmed up again. The general shape of the curve is similar to that of curve *A*, when allowance for the higher value of insulation for a high-voltage transformer is made.

Industrial Applications

The Economical Utilization of Electrical Energy in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

Method of Supporting Openwork Conductors on Steel Members

FOR carrying open-wire circuits along the roof trusses and other members in modern steel-frame industrial plant buildings an economical and satisfactory type of construction is shown in the accompanying drawing. It consists of clamping a wooden block to the steel angle, struts, ties or chords by means of a through-bolt.



METHOD OF CARRYING OPEN WIRE ALONG STEEL ROOF TRUSSES

Each block is bored for the bolt and is in addition countersunk so that the head of the bolt will lie below the surface of the block. To this block the porcelain cleats can be fastened with wood screws. Small receptacles or other wiring fittings can be mounted on these wooden blocks.

The general scheme illustrated is that which has been used in many United States Army buildings erected within the last year or so in various parts of the country.

Detroit, Mich. C. WALKER.

Three-quarter-Inch Rivets Cut Electrically in Five Seconds

THE work of cutting off rivet heads in car shops of the Middle West has been greatly expedited by the use of the electric arc. It takes one man an average of five seconds to burn off a 0.75-in. (19-mm.) rivet head with the electric arc, and with a 70-volt generator the energy consumption required to do this work is 39 watt-hours. With an air buster it takes a man from thirty seconds to ninety seconds to do the same work, and it requires about five times as much energy. If a sledge hammer and cold chisel are used, it usually takes two men from five minutes to seven minutes to cut off a rivet head of the same size. After the heads have been cut off the rivets are backed out with a sledge or air hammer, preferably the latter, and the electrically cut rivets are as easy to back out as those cut by other means.

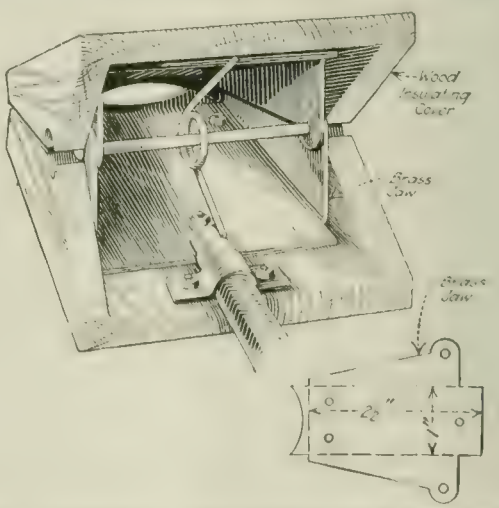
Energy is obtained from a 70-volt flat-compounded direct-current generator, and a machine rated at 1,000 amp. is sufficient to supply operators at four stations with a maximum of 400 amp. each. A grid resistance of 5.7 ohms is connected in series with each station so that on dead short circuit the current is limited to 400 amp. at 70 volts.

The operators are provided with a carbon holder containing a $\frac{5}{8}$-in. (16-mm.) graphite cutting electrode. The eyes of the men are protected by a heavy fiber or sheet-iron shield fitted with both blue and amber glass. The carbon holder is connected to the positive side of the generator and an arc is struck from the head of a rivet. The arc is maintained until the rivet head is burned off. This takes from four seconds to seven seconds, depending on the size of the rivet. A good operator will jump the electrode from one rivet head to another without breaking the arc.

J. A. OSBORN,
St. Louis, Mo. Electrical Engineer.

Test Clips with Insulating Handles

A TEST clip with a capacity of 250 amp. having an insulating covering to protect the tester and to prevent short circuit with other clips has been developed by the writer for use in a New Jersey industrial plant. The two jaws of this clip are stamped out of heavy brass and bent as shown in the accompanying drawing. They are hinged together with a rivet around which is a strong spring made of steel wire which holds the jaws together. The contact edges of the jaws are rounded so



250-AMP. TESTING CLIPS WHICH HAVE INSULATING WOOD COVERING

that when more than one cable is to be connected with a clip the cables will crowd together in the center of the jaws, assuring contact against each other and preventing the clip from slipping off. These clips will hold any leads or cable ends up to 1 in. (2.5 cm.) in size. They are entirely covered with a hard-wood insulating cover

¼ in. (6.4 mm.) thick. This cover is held to the jaws by three flat-head machine screws the heads of which are countersunk against the wood and covered with insulating pitch. The wood is well shellacked, and there is no trouble from oil as is the case with soft rubber-covered clips.

These clips have proved to be useful throughout the test floor for temporarily connecting up machines. They are easy to use, and there is no danger of receiving a shock from them nor of a short-circuit between the clips. PHILIP G. BERNHOLZ.

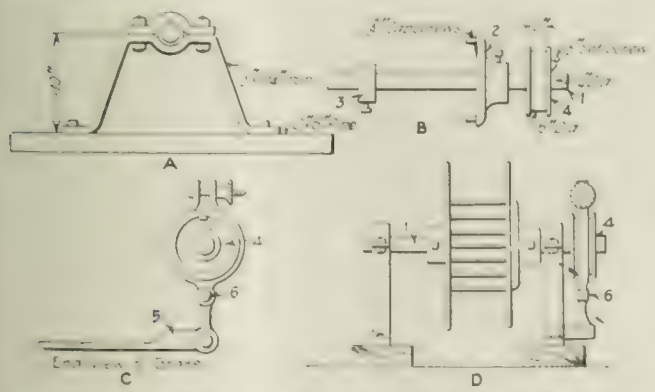
East Orange, N. J.

Stand for Holding Reel While Winding Coils

FOR holding wire reels and applying tension to the wire while winding armature coils the device described here has been developed for use in a large textile manufacturing company. The device consists of two pedestals holding a shaft for supporting the reel of wire and a brake for putting the proper tension on the wire as it is wound on the coil. The iron pedestals used for supporting the shaft (*A*) are made of ½-in. x 1¼-in. (1.2-cm. x 3-cm.) strap iron, bent as shown. The top of the pedestal is made to form half of the bearing for the shaft, and the other half is made of a similar piece of flat iron. Two bolts secure the top half to the pedestal.

The shaft itself consists of a piece of round cold-rolled steel, suitable in size for the hole in the reel, which averages about 1¼ in. The carrier (2) is preferably a casting bored to fit the shaft, and near the extremity of each arm is a ⅜-in. (1.5-cm.) cap screw, the heads of which are sawed off in order to fit into holes drilled in the side of the reel. This carrier is fastened to the shaft by means of a ½-in. setscrew. The collar (3) serves to keep the reel from lengthwise movement along the shaft.

For applying tension to the wire while the coil is being wound a 6-in. pulley (4) is mounted on the outside end of the shaft and a brake (*C*) is made to bear upon this pulley. The brake band is of cast iron and is in two halves, which are hinged at (6). One of the halves extends down to the lower arm (5), to which it



HOME-MADE REEL STAND FOR PUTTING TENSION ON WIRE WHILE WINDING COIL

is pivoted, and this arm is screwed down to the 2-in. x 6-in. pine board. The tension on the brake is adjusted by means of the thumbscrew at the top. In using the contrivance the reel should be placed on the shaft so that the wire pulls off the top side of the drum.

Glasgow, Scotland. L. E. WOOD.

Window Bricked In to Hold Service Switch

TO OBTAIN a short, direct run of service wires a Massachusetts factory purchasing central-station energy ran them through a window the top half of which was bricked up to hold the service switch inside the building, as shown in the accompanying illustration. The most convenient entrance location for the conduit carrying the service wires was at the top of this window and just below the ceiling. The leads from the transformer on the pole outside the factory were dead-ended on pin-type insulators carried on cast-iron brackets bolted into the wall with expanding bolts. From these leads drip loops were carried downward and into the conduit fitting as shown. The upper half of the window was bricked in, thus providing ample space inside for the service switch, fuses and meter clear from columns and beams and contributing to low cost of installation. R. JOHNSON.



HALF OF WINDOW FILLED IN TO SUPPORT SWITCH AND METER

Lynn, Mass.

Subdivision of Motor Maintenance Items Which Assists Record Keeping

TO FACILITATE making out time cards on motor-repair jobs and to provide continuous information as to the cost of doing such work in the shop of the Electric Motor Repair Company, the following classification of items is used. The items may be abbreviated as desired, in order to save time in making out the cards.

All work of this kind performed in this shop is listed as provided in this classification and when making up the cost records these accounts are segregated, thereby permitting of ready comparison between different jobs.

Make-Ready.—Includes taking motor or other equipment apart, stripping, cleaning, or other work preparatory to making motor or armature ready for coils.

Insulating.—Cutting, fitting and inserting insulation.

Making Coils.—Making and shaping coils.

Taping Coils.—Coils taped before insertion.

Inserting Coils.—Inserting coils and soldering leads of coils already taped.

Taping and Inserting Coils.—Inserting coils when they are taped at the time that they are inserted and soldering leads.

Banding.—Banding and soldering band.

Testing and Varnishing.—Testing completed work; varnishing and baking out.

Refilling Commutators.—Completely refilling commutators, taking off and putting back on armature.

Repairs to Commutators.—Partially refilling or other repairing of commutators.

Repairs to Fields.—Specifying kind of work done on these.

Boxing and Crating.—Time consumed on this work.

Miscellaneous.—Making brushes, minor repairs and other items that are not properly classified under the above headings.

Springfield, Mass. J. B. TUFTS.

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

Pacific Power & Light Company Forms Securities Department

WHAT is to be known as the securities department was recently organized by the Pacific Power & Light Company of Portland, Ore. A manager, formerly connected with an investment banking house of Portland, has been placed in charge of the department, which will have supervision of the marketing of the company's preferred stock in the territory served. With this in view an organization will be built up by the addition of salesmen exclusively employed in the department, who will co-operate with all other employees of the company.

It is the purpose of the department to assist employees in increasing the volume of sales of preferred stock in order to provide funds to make extensions and additions to the company's service facilities.

While the company's employees generally have shown a fine spirit of co-operation in the sale of stock, the company felt that there were many of its customers and residents of the territory who could not be reached by the employees. Numbers of these could be made stockholders if the merits of the investment were placed before them. By establishing the securities department with its salesmen in the field, in addition to the efforts of other employees, the company believes that a number of new customer-stockholders will be gained.

High-Priced Coal Affects Detroit Edison's Net Earnings

EFFECTS of the increased cost and comparatively poor grade of coal obtainable are reflected in the consolidated earnings and income statement of the Detroit Edison Company for the first five months of this year. Total gross revenue for five months of 1920 was $8,701,199, a 30.8 per cent increase over the same period during the previous year. Total operating and non-operating expenses, including $385,000 renewal, replacement and contingent reserve appropriation, were $6,762,575, an increase of 41.9 per cent, making the net revenue for five months $1,938,623, or 2.6 per cent more than 1919. Interest on funded and unfunded debt was $884,512, or 28.8 per cent above last year, leaving a net income of $1,054,111, a decrease of 12.2 per cent as compared with the same period of the previous year.

The largest increase is found in operating expenses, which include coal cost. With a growth of 30.8 per cent in gross revenue there would be corresponding increases in expenses. However, the coal cost is out of proportion to all other expenses. During May of this year gross revenue was $1,669,921 and operating and non-operating expenses, the principal item of which is coal, were $1,303,900. Gross revenue increased by 37.9 per cent, while operating and non-operating expenses were 52.5 per cent more than May of last year.

Because of difficulty in obtaining delivery of contract coal the Detroit Edison Company has been forced to purchase coal in the open market at almost prohibitive prices. The fuel thus secured was often of an inferior quality, which, coupled with its high cost, resulted in excessive operating costs.

Inspection Department Is Important Factor in Good Service

By C. B. Merrick

CORRECT billing of customers for energy consumed and maintaining accurate records of the installations on consumers' premises is part of the service of the San Joaquin Light & Power Company. It has an inspection department whose duties are to prevent faulty installation of equipment and metering devices and to check the bills rendered to the consumer. Proper installations are assured by inspection in the field, whereby any irregularities are reported and followed up until remedied. Correct billing is made certain when the data and meter constants obtained by this inspection are checked and found to agree with the constants and readings as entered on the ledgers.

The procedure is as follows:

1. A "service order" tag is made out for setting or changing all meters.
2. An "inspection tag" is made out for checking the data as reported on the "service order."
3. Inspections of all meters are made at regular intervals from the "meter tester's reports."
4. "Complaint tags" are issued and special investigations made for all unusual fluctuations in consumption or demand, as well as for complaints of high bill, voltage or other causes.

The standardized forms of these four tags are shown herewith. Irregularities in the installations and discrepancies found in the records are noted on the tags and summarized on monthly reports, as shown in the accompanying tabulations. Copies of these reports are sent to the departments concerned, so that corrections can be noted and returned to the office for clearing the files.

TABLE I—DISCREPANCIES FOUND IN INSPECTION AND TEST TAG REPORT, FRESNO DISTRICT, MAY, 1920

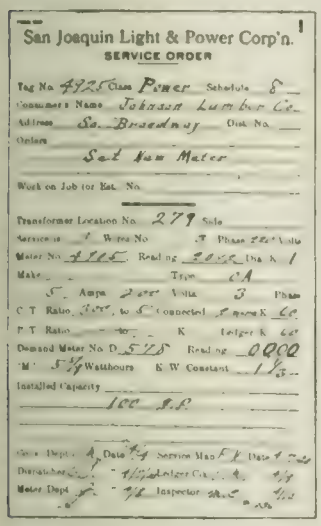
Meter No.	Test Tag No.	Location	Ledger Data (Found Correct)	Test Tag Data (Found in Error)
4905	101	Johnson Lumber Co..	Demand K = 1½	K = 1 0 — ½
32547	97	Platt Hotel . .	Demand meter No. 607	No. 1607
6074	366	Standard Mfg. Co...	Demand K = 0.5 + ½	K = 0.533 —2/9
			Ledger Data (Found in Error)	Test Tag Data (Found Correct)
15551	83	City Water Company.	200-volt	100-volt
30713	105	1323 Belmont	No. 33713	No. 30713
36509	77	2019 Broadway	15 hp . .	25 hp.
1856	201	L. E. Hudson .	Three-phase	Single-phase

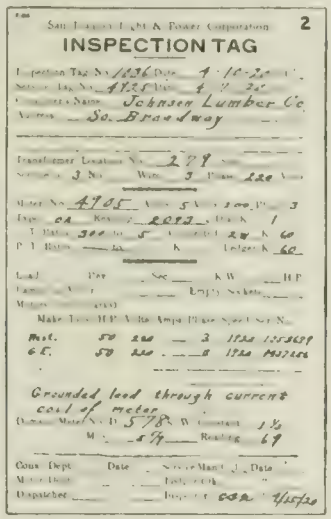
* The ledger was corrected in the above cases to correspond with the tag data, which was found to be correct.

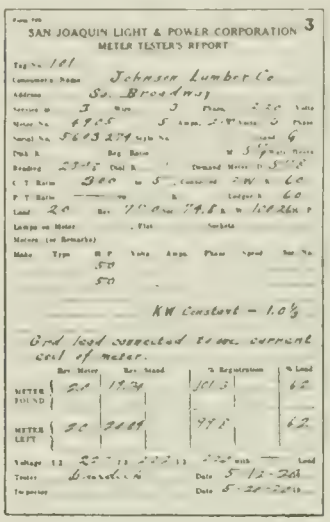
TABLE II—METER DEPARTMENT IRREGULARITIES REPORTED IN [illegible] DISTRICT, MAY, 1920

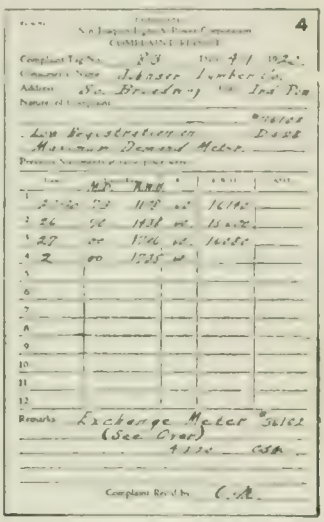
Meter No.	Location	Details
4905	Johnson Lumber Co., Plant No. 1	Grounded lead connected to one current coil of meter.
31776	Johnson Lumber Co., Plant No. 2	No molding over ground wire.
32547	Platt Hotel	Current transformer very hot; should be 80-amp. capacity.
4853, 25076, 33401	Globe Oil Co.	Three transformer banks paralleled, no secondary ground.
6074	Standard Mfg. Co.	Joint in secondary lead of current transformer not soldered.
26747	Burbank School	No door on meter box, meter exposed to the weather.
26753	Pioneer Brickyards	Part of lights connected ahead of meter on power circuit; service switch connected with blades hot.

Every new installation for power or lighting service and each reconnection of meter or service must be made on a "service order." Nothing is allowed to be connected to the lines without this order. Fig. 1 shows the form of this order, which is made out in triplicate, the duplicate and original going to the service department for meter rating and necessary instructions. The triplicate remains on the stub file, where the return of the original can be checked at any time. The cut-in man runs the service, sets the meter and does any other work


1
San Joaquin Light & Power Corp'n.
SERVICE ORDER
Tag No. 4925 Class Power Schedule S
Consumer's Name Johnson Lumber Co.
Address So. Broadway Dist. No.
Orders
Set New Meter
Work on Job for Est. No.
Transformer Location No. 279 Sole
Meter No. 4905 Reading 2005 Dial No. 1
Make Type CA
5 Amps. 200 Volts 3 Phase
Demand Meter No. D 578 Reading 0000
Installed Capacity
100 H.P.
Service Man F. Y. Date 4-7
Inspector C.O.R. 4/15/20


2
San Joaquin Light & Power Corporation
INSPECTION TAG
Inspection Tag No. 1836 Date 4-10-20
Service Tag No. 4925 Class 4 " 20
Consumer's Name Johnson Lumber Co
Address So. Broadway
Transformer Location No. 279
Service No. 3 No. Wire 3 Phase 220 Volts
Meter No. 4905 Class CA Kind 2053 Dial No. 1
C T Ratio 300 to 5 Connected 2 W K 60
P T Ratio — to — K Ledger K 60
Load 20 Fuse Sec KW HP
Make Type H.P. Volts Amps. Phase Speed Ser. No.
Mot. 50 220 3 1750 1253609
G.E. 50 220 3 1750 M37626
Grounded lead through current coil of meter.
Ordered Meter No. D 578 K. W. Constant 1½
Make 5A Reading 69
Conn. Dept. Date Service Man J. Date
Meter Dept. Inspector C.O.R. 4/15/20
Dispatcher


3
SAN JOAQUIN LIGHT & POWER CORPORATION
METER TESTER'S REPORT
Tag No. 101
Consumer's Name Johnson Lumber Co
Address So. Broadway
Service No. 3 Rate 3 Phase 2 Volts
Meter No. 4905 5 Amps. 2 Wire 60 Phase
Serial No. 5643 254 Style No. Load 6
Dial No. Reg. Ratio W 5 Watts Hours
Readings 2345 Dial No. Demand Meter No. 578
C T Ratio 300 to 5 Connected 2 W K 60
P T Ratio — to — K Ledger K 60
Load 20 Fuse 15 Amps. 74.8 K 120 Volts
Lamps on Meter Plug Socket
Meters (or Remarks)
Make Type H.P. Volts Amps. Phase Speed Ser. No.
5A
KW Constant = 1.0½
Grd. lead connected to rec. current coil of meter.
Bur. Meter Bur. Stand % Registration % Load
METER FOUND 20 19.74 101.5 62
METER LEFT 20 20.05 99.5 62
Voltage 121 121 121 Load
Tester Brownell
Date 5-12-20
Inspector Date 5-20-20


4
San Joaquin Light & Power Corporation
COMPLAINT REPORT
Complaint Tag No. 93 Date 4-1 1920
Consumer's Name Johnson Lumber Co.
Address So. Broadway 2nd Floor
Nature of Complaint
Low Registration on Demand Meter.
Maximum Demand Meter.
Previous Complaints
Date Meter No. Reading Adjustment
4-2-20 D 578 117 at 1610
3-26 " 1431 " 1500
3-27 " 1746 " 1605
4-2 " 1535 "
Remarks Exchange Meter 56102 (See Order)
4-2-20 C.O.R.
Complaint Received by C.A.

TYPES OF SERVICE, INSPECTION AND TEST ORDERS

which is required on the particular job after the transformer or secondaries are provided by the line crews. He makes the necessary notations of constant, set reading and other data on the "service order," which is then used for making up the meter and transformer records in the service department. The duplicate is held in this department for record, while the original is returned to the consumer's department for ledger entries and the clearance of the triplicate.

On completion of the ledger sheet, an "inspection tag" (Fig. 2) is made out, showing only the meter number in addition to the name and address of the consumer. The inspector visits the meter installation and fills in the rest of the inspection tag, giving meter description, reading, current and potential transformer ratios and constants, and connected load. He also inspects the meter for proper connection and operation. He then checks the record on the meter card, made from the service order, and the entry on the consumer's ledger, placing his stamp and tag number opposite the entries when found correct. This checks the accuracy of the meter data on which correct billing depends. Unrecorded connections are prevented by frequent checking to see that all "service orders" are accounted for by the inspector, and by the rigid rule that no service is connected or changed without a service order.

In addition to the inspection of meters set or exchanged, a periodic inspection of all meter locations is obtained when the regular meter tester turns in his reports. These test tags (Fig. 3) include an inspection of the meter installation, reading and constants the same as the previous tags. All irregularities, dangerous or faulty connections in installation are included in a monthly report by the meter department. As a tester completes a district the duplicates of his test tags are checked by the inspector with the ledger and meter card records. All discrepancies found in this manner are listed in a monthly report by the inspection department, showing the responsibility for the errors. By this system a periodic inspection is obtained at minimum cost.

Special investigations are made of all abnormal fluctuations in consumption or demand, either high or low, by means of the "complaint tags" (Fig. 4).

This system of inspection has proved very effective in the prevention of dangerous installations, location of defective meters or connections shortly after installation, and the correction of errors in billing constants, demands, readings and ledger entries. In addition to these direct results the psychological effect on employees has brought about greater accuracy in their work, knowing, as they do, that an inspection will follow.

Refund of Customers' Deposits

UNTIL satisfactory credit is established non-property owners and apartment-house customers of the Philadelphia Electric Company are required to make deposits against the payment of bills for energy consumed. While these deposits are held by the company interest at 6 per cent is allowed, which is credited to the customers' accounts at the end of each year. If at the end of two years a customer has not allowed his bills to become delinquent and in the opinion of the credit department has established a good credit record the deposit is refunded automatically. The Philadelphia company has found this practice to be very satisfactory to its cutsomers, and the fact that the deposits are returned without their having to request it places the company in a favorable light. With this arrangement total deposits can also be held at a minimum.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Ventilation and Temperature Problems in Large Turbo-Generators.—B. D. LAMME.—In the first part of this paper are set forth general descriptions and characteristics of radial, axial and circumferential ventilation, followed by a discussion of the flow of heat in the copper and iron parts of machines. The article is based on a paper read by the author at the 1920 convention of the A.I.E.E.—*Electric Journal*, July, 1920.

Fundamental Principles of Polarity and Phase Rotation and Voltage Diagrams of Transformers.—A. BOYAJIAN.—The article was prepared to clear up some of the difficulties and uncertainties which arise in determining transformer polarity, phase rotation and angular displacement when two or more units are to be arranged for parallel operation. The author explains the fundamental principles as applied first to single-phase circuits and then to three-phase circuits. He also discusses their bearing on parallel operation and solves problems of a practical nature.—*General Electric Review*, May, 1920.

Carbon and Commutator Wear.—R. E. HELLMUND.—It is said that although sparking voltages are the same in direct-current and alternating-current machines, the same sparking voltage may give widely different results under different conditions in either type of machine. Experiments are cited to show that the current density has an appreciable influence upon the arcing at the brushes. The influence of temperature and speed upon brush and commutator wear are also taken up.—*Journal A.I.E.E.*, June, 1920.

Present Tendencies in Turbo-Alternator Design.—J. SHEPHERD.—The writer deals particularly with the problem of ventilating turbo-alternators. He states that the application of water cooling to rotors has been put in practice by a British firm. He believes that the fire risk is thus greatly reduced on account of the fact that in air-blast ventilation any fire is rapidly spread through the whole machine. He also deals with the problem of properly insulating coils and the danger to the coils of vibration, breaking, etc.—London *Electrician*, July, 1920.

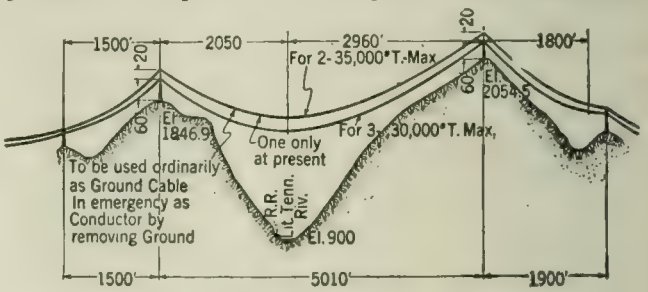
Lamps and Lighting

Maintenance of Lighting System.—A. L. POWELL.—The writer first considers the depreciation of lamp reflectors and their surroundings. He then shows how systematic cleaning is rewarded in increased efficiency of the system and saving in light. He also points out how illumination may be measured.—*Bulletin L. D.* 101 *Edison Lamp Works*, April, 1920.

Enclosed Carbon Arc Lamps Versus Novalux Mazda Units.—H. E. BUTLER.—During the period of the war and during the coal strike street lighting was curtailed in this country in the interests of economy. Two very important truths have been revealed, it is said, as the result of this experience: (1) That reduced street lighting is accompanied by an increase in crime and accidents; (2) that an appreciable waste of power exists in street-lighting systems because of the use of the inclosed carbon arc lamp. The author takes up this second matter in particular and by detailed analysis points out the wastefulness of keeping in service obsolete forms of lighting units.—*General Electric Review*, June, 1920.

Generation, Transmission and Distribution

The 150,000-Volt Transmission Line of the Knoxville Power Company.—THEODORE VARNEY.—A description of the new hydro-electric development of the Knoxville Power Company in the Little Tennessee River, which is to be part of a considerable interconnected network. The operating voltage of this network is to be 150,000. The power house provides for four generating units, of which three are installed at the present time, the generators being capable of delivering 20,000 kw. and operated at a speed of 171½ r.p.m. These generators



ELEVATION OF KNOXVILLE POWER COMPANY'S LONG SPAN ACROSS LITTLE TENNESSEE RIVER

are connected directly to the low-tension side of the transformers through automatic oil switches without a low-tension bus. Details of the transmission lines are given. In particular a long span of 5,010 ft. (1,527 m.) was installed, as shown in the illustration. The cable used was a steel-clad aluminum cable of 1.125 in. (3.2 cm.) diameter.—*Transactions A.I.E.E.*, June, 1920.

Traction

Electric Freight Locomotives for the St. Gotthard Railroad.—A detailed description, including many photographs and complete connection diagrams, of the new so-called 1C + 1C freight locomotives, which have been specially designed to comply with certain regulations requiring 860-ton trains to be hauled from Goldan to Chiasso and back inside of twenty-eight hours. The locomotives are designed for 15,000-volt, single-phase supply, at 16⅔ cycles, but the line is at present run at half the voltage to avoid insulator troubles due to smoke deposits from steam locomotives, which are still used to some extent. The locomotives develop 1,250 kw. with a quarter-hour maximum of 1,920 kw. and give a drawbar pull of 13,000 kg. (28,900 lb.), with a maximum at start of 24,000 kg. (53,000 lb.). The motors are of a compensated series type, with twelve poles, and provided with phase-displaced commutating fields. Each

locomotive has four motors, coupled to the wheels by cranks and connecting rods. A number of secondary taps on the 15,000/400-volt transformers provide for necessary speed regulation.—*Schweizerische Bauzeitung*, May 22-29, 1920.

Installations, Systems and Appliances

Recent Electric Vehicle Progress.—F. AYTON.—It is stated that in England the superiority of the electric truck for delivery and other service in urban and suburban areas has been admitted. Moreover, the soaring cost of fuel for the internal-combustion engine, not to speak of the extremely heavy cost of keeping in repair vehicles fitted with this type of motor, is giving a greater and yet greater advantage to the simple and economical "electric." The author says, however, that the electric vehicle will not be employed to the maximum extent possible until charging facilities upon an ample scale are available in every locality. He then passes to the design of electric vehicles and pays particular attention to the Steinmetz car, developed in America. The writer calls attention to the De Martis lead type of "lead-acid" battery, of Italian origin, in which it is claimed that by the use of a special paste which combines extreme hardness with great porosity that formation of lead sulphate is prevented. Other advantages claimed for this battery are higher capacity for the same weight, slightly higher voltage on discharge and increased watt-hour efficiency.—London *Electrician*, July 2, 1920.

Air Cleaning by the Cottrell Electrical Precipitation Processes.—P. E. LANDOLT and H. M. PIER.—It is said that there is an ever-increasing demand for clean air for various industrial and domestic purposes. The application of the Cottrell process to the smoke and gas discharge from industrial plants is explained.—*Journal Engineers' Club of Philadelphia*, May, 1920.

Units, Measurements and Instruments

Locating Faults in Power Cables.—K. DE KONING.—The ordinary methods for determining the position of faults in cables may give quite erroneous results for multi-conductor cables, if short-circuits exist between more than two conductors, and in particular do not apply when one of the conductors is actually broken at the fault, both ends being welded to one of the other conductors. In general different values are then obtained for the resistance in the fault, if measured from one end of the cable or from the other. The author therefore suggests that in doubtful cases resistance measurements always should be made from both ends of the cable and between every two conductors. If satisfactory cross-checks are not obtained when computing the location of the fault from independent combinations of measured data, this shows that some complication has occurred. By means of interesting examples from practice, the author shows, however, that even under very peculiar circumstances the fault may be correctly located by proper analysis of the measured resistance values.—*Elektrotechnische Zeitschrift*, April 1, 1920.

A Dynamometrical Comparator.—EDY VELANDER.—The auther deals with a differential dynamometer for accurate comparison of alternating and direct-current strengths. He states that, owing to the inherently lower precision of alternating-current measurements, more accurate results are often obtained by transferring, by means of a comparator, the alternating-current measurements into direct-current of related type. A dynamometrical comparator was devised and developed by the writer by the introduction of a special control box and the provision of means for the quick and accurate adjustment of the comparator ratio. He concludes that a comparator in conjunction with a direct-current potentiometer appears to offer the most accurate means known at the present time for the determination of the effective value of alternating currents of the order of 5 to 50 milliamperes at frequencies up to about 2,000 cycles.—*Journal A.I.E.E.*, July, 1920.

A Direct Recording Method of Measuring Magnetic Flux Distribution.—F. S. DELLENBAUGH, JR.—The method described involves the use of a revolving search coil fitted with a collecting device and operating at a high and constant speed. The coil is rotated by a small storage-battery motor fitted with a governor to control the speed and a magneto to indicate the speed.—*Journal A.I.E.E.*, June, 1920.

Telegraphy, Telephony and Signals

Cross-Talk on Long Telephone Lines.—L. LICHTENSTEIN.—After adapting the ordinary equations of electric transmission along wires to the case of two neighboring pairs of wires the author establishes solutions which permit a predetermination of the voltages induced in one pair of wires when known telephonic currents are transmitted over the other pair. The expressions refer only to the case of non-transposed lines but nevertheless are rather complicated. In special cases, however, they may be transformed to practically useful formulas. The analysis is extended also to the case of phantom lines for determining cross-talk from one pair to the phantom and vice versa.—*Elektrotechnische Zeitschrift*, March 4 and 11, 1920.

Production and Measurement of High Vacua, I.—SAUL DUSHMAN.—Rapid development during the past few years in the application of hot-cathode devices to the field of wireless telephony and telegraphy has been due in considerable part to the great progress in the art of producing and maintaining extremely high vacua. In this, the first article of the series, the author discusses fundamental principles of kinetic theory of gases which are of importance in connection with the subsequent discussions of methods for the production and measurement of high vacua.—*General Electric Review*, June, 1920.

Miscellaneous

Future of Electric Heating in Switzerland.—M. HOTTINGER.—The author analyzes the heat energy required in Switzerland's climate and finds that on an average 2,500 kw.-hr. per person in the winter season will be sufficient for heating not only residential apartments but also offices, factories, etc. For the heating alone a total of 10,000,000,000 kw.-hr. would be expended per year in Switzerland, or just one-half of the maximum total of hydraulic energy which could be utilized per year by careful development of all available waterfalls. A difficulty with electric heating is the seasonal demand, which prevents a high economy. The author does not expect a general application of electricity for heating purposes.—*Schweizerische Bauzeitung*, Feb. 7, 1920.

Electric Plowing.—GUÉDENEY.—The author describes apparatus and methods for electric plowing. He also reports on some experiments made to determine the power expenditure per acre under different conditions.—*Bulletin de la Société Française des Electriciens*, February, 1920.

News in Brief

Summary of Market Conditions and of Recent and Approaching Happenings of Importance to the Industry

A QUIET market for electrical material prevails in all sections of the country as compared with previous weeks, but sales in no section are so low as to create alarm. A slump is reported in Seattle, and a dearth of construction exists in the Intermountain States. In the East, South, Middle West and Northwest activity is good for the midsummer season.

MORE effort in making collections is reported as necessary throughout the country, though in all sections but one business conditions are said to be satisfactory and the credit situation gives no cause for alarm. The exception is the Intermountain district, but even there the peak of the trouble is thought to be past and the crop outlook is good.

TRANSPORTATION conditions improve spasmodically, though the serious car shortage still hinders building in the South and is interfering with grain shipments in the Northwest.

SMALL stocks with a poor outlook for bettering them give apprehensions of a shortage of heating appliances in the East. West of the Mississippi supplies are in better shape. Fan sales are still off, though a hot spell has induced lively trade in the Intermountain States.

NO PERMIT within the boundaries of a national park will be granted by the Federal Power Commission until Congress has an opportunity to act. The executive secretary of the National Parks Association has denounced the bill as having a "destructive application" to the parks.

PRIVATE development and operation of the state's water powers on leases from the government and subject to regulation by the Public Service Commission are favored in the platform of the Republican party of New York State. The Democratic platform advocates state development and operation.

A REFERENDUM, held by the United States Chamber of Commerce on declarations of principle resulted in overwhelming indorsement of its industrial planks by its membership. Legal prohibition of strikes by employees of public utilities and the creation of a tribunal to settle such disputes in a binding manner were favored by 1,564 to 97 and 1,571 to 100 respectively. The open shop was also called for.

A SECOND 20,000-kw. turbine has just been installed at the Ashley Street station of the Union Electric Light & Power Company of St. Louis. Another unit of this size and also one of 10,000 kw. are to follow, probably in September.

EIGHT papers on engineering topics, besides committee reports, will be presented at the September meeting of the A. I. and S. E. E. in New York, according to the tentative program.

BOND and stock issues of electric utilities for July amounted to $24,800,000. The rate of interest of the issues, eleven in number, is from 6 to 8 per cent, and they will yield from 7¼ to 8.45 per cent.

ORGANIZATION of the International Chamber of Commerce is proceeding in Paris as a result of the meeting of 500 delegates, representing France, Belgium, Italy, Great Britain and the United States.

HOLDING that a municipal plant is not authorized to charge rates that would yield it a profit, the Maine Public Utilities Commission has disapproved an increase of 1 cent a kilowatt-hour made by the Kennebunk plant, and has ordered the old rates restored.

A WIRELESS telephone service to farmers is to be provided by the Michigan Agricultural College.

DIFFICULTIES in recruiting the required personnel from the staffs of the Department of War, Agriculture and the Interior confront the Federal Power Commission and may cause delay in organization. All interests affected by the regulations to be drafted by the commission will be called into conference before the rules are promulgated. The duties of the executive secretary have been outlined.

HIGH cost of financing and high prices of equipment will prevent any further expansion of the Detroit Edison Company after work now under way is completed, according to Alex Dow, president of the company.

RESIGNATIONS from technical employees of the Patent Office have numbered 150 in the last year, and the work is now six months behind.

SAN FRANCISQUITO plant No. 2, with an initial capacity of 35,000 kva., has been put into operation by the city of Los Angeles.

A SLIDING scale of rates on the basis of oil costs has been proposed to the California Railroad Commission by the Western States Gas & Electric Company.

GASOLINE costs are forcing more and more small plants that have been operating with oil engines to apply for central-station service, according to the Illinois Northern Utility Company.

THE MUNICIPAL plant of Seattle at Lake Union and other Pacific Coast plants may find it necessary to replace oil with coal on the ground of saving in cost.

THE PRICE of its advanced accounting course has been reduced from $65 to $40 by the National Electric Light Association.

B. E. SUNNY, president of the Chicago Telephone Company, urges that public utility securities should be exempt from taxation.

ST. LOUIS faces a grave coal shortage because of the strike in the Illinois coal mines, and the Mayor has appointed a committee of coal men, railroad men and city officials to distribute the available supply.

AN ISSUE of $5,620,000 thirty-year 6 per cent bonds has been placed on the market by the Adirondack Power & Light Company at 84½, to yield 7¼ per cent.

A 20 PER CENT surcharge to cover the extra cost of street lighting at Hartford, Conn., was put into effect Aug. 1 by the Hartford Electric Light Company, previous rates having failed to compensate for post-war costs.

REPRESENTATIVES of about a dozen utilities advocated the establishment of a service charge at a recent hearing before the Massachusetts Department of Public Utilities, seeking to repeal the existing statute prohibiting a meter charge in case electricity to the value of $9 is used during twelve consecutive months.

A REDUCTION of 1 cent per kilowatt-hour in the rates of the Kennebunk (Me.) municipal plant has been ordered by the Maine Public Utilities Commission on the ground that the proposed tariff is unreasonable.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

All Interests to Confer on Water-Power Regulations Now Being Drafted

ALL interests affected by the regulations being drafted by the Federal Power Commission will be called into conference before these regulations are promulgated. Ample opportunity will be given to correct any injustices and careful record will be made of all objections which may be voiced against any of the regulations, with the idea that means will be found to meet any worthy suggestion.

No Power Permits for National Parks Until Congress Has Chance to Act

THE Federal Power Commission has ruled that no permits will be granted within the boundaries of a national park until Congress has had an opportunity to express itself on the subject.

Robert S. Yard, the executive secretary of the National Parks Association, regards the passage and approval by the President of the water-power bill as most unhappy since it has a "destructive application" so far as the parks are concerned. Congress has turned its power over to three men, he declared. He states, however, that "so far as the present administration is concerned, the parks probably are safe, for Secretary Payne at least is uncompromising in their defense and probably will bring his fellow commissioners to his point of view, if perchance they do not already hold it."

B. E. Sunny Urges Tax Exemption on Utility Bonds

THE interest on bonds of public utility companies should be given the same exemption from federal income tax that is accorded the earnings of municipal obligations, B. E. Sunny, president of the Chicago Telephone Company, stated in an interview with a representative of the ELECTRICAL WORLD.

"This is not intended to help the rich man," said Mr. Sunny, "but the utilities must depend upon the rich for the large amounts of capital needed every year to supply the public with the service it has a right to expect. Under present conditions men with a taxable income of $50,000 would earn only 4 per cent net on a 5 per cent public utility bond at par, and to earn the full 5 per cent after paying the income tax the bond would have to be bought at about 81. The prices at which the net yield would be 5 per cent drop rapidly with increasing incomes, and with $300,000 a year the price to the investor would have to be about 46¼. This accounts in a very large measure for the great depreciation of public utility securities. The public loss of revenue by making utility bonds tax-exempt would be more than made up by the resultant reductions in the rates charged for public utility service.

"The interest on municipal bonds was exempted presumably because it is paid by the people, but a much greater number of people would be affected by an exemption in favor of utility bonds. For instance, in the city of Chicago there are fewer than 400,000 taxpayers, while there are more than 600,000 gas, electric light, power and telephone customers, in addition to the hundreds of thousands who use the surface and elevated lines. There is a great similarity between municipal and public utility bonds, as both are for public service, though performed by different agencies. The taxpayers pay the interest on the municipal obligations, and the public utility customers pay the interest on the utility securities through the rates for service."

Invitations to Join Federation Out This Week

INVITATIONS were sent out on Friday to approximately 150 national, regional, state and local technical and engineering societies, with a total membership of around 225,000, to become charter members in the Federated American Engineering Societies. As stated by joint conference committee of the four founder societies, this action is in conformity with the action taken at the June organizing conference.

The invitations ask each society to name the requisite number of delegates to a meeting to be held in the fall, the exact time and place to be announced later. It was stated at the offices of the American Society of Mechanical Engineers that this meeting would take place simultaneously with the meeting of the American Engineering Council, scheduled for November.

Railroad Rate Decision Has Important Bearing on Utility Charges

OUTSTANDING among the week's commercial news was, of course, the decision of the Interstate Commerce Commission to grant to the railroads of the country a 20 per cent increase in rates. This increase is calculated to yield 6 per cent on an arbitrary valuation of $18,900,000,000 fixed by the commission. This valuation is only $1,716,000,000, or about 10 per cent, less than the valuation claimed by the railroads themselves. Estimated income from the increased rates is:

Freight (6 per cent of roads' valuation)	$1,134,000,000
Passenger fares (20 per cent increase)	233,827,982
Pullman car rates (50 per cent surcharge)	43,639,344
Excess baggage (20 per cent increase)	1,420,999
Milk transportation (20 per cent increase)	5,000,000
Total	$1,417,888,325

The effect of the decision of the Interstate Commerce Commission, which was more liberal than business inter-

ests generally and probably the railroads themselves expected, upon applications for increased rates by public utilities cannot fail to be marked. The unusually close approximation of the official to the companies' own valuation and the clear recognition of the need for restoring prosperity to the transportation arteries of the nation will be an encouragement to the utility interests subject to state control and must command the respect of the state commissions in its bearing on the similar questions that are coming before them for adjudication.

Adirondack Power & Light Puts New Bond Issue on Market

AN ISSUE of $5,620,000 thirty-year first and refunding mortgage series gold bonds, bearing 6 per cent interest and dated March 1, 1920, has just been placed on the market by the Adirondack Power & Light Corporation. These bonds are offered at 84½, to yield 7¼ per cent. They are a legal investment for savings banks in Rhode Island, New Hampshire and Vermont.

The Adirondack Power & Light Corporation does the entire electric light and power business in Schenectady, Amsterdam, Watervliet, Oneida, Saratoga Springs and many other communities in the adjacent industrial region. The company also furnishes, under long-time contracts, all the electricity used by the distributing companies in Troy and Mechanicville and by the electric railway systems in and about Albany, Schenectady, Troy, Utica and Rome, including practically all the interurban roads in the territory.

Financing for July Amounts to Almost $25,000,000

THE total of bond and stock issues of electric public utilities for July fell a bit below the average for the first six months of the year. Ten companies floated bond issues amounting to $20,800,000, and the Middle West Utilities Company placed $4,000,000 of prior lien stock on the market carrying 7 per cent and a 50 per cent bonus in common stock. This brings the July total to $24,800,000. Included in the bond issues are long-term bonds of the Duquesne Light Company and of the West Penn Power Company, the former $8,000,000, yielding 7.25, and the latter $3,000,000, bearing 7 per cent interest and yielding 7.50. This is the highest interest rate that has appeared so far this year on a long-term public utility security. The tendency toward high yields which was noticeable all through the first half of the year is still apparent. All but one of the short-term offerings yield 8 per cent or more, and this one exception, which is a 7.50 yield, is a ten-year issue. Details of the July offerings are as follows:

Company	Amount of Issue	Period	Class of Security	Rate of Interest	Per Cent Yield	Offered at
Penn Public Service Corp.	$850,000	15-year	First and refunding gold mortgage bonds	7½	8	95½
Escambia Power & Traction	200,000	2-5-year	Secured convertible serial notes	7	8	
Middle West Utilities Co.	4,000,000		Prior lien stock with 50 per cent bonus in common stock.	7		90
Municipal Service Co	650,000	3-year	Coupon notes	8	8 30	99½
Duquesne Light Co.	8,000,000	30-year, dated July 1, 1919	First mortgage and collateral trust gold bonds	6	7 25	85
Utica Gas & Electric Co	1,700,000	5-year	General mortgage bonds	7½	8	98
Louisville Gas & Electric Co.	3,500,000	2½-year	Bond-secured gold notes	8	8.45	99
United Electric Light Co	1,000,000	10-year	Coupon gold notes	7	7 50	96 53
Continental Gas & Elec. Corp	1,400,000	2-year	Convertible trust notes	7	8 10	98
West. Penn. Power Co.	3,000,000	30-year, dated March 1, 1916	First mortgage gold bonds	7	7 50	94½
Cincinnati Gas & Elec. Co	500,000	3-year, dated Dec. 1, 1919	Gold notes	7	8	97½
Total	$24,800,000					

St. Louis to Distribute Coal to Utilities and Others

WITH only a few days' coal supply on hand where in previous years there was always ample storage, St. Louis, in consequence of the Illinois coal strike, is facing an acute shortage. As a result Mayor Kiel on July 29 appointed a committee of coal men, railroad men and city officials to take over the coal in the St. Louis switching limits and distribute it to public utilities and the essential food and steam consumers. Some coal is being brought in for railroad use from the Southeast and from western Kentucky and will be distributed by the committee.

No Further Expansion in Detroit at Current Money and Material Costs

WHEN the extensions and additions to its plant, substations and distribution system now under way are completed, the Detroit Edison Company plans to curtail further improvements. This policy has been adopted, Alex Dow, president of the company, said to a representative of the ELECTRICAL WORLD, because of the present cost of financing and the high prices of all equipment and apparatus. Thus far, Mr. Dow said, the Detroit Edison Company has been able to secure funds for new construction at a rate of interest under 7.5 per cent, but in the present money market a rate of at least 8 per cent and probably more would have to be paid. To invest such costly money in just as high-priced equipment he believes would be ill-advised. Five years hence, after an adjustment of values, a utility would find itself seriously handicapped with an investment in equipment whose cost would be out of all proportion to its reproduction value at that time.

All improvements that have been promised to power users are to be completed, and the Detroit Edison Company will be in a position to handle its present business. However, additions to its plants looking to an extensive expansion of the company's business will be delayed until conditions are more nearly normal.

Idaho Power Company to Make Extension

THE Idaho Power Company is completing surveys for a 66,000-volt double-pole line from the Thousand Springs plant 115 miles west into the Hageman Valley, where many new irrigation consumers will be served. The financing was through the recent sale of $2,000,000 of 8 per cent first and general lien bonds. The line is to be in operation by July 1921 and is designed for an ultimate voltage of 132,000.

Federal Power Commission Organization

THE heads of the divisions into which the Federal Power Commission is divided are to be known as the chief engineer, the chief accountant, the chief counsel and the chief clerk. The chief engineer will be in immediate charge of the engineering division. This place will be filled by Lieut.-Col. William Kelly, who has been detailed as the engineer officer of the commission. Colonel Kelly will arrive in Washington Aug. 15.

For the present at least the accounting and statistical divisions will be combined. The organization of these divisions may have to be delayed until Congress gives authority to employ personnel. The most important item of work under this division will be the formulation of a system of accounting. This will involve a critical review of the accounting systems of the several states and the adaptation of the commission's system as far as practicable to those of the states. The head of this division must be a man who has had thorough training in the theory and practice of public utility accounting. The work will call for technical qualifications of a high order. It is not regarded as probable that an employee can be found in the Department of War, Agriculture or the Interior with the training or the experience which would qualify him to perform this work. It will be necessary, therefore, either to obtain the temporary detail of some qualified person from the Interstate Commerce Commission, which has on its staff a number of specialists in valuation, or to employ some one from outside the government service.

The accounting system and its operation are fundamental features of the act and will be involved in the issuance of every license, the operation of every project and in the action taken toward regulation of rates and securities.

The general statistical work will be a matter of development. Information concerning water-power resources, utilization and distribution is far from adequate. The commission will attempt to develop this branch of its activity in co-operation with the industry, with the public utility commissions of the states and with other government agencies.

The licensing and legal division probably will be handled by assignment of a properly qualified man from the War Department. This division will be concerned with all legal matters affecting the work of the commission. It probably will have charge of the preparation of all permits and licenses and of their extension, transfer, termination and revocation. Many important legal questions are certain to arise. Among these will be the relation between the authority of the commission and that of the several states; interpretation of state laws, such as those covering water rights, water-power franchises and certificates of public convenience and necessity; assistance in the conduct of judicial proceedings, particularly in connection with the valuation of properties and decisions on international questions. For these purposes knowledge and experience in the workings of the public land law, the law of waters, public utility statutes and government practice and procedure are highly desirable.

The regulatory division will deal mainly with rates, service and security regulation. Since these matters will not develop until later, there is no immediate need for the organization of that division.

The operation division will handle the details of office matters, such as care of quarters, procurement of equipment, letterheads, seal and general supplies; maintenance of files, record and library; preparation of annual reports, handling of details of advertisement of applications, and appointment, transfer and regulation of personnel.

The act requires that before an application is granted public notice shall be given in writing to any state or municipality likely to be interested. In addition, notice must be published for eight weeks in a newspaper published in the county or counties in which the project is situated. This work will have to be begun at once. The commission will have a formal session each second and fourth Monday.

Duties of Executive Secretary of Federal Power Commission

AT THE last meeting of the Federal Power Commission the duties of the executive secretary were outlined as follows: To administer the act as executive officer of the commission and to see that the rules and regulations of the commission are carried out; to supervise under the act and regulations all personnel that may be employed by or detailed or assigned to the commission and to prescribe their duties within the limits of the act and regulations; to have general administrative charge of the conduct, preparation and publication of all investigations, hearings, valuations and reports authorized or required by the act, unless otherwise provided by the commission; to approve vouchers for expenditures incurred on account of salaries or expenses payable under the provisions of the act; to administer oaths and affirmations, examine witnesses and receive evidences; to formulate, authenticate and record the findings of the commission provided for in the act; to attest all orders, decisions or regulations of the commission and to certify under seal copies of such orders, decisions or regulations, or of any finding, report, map, plan or other record of the commission, whenever required for any lawful purpose; to execute and issue permits and licenses under the seal of the commission; to approve under the seal of the commission voluntary transfers of licenses or of the rights thereunder granted, and to cancel or terminate permits or licenses under the conditions prescribed in the act.

Water-Power Districts



THE Federal Power Commission has divided the county into five districts as shown above, with headquarters at which branch offices will be maintained as follows: No. 1, Washington; No. 2, St. Paul; No. 3, St. Louis; No. 4, Denver; No. 5, San Francisco.

Iron and Steel Electrical Engineers Adopt Tentative Program

FOR the fourteenth annual convention of the Association of Iron and Steel Electrical Engineers, which is to be held at the Hotel Pennsylvania, New York City, on Sept. 20 to Sept. 24, a tentative program has been adopted containing these papers: "A Condensed History of Ore and Coal Loading and Unloading Machinery," by W. K. Monroe; "The Reversing Electric Mill Considered from the Standpoint of Tonnage," by K. A. Pauly; "Power Transmission for Industrial Plants," by D. M. Petty; "Centralized Turbine Generating Stations for Steel Mills," by T. E. Keating; "Some Considerations in the Determination of Auxiliary Drives," by Gordon Fox; "Relation of Standardization in Electrical Equipment to Safety," by Walter Greenwood; "Underground Transmission," by A. L. Freret, and "Current Limit Reactance," by R. H. Keil.

E. S. Jefferies will present the report of the electrical development committee for 1920, E. T. Moore the report of the electric furnace committee, W. T. Snyder the report of the standardization committee, and the educational committee will deal with the practical education of steel-mill electricians.

Consider Replacing Oil by Coal on Pacific Coast

NOT a few electric light and power plants on the Pacific Coast are considering the use of coal in place of fuel oil. A number of inquiries for stokers, it is learned, have recently been received for this section.

The City Council of Seattle, Wash., is discussing a plan to substitute coal for fuel oil at the Lake Union steam-power plant. N. D. Moore of the Pacific Coast Coal Company has presented estimates of the cost of changing the plant over to coal, placing it at approximately $650,000. Mr. Moore recommends the use of powdered coal at this plant. He further asserts that coal can be delivered at the plant at $8 per ton and that one ton of this coal is equivalent to 3.4 barrels of fuel oil in heating value, which would result in a saving of 20 cents on each of the million barrels of fuel oil used each year.

Municipal Plants Not to Make a Profit, Declares Maine Commission

RATES established by the Kennebunk (Me.) municipal lighting plant last December are declared unreasonable in a finding of the Maine Public Utilities Commission issued July 20, and a re-establishment of the rates formerly in effect has been ordered. Under the old schedule the commercial lighting rate was 9 cents per kilowatt-hour in case the customer owned the meter and transformer, and 10 cents otherwise. Power rates ranged from 7 cents to 5 cents per kilowatt-hour where the customer owned the transformer and meter and from 8 cents to 6 cents otherwise. These rates were raised 1 cent per kilowatt-hour each, and the board was appealed to by customers.

The commission investigated the conduct of affairs at the plant and found it unbusinesslike. The total assets on Jan. 1 last were $87,568. The town plant represents a property investment of $79,000, upon which exists a mortgage of $12,000. The commission holds that the city is not authorized to charge rates which would yield a profit upon the investment, points out that no difficulty will be experienced in refunding the mortgage bonds, and states that the rates should be sufficient only to cover the cost of operation, maintain a sinking fund and set aside a reasonable amount for depreciation and working capital. Operating revenue for 1919 was $15,267 and operating expenses were $9,503. The net income after bond interest was $6,773, representing a return of between 7 and 8 per cent on the outside value of the property. After studying former accounts, the commission finds that under previous rates the town was not only able to pay all its operating costs but to provide a sufficient margin for sinking fund and depreciation and leave an amount for working capital larger than necessary. No special rates for street lighting were included in either the old or the new tariffs, and the commission points out that such rates should be provided and on a basis comparable with charges for street lighting in other communities. In the decision the board emphasizes the inadequacy of accounting methods followed by the municipal plant and points out the necessity of establishing direct management under one person and providing for a proper check upon the purchasing, receipt, storage and use of materials and supplies.

Gasoline Cost Drives Municipalities to Central-Station Service

INCREASING fuel and operation costs are rapidly turning the minds of those now dependent upon electric power derived from individual plants to public utility sources of supply, it is reported by the Illinois Northern Utility Company. Numerous small municipalities which have been operating electric light plants, generating power by gasoline-driven motors, have applied for service to this company, giving the increased cost of gasoline as a reason. Similar conditions are noted where manufacturing plants are finding that it is cheaper to provide for their power needs by using central-station supply.

Among the municipalities which have recently applied to the company for service are Fairdale, Monroe Center and Davis Junction, all in the Belvidere district of the company's territory.

Wireless Telephone to Improve Farm Living Conditions

BY MEANS of its wireless telephonic transmission station Michigan Agricultural College is about to make a dream come true. Plans are under consideration to inaugurate a system of wireless telephony whereby the farmers of the state may be kept informed as to the market prices of their products, receive weather forecasts and even "listen in" to hear music or lectures on practical and scientific topics such as are delivered at the college. Some fifty instruments are installed at the present time around Lansing. A system is being worked out whereby all the farmers of the state may eventually obtain instruments from the college to receive radio transmitted. The instruments are much less expensive than those required for transmission.

International Chamber of Commerce Preparing for Work

UNDER the direction of Dr. Edward Dolleans of the University of Dijon, who is temporary secretary-general of the International Chamber of Commerce, assisted by David A. Skinner, secretary of the Chamber of Commerce of the United States, the work of setting up the machinery of the newly organized chamber is under way in the temporary headquarters in Paris. Five hundred delegates from the five foundation countries—France, Belgium, Italy, Great Britain and the United States—met at the convention which organized the body and large results in matters affecting international production and distribution are anticipated from its operation. Among the objects which it has set before it are the promotion of import and export trade and its safeguard against waste and fraud, the standardization of international commercial documents, practices and laws, the removal of international friction arising from commercial differences, and the increase of the world's production and of the availability of its products to consumers everywhere. A board of three directors and three alternates from each of the countries represented will constitute the executive body.

Resolutions adopted urged colaboration between business bodies and their respective governments, favored the establishment of a bureau of exchange of foreign credits on the basis of reciprocal relations for the use of exporters, condemned existing inequalities of treatment granted to foreign banks in different countries, advocated special concessions to promote prospecting for new sources of petroleum and provided for the investigation from a legal standpoint of the mischievous use of trade names.

In addition the following recommendations were made to all countries: To hasten the utilization of hydroelectric power in every possible way; to hasten the carrying out of the measures which tend to have mineral fuel used in the most scientific and economic way, and to develop to the utmost the coal resources of the world.

Additional Capacity Installed at St. Louis

THE original 12,000-kw. station built by the Union Electric Light & Power Company of St. Louis in 1902 will have its generating capacity increased to 128,000 kw. when a 10,000-kw. unit and another 20,000-kw. unit are put in service next September. The second 20,000-kw. machine (No. 8) was tested at the station last week preparatory to putting it into service.

The Ashley Street station was originally equipped with five cross-compound Corliss-engine-driven generators aggregating 12,000 kw., and two years later the capacity was trebled by the installation of additional boilers and six Curtis turbines. These were replaced in 1911 by machines of about twice their size. About four years ago plans were made to remove the old engine units and small turbines to make room for three 20,000-kw. and one 10,000-kw. turbine. One of the 20,000-kw. turbines has been in operation for about a year, another, as just stated, is now being put in service, and it is expected that the two remaining units, one of 10,000 kw. and one of 20,000 kw., will be installed before the end of September.

Chamber of Commerce Declares for the Prohibition of Utility Strikes

RESULTS just published of the referendum to the membership of the United States Chamber of Commerce of two recommendations of the chamber's committee on public utilities declaring for the prohibition of strikes of public utility employees and for the creation of a tribunal to settle labor disputes arising in utilities show that they were carried by overwhelming majorities. The first recommendation, on which the vote was 1,564 to 97, reads as follows:

"The committee recommends that strikes by employees of all public service corporations performing public service essential to the lives, health, security, comfort and well-being of the people should by law be explicitly prohibited."

On the second recommendation the vote was 1,571 to 100. It reads:

"The committee recommends that suitable tribunals should be created by law to adjudicate differences between the employees of public service corporations and their employers and that the decisions of such tribunals should be final and binding upon both parties."

In addition to these two propositions, a platform containing twelve principles of industrial relations was submitted to the membership, each paragraph being voted upon separately. All were carried by a vote approaching unanimity, from two to fifty-four representing the strength of those opposing them, while the affirmative vote fell below 1,600 in only one instance. These twelve principles are substantially as follows:

1. The right of every person to engage in any lawful business or occupation, individually or collectively, either as employer or employee, subject to limitation only through a valid exercise of public authority.
2. The right of open-shop operation.
3. The equal right of all to associate voluntarily for the accomplishment of lawful purposes by lawful means, but with no denial of the right of those who do not desire to act or deal with them.
4. Associations or combinations of employers or employees to be equally subject to the authority of the state and legally responsible to others for their conduct and that of their agents.
5. Condemnation of restriction of productive effort or of output.
6. The duty of managements to co-operate with the workers in all practicable and reasonable ways to increase the value of their productive effort.
7. Reduction in working hours below a carefully ascertained economic limit should be made only with full acceptance of the fact that it involves a commensurate loss in the earning power of the workers and an increase in the cost of the product.
8. Adequate means satisfactory to both sides for the just and prompt settlement of all disputes.
9. Representatives of either employer or employees should not be chosen or controlled by, or in any degree represent, any outside group or interest in the questions at issue.
10. The successful conduct and full development of the particular industrial establishment in which employer and employees are associated must be sought.
11. Community welfare demands that no combination to prevent or impair the operation of government or of any government function shall be permitted.
12. In public service activities the public interest and well-being must be the paramount consideration. The power exercised by the state over the corporation should extend to the employees to assure adequate, continuous and unimpaired operation of public utility service.

Patent Office Six Months Behind

DURING the past year there have been 150 resignations on the part of the technical employees of the Patent Office. Among these was that of the Commissioner of Patents, James T. Newton. During the past fifteen months business in the Patent Office has increased 50 per cent. The force of examiners would be inadequate even if all the positions were filled, but more than one-fifth of these positions are vacant through inability to interest technical men at the salaries paid. The work of the office is said to be six months behind. Protests from the industries which must use the Patent Office are growing in volume.

Pennsylvania Commissioner Declares 7 per Cent Utility Return Not Enough

DISSENTING from the decision of the Public Service Commission of Pennsylvania in establishing rates designed to bring a 7 per cent return to a water company, Commissioner John S. Rilling declared that in existing conditions this standard of earnings does not meet that contemplated by the public service company law of the state. Mr. Rilling's view was that owing to the depreciated purchasing power of money a 7 per cent return means a greatly reduced income to owners of utilities and that a poorly paid utility cannot render efficient service. While he did not hold that an 8 per cent return is necessary in every instance, he was emphatic in asserting the right of public service companies, which cannot discontinue service without the consent of the state, to an adequate income.

N. E. L. A. Reduces the Price of Its Advanced Accounting Course

IN ORDER to introduce thoroughly throughout member companies its advanced accounting course, the National Electric Light Association has reduced the price thereof from $65 to $40.

It is expected that a great many of the member companies will take advantage of this opportunity to establish classes in advanced accounting. This course consists of thirty-six lessons and follows carefully the best practices of progressive light and power companies.

The price of the elementary accounting course remains the same as formerly, the complete course costing $16, and groups of ten or more sent in at one time $14 per course. For the beenfit of the industry as a whole the association last year removed all the restrictions as to enrolment in these courses, and they are now open to all those who may apply at the regular association prices.

New York Republicans Oppose State Development of Water Power

MEETING at Saratoga Springs last week, the Republican party of New York State adopted a plank declaring for private development and operation of water powers, title to which, however, should remain vested in the state. It also asserted that where industrial disturbances menace the "health or existence" of the public, both employers and employees must realize that the public right is higher than their own and that "the right of the people to continuous and adequate service in transportation, food, supplies, fuel and other necessities of life must be maintained unimpaired."

The water-power plank follows:

"The state should never again part with the title to any of its remaining water powers, but they should be developed and operated by private capital on leases fair both to the state and to the operating corporations, and such corporations should be regulated by the Public Service Commission as to capitalization, rentals and rates."

The platform of the Democratic party of New York, adopted at Saratoga Springs on Wednesday of this week, takes direct issue with the Republican platform and demands the development and distribution of water power by the government of the state. It says:

"The Democratic party has always stood for the conservation of our forests and natural resources. We reiterate our support for the development and distribution by the state of hydro-electric power for the benefit of the people. The Republican Legislature has twice refused to enact legislation proposed by Governor Smith to accomplish this purpose and has attempted to substitute therefor the exploitation of the state's water resources for the benefit of those influential enough to obtain franchises therefor.

"We commend Governor Smith's veto of the Sage bill, which attempted to revive privately owned and practically dormant charters affecting the border waters of the state."

Engineering Professors Taking Westinghouse Summer Course



ENGINEERING professors from fourteen colleges and thirteen states are in attendance at the summer course for engineering teachers held by the educational department of the Westinghouse Electric & Manufacturing Company, East Pittsburgh. This course is designed to give engineering professors the advantages of practical experience in manufacturing. Lectures are given by heads of the various departments of the company, and the professors are able to combine theoretical and practical knowledge to their advantage.

Professors taking the course and their colleges are as follows: S. W. Anderson, Virginia Military Institute; William Anderson, Rhode Island State College; G. C. Blalock, Purdue University; B. B. Brackett, South Dakota State College; R. E. Brown, University of Pennsylvania; P. H. Burkhart, University of Illinois; J. M. Coahran, State University of New Mexico; P. H. Daggett, University of North Carolina; M. M. Flanders, Bliss Electrical School; V. B. Hall, Bucknell University; W. B. Hall, Sheffield Scientific School; J. H. Mustard, University of North Carolina; W. L. Teague, University of Arkansas, and F. G. Tucker, State College of Washington.

More Rate Raises.—Among increases granted to electric light and power companies recently by public service commissions are one of 30 to 50 per cent to the local companies at Montgomery, Ala., and one of 24 to 30 per cent on lighting and of 55 per cent on power to the municipal plant at Richmond, Ind.

Wireless Stations of United States Government.—There are eighty-eight shore wireless-telegraph stations belonging to the federal government, not including twenty in Alaska, nineteen in the Philippines, three in the Canal Zone, two in Hawaii and one each in Porto Rico, Guam and Samoa, or a total of 135. The government ship stations number 470.

Natural Gas May Help Save Fuel Oil in California.—Power companies in the central part of California are interested in a project of the California Natural Gas & Development Company to build a pipe line from the oil fields and gas fields around Tulare Lake to San Francisco to furnish natural gas to the industries around the bay. Such a plan would mean the conservation of a large amount of fuel oil for the standby plants of the large power companies.

Uniform Accounting Systems.—The Public Service Commission for the State of New York, First District, has issued three booklets containing the uniform systems of accounts as prescribed by it for electrical corporations, street and electric railways and gas corporations respectively. The first-named of these publications contains seventy-four pages and gives the final order and four modifying orders governing electrical company accounting, the last of these modifying orders bearing date of June 29, 1917.

Electrification of Belgian Railways.—The first step in an extensive program of electrification of Belgium's railroads will be to substitute electricity for steam in the passenger service between Brussels and Antwerp, involving 27 miles of double track. The government plans call for thirty-eight trains a day in each direction, each train with a seating capacity of 500 persons. An average speed of 40 miles an hour is to be maintained, with a maximum of about 54 miles. Freight service will follow, and the project calls for the gradual extension of electric traction over the kingdom until the steam locomotive shall become a thing of the past.

North Dakota's Governor Installs Wind-Driven Electric Plant on His Farm.—Gov. Lynn J. Frazier of North Dakota has installed on his farm near Hoople a wind-driven electrical plant for heating and lighting his home and operating his farm machinery. This plant, designed by George Manikowska, a North Dakota farmer, is operated in connection with a storage battery and is said to utilize almost 100 per cent of the available power of the wind, storing energy derived from surplus velocity for use in periods of calm. A similar plant is said to furnish light for 120 incandescent lamps, run a washing machine, cream separator, vacuum cleaner, flatiron and fanning mill, pump water for 200 head of stock and light a church. The machines are coming into use on farms throughout North Dakota.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

A New Manitoba Transmission Line.—A 60-mile transmission line from a municipal substation in Winnipeg, Manitoba, to Portage la Prairie, a town of 6,000 people, is almost ready for operation and will ultimately supply power for an installation with a capacity of 6,700 hp. This will supplant the old municipal plant of Portage la Prairie, rated at 960 hp., which will be kept as an emergency reserve.

Water-Power Commission for Province of New Brunswick.—Development of the water powers of the Province of New Brunswick, Canada—notably the Lefreaux, east of St. John, and the Pokiok, near Woodstock—is to be pushed by a commission appointed by the provincial government. C. O. Foss, St. John, N. B., will be chairman and chief engineer and C. W. Robinson and Reid McManus of Moncton, N. B., the other members.

Electrical Homes in Demand in San Francisco—The success of the sample "electrical home" in San Francisco has led its promoters to start construction of five more homes that will be as completely wired and have as many convenience outlets as the original one. The new homes, situated in St. Francis Wood, are provided with double-wiring circuits for illumination and power appliances. More than 18,000 visitors passed through the first electrical home in the short time it was on exhibition.

An International Water-Power Source.—The Duero River, which for more than 90 miles forms the boundary between Spain and Portugal, has along that stretch a total fall of 1,350 ft. and thus is a valuable source of potential power, though the volume of water varies greatly with the season. A Spanish syndicate is now seeking to develop this portion of the river, which, it is said, will afford 300,000 hp.; but an international difficulty has arisen, the Portuguese government claiming that under an old treaty half of the power developed would belong to Portugal, which would thus acquire 150,000 hp. without any expense to itself. The Spaniards offer Portugal the equivalent of half the power of the natural waterfalls, or 35,000 hp., but insist that the reward of Spanish capital and labor should accrue to Spain.

Exportation of Hydro-Electric Energy from Switzerland.—Opposition to the exportation across the frontier of the surplus power developed in the summer months by the hydro-electric plants of Switzerland has become so strong that the Swiss government has put severe restrictions upon it, although it has refused to prohibit it entirely. Swiss electrical manufacturing firms hold that any surplus energy should be converted into heat to save coal, and that the general development of the industry that this would bring about is of greater importance to the country than the development of large power companies.

Radiographs of Steel Reveal Hidden Flaws.—Announcement is made that by means of the Coolidge X-ray tube research workers have discovered a flaw in a steel casting that was invisible to the eye. Surface radiographs of a large casting weighing almost a ton showed markings that appeared to indicate blow-holes in the interior. A circular piece an inch in diameter was therefore punched from the casting at one of the points apparently defective, and on this being radiographed a light streak appeared, clearly disclosing the existence of the hole. Great usefulness is predicted for this method when it comes into more common use for testing cast metals.

Hydro-Electric Construction Under Way and Contemplated.—Work is reported as progressing upon the Georgia-Alabama Power Company's dam and power house on the Flint River at Albany, Ga., which will cost about $1,000,000, and upon the same company's hydro-electric development on Pataula Creek, 9 miles north of Fort Gaines, Ga. Dams are being built for hydro-electric purposes across the Chattahoochee River at Riverview, Ala., and across the Oconee River at Milledgeville, Ga. A hydro-electric plant on the Big Niangua River, 120 miles from Kansas City, Mo., to develop 38,000 hp., the electricity generated to be transmitted throughout the district, is another project with good prospects of early realization.

A Proposed Experiment in Technical Education.—A change of policy favored by the education committee of Manchester in the conduct of the Manchester College of Technology, and adopted by the City Council, meets with the condemnation of the London *Electrician*, speaking no doubt for the great majority of English technical men and engineers. The college, which has ranked high, has accommodation for 240 students. The committee, against the protest of the principal of the college, proposed to limit the number admitted to the degree courses to 110, although there are said to be plenty of candidates, and to devote the remainder of the facilities of the school to the training of young boys by means of two-year courses, the latter to be known as "non-degree" students. The adoption of this program was followed by the resignation of the principal.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Item Representing No Tangible Property Disallowed as Part of Rate Base.—The New York Public Service Commission, Second District, has refused to include as a part of the rate base of a natural-gas company an item of $100,000 which, the commission says, does not represent any property that can be located, notwithstanding that this item was allowed in 1906 by the then existent Commission of Gas and Electricity.

Five per Cent for Depreciation, 6.3 per Cent for Interest.—In granting an increased rate schedule to the Fayetteville Gas & Electric Company, the Arkansas Corporation Commission declared that to attempt to require the company to continue to operate at the old rates would be to force a complete breakdown in service. The commission found that the proposed rates would allow 11.3 per cent on the valuation accepted as a rate basis, divided as 5 per cent for depreciation and 6.3 per cent for interest, which figures were held to be reasonable.

Crossing a Railroad with High-Tension Wires.—In Buffalo & Susquehanna Railroad Corporation vs. Dubois Electric Company, the Pennsylvania Public Service Commission has held that a railroad whose facilities are paralleled, crossed and recrossed by the high-tension lines of an electric company in such a manner that they may cause inductitve interference with the ground telephone and electric signal systems of the railroad may file a complaint with the commission in order that the rights of the parties may be determined. The sum of $16 per annum for each crossing over the right-of-way and tracks, except such crossings as occur at established highways, was found by the commission to be a just and reasonable charge against the electric company and was ordered paid.

Heavy Line Loss as Affecting Rates of Small Company.—In a complaint made against the rate of 14 cents a kilowatt-hour charged by the Wynantskill Hydro-Electric Company of Rensselaer County, N. Y., which, in addition to purchasing power for distribution, has a water-power plant with steam auxiliary and 20 miles of line, serving 325 customers, it developed that transformer and line losses were so heavy that only about 45 per cent of the power generated reached the customers. The complainants held that a portion of this heavy loss should be borne by the company. The Public Service Commission for the Second District of New York estimated that even at the rate charged this was already the case and permitted the charge to stand as a maximum until further order from the commission.

Abandonment of Service Forbidden.—The Arkansas Corporation Commission has ordered the Mays Manufacturing Company to continue its service in the city of Leslie, where it has a fifty-year franchise which it desired to abandon because the commission had denied its petition for an increase in rates, on the ground of insufficient evidence. Pointing out that the owner of the company could renew his application at any time with proper evidence but had chosen instead to discontinue business, the commission declared that the great weight of legal authority was to the effect that a public service company which has accepted a franchise from a city or state cannot discontinue service at will but must comply with the terms of the franchise as fully as must the city or the state on its part. The fact that an individual instead of a corporation was operating the plant made no difference.

Establishing Depreciation Reserve by Means of Sinking Fund.—In an instance where a public utility had not in the past established a depreciation reserve, the Railroad Commission of Wisconsin directed that provision for depreciation should be made upon a sinking-fund basis, this basis assuming that a part of the earnings remaining after direct operating expenses have been met will be credited to the depreciation reserve so that it will be built up in part by direct charges to operating expenses and in part by interest credited to it. Depreciation reserve, the commission explained, has no relation to the installation or construction of new equipment but only to the removal or abandonment of worn-out, obsolete or inadequate property, the original cost of which should be credited to the appropriate plant account and charged to the depreciation reserve when equipment is retired from service.

Valuation of a Seldom Used Standby Plant Objected To.—In granting a revised schedule of rates to the Douglas County Light & Water Company, the Public Service Commission of Oregon found fault with an item of $64,685 included by the company in its valuation figures as reproduction cost new of a small hydro-electric unit acquired as the result of competitive conditions many years ago and now seldom used, a standby steam plant being sufficient in all ordinary emergencies. It was shown, however, that under unusual conditions the small water-power plant had effected a saving in fuel when used instead of the steam plant, and the commission therefore ordered that, instead of including an allowance for its value, a rental should be allowed for its use equivalent to any actual saving effected thereby, such rental to be charged to operating expenses and credited to non-operating revenue.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Judge Refuses to Hinder Seattle's New Plant.—In overruling the demurrer of Whatcom County to the amended petition of the city of Seattle to condemn certain lands in the Upper Skagit Valley for the building of a big electric plant there, Judge Edward F. Hardin in the Superior Court of the State made the comment that the claim of the county that it might be deprived of some of its taxable property was "narrow and unwarranted." The court stated that the county had no right to anticipate that Seattle was going to violate the state laws.

Circumstantial Evidence of Contributory Negligence Not Necessarily Conclusive.—In a suit against the Citizens' Light, Heat & Power Company of Salisbury for damages because of the death of a man electrocuted by a high-tension wire which had fallen to the ground along a pathway beside a public road, the trial judge entered judgment for the defendant, holding that a clear case of contributory negligence was established by the attitude of the dead man, who appeared to have grasped the fallen wire "from motives of curiosity." The Supreme Court of Pennsylvania has reversed this judgment, declaring that other evidence showed the man to have been aware of the danger from the wire, that the presumption was he did not purposely run into harm, and that the testimony must be read in the light most advantageous to plaintiff and the benefit of every doubt be given to him. (110 A. 372.)

Responsibility for Damages Caused by Fire Set by Employees.—A somewhat unusual case came before the Supreme Court of California recently when judgment against the San Joaquin Light & Power Corporation for damages arising because of a fire started in that company's right-of-way by men alleged to be employees of the company was affirmed. The fire destroyed standing grain, and an insurance company which had issued a policy on the crop sued through the owner of the grain for the amount of loss. The electric company maintained that there was no proof that the men held to have started the fire were its employees or, if they were, that they had started the fire or negligently permitted it to spread; but the court held these allegations to be sufficiently established by evidence to the effect that the men had been seen working on the transmission-line poles with a team and wagon near by and a fire pot and torch on the ground. (190 P. 198.)

Lorin E. Imlay, who has been appointed division engineer in charge of the power transmission division of the super-power zone engineering staff, was graduated from Cornell College, Mount Vernon, Iowa, with the degree of B. C E. in 1888. In 1893 he received the degree of C. E. Upon graduation he entered the employ of the San Antonio (Tex.) Light & Power Company, where he remained for one and one-half years. Mr. Imlay supervised the installation and operation of the first 10,000-volt long-distance transmission line in the United States, near Pomona, Cal. He spent eight years with the Westinghouse Electric & Manufacturing Company, this experience including testing, experimental and construction work. He also spent several months as assistant to the superintendent of construction of the Westinghouse company. In 1902 he entered the employ of the Niagara Falls Power Company and served as superintendent of that company and the Canadian Niagara Power Company until they were consolidated in 1918 with the Hydraulic Power Company of Niagara Falls to form the present Niagara Falls Power Company. In the new organization Mr. Imlay was appointed operating engineer, the position be now holds.



L. E. IMLAY

W. Jocelyn E. Dale, electrical and mechanical engineer, formerly of the Matahambre Copper Mine, Pinar del Rio, Cuba, and recently electrical engineer for the Elia Sugar Company, has been engaged by Antonio Perez, S. en C., as electrical engineer and will be stationed at his sugar mill, "Central Cespedes," Cespedes, Camaguey, Cuba, where he will take charge of the electrical machinery that is being installed this year. Mr. Dale for the past two years has been actively engaged in electrifications of sugar mills.

J. B. McCall, president of the Philadelphia Electric Company, has been appointed a member of the advisory board of the super-power zone engineering staff, representing the National Electric Light Association.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

Gen. Harry Taylor of the Corps of Engineers of the army, who has just been raised to the rank of brigadier general to be assistant to the Chief of Engineers, has played a large part in the development of the use of the searchlamp for military purposes. He first developed it for use in connection with seacoast defences. The generating sets used to operate those searchlamps, developed fifteen years ago, are still the standard used in the army and give good satisfaction. They are 25-kw. sets and occupy very small space.

O. N. Wiswell, superintendent of the Snoqualmie plant of the Puget Sound Power & Light Company, Seattle, Wash., has resigned. Mr. Wiswell entered the employ of the Puget Sound company in April, 1900. He served in different capacities until June, 1905, when he was appointed superintendent in charge of the Snoqualmie district.

George J. Walton, for nine years manager of the Klamath division of the California-Oregon Power Company at Klamath Falls, Ore., has resigned and will engage in private business. Mr. Walton has been connected with the company in various capacities since 1906.

N. J. Tubbs of the United States Geological Survey is en route to the West to take personal charge of the classification of lands in Montana, Idaho, Oregon and Washington and to determine their value in connection with the development of water power.

H. J. Pettengill, formerly sales manager of the Woonsocket division of the Blackstone Valley Gas & Electric Company, has been appointed sales manager of the Blackstone Valley Gas & Electric Company, with headquarters in Pawtucket, R. I.

John H. Pardee, president of the J. G. White Management Corporation, New York, has been appointed to the advisory board of the super-power zone engineering staff, representing the American Electric Railway Association.

A. T. Hardin, vice-president of operation of the New York Central Railroad, has been appointed by W. S. Murray, head of the super-zone engineering staff, to the advisory board, representing the New York railroads.

C. V. Peeling, formerly manager of the Cornwall (Ont.) Street Railway, Light & Power Company, has become connected with the Palmetto Power & Light Company, Florence, S. C.

D. B. Rushmore, chief engineer of the power and mining department of the General Electric Company, has been elected vice-president of the American Welding Society.

H. W. Butler, who has been designated as industries division engineer of the super-power zone engineering staff, received his training as an electrical engineer at Cornell University, where he was graduated in 1900. Mr. Butler was born in New York City in 1877. His early education was obtained in the public schools of that city. Following his graduation from Cornell he was employed with the Interborough Rapid Transit Company, where he served seven years. He resigned to accept a position with J. G. White & Company, with whom he was engaged until 1913. Later he did consulting work in New York. At the outbreak of the war he entered the army and was assigned to aircraft production. Since the armistice Mr. Butler has been acting as engineer for a superheater concern.



H. W. BUTLER

Obituary

George A. Woolley, district manager of the General Electric Company, with headquarters at Denver, Col., died from the effects of a stroke of apoplexy, July 4, at his summer home at Evergreen, near Denver. Mr. Woolley had been in the service of the General Electric Company for more than thirty years, for the past nine years district manager.

Frank Taylor, a founder and former president of the Taylor Instrument Companies of Rochester, N. Y., died there July 27, at the age of seventy-five years. In 1866, with H. F. Richardson, he started the business of making thermometers.

E. H. Murdock of Cincinnati, reputed to be the father of daylight saving in America, died in Baltimore on July 23. He was fifty-eight years old.

Trade and Market Conditions

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

Universal Key Simplifies Outlet Box and Cover Matching

FOLLOWING the approval by the Outlet-Box Section of the Associated Manufacturers of Electrical Supplies of the standardized system of numbering outlet boxes and covers, as noted in these columns on Sept. 27, 1919, the Sprague Electric Works has not only applied to its products this system of numbering, but also has developed a key for use in connection with the devices, outlet boxes and covers of other manufacturers. The company has called it "the universal key—a quick cross-reference for matching any standard wiring device to any desired box and cover." A copyright protects this name and the design.

The "universal key" consists of a folding cover enclosing a seventy-page booklet. There is reproduced herewith, merely for purposes of illustration, a part of the inside of the first cover, sufficient of the second cover to show the names of some of the fifteen manufacturers of wiring devices listed thereon and a part of page forty of the booklet. This comprises the left half of the complete key when opened out.

In the first column of the left-hand cover will be found the new catalog numbers of the 4 1/16-in. square and 4-in. square outlet boxes and covers; in the second column the new catalog numbers of the 4-in. octagonal boxes and covers. The right-hand cover leaf, not reproduced here, shows the new catalog numbers of the 3¾-in. octagon boxes and covers and the new-type shallow and deep device conduit bodies and covers for exposed conduit wiring.

A contractor, having decided to use the General Electric Company's device, catalog number 9184, but not knowing what box or cover will best go with it, or a jobber, not carrying G. E. outlet boxes or covers, wishing to match up those of other makes to fit G. E. device No. 9184, will first turn to the catalog page listing the G. E. device number in its left column. In the middle column, under the heading "Boxes," will be found six symbols, each of which refers to an outlet box which will fit the specified device. The symbol 2A, by reference to the left-hand flyleaf, refers to a 4-in.-square box, new catalog number 51151; symbol 3A refers to a 4-in. octagon box of two different depths, etc. Covers to fit are taken from the symbols in the right-hand catalog column marked "Covers"—2D referring to cover with new catalog number 52C28, etc. If box 2A is used, cover 2D must be used, the cover numeral corresponding to that of the box. Cover number carries letter "C."

Thus in time, when, as it is expected, all manufacturers' catalog numbers will be identical, it will be very simple to match up devices, boxes and covers of various makes. Until that time, if it be desired to use a box or cover of a manufacturer not employing the new numbering, sufficient description is given in the key from the symbol to enable the product to be picked out from the dimensions.

Decrease in catalog space, the elimination of manufacturers' private numbers, reduction in variety of jobbers' stocks and great time and labor saving are expected to result from the use of this key with the standardization of catalog numbers. The new numbers have been made on so flexible a system that new boxes and covers may be added to the list without difficulty.

Cat. No.	4-1/16" Square		Cat. No.	4" Octagon	
72151	1½" Deep	1A	54151	1½" Deep	3A
72171	2⅛" Deep	1A	54171	2⅛" Deep	3A
72C3	Canopy 2¾" S.C.	1C	54155	1½" Deep	3A
72C39	Fluted Catch	1J	55151	Ext. Ring 1½" Deep	3A
	4" Square		55171	Ext. Ring 2⅛" Deep	3A
51151	Comb. Gas Pipe & Str. Elec. 1½" Deep	2A	56111	½" Deep	3B
53151	Ext. Ring 1½" Deep	2A	56115	½" Deep	3B
51C5	Canopy 2¾" S.C.	2C	56121	¾" Deep	3B
52C3	Canopy 2¾" S.C.	2C	56125	¾" Deep	3B

Sprague	1-10&66-72
Arrow Elec.	12-22
Benjamin	22
Bryant	23-33
Chelton	33
C-H	34
Diamond H	34-35

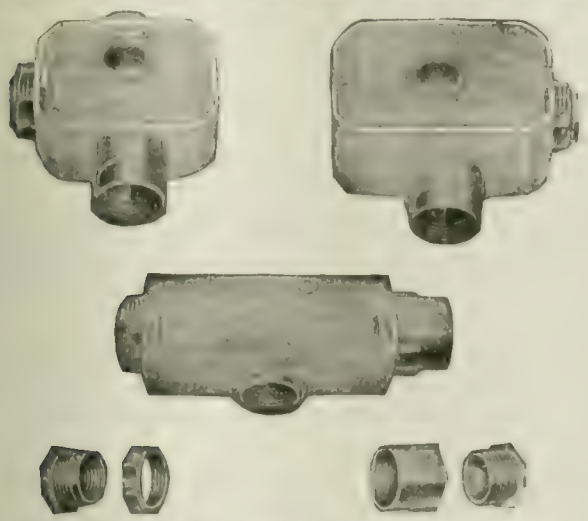
GENERAL ELECTRIC CO.

Cat. No.	Boxes	Covers
9184	2A-3A-3B-4A-4B-5A	2D-3D-4D-5D
9185	2A-3A-3B-4A-4B-5A	2D-3D-4D-5D
28856	2A-3A-3B-4A-4B-5A	2D-3D-4D-5D
33559	2A-3A-3B-4A-4B-5A	2D-3D-4D-5D
36817	2A-6A	2K-6O
39236	2A-3A-3B-4A-4B-5A	2D-3D-4D-5D
39237	2A-3A-3B-4A-4B-5A	2D-3D-4D-5D
40496	2A-3A-3B-4A-4B-5A	2D-3D-4D-5D
49355	2A-3A-3B-4A-4B-5A	2D-3D-4D-5D
50717	2A-3A-3B-4A-4B-5A	2D-3D-4D-5D
50745	2A-3A-3B-4A-4B-5A	2D-3D-4D-5D
50746	2A-3A-3B-4A-4B-5A	2D-3D-4D-5D
50753	2A-3A-3B-4A-4B-5A	2D-3D-4D-5D
50755	2A-3A-3B-4A-4B-5A	2D-3D-4D-5D
50786	2A-3A-3B-4A-4B-5A	2D-3D-4D-5D
50797	2A-3A-3B-4A-4B-5A	2D-3D-4D-5D
50798	2A-3A-3B-4A-4B-5A	2D-3D-4D-5D
59807	2A-3A-3B-4A-4B-5A	2D-3D-4D-5D
59873	2A-3A-3B-4A-4B-5A	2D-3D-4D-5D
59874	2A-3A-3B-4A-4B-5A	2D-3D-4D-5D
59875	2A-3A-3B-4A-4B-5A	2D-3D-4D-5D
60018	2A-3A-3B-4A-4B-5A	2D-3D-4D-5D
60019	2A-3A-3B-4A-4B-5A	2D-3D-4D-5D
60020	2A-3A-3B-4A-4B-5A	2D-3D-4D-5D
60124	2A-3A-3B-4A-4B-5A	2D-3D-4D-5D
60294	2A-3A-3B-4A-4B-5A	2D-3D-4D-5D
60295	2A-3A-3B-4A-4B-5A	2D-3D-4D-5D
60296	2A-3A-3B-4A-4B-5A	2D-3D-4D-5D
60447	2A-6A-3B-4A-4B-5A	2D-3D-3M-4D-5D
60448	2A-3A-3B-4A-4B-5A	2D-3D-3M-4D-5D

THE UNIVERSAL KEY—A QUICK CROSS-REFERENCE FOR MATCHING ANY STANDARD WIRING DEVICE TO ANY DESIRED BOX AND COVER

New Conduit Bodies Expected to Simplify Exposed Wiring

FROM time to time attempts have been made to introduce the advantages of knockouts into conduit bodies and thus gain the wide range of flexibility possessed by outlet boxes. This had proved impracticable of accomplishment up to the time of the war, largely because engineers were not driven to standardize. Since the war, however, and its accompanying era of standardization, four representative outlet-box manufacturers have brought out a line of pressed-steel conduit bodies with knockouts—a line so highly standardized that virtually the whole range of exposed conduit wiring requirements for ½-in. and ¾-in. conduit is compassed with but three basic bodies and two connectors, which when combined in any form desired result in a conduit body.



THREE CONDUIT BODIES AND TWO CONNECTORS FOR EXPOSED CONDUIT WIRING

This new line is being exploited independently by the Sprague Electric Works, which has adopted the trade name of "Spraguelets"; Thomas & Betts, who are calling their line "T & B Conduit Bodies"; the Pratt-Chuck Company, which names its product "Pratt Conduit Bodies," and the Steel City Electric Company, which has adopted the trade name of "Wirelets."

To meet the requirements of exposed wiring, a conduit body must be rigidly connected to the conduit without support. The connector affords just such a rigid arrangement, according to the statement of the manufacturers. The two connectors, employing the Chase nipple features, one designed for ½-in. conduit and the other for ¾-in. conduit, both fit the one size of knockout used in all the three bodies.

Adaptability to virtually any standard make of wiring device is one of the main features of these conduit bodies. To the long body, or "branch" body, with inside dimensions 3¾ in. long, 1¼ in. wide and 1⅜ in. deep, with eleven knockouts, are applied sixteen covers; to the "shallow" body, 2⅜ in. long, 2¼ in. wide and 1⅜ in. deep, with five knockouts, are fitted twenty-four covers, while to the "deep" body, 3½ in. long, 2¼ in. wide and 1⅞ in. deep, with five knockouts, there are fifteen covers. Thus with three bodies, two connectors and fifty-five covers, there are few standard exposed wiring device jobs which cannot be handled.

It is expected that these conduit bodies will effect economies through low stock investment for a complete line, with a corresponding reduction in shelf space; through saving in time of wiremen, who can almost instantly adapt a conduit body to virtually any standard condition, and through their ready reception of any standard make of wiring devices, thus eliminating the necessity of duplicating stock investments.

As the head of the connector nipple is octagonal, eight positions of the body in 360 deg. are permitted; a body at will becomes either a right-hand or a left-hand body, as desired; a body can be removed from or inserted into a conduit at will, without destroying the existing system, except for wire splicing; additional circuits can be added later, up to the limit of the knockouts in each body, and regardless of the thread length on the conduit, the system remains rigid and solid as the securing of the bodies is accomplished by tightening the conduit nut, after the conduit has been screwed into the conduit nipple.

Each body has been equipped with two or four ½-inch knockouts in the bottom in order to make the bodies as universal as possible, where it may be desired to use a support.

A unit package consists of ten pieces, and a standard package consists of ten unit packages. For the bodies and for the couplings a standard package consists of 100 identical units, while in a standard package of covers unit packages may be combined. Electro-galvanized finish only is applied to bodies, couplings and some covers, while other specified covers are of porcelain. According to present figures, it will cost a jobber approximately $600 to lay in a stock of one standard package of each item.

With the substitution of one piece of the two-piece connector, the conduit bodies may be adapted to wiring with flexible armored conductor.

In view of the fact that statistics show that about 85 per cent of the exposed wiring jobs done in the United States use ½-in. and ¾-in. conduit, it is felt that the manufacture of larger size bodies would not be justified at this time. At the same time it is expected that other manufacturers will enter this field of pressed-steel conduit bodies with knockouts.

Metal Market Situation

BUSINESS in copper during the past week has been decidedly dull, although the tone of the market seems firm. Producers are holding for 19 cents through the third quarter, but 19.25 cents is quoted for deliveries later than September. Purchases beyond October are not encouraged, even at 19.25 cents, because of uncertainties as to prices.

The outside market is shading prices from 25 to 50 points with sales rather quiet. The 40 per cent increase in freight rates effective on August 26 will, it is expected, increase the cost of copper about a cent a pound, and as a result of this a stimulation in the demand for early shipment is anticipated in order to take advantage of present prices. Labor conditions in the brass works of the Connecticut Valley are improving, and with production increasing in the district a heavy buying movement is looked for from that quarter.

Lead producers are generally sold up through August, and, although the market is firm, little activity is evidenced as buyers for later delivery are holding off. There is practically no market in either tin or zinc, quoted prices being merely nominal.

There is a very light market at present in tin, and while zinc is also quiet the tone is firm, with prices only nominal. The evidence of strength is the outgrowth of rumors of impending labor troubles together with the usual summer labor drift away from the smelters to the harvest fields.

NEW YORK METAL MARKET PRICES

	July 27	August 3
Copper	£ s d	£ s d
London, standard spot	92 0 0	92 10 0
	Cents per Pound	Cents per Pound
Prime Lake	18 62½	18 62½
Electrolytic	19 00	19 00
Casting	18 00	18 00
Wire base	22 50-23 00	22 50-23 00
Lead, trust price	8 50	8 50
Antimony	7 25	7 25
Nickel, ingot	43 00	43 00
Sheet zinc, f.o.b. smelter	12 50	12 50
Zinc, spot	8 00	8 00
Tin	48 75	48 25
Aluminum, 98 to 99 per cent	33 00	33 00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	15 50 to 16 00	15 50 to 16 00
Brass, heavy	9 25 to 9 50	9 25 to 9 50
Brass, light	7 25 to 7 75	7 25 to 7 75
Lead, heavy	7 25 to 7 50	7 25 to 7 50
Zinc, old scrap	5 00 to 5 50	5 50 to 5 75

THE WEEK
IN TRADE

ALTHOUGH the market for electrical material has been rather quiet all over the country as compared with past weeks, in no section are sales alarmingly low. In the East, in the South, in the Middle West and in the Northwest a good volume of sales is reported for this time of year, while Seattle seems to be experiencing an isolated slump, and trade in the Intermountain States is suffering from a dearth of construction work.

Collections appear to be uniformly tightening throughout the country, with more effort being required in obtaining payment of bills. A favorable factor in the situation, however, is that all districts but one report satisfactory underlying business conditions and express the opinion that the credit situation gives no cause for alarm. The one exception is in the Intermountain section, where a condition bordering upon business depression exists, but even here the peak of the trouble seems to be past and a good crop outlook gives rise to optimism.

The transportation situation improves spasmodically, with better deliveries ruling in the East and Middle West, but in Southern territory the car shortage is seriously interfering with building construction work, and in the Northwest a car supply about 60 per cent under normal has tied up grain shipments.

Light stocks and poor prospects for obtaining supplies of heating appliances are giving rise to fears for a shortage in the East, but supplies west of the Mississippi seem to be in fairly good shape with lessened demand. Fan sales are still off except in the Intermountain section.

NEW YORK

The local market for electrical goods has been a little quiet the past week, jobbers report, but in spite of lighter sales the volume of business is considered favorable.

Residential construction work is decidedly off, probably because of prevailing high prices of building materials, and consequently the demand for electrical material is shifting to industrial requirements. As a result of the few houses being built, the situation for most of the wiring materials is easing up and fair stocks are now accumulating. Another factor aiding this circumstance is the continued improvement of transportation which has allowed shelves long bare of stocks to be replenished. Although few new houses are being erected, construction for industrial and business purposes continues with no letup. During the past week several large real estate deals have been put through in uptown districts preparatory to commencing building operations, and plans which will eventually make New York the finest port in the world have just been approved for the construction of eighteen mammoth piers, replacing thirty-two antiquated structures in the North River.

The general tone of the electrical industry as to future business prospects in this section would seem to be optimistic. Collections are tighter if anything, but the credit outlook, as expressed recently by the Comptroller of the Currency and by the governor of the Federal Reserve Board, is favorable and gives no cause for uneasiness.

Rigid Conduit.—Demand is very heavy and stocks are generally bare. The shortage continues, but here and there a slight rift appears, with one jobber reporting a little easier demand, while another has just accumulated a good stock through recent shipments. Quotations for ½-in. white are about $90 to $100 per 1,000 ft.

Flexible Armored Conductor.—The situation is quite a bit easier, with lessened demand and better shipments, allowing fair stocks to accumulate. Prices for No. 14 in 1,000-ft. lots range from $104 to $110.

No. 14 Rubber-Covered Wire.—Good stocks seem to be the rule, with a lessened demand in evidence. Shipments are coming through nicely. Prices average around $11.50 per 1,000 ft.

Non-Metallic Flexible Conduit.—Demand seems to have fallen off, with the result that no shortage is felt. The ⅜-in. size is quoted at from $33 to $36, and the ½-in. from $36 to $39 per 1,000 ft.

Fans.—Some jobbers report they will have to carry over stocks, while others consider themselves lucky in expecting just about to sell out supplies on hand. All agree that sales have been very disappointing.

Bells and Buzzers.—A curious condition exists in that demand has greatly slackened, yet with many jobbers a shortage exists. Stocks are spotty. One firm is unable to obtain any supplies and others are away behind on orders. This can be traced to slow deliveries heretofore, but shipments are now better and relief is expected soon.

Dry Cells.—Plentiful stocks, a demand that is about normal and good shipments feature the market.

Schedule Material.—A few items, such as flush receptacles, are short in some quarters, but stocks in general are good. Demand seems to have eased up and also to be shifting to industrial requirements. Shipments on the whole are fairly good.

Porcelain.—Some jobbers think demand is holding up, but several have found it slackening. Nevertheless, no relief is in sight with shipments of this material as bad as they are, and famine stocks continue. Some distributers will accept no new orders.

Heating Appliances.—Stocks are reported very light and a normal demand exists for this time of the year. An extremely heavy trade is anticipated in the fall, but the consensus of opinion is that a serious shortage will result. Shipments are poor; one jobber has received no hollow-ware for six months, and some firms will take no further orders now.

BOSTON

Trade is somewhat spotty this week, some jobbers reporting continued heavy orders and others noting a decided slackening in demand. Stocks are being liquidated, however, wherever possible, and purchasing is being handled by wholesalers on a very conservative basis. One large house had $100,000 in overstock the first of the week and has cut buying to its estimated needs two months hence. A leading jobber reports the largest July trade in his history, while another representative house has cleaned up most of his back orders and is pursuing a waiting policy. Deliveries are much improved except on small motors, hollow ware and porcelain fittings. Collections are being pushed more sharply. Labor is quieter than for some time. Building and engineering contracts for the last two weeks of July in New England fell off from $12,486,000 last year to $11,916,000 in 1920. Prices stiffened last week in fiber conduit, "Square D" safety switches and Simplex ranges. Apart from occasional cut-price sales of irons, portable lamps, flashlights, etc., prices hold firm on electrical goods and supplies. Contractor-dealers are extremely busy on factory work, but little house wiring is being done.

Many contractors have been so busy that their invoices have been neglected, and jobbers have suffered accordingly from the curtailment of actual remittances. The underlying situation appears sound enough, but closer attention to collections is a vitally important matter in smooth business operation.

Fans.—Continued humid weather has reduced stocks to small totals.

Lamps.—Low-voltage lamps for farm-lighting sets are reported short. It is very hard to accumulate any real stocks of lamps in regular sizes.

Motors.—Reports continue of cleaned-out stocks of small motors. One purchaser of a 1-hp. direct-current motor visited twelve jobbers last week before success was attained, and this unit was the last the house had.

Wire.—Good stocks are on hand and production is once

more meeting current requirements. Rubber-covered No. 14 sells at $11 per 1,000 ft. in 5,000-ft. lots, weatherproof No. 6 at $31 per 100 lb. in 200-lb. lots, and bare on a 23-cent to 24-cent base.

Ranges.—Simplex ranges were increased in price July 26. No. 27 is now quoted at $190 list instead of $175, with 25 per cent off to small dealers.

Rigid Conduit.—Fair stocks are now in hand. Jobbing prices are as follows, less 5 per cent for cash on these sizes: ½-in. galvanized, $99.58 per 1,000 ft. in less than 2,500-lb. lots; black, $93.98. In such lots the ¾-in. size brought $132.20 in galvanized and $124.60 in black. Galvanized 1-in. pipe sold at $195.42 per 1,000 ft. in less than 2,500-lb. lots, and the 1-in. black pipe brought $184.20.

Couplings.—Price on ½-in. couplings is $8.66 per 100, less 5 per cent off for cash, $12.37 being charged for ¾-in. and $16.10 for 1-in. fittings, with the above discount. Stocks are reasonably good.

Schedule Material.—Severe shortages are reported in porcelain sockets, switches and fittings, although tubes and knobs are in fair stock. Sockets are plentiful, and there is no change from recent quotations of 50 cents net on pulls, 28 cents on keys and 26 cents on keyless, in case lots.

Flexible Armored Conductor.—Current demands are being well met, No. 14 single-strip being quoted at $110 per 1,000 ft. in 1,000-ft. lots.

Non-Metallic Flexible Conduit.—Good stocks are on hand, with steady prices. The ½-in. size brings $33.50 per 1,000 ft., and the ¾-in. size $36.50, in 5,000-ft. and 1,000-ft. lots respectively.

Fiber Conduit.—Prices were advanced about 15 per cent last week, owing to raw-material shortages, transportation difficulties and labor costs. The demand is active, but freight embargoes are burdensome. Eight to ten weeks' delivery is quoted on fair-sized orders.

Paper-Insulated Cables.—The demand is extremely heavy. In a representative case cable manufacturers are paying 30 cents a pound for paper and have recently increased their demand from 250 tons to 500 tons a month.

CHICAGO

The financial situation has recently showed marked improvement, due partly to an improvement in the transportation situation and partly to the fact that all branches of the electrical industry are becoming accustomed to doing business under delayed traffic conditions and are finding ways to adjust their finances to the new order. Many concerns, formerly consistent discounters of bills, have this spring been forced to take sixty and even ninety days for payment. They are gradually reducing this time, some having recently resumed discounting and others indicating that they will soon be able to do so.

As a whole, business remains good, but a noticeable falling off is noted in household appliances. This also has been largely influenced by financial conditions, as difficulty has been experienced in financing extended payments. It is stated that this condition is improving and increased selling will probably develop at an early date. Certain industrial centers which have experienced wholesale lay-offs of workmen have been unable to absorb their allotment of this class of material. It is thought that an adjustment of the fuel situation will probably correct this.

Motors.—Business is practically as good as ever, with deliveries still ranging from three months to a year on large sizes. The General Electric Company has announced a 15 per cent increase on synchronous motors and generators, both alternating and direct current. Some makers of fractional-horsepower motors are having difficulty in finding an outlet for their production.

Compensators.—Great difficulty is being experienced in obtaining sufficient units to supply demand, motors being frequently shipped with compensators to follow. Deliveries range from sixty days up, with definite promises hard to obtain.

Transformers.—No change either in prices or in supply has been noted recently. Stations transformers are slow in delivery, and the pressure of new orders is sufficient to maintain this condition for some time to come.

Oil Switches.—Motor-driven types are obtainable in from thirty to sixty days, but panel types are harder to get. There are almost none in local stocks, and from four to five months is required fer delivery from factory. Prices show no indications of immediate change.

Porcelain.—Badly broken stocks and seriously retarded deliveries are the rule. No price changes have been made effective, but manufacturers are careful to state that current quotations on knobs, tubes and cleats are not guaranteed.

Receptacles.—All quotations are withdrawn, orders being booked with no promise as to delivery and at the price ruling at time of shipment. Particular difficulty is experienced in obtaining electric sign receptacles.

Heating Appliances.—Retail sales are noticeably light, and this is largely attributed to the backward season, though prevailing high prices may be having a deterrent effect. Jobbers' stocks are getting in better shape, and retailers are able to supply all requirements.

Washing Machines.—The financial situation has caused a reduction in the volume of sales, but improved conditions with manufacturers and jobbers should cause an immediate improvement. Chicago sales continue good, must of the slackening of sales being noted in surrounding towns.

ATLANTA

Apparently there is a strengthening of the public's determination to hold off purchasing until prices show a greater decline than has been realized to date. Retailers are placing orders with a great deal of care and feel sure that a decline is sure to come, though this conclusion is not concurred in by the wholesale trade. The holding off in placing orders is particularly noticeable in rural districts where most of the business done is with the smaller houses.

Activity in electrical supplies in Atlanta continues very brisk, however, stimulated by the enormous building activities throughout the city. The month of June saw a new high total of building permits reached, and this construction is just getting under way. July permits show a decline as compared with the preceding month. General conditions are reported excellent in Florida, where the fruit and citrus outlook is very bright, and pig iron in the Birmingham district shows an increase in production of approximately 250,000 tons over the same period of last year.

Car shortage is causing difficulty both in this district and in lumber production centers and is interfering seriously with building operations. Lumber prices have settled to a basis approximately 10 per cent to 15 per cent under the quotations of thirty days ago. Money continues tight and collections are reported not altogether satisfactory.

Heating Appliances.—The situation is not at all satisfactory, shipments coming through very slowly and practically all being applied on back orders, thus preventing any stocks accumulating for the holiday trade. A price advance of approximately 15 per cent is to be noted on irons, percolators and certain types of heaters.

Wire.—Stocks are only in fair shape, despite the receipt this week of a car of assorted sizes which was entirely absorbed by back orders. The popular and very large sizes are particularly unsatisfactory, shipments on 500,000-circ.mil and over and varnished-cambric cable running anywhere from seven to thirteen weeks in the face of a very urgent demand.

Electrical Toys.—Jobbers report an awakening activity, and shipments to dealers are beginning to move. This is the result of instructions to jobbers' salesmen to push the trade during the summer months.

Stamped-Steel Boxes.—Outlets and service boxes are short, with shipments quite unsatisfactory. The demand is brisk, with little prospect of it slackening until building activities ease off.

Sewing Machines.—A slump is reported in their movement and very few orders are being received. Prices remain steady and good stocks are reported on hand.

Electric Ranges.—Local demand is reported as having picked up considerably in the past few weeks, being stimulated by the high price of fuel. The receipt of a considerable shipment by one of the large jobbers has assisted in meeting this demand, and local stocks in some sizes are in fair shape. Shipments, however, are very slow and unsatisfactory.

Schedule Material.—Prices have been withdrawn and jobbers are quoting prices only on such material as they happen to have in stock. Supplies are rather spotty and in some lines very unsatisfactory. Stocks of push-button switches are exhausted and shipments are coming through very slowly.

Porcelain.—Porcelain continues very scarce, despite the receipt of a car of assorted knobs, cleats and tubes last week, and no ⅞-in x 3-in tubes are on the market, with little prospect of shipments coming through in the near future. Back orders immediately absorb all supplies received.

SAN FRANCISCO

Trainload shipments of fruit are now on their way East, and during the height of this season the canneries are in their busiest period. Jobbers have just concluded their quarterly convention at Del Monte. The soliciting salesmen of all the jobbers have just returned from their annual vacation. This is the third season that a simultaneous vacation has been set for all soliciting salesmen, and the plan has been so successful that it will be continued indefinitely.

Vacuum Cleaners.—These are the best selling household device and stocks of all makes are reported excellent. A considerable portion of the sales is being made on the time-payment basis to customers who a few months ago requested cash prices and are still able to pay them but are now retrenching.

Insulating Material.—Local stocks of tapes, cloths and insulating compounds are good. Demand is fair and steady.

Water Heaters.—Local stocks are better than they have been for many months with most of the call in favor of the 4-kw. and 5-kw. sizes. Summer resorts have offered a particularly good field this season, with local makes getting the call and quick delivery the rule.

SEATTLE—PORTLAND

Business along electrical lines in the Pacific Northwest, with the exception of Seattle, is well sustained and on the whole quite satisfactory. In Seattle sales along all lines, from appliances to heavy power apparatus, are showing decreases. Towns in the Puget Sound district report that sales are holding up well and are even showing increases on schedule materials, household appliances, farm-lighting plants, storage batteries and automobile lamps. The situation in Seattle is attributed to the general feeling of uncertainty which prevails, to the employment situation and the scarcity of new construction.

Stocks in nearly all cases are in excellent condition, and on such items as farm-lighting plants, lamps, domestic appliances and fixtures there is a surplus. Seattle and Tacoma are considerably exercised over the recent action of the United States Shipping Board in releasing for the market an enormous amount of electrical material purchased during the war period and held since the armistice. It is believed that this flooding of the market will cause a depression until the materials have been absorbed.

Collections in the Seattle district during the month of July were excellent. Cities in the Puget Sound section report that collections vary from fair to good. Credits are being extended sparingly at present, with prospective accounts asked to pay cash. The car shortage has already partially tied up early movements of grain and other crops from this district. Present indications are that there will be no substantial relief for the next few months. The present car supply is estimated at between 60 and 65 per cent below normal. Plans for two passenger steamships to be operated between Seattle, San Francisco and Los Angeles, each costing approximately $4,000,000, have been approved by officials of the Pacific Steamship Company and bids are expected to be called for shortly.

Conduit.—Sales during the past two weeks have increased materially, the major portion being used in reconstruction work. Demand far exceeds available supply.

Storage Batteries.—In Seattle sales are showing a gradual decrease, owing to inactivity in automobiles. This decrease in the sales of automobiles is attributed to tightening credit and the gasoline situation, which is not expected to improve before September.

Farm Plants.—Jobbers in Seattle, Portland, Tacoma and Spokane have no stocks. Demand, it is predicted, will be heavy later in the season. Sales are expected to be light until crops have been moved. Prices have not increased, but a rise would not be surprising.

SALT LAKE CITY—DENVER

Inactivity in all kinds of building and construction work in Denver has caused a noticeable slump in the sale of electrical equipment for new installations. The controversy between trade unions and employers adhering to the "American plan" has brought building to a standstill in many sections. The deadlock in some sections has held out for weeks, but there are indications that the worst of the trouble is past and that construction work will soon be back to normal.

Transportation is irregular and uncertain. Jobbers complain of being unable to get shipments in time to meet demands made on them. In lines where demand has fallen off stocks are ample, but where sales are brisk shortages are noted. The money stringency has brought about a condition that verges on business depression. Bankers are hopeful, however, that the peak of the trouble is past. The outlook for heavy crop yields is good, particularly in irrigated regions.

Schedule Material.—Demand is not at all brisk, and as a result there is an accumulation of stocks in some quarters. The sluggish condition of the market is attributed to the general slump in building lines.

Fans.—A lively trade in fans is reported from many retail centers, and jobbers report a good volume of sales. Vigorous advertising campaigns appealing to households, have brought satisfactory returns. A month of dry, sweltering weather has made the appeal opportune.

Household Appliances.—There has recently been a noticeable falling off in demand for vacuum cleaners and washers. Sharp advances in prices are believed to account for this. The present level of prices makes buying prohibitive to the average householder and the inability of bankers to cooperate with dealers in a way that makes possible the handling of time sales further aggravates this condition.

Heating Appliances.—Demand is holding up to something like normal. Stocks are fairly ample with occasional complaints of irregular shipments.

Street-Lighting Installations.—An unusual interest in street lighting is being manifested by intermountain municipalies. Many new installations are reported from both large and small towns.

Porcelain.—The condition of scarcity continues here. Demand is not excessively heavy, but the available supply is abnormally low.

Lamps.—These are not showing any tendency to move. This is to be expected as a sluggish market is characteristic of the summer season. Dealers are stocking for the fall and winter trade.

Rigid Conduit.—Stocks are scarce and jobbers cannot begin to meet the demand.

Pole Line Material.—Construction work in many sections is responsible for a brisk demand for line materials. A mammoth transmission line from the Thousand Springs plant to Caldwell, Idaho, carrying 132,000 volts is now in course of construction and this has created a special demand for all kinds of pole line material and equipment.

Wire.—Many jobbers are short because of eastern factories closing down.

NEW APPARATUS & APPLIANCES

A Record of Latest Developments
and Improvements in Manufacturers' Products
Used in the Electrical Field

Electric Glue Pot

A two-quart dry-type glue pot, the glue vessel of copper, is being sold by the Westinghouse Electric & Manufacturing Company. The single-heat constant-input heater is said to give the correct working temperature to the glue for continuous operation of the dry-type glue pot.



WATER BATH ELIMINATED

Panel for High-Speed Motors

Two types of floor-mounted panels have been developed by the General Electric Company to operate and control the new high-speed motors and generators, of frequencies higher than 60 cycles, just brought out by that company. The dead-front type contains a safety-first switch and fuses for both incoming power lines and outgoing high-frequency lines, an oil switch with undervoltage protection for the electrical and excitation power circuit and a starting device for the driving motors. These panels are so constructed as to furnish protection from accidental contact with live circuits.



DEAD FRONT AFFORDS PROTECTION FROM ACCIDENTAL CONTACT

The second type is less elaborate but contains everything necessary to efficient control. It has three fuses for the high-frequency lines and a contactor to connect the stator to the lines automatically after the driving motor has started. It is further equipped with a hand starting device mounted on the pipe supports below the panels.

Automatic Electric Range

Easy and quick-servicing is the manufacturer's designation of the feature of the new range, type M-1, placed on the market by the Westinghouse Electric & Manufacturing Company. Advantages claimed for it are easily removable burners of the open-coil type, removable platform for accessibility to connections, separate fuse boxes and interchangable oven and platform. The oven and broiler burner has a capacity of 2,000 watts, while of the four 8-in. stove-top burners two are of 1,500 watts and two of 1,000 watts. Full automatic, half-automatic or non-automatic equipment may be furnished.



DOOR HINGES CARRY AUTOMATIC CONTROL

Portable Electric Dish Washer

A new electric dishwashing machine of the Jewel Electric & Manufacturing Company, 1833 Berteau Avenue, Chicago, is now on the market, designed for domestic use. Weighing about 35 lb., the machine is portable and provided with a spun automatic ventilated top fitted with a round glass cover. It is said to be self-cleaning. Other features of the machine are the method of throwing the water upward by means of a patented two-blade dasher and the method of draining the water. A Universal motor drives the vertical shaft through a rubber belt.

Meter-Loading Rheostat

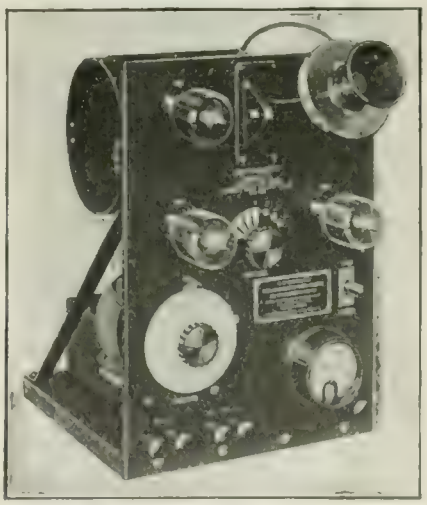
A portable means of loading direct-current meters for test that is said to be rugged, compact, convenient and safe is being put out by the Standard Scientific Company, 147 Waverley Place, New York City. This company supplies the carbon rheostat and other apparatus in connection with the Edison storage battery, the sets being termed the Allen meter-loading rheostats. They come in five types.



EDISON BATTERY PROVIDES LOADING CURRENT

Radiophone

The OT-5 radiophone, which operates without "B" battery or external source of high potential, has been developed by the De Forest Radio Telephone & Telegraph Company, 1415 Sedgwick Avenue, New York City. The entire output may be easily transported; the transmitter weight is 60 lb., including two 6-volt storage batteries. It operates with any suitable type of receiver and audion detector, the manufacturer says, with or without an audion amplifier, depending on range, loudness, etc. The set is designed to operate an antenna whose capacity to earth varies from 0.002 mf. to 0.0007 mf., although it may be used on even smaller antennas.



SET OPERATES ON TWO SIX-VOLT STORAGE BATTERIES

Electric Clothes Washer

The new Thor No. 32 galvanized washer of ten-sheet capacity is being marketed by the Hurley Machine Company, Chicago. The all-metal sheet-



OCCUPIES RELATIVELY SMALL FLOOR SPACE

steel body is equipped with an 11-in. ball-bearing swinging wringer and can be furnished in either wood or copper cylinder. It also comes in copper body with wood or copper cylinder. The copper body is tinned on the inside and enameled on the outside. A ½-hp. motor drives the eight-revolution reversing cylinder. Floor space of the ten-sheet size is 25 in. x 38 in.; of the six-sheet size, 25 in. x 33 in.

Advertising Projector

The Automatic Balopticon, a product of the Bausch & Lomb Optical Company, marketed by the Automatic



AUTOMATIC OR MANUAL PICTURE PROJECTOR

Illuminated Advertising Corporation, Baltimore, Md., is an illuminated advertising projector, operating automatically and continuously, intermittently showing sixty-eight slides of any desired picture or reading matter. These are shown on a screen 20 in. x 20 in. and change every ten seconds. By using a push-button and cord control pictures may be changed at will by a speaker when used for lecture purposes; in this case a 10-ft. x 10-ft. picture may be projected.

Electro Dental Atomizer and Water Heater

A newly designed combination heater having separate regulation for the water glass heater and the three atomizer heater cups is a product of the Electro-Dental Manufacturing Company, Philadelphia. The outfit includes the heater, one glass each for water heater and atomizer heater cup. The base of the heater is of onyx.

Mogul Condulets

To meet a demand for condulets having an unusually long cover opening and big wiring chamber, the Crouse-Hinds Company, Syracuse, N. Y., has developed for the market a new series of "mogul obround" condulets. These are made in eight types, each type in eight conduit sizes ranging from 1 in.



LONG COVER OPENING AND LARGE WIRING CHAMBER

to 4 in. Four sizes of composition and cast-iron covers are made, the composition covers finished blank with from one to nine holes, the iron cover finished with or without round rubber gasket.

Notes on Recent Appliances

Electric Washing Machine

An electric clothes-washing machine operating on the vacuum-cup principle has been developed by the Plex Vacuum Electric Washing Machine Company, Inc., Pekin, Ill.

Rheostats for Radio Use

The General Radio Company, Cambridge, Mass., has placed on the market a rheostat of small rating for laboratory and radio use.

Electric Bell

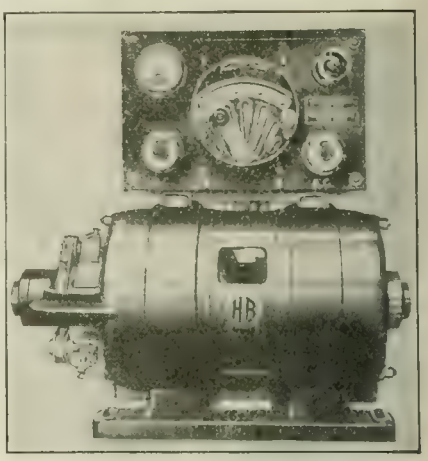
The Electrical Trading Company, 200 Broadway, New York City, has brought out an electric bell with operating mechanism under gong.

Electric Sterilizer

An electric sterilizer for soda-fountain use has been manufactured by the Holcomb & Hoke Manufacturing Company, Indanapolis, Ind.

Battery-Charging Outfit

A new ten-battery charging set of 600 watts rated capacity is being marketed by Hobart Brothers Company, Troy, Ohio. It is equipped with ball

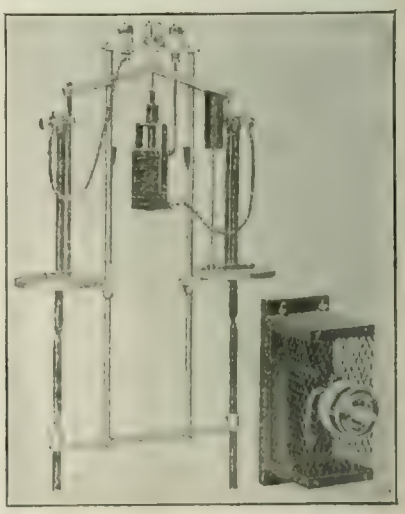


CHARGES 6, 12 OR 24-VOLT CELLS

bearings and the switchboard, with ammeter, pilot lamp, field rheostat, fuses and switches, is mounted on top of the set. The output is 10 amp., 6 volts to 70 volts; the weight is 300-lb. The set is made for floor or bench mounting only.

Photographic Arc Lamp

The Hi-Power twin-arc lamp is being manufactured by J. H. Wagenhorst & Co., Youngstown, Ohio. It is a white-flame arc and, according to the manufacturer, may be used for making blueprints, copper and zinc plate halftones, portrait proofs and copy work. The photographic and photo-engraving outfits consist of portable stands with lamp and reflector as one unit adjustable in a vertical line. Its over-all height is 8 ft. 6 in. and it is 28 in. wide. Either direct current or alternating current at 105 to 115 volts and 215 to



GIVES WHITE FLAME

225 volts may be used. A rheostat and control unit is made up as a separate part for installation at any convenient place.

MANUFACTURERS' ACTIVITIES

Record of Changes Affecting Sales and Distribution
Together with Trade Personals and Notes on Foreign Trade,
Jobbers' News and New Trade Literature

THE DUPLEX STORAGE BATTERY COMPANY, 537 Edison Street, Milwaukee, Wis., is planning to move its factory to Neillsville, Wis., about Oct. 1. The capital stock of the company will be increased from $60,000 to $250,000 to finance the construction and equipment of a new plant. A. G. Shedden of Neillsville is secretary and treasurer.

THE FORT WAYNE (IND.) BATTERY MANUFACTURING COMPANY has been reorganized under the name of the Samson Manufacturing Company.

THE HERCULES ELECTRIC COMPANY, Indianapolis, Ind., manufacturer of electric machines and devices, has sold its plant to Charles G. McCutcheon, B. P. Remy and Frank Remy, builders of the Remy plant at Anderson, Ind.

THE AUTOMATIC LIGHT SWITCH COMPANY, 304 West Breckinridge Street, Louisville, Ky., recently organized to manufacture specialties and automatic switches for electrical service, is planning to erect a new plant in the near future. J. W. Roberts is president.

THE INDEPENDENT ELECTRIC MACHINERY COMPANY, Kansas City, Mo., announces that it is now established in its new building, located at the corner of Twentieth and Central Streets. This change was made necessary by the demand for more space in its factory, which will be accomplished by converting other properties into factory and warehouse space.

THE H. W. JOHNS-MANVILLE COMPANY, New York City, has started work on construction of the first unit of a plant at Waukegan, Ill., consisting of five buildings, each 250 ft. x 1,000 ft., to be followed by a second unit of the same proportions.

THE LOCKE INSULATOR MANUFACTURING COMPANY, Victor, N. Y., has been granted permits to erect two factory buildings, one 66 ft. x 59 ft. and the other 62 ft. x 141 ft., at Charles and Cromwell Streets, Baltimore, Md., to cost about $44,000.

THE COMMERCIAL RADIO COMPANY OF AMERICA, Providence, R. I., manufacturer of wireless equipment, has filed notice of increase in capital stock from $100,000 to $1,000,000.

THE GENERAL MOTORS CORPORATION, Detroit, Mich., has leased the plant of the Waukesha (Wis.) Malleable Iron Company for a period of five years. The company has reserved the right to purchase the property at the expiration of the lease.

THE STEEL CITY ELECTRIC COMPANY, Pittsburgh, Pa., has filed plans for the erection of a new plant, three stories, to cost about $30,000, at 1923 Columbus Avenue, Northside.

THE JAMES LEFFEL COMPANY, Springfield, Ohio, manufacturer of turbine waterwheels and stationary engines and boilers, is considering increasing its capital stock by $700,000, of which $400,000 will be in 8 per cent cumulative preferred and $300,000 in common stock. The company has recently completed its new manufacturing plant, containing 160,000 sq. ft. of floor space, and is now transferring the machinery from its old plant on Lagonda Avenue to the new building. The Robbins & Myers Company, manufacturer of electric fans, generators and motors, will occupy the old plant.

THE COLUMBIA X-RAY & ELECTRICAL CORPORATION, 131 East Twenty-third Street, New York City, has filed notice of increase in capital stock from $40,000 to $100,000.

THE EXIDE BATTERY DEPOTS, INC., 191 West End Avenue, New York City, has acquired a site at Spring and Clark Streets, 115 ft. x 125 ft., on which it proposes to erect a new two-story service building, to cost with equipment about $225,000.

THE BROWN INSTRUMENT COMPANY, Wayne and Windrim Streets, Philadelphia, is making arrangements for an extension to its plant, to cost about $20,000.

THE STANDARD ELECTRIC MANUFACTURING COMPANY, 216 South Clinton Street, Chicago, has awarded contract for the erection of a plant, 80 ft. x 150 ft., five stories, at 925-37 Wrightwood Avenue, to cost about $250,000.

THE ARTHUR JONES ELECTRICAL COMPANY, 2837 South State Street, Chicago, has awarded contract for the construction of an automobile service station, 125 ft. x 125 ft., at 311 East Twenty-ninth Place, to cost about $62,000.

WILLIAM BURNS, Woodstock, Ill., manufacturer of storage batteries, has purchased the machine shop owned by E. G. Griebel on Main Street and will establish his plant there.

DELCO-LIGHT CONVENTION.—Sixty-five salesmen of the Delco Light Company, Dayton, Ohio, in Kentucky, southern Indiana and southern Illinois held a two-day convention in Louisville the middle of July. E. L. Uncapher, head of the E. L. Uncapher Company, agent in charge of this territory for the products of the Delco Light Company, acted as host to the convention.

MACBETH EVANS CHANGES.—J. F. Humez has become domestic manager and H. L. Lissfelt export manager of the New York office of the Macbeth-Evans Glass Company, 19 West Forty-fourth Street. G. N. Lukens, formerly manager of the New York office, and J. W. Harvey, assistant manager, resigned about July 1 to enter the export business.

THE REPUBLIC FLOW METERS COMPANY, Chicago, announces removal from 565 Washington Boulevard to its new factory at 2240 Diversey Boulevard.

E. E. POTTER has become district sales manager of the New York office of the Edison Lamp Works, 120 Broadway, to succeed R. G. Henderson, who becomes merchandising manager of the International General Electric Company, same address.

G. F. KIRKPATRICK, formerly manager of the appliance department of the Pacific States Electric Company, Seattle, Wash., has taken a similar position with the Electric Appliance Company, 1214 Third Avenue, Seattle.

THE FRANKLIN ELECTRIC COMPANY, Louisville, Ky., has filed notice of change in name to the Franklin Electric Company of Louisville.

Supply Jobbers' Notes

PHILIP J. BOHNE, formerly vice-president of the Lincoln Savings Bank & Trust Company, Louisville, Ky., has resigned to become secretary and treasurer of the E. L. Uncapher Company, jobbers of electrical supplies. The company has filed notice of increase in capital stock from $100,000 to $350,000.

Foreign Trade Notes

R. G. HENDERSON has become merchandising manager of the International General Electric Company at 120 Broadway, New York City.

INDUSTRIAL FAIR IN NORWAY.—An industrial fair will be held in Christiania, Norway, from Sept. 5 to Sept. 12, under the direction of the Norwegian Secretary of Commerce. The object of the fair is to promote the sale of Norwegian industrial, electrical and mechanical products. During the latter years this sale has had a very noticeable growth, particularly within the electrochemical and electrometallurgical industries, which has been very large. During the years 1909-1916 the exports of these industries have been doubled four times and the value has been doubled sixteen times.

Foreign Trade Opportunitie

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A commission firm in Rumania (No. 33,293) desires to be placed in communication with manufacturers for the sale in that country of electrical supplies, etc.

A commercial agent in Brazil (No. 33,322) desires to secure agencies from manufacturers and exporters for the sale of electrical supplies, etc.

A commercial agent in Italy (No. 33,327) desires to represent firms for the sale of electrical goods, etc.

A merchant in Switzerland (No. 33,382) desires to secure an agency from the manufacturers for the sale of electric motors, electric tools, electric appliances and allied lines.

A merchant in Switzerland (No. 33,387) desires to secure an agency on a commission basis for the sale of electrical apparatus, etc.

Trade Publications

PIPE JOINT CLAMPS.—The Yarnell-Waring Company, Chestnut Hill, Philadelphia, has issued folder No. C-805, describing its "Yarway" pipe joint clamps and "Yarway Holtite" pipe clamps.

AIR SEPARATOR.—The Griscom-Russell Company, 90 West Street, New York City, has issued bulletin No. 1111, covering its Stratton air separator.

SAFETY APPARATUS.—The Canadian Krantz Electric & Manufacturing Company, Ltd., Toronto, Ont., Canada, has issued catalog 12-A, describing its safety apparatus for panelboards, switches, etc.

INDUSTRIAL HEATING APPARATUS.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is distributing miniature catalog 9-A-2, which describes its industrial heating apparatus.

HEATING DEVICES.—"Satisfaction Guaranteed" is the title of the catalog recently issued by the Satisfaction Guaranteed Corporation, 651-55 Fulton Street, Chicago, which describes its electrical heating appliances.

TIME-SAVING ACCESSORIES.—In the latest issue of the "Esterline Graphic," published by the Esterline Company, Indianapolis, Ind., the subject of time-saving accesories for use with graphic meters is taken up.

ELECTRICALLY DRIVEN TOOLS.—The James Clark, Jr., Electric Company, Louisville, Ky., has issued catalog No. 28, covering the "Willey" electrically driven tools, generators and motors, etc.

PNEUMATIC POWER HAMMERS.—The Nazel Engineering & Machine Works, 4041-4045 North Fifth Street, Philadelphia, have issued a catalog covering their pneumatic power hammers for belt or direct motor drive.

FLEXIBLE SHAFTING.—The Stow Manufacturing Company, Binghamton, N. Y., has issued Bulletin No. 20, covering its flexible shafting for motor-driven tools.

New Incorporations

THE ADAIRVILLE (KY.) ELECTRIC COMPANY has been incorporated with a capital stock of $1,000 by G. H. Byars, G. A. Stone and L. G. Moss.

THE WHITE PLAINS (KY.) LIGHT & POWER COMPANY has been incorporated with a capital stock of $25,000 by O. C. Littlepage and others.

THE WOODWORTH RURAL POWER & LIGHT COMPANY, Grand Rapids, Wis., has been incorporated with a capital stock of $100,000 to supply electricity in Pittsville, Vesper, Arpin, Milladore, Sherry Mills, Rudolph and Blenker. George Horn, J. C. Kieffer, Charles Corn and W. W. Clark are interested in the company.

New England States

FORT KENT, ME.—The Public Utilities Commission has authorized the Fort Kent Electric Company to increase its capital stock from $50,000 to $125,000 for the purpose of extending transmission lines through the towns of Frenchville, Madawaska and Grand Island to connect with the feed lines of the Gould Electric Company in Van Buren.

GREENE, ME. — Permission has been granted to the Central Maine Power Company of Augusta to extend its service to Greene for a street-lighting system.

CLAREMONT, N. H.—Plans are under way by the Vermont Hydro-Electric Corporation of Rutland, Vt., for the erection of a transmission line from Claremont, N. H., to Newport, Vt., thus enabling the furnishing of power to the Newport Electric Company as well as to Ludlow, Chester, Springfield and other towns in Vermont.

BOSTON, MASS.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 18 for installing conduit and wiring system in remodeling of main building. United States Public Buildings Boston. For further information address above.

CONCORD, MASS.—It was voted at a recent town meeting to appropriate $50,000 for improvements to the municipal electric light plant.

HOLYOKE, MASS. — The New England Tire & Rubber Company contemplates the erection of an electric power house to be used in connection with a new factory to be located on Main Street. The total cost is estimated at about $300,000.

SPENCER, MASS. — The Chamber of Commerce will consider the proposition to have the Spencer Gas Company, which has the electrical and gas rights of Spencer, install an emergency power plant in its Elm Street plant. The company purchases electrical energy from the Massachusetts Central Company and in turn distributes it to the town.

WAKEFIELD, MASS. — The Heyward Brothers & Wakefield Company contemplates the erection of a power house at its local furniture factory.

NORWICH, CONN. — Bids will soon be received by the United States Finishing Company for the erection of a proposed new electric power plant at its textile mills, to cost about $400,000. Day & Zimmerman, Inc., 611 Chestnut Street, Philadelphia, Pa., are engineers.

WATERBURY, CONN.—The Connecticut Light & Power Company has applied for permission to erect poles, wires and fixtures on South Riverside Street.

Middle Atlantic States

BUFFALO, N. Y.—Julius Schultz, architect, 1370 Main Street, is preparing plans for the erection of a power house to cost about $10,000.

BUFFALO, N. Y.—The Bureau of Water contemplates the purchase of thirteen three-phase, 2,300-volt switchboard panels and one multi-stage centifugal type pump, rating 250 gal. per minute, with 10-ft. suction head capable of discharging against a head of 700 ft. A. W. Kreinheder is Commissioner of Public Works.

DE RUYTER, N. Y. — Application has been made to the State Public Service Commission for permission to erect, maintain and operate a municipal electric lighting system in this village.

MALONE, N. Y.—The Malone Light & Power Company has been authorized by the State Public Service Commission to issue $100,000 in bonds for improvements and extensions to the company's property.

SCHENECTADY, N. Y. — Extensions to the street-lighting system on various streets of the city have been authorized by the Common Council.

ULSTER, N. Y.—Charles P. Dickinson, of Ellenville, contemplates the erection of an electric light plant in Ulster and also extension to the electric plant in Rosendale.

OCEAN CITY, N. J. — Negotiations are being arranged by the City Commission with the Atlantic City Electric Light Company for improved lighting service along the boardwalk.

ARDMORE, PA.—The Counties Gas & Electric Company has applied to the Public Service Commission for permission to issue $486,000 in bonds, part of which will be used for proposed extensions to its electric plant and system.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

KINGSTON, PA.—Application has been made to the Public Service Commission by the Luzerne County Gas & Electric Company for permission to issue $1,150,000 in bonds for improvements and extensions to its electric plant.

OIL CITY, PA.—The Citizens' Traction Company has applied to the Public Service Commission for authority to issue $59,000 in bonds for extensions and betterments to its electric plant.

PALMERTON, PA.—The Public Service Commission has granted permission to the Palmerton Lighting Company to issue $70,000 in stock, the proceeds to be used for improvements to its plant.

PHILADELPHIA, PA.—Plans have been filed by Henry Disston & Sons, Inc., of Tacony, for the erection of an electric substation at its saw and file works on Milner Street, to cost about $15,000.

PITTSBURGH, PA.—The Council of Ben Avon has authorized the installation of a new lighting system in that town. Plans call for sixty-five lamps of 100-cp., thirty lamps of 200-cp. and an indefinite number of 400-cp. lamps.

WILLIAMSPORT, PA. — The Lycoming Edison Company has made application to the Public Service Commission for permission to issue $123,000 in notes for proposed extensions and improvements to its plant and system.

YORK, PA.—The erection of two automatic electric substations is being planned for by the York Railways Company.

BALTIMORE, MD. — A special election will be held on Nov. 2 for the purpose of voting on an issue of $26,000,000 in bonds for municipal extensions and improvements, including an electric street-lighting system.

FROSTBURG, MD. — Arrangements are being made by the Brophy Coal Company of Midlothian for the installation of new electrical equipment, including motors and electrically operated dumping apparatus.

HAGERSTOWN, MD.—The erection of a local substation and a 33,000-volt transmission line in New Market and Monrovia is under consideration by the Hagerstown & Frederick Railway Company.

BLUEFIELD, W. VA.—The installation of new electrical equipment, to cost about $40,000, at the properties of the Point Lick Coal Company is contemplated.

WILLIAMSON, W. VA. — Arrangements have been made by the Williamson Electric Company for an issue of $160,000 in bonds for proposed extensions and betterments to its electric power plant and system.

SHIPMAN, VA.—The Red Apple Orchard Company contemplates the erection of a power house to be used in connection with its local canning plant.

WASHINGTON, D. C.—Bids will be received at the office of the Chief of Bureau of Yards and Docks until Aug. 11 (Specification 4239) for furnishing five 40-ton electric traveling cranes for shipbuilding slips at the navy yards at New York, Philadelphia and Norfolk. For further information address the above.

North Central States

DETROIT, MICH. The Board of Water Commissioners, 232 Jefferson Avenue, has awarded contract to Martin & Krausman, 717 Garland Avenue, for the erection of a machine shop, at a cost of $21,180. Individual motors and electric lighting equipment will be installed.

SUNFIELD, MICH.—A committee has been appointed to investigate various lighting outfits suitable for a town the size of Sunfield.

CLEVELAND, OHIO. — Ordinances have been passed authorizing the expenditure of $400,000 for the purpose of erecting, enlarging and extending the municipal electric light and power system as follows: Purchase of a turbo-generator, $180,000; condenser equipment, $76,000; auxiliary equipment, $10,000; switchboard equipment, $18,000; wire and cables, $35,000; transformers and equipment, $25,000; meters, $18,000; service equipment, $10,000; pole and line equipment, $7,000, etc.

LIMA, OHIO. — The City Council has under consideration an issue of $180,000 in bonds for the installation of boulevard lights.

HARRODSBURG, KY.—Improvements to the municipal electric light and waterworks are contemplated. Pease, Greeley & Hensen, Chicago, Ill., are engineers.

LOUISVILLE, KY.—Arrangements have been made by the Louisville Gas & Electric Company for an issue of $3,500,000 in notes for extensions and improvements to its electric power plants and systems.

FORT WAYNE, IND.—Extensions to the street-lighting facilities are being planned for by the Fort Wayne Development Company.

GOSHEN, IND. — The power plant and other buildings of the Hartwell Coal Mining Company, it is reported, have been destroyed by fire, causing a loss of about $45,000.

CHICAGO, ILL. — The Commonwealth Edison Company, 72 West Adams Street, is having plans prepared for the construction of two reactor buildings, the first 15 ft. x 350 ft., to be erected at the Fisk Street plant, and the other 20 ft. x 200 ft., to be inside the Northwest plant at Roscoe Street and North California Avenue.

DECATUR, ILL.—An ordinance has been passed authorizing the installation of an ornamental street-lighting system on Cobb Avenue.

OTTAWA, ILL.—A meeting of the residents of Ottawa is being arranged for the purpose of considering the installation of an ornamental street-lighting system on the east side. Estimates show an expenditure of about $30,000 would be required for such an improvement.

CEDARBURG, WIS. — Bids will be received by Fred Schuette, city clerk, until Aug. 24, for the erection of a reservoir and pumping station; also for one air compressor, one 300-gal.-per-minute motor-driven centrifugal pump, one 60-hp., two-phase, 60-cycle, 440-volt motor, etc.

MILWAUKEE, WIS. — Plans have been filed with the Department of Public Works for the installation of underground conduits, carrying ten cables, for conveying electric energy into Milwaukee from the new $8,000,000 power plant of the Milwaukee Electric Railway & Light Company, near St. Francis, now under construction.

GRAND RAPIDS MINN.—The installation of an ornamental lighting system on Main Street is contemplated by the village officials.

PLANKINTON, S. D.—A conference has been held by the owners of the electric light plants at White Lake, Stickney and Mount Vernon for the purpose of discussing the establishment of a central lighting plant to supply electricity to the three towns, thus doing away with two plants. It is probable that Plankinton may be selected as the site for the central plant.

WAKEENEY, KAN. — Bonds to the amount of $65,000 for the erection and equipping of a new municipal power house have been voted. Black & Veatch, 701 Mutual Building, Kansas City, Mo., are engineers.

Southern States

ASHEVILLE, N. C. — The Asheville Power & Light Company plans to remodel and enlarge its plant at a cost of about $100,000. John D. Caldwell is superintendent.

MURPHY, N. C.—An ordinance has been authorized for an issue of $25,000 in bonds for the completion of an electric light and power plant in the town of Murphy.

PICKENS, S. C. — The Pickens Cotton Mill plans the installation of an electric lighting and power system at its plant.

TOWNVILLE, S. C.—A company is being organized by Frank McLeese for the purpose of installing and operating a local electric power system and the erection of a transmission line from Portman to Townville. The new company will purchase energy from the Southern Utilities Company of Anderson.

ST. PETERSBURG, FLA.—Contract has been awarded to the Lemasve Electric Company of St. Petersburg for the erection of 102 electric lamps on Central Avenue, to cost $19,500. Iron poles will be used.

TILLAR, ARK.—Application has been made to the Arkansas Corporation Commission by the Tillar Light & Power Company for a certificate of convenience and necessity to erect an electric transmission line from Tillar to Winchester for furnishing electricity to the latter town.

MOUNTAIN VIEW, OKLA.—Bonds to the amount of $30,000 have been voted for the erection of an electric light plant in Mountain View. T. E. Givens is city clerk.

SAN ANTONIO, TEX.—H. D. Kellar, of Coldwater, Mich., contemplates the installation of an electric light plant.

Pacific and Mountain States

OAK HARBOR, WASH.—C. A. Strong, manager of the Western Electric Company of Bellingham, with several expert electricians, has been making a survey in Oak Harbor for an electric light plant. It is proposed to secure power from a creamery company which is ready to provide room for a dynamo and supply power from its 40-hp. boiler and engine.

RAYMOND, WASH.—The Willapa Electric Company of Raymond has purchased the Willapa Power Company for $50,000. The new owners will proceed immediately to extend its lines for furnishing power to the various industrial plants in the vicinity.

LOS ANGELES, CAL.—The city has filed application with the State Water Commission for appropriation of streams for new power plants as follows: For storage basins in the Kings River district, Kern County, total 225,000 acre-feet per annum, to develop power at contemplated plants to be known as Plant No. [illegible] South No. 2 North and No. 2, the plants will levelop 15,000 hp., 156,000 hp., 85,000 hp and 40,000 hp. respectively; for storage basin in the middle and south forks of the Kings River, contemplated to hold 20,000 acre-feet per annum; for power plant to develop 170,000 hp.; storage basin in Rock Creek, Mono County, to develop a 15,000-hp. electric plant. Other sites to furnish storage basins are Tuolumne County, to develop 159,700; Mariposa and Madera Counties, a total of 156,300 hp., and Tulare County, 150,000 hp. This extensive program is pending, subject to the decision of the Supreme Court, which will establish the legality of the $13,000,000 in bonds voted last year for the municipal distribution of power. The development of the system will be gradually undertaken for completion to meet the needs of the city of Los Angeles.

MILL VALLEY, CAL.—An election has been held for the purpose of voting on the formation of a lighting district to be known as the Tamalpais Valley Public Highway Lighting District. R. E. Graham is clerk.

BOUSE, ARIZ.—Application has been filed with the State Water Commissioner by R. M. Stene and associates of Bouse for permission to harness Williams River for the purpose of generating electric energy to supply mines in Mohave County and to irrigate land in Yuma County.

CASA GRANDE, ARIZ.—The Chamber of Commerce is considering the possible establishment of a new electric system in this place. It is proposed that the farmers of the valley organize an electric power district and bond their lands for a sum sufficient to erect a power plant and distribution system to care for all pumping plants and to supply electric energy for other purposes.

FORT STANTON, N. M.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 16, for remodeling power house, boiler plant, etc., at the United States Sanitarium, Fort Stanton. Drawings and specifications may be obtained from the custodian at the sanitarium or at the Washington address.

Canada

FORDWICH, ONT.—Bids will be received by the Town Council, care of J. H Rogers, until Aug. 17, for the installation of a hydro-electric lighting and power distribution system, to cost about $10,000.

LONDON, ONT.—The installation of an electric motor and waterworks electric pumping equipment will be made in a new school now under construction in London. W. G. Murray, Dominion Savings Building, is in charge.

(Issued July 13, 1920)

1,346,128. DEVICE FOR ATTACHMENT OF ELECTRIC CONDUCTORS TO INSULATORS; Frederick H. Krebs, Frederiksberg, near Copenhagen, Denmark. App. filed June 4, 1919. For quick attachment or detachment.

1,346,223. ELECTRIC ARC FURNACE; Lamberto Lombardi, Rome, Italy. App. filed Jan. 27, 1919. Arc blown against material by magnetic field.

(Issued July 20, 1920)

14,921 (reissue). TELEGRAPH TRANSMITTER; Edwin H. Piersen, Topeka, Kan. App. filed Dec. 31, 1918. Perforated-tape system.

1,346,821. DYNAMO FOR LIGHTING AND MOTOR IGNITION; Emile F. Guardeau, Paris, France. App. filed Oct. 15, 1915. Single armature for ignition and lighting.

1,346,849. ELECTROLYTIC CELL; Robert M. Shaw, St. Louis, Mo. App. filed July 29, 1918. For separating fluids into their component gases.

1,346,854. ELECTRIC FURNACE; Edwin L. Smalley, East Orange, N. J. App. filed Oct. 21, 1919. Easily removable heating elements.

1,346,860. ELECTRICAL PLUG CONNECTOR; William C. Tregoning, Cleveland, Ohio. App. filed March 24, 1917. Conductors easily soldered to plug.



1,346,128. Device for Attachment of Electric Conductors to Insulators

1,346,874. RESISTANCE MATERIAL; Harry T. Bellamy, Oak Park, Ill. App. filed Nov. 16, 1918. Insulating material for use with heating elements.

1,346,994. SIGNAL; Frank H. Thone, Bingham Canyon, Utah. App. filed March 3, 1919. Automobile direction indicator.

1,347,002. ELECTRIC IMPULSION MOTOR; M. E. A. Baule, Lyons, France. App. filed May 1, 1919. Electric magnet motor.

1,347,013. TOASTER; Lloyd G. Copeman, Flint, Mich. App. filed Oct. 31, 1919. Grid readily removed.

1,347,026. APPARATUS FOR EXTRACTING METAL FROM ORES AND THE LIKE; Harold H. Godfrey, Los Angeles, Cal. App. filed Aug. 4, 1919. For gold precipitation, etc.

1,347,049. CORRECTING CIRCUITS FOR HIGH-DISTORTION LINES; William H. Martin, New York, N. Y. App. filed June 18, 1918. Keeps zero from wandering

Record of Electrical Patents

Notes on United States Patents

1,347,069. AUTOMATIC TELEPHONE SYSTEM; George A. Yanochowski, Chicago, Ill. App. filed April 10, 1916. Automatic two-wire systems.

1,347,088. ELECTROLYTIC APPARATUS; William E. Greenawalt, Denver, Col. App. filed Feb. 1, 1917. Electrolysis of liquids having gas in solution.

1,347,089. APPARATUS FOR TREATING LIQUIDS WITH GASES; William E. Greenawalt, Denver, Col. App. filed March 25, 1915. Recovery of metals from volatile fumes.

1,347,102. RESISTANCE DEVICE; Leonard Kebler, Bronxville, N. Y. App. filed Oct. 23, 1915. Resistive conductor covered by insulating coating.

1,347,175. TELEPHONE INSTRUMENT; Frank J. Reichmann and John Press, Chicago, Ill. App. filed June 21, 1918. Amplifier in loud-speaking circuits.

1,347,176. TELEGRAPH SIGNALING SYSTEM; Harry O. Rugh, Chicago, Ill. App. filed May 8, 1919. Signal of the buzzer type.

1,347,177. ELECTRIC APPARATUS FOR HEATING AND VAPORIZING HYDROCARBON FUELS; Edward Saslow, Muskegon, Mich. App. filed Feb. 16, 1920. For internal-combustion engines.

1,347,184. ELECTRIC ARC-WELDING MACHINE; Reuben S. Smith, Milwaukee, Wis. App. filed May 17, 1920. Covering applied to electrode while welding.

1,347,189. RECOVERY OF ZINC BY ELECTROLYSIS; Royale H. Stevens, Hobart, Tasmania, Australia. App. filed Nov. 11, 1919. From zinc sulphate solution obtained by leaching ores, etc.

1,347,209. DOUBLE-COIL OSCILLATING MOTOR; Loren O. Crenshaw, Los Angeles, Cal. App. filed May 7, 1919. For railway signals.

1,347,239. TROLLEY FINDER; William F. Yancey, Portsmouth, Va. App. filed July 15, 1919. Prevents arm rising above wire.

1,347,250. ELECTROCHEMICAL PROPELLING AND TRANSMITTING MECHANISM; Abraham F. Clark, Los Angeles, Cal. App. filed March 27, 1917. For motor vehicles.

1,347,258. ELECTRICAL SIGNALING SYSTEM; Arthur T. Dawson and George T. Buckham, Westminster, London, England. App. filed May 29, 1918. For gun-fire control, etc.

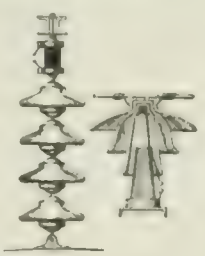
1,347,278. METHOD OF ELECTRICALLY WELDING METAL PLATES; Charles H. Kicklighter, Macon, Ga. App. filed May 5, 1920. Welds through small piece of metal between plates.

1,347,305. MOTOR CONTROL; William G. Taylor, Schenectady, N. Y. App. filed May 29, 1917. Drive of embossing machines.

1,347,323. AUTOMATIC BATTERY-CHARGING SYSTEM; Frank E. Case, Schenectady, N. Y. App. filed Dec. 14, 1918. Controlled by current through artificial load.

1,347,328. RADIO-SIGNALING SYSTEM; Alfred N. Goldsmith, New York, N. Y. App. filed March 29, 1917. For controlling the amplitude of oscillations.

1,347,378. SPARK-GAP INDICATOR; Tomlinson F. Johnson, Jr., Atlanta, Ga. App. filed Jan. 12, 1920. To give automatically sensible indication of weakening or break-down in insulators.



1,347,378. Spark-Gap Indicator

1,347,421. ELECTRICAL INDICATOR; Fred W. Temple, Kalamazoo, Mich. App. filed Sept. 25, 1917. House number light and bell.

1,347,423. FLASHLIGHT; Joseph Vince, Brooklyn, N. Y. App. filed Sept. 18, 1919. Spring assures good contacts.

1,347,440. APPARATUS FOR PROPAGATING AND INTENSIFYING ELECTRICAL OSCILLATIONS; John J. Callaghan, Livermore, Cal. App. filed Nov. 11, 1918. Approaches frequency of light waves.

1,347,457. FEEDING POLYPHASE-CURRENT CIRCUITS WITH MONOPHASE CURRENT; Herbert Gutzwiller, Schonenwerd, Switzerland. App. filed Aug. 5, 1918. Splits current by commutator.

1,347,469. MEANS FOR SUPPLYING LIGHTING AND IGNITION CURRENT FOR AUTOMOTIVE VEHICLES; John A. Heany, Flint, Mich. App. filed July 27, 1910. Constant-current generator.

Directory of Electrical Associations

Printed in the First Issue of Each Month

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co.

AMERICAN ASSOCIATION OF ENGINEERS. Secretary, C. E. Drayer, 63 East Adams St., Chicago, Ill. Annual convention, Buffalo, N. Y., May 10, 1921.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, E. B. Burritt, 8 West 40th St., New York City. Annual convention, Atlantic City, N. J., Oct. 11-15.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, Bethlehem, Pa. Annual meeting, Cleveland, Ohio, Sept. 30-Oct. 2.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS, INC. Secretary, F. A. Molitor, 35 Nassau St., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York City. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country.

AMERICAN PHYSICAL SOCIETY. Secretary, Dayton C. Miller, Case School of Applied Science, Cleveland, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary-treasurer, C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

AMERICAN WELDING SOCIETY. Secretary, H. C. Forbes, 29 W. 39th St., New York City.

ARKANSAS UTILITIES ASSOCIATION. Secretary, S. E. Dillon, Hot Springs, Ark.

ASSOCIATED MANUFACTURERS OF ELECTRICAL SUPPLIES. General secretary, C. E. Dustin, 30 East 42d St., New York City.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, Preston S. Millar, Electrical Testing Laboratories, New York City.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, John F. Kelly, Empire Building, Pittsburgh, Pa. Annual convention, New York, Sept. 20-24.

ASSOCIATION OF MUNICIPAL ELECTRICAL UTILITIES OF ONTARIO. Secretary, S. R. A. Clement, 190 University Ave., Toronto.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Joseph A. Andreucetti, Chicago & Northwestern Railway, Chicago, Ill. Annual meeting, Chicago, Ill., Oct. 28-31.

BRITISH COLUMBIA ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary-treasurer, Capt. W. J. Conway, 406 Yorkshire Building, Vancouver, B. C. Annual meeting, Vancouver, B. C., Oct. 19.

CANADIAN ELECTRICAL ASSOCIATION, affiliated with N. E. L. A. Secretary-treasurer, Eugene Vinet, Shawinigan Water & Power Co., Montreal, Canada.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary-treasurer, M. B. W. Baker, Denver, Col. Annual convention, Glenwood Springs, Col., Sept. 13-15.

CONFERENCE CLUB. Secretary, Sullivan W. Jones, 19 West 44th St., New York City.

COMMERCIAL SECTION, N. E. L. A. Secretary, R. H. Tillman, Baltimore, Md.

EASTERN NEW YORK SECTION, N. E. L. A. Secretary, J. L. Hemphill, General Electric Co., Schenectady, N. Y.

ELECTRIC HOIST MANUFACTURERS' ASSOCIATION. Secretary-Treasurer, E. Donald Tolles, 52 Broadway, New York City.

ELECTRIC FURNACE ASSOCIATION. Secretary, Dr. C. G. Schluederberg, Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

ELECTRICAL MANUFACTURERS' CLUB. Secretary, F. L. Bishop, Hartford Faience Co., Hartford, Conn.

ELECTRICAL SAFETY COUNCIL. Secretary, Dana Pierce, 25 City Hall Place, New York City.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General secretary, Franklin Overbaugh, 411 South Clinton St., Chicago, Ill.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION, ATLANTIC DIVISION. Secretary, E. Donald Tolles, 52 Broadway, New York City.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION, PACIFIC COAST DIVISION. Secretary, Albert H. Elliot, 502 Flatiron Building, San Francisco, Cal.

ELECTRICAL TRADE ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Canada.

ELECTRIC POWER CLUB. Secretary, C. H. Roth, 1410 West Adams St., Chicago, Ill.

EMPIRE STATE GAS AND ELECTRICAL ASSOCIATION. Secretary, Charles H. B. Chapin, Grand Central Terminal Building, New York City.

FLORIDA ENGINEERING SOCIETY. Secretary, J. R. Benton, Gainesville, Fla.

ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary-treasurer, R. V. Prather, Springfield, Ill.

ILLUMINATING ENGINEERING SOCIETY. General secretary, Clarence L. Law. Sections in New York, Philadelphia, Pittsburgh, Cleveland, Chicago and Boston. Annual convention, Cleveland, Oct. 4-7.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Thomas Donohue, Lafayette, Ind. Annual convention, Sept. 15-17, French Lick, Ind.

INDUSTRIAL ELECTRIC HEATING ASSOCIATION. Secretary, Homer Kunz, Toledo Railways & Light Co., Toledo, Ohio.

INSTITUTE OF RADIO ENGINEERS. Secretary, Alfred N. Goldsmith, College City of New York, New York.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex. Annual convention, New Orleans, La., Oct. 19-22.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria Street, Westminster, London, S. W., England.

IOWA SECTION, N. E. L. A. Secretary-treasurer, M. G. Linn, Des Moines, Iowa.

JOVIAN ORDER. Jupiter (president), Arthur J. Binz, Houston, Tex.

KANSAS PUBLIC SERVICE ASSOCIATION. Secretary-treasurer, W. W. Austin, Cottonwood Falls, Kan.

MICHIGAN SECTION, N. E. L. A. Secretary, Herbert Silvester, Ann Arbor, Mich. Annual convention, Ottawa Beach, Mich., Aug. 24-26.

MISSISSIPPI ELECTRIC ASSOCIATION, affiliated with the N. E. L. A. Secretary, E. S. Myers, Vicksburg, Miss.

MISSOURI ASSOCIATION OF PUBLIC UTILITIES. Secretary-treasurer, F. D. Beardslee, 315 N. 12th St., St. Louis, Mo.

NATIONAL ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary, W. H. Morton, 110 West 40th St., New York City, N. Y. State associations in Alabama, Arkansas, Connecticut, Georgia, Kansas, Illinois, Indiana, Iowa, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Missouri, New Jersey, New York, Ohio, Oregon, Pennsylvania, Tennessee and Wisconsin. Annual convention, Baltimore, Md., Oct. 4-8.

NATIONAL COUNCIL OF LIGHTING FIXTURE MANUFACTURERS. Secretary, C. W. Hoffrichter, 8410 Lake Ave., Cleveland, Ohio.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, William L. Smith, Northeastern College, Boston, Mass.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive assistant to president, M. H. Aylesworth, 29 West 39th St., New York City.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1350 Marquette Building, Chicago, Ill.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

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Tax-Exempt Utility Bonds

THE president of the Chicago Telephone Company suggests in all seriousness that public utility bonds be placed on a parity with municipal and other governmental obligations so far as exemption from taxation is concerned. The plea offered is that the utilities render a public service like municipalities and that if the bonds were tax exempt reductions in rates would ensue. There is no doubt that such exemption would add materially to the attractiveness of all railroad, railway, gas, water and electric securities, but we doubt whether the suggestion will receive consideration. There is a feeling already in existence that the list of tax-free securities is too large as things are.

Higher Rates Necessary

THE Federal Reserve banks are offering Treasury certificates of indebtedness for $150,000,000. The certificates will be exempt both as to principal and interest from all taxation now or hereafter imposed by the United States or any state or possession of the United States and from any local tax, and they will yield interest at the rate of 6 per cent per annum. We cite this as an instance of the high cost of money to the government and offer it as justification for higher rates of return to public utilities. Considering the tax-exempt features of the notes, the yield to the investor is more than 6 per cent, and yet public utilities are expected to make extensions on borrowed money yielding 8 per cent or less. Of course the money cannot always be obtained. Only recently a leading Illinois utility offered $10,000,000 worth of three-year 7 per cent notes, and five leading Chicago bankers jointly bid 94½ for the issue, or a yield basis of almost 9 per cent. This was considered prohibitive public utility credit, and the company withdrew the issue and the needed improvements were not made. Thus, unless higher rates are forthcoming to justify earnings which will procure money in an abnormally high market, utilities are punished, but only at the expense of the general public.

Massing Engineering Society Influence

IN THE two months that have elapsed since the Federated American Engineering Societies was so auspiciously ushered into being at Washington, D. C., much has been accomplished toward the completion of its organization plans. The four founder societies have taken favorable action and are now considering definite procedure for completing their affiliation. Invitations have been sent to some 150 national, regional, state and local engineering bodies to become charter members. It is now the obligation of every engineer who is a member of any one or more of such organizations to familiarize himself with the work of the new federation, as outlined in detail in the issue of the ELECTRICAL WORLD for June 12, pages 1359 to 1364. No movement in the history of engineering organizations has been so far-reaching and no previous opportunity has come to engineers as a body to make their influence a real power in national affairs and the work in which engineers are themselves vitally interested as individuals. It makes possible group action on matters heretofore taken up by individual societies and co-ordinates the efforts of all engineers on matters of common interest. This influence among others that the new body will exert should compel prompt consideration of membership applications by the many small as well as the larger organized groups of engineers. Indifference in this matter will not be in accord with the kind of thinking that is generally credited to the engineer, for this is the fitting opportunity for him to establish himself and his profession in national as well as local engineering affairs.

Qualifications of Engineering Teachers

FROM the growing discussion of how to obtain and retain competent instructors in the technical colleges against the competition of the industrial interests, and in the face of the fact that stipends all too meager in 1914 mean actual privation in 1920, a few notes sound clearly. One of these is that the competent engineering teacher, or, rather, teaching engineer, must have had practical experience which he can translate into instruction. The days when a newly robed graduate could step from the scholar's bench to the schoolmaster's rostrum with no further qualification than mastery of textbook theory have been swept into the past.

Faith in Regulation Justified

THE railroads of the country have set an example of patience and forbearance which is worthy of emulation. Harassed by low rates, high costs and labor difficulties innumerable, not to mention government ownership, they have steadfastly maintained their faith in American interests and principles. Did the proper authorities award high wages, the verdict was accepted and labor paid. Were freight embargoes promulgated, the orders were scrupulously observed. Any and every edict, though it plunged the railroads deeper into the slough of economic despair, was carried out. Even the Interstate Commerce Commission, which was presumed to serve as a bulwark between the railroads and the public, for years treated the roads in a niggardly fashion. Nevertheless, they kept right on. Undernourishment, however, had its effect, and when at length the railroads appeared, weak and emaciated, before the Interstate Commerce Commission and asked for help that august body perceived the serious consequences of its lack of action and straightway granted relief to the tune of $1,500,000,000. The whole episode should strengthen

the faith of every public utility in commission regulation. Some will claim that the award to the railroads was rather belated, but the main fact is that the award came, and this in itself is a triumph for regulation.

Transoceanic Telephony

JULY, 1920, was marked by two important developments in radio-telephony (reported in our issue for July 31) which have an important bearing upon the final goal of radio engineers, the transmission of speech across the oceans. While speech has been transmitted from Washington to Honolulu and from New Brunswick, N. J., to France previously, the problem of extending as rapidly as possible the radius of speech by the use of commercial apparatus is being still further investigated, and it is said upon good authority, although complete details are lacking, that the St. John's demonstrations of the Marconi engineers were a step nearer to the use of commercial apparatus for such service. It should be borne in mind, moreover, that success at 600 miles (950 km.) in the summer time may easily be equal to 1,000 miles (1,600 km.) in the winter time, when atmospheric electricity offers much less disturbing influence. Moreover, in extending its telephone service across the water, even a distance of 30 miles (48 km.) to the Catalina Islands, without intervening wires, the American Telephone & Telepraph Company has established what is believed to be the finest commercial service of this sort. One may conceive of the huge Bell system gradually reaching out into the waters to establish regular telephonic communication between this country, its insular territory near the coast and even across the seas, and boats leaving and entering American ports. To establish communication where wires cannot readily be installed is, of course, pre-eminently the future field for radio-telephony. Commercial service of this nature has now begun.

The Strategy of Interconnection

WHEN interconnection has to be effected as part of an effort to keep down costs by those who are trying to run a system for operating profit against rising expenses, the treatment of the situation requires finesse. It is such a case that we consider this week—the gathering into a coherent system of a group of small towns and cities in the rich farming country of Indiana, facing the need of rigid economy by reason of the scattered service. Our readers will find the story particularly instructive because of its dealing with costs. The places served were in two groups quite apart, and to reap the advantages of interconnection it was necessary to erect about 125 miles (200 km.) of transmission line. Some useful economies were introduced by rebuilding 6,600-volt lines to accommodate 33,000 volts, while the main link was a new line of the latter voltage.

This line was built on a strikingly economical basis and has given good service. It consists of 30-ft. (9-m.) cedar poles with 6-in. and 7-in. (15-cm. and 17.5-cm.) tops, butts treated, and spaced at about 130 ft. (39 m.). Metallic cross-arms were mounted on these, carrying 45,000-volt pin-type insulators. The construction is light, but heavy enough for the No. 6 medium-hard-drawn conductors used. The remarkable feature of the case is that even in these expensive times this line was built for a shade under $2,000 a mile for labor and material. Including some reconstructed 6,000-volt line, right-of-way and even substations, the 33,000-volt line barely turned $2,500 per mile.

At one end an old plant was rehabilitated and put in shape for emergency service by installing a new boiler unit and feed-water heater, lagging steam pipes and putting engines in first-class condition. This was done without breaking service in the absence of transmitted power, though the task proved to be a strenuous one.

Incidentally a most efficient job was done in the erection of two substations of the outdoor kind, each rated at 600 kva. in three units. One of these is equipped with electrolytic lightning arresters, while the other involved the extra expense of a pair of induction regulators. The first of these substations cost ready to run about $15.50 per kva., the second only $13.15. There is a lesson for many a group of small properties in the care and ingenuity by which an efficient rehabilitated system was put into operation at a singularly low cost. A struggle to achieve results of this sort costs in resourcefulness and thought more than many a pretentious network, and it is such a struggle that comes in the adverse conditions that surround scores of small undertakings.

Fuel-Oil Atomization

DISCUSSION is in progress among some central-station operators as to the advisability of a change-over from coal as fuel to the use of fuel oil or crude petroleum. Owing to the necessity for ever-increasing power plant capacity, attention must of course be given to the particular type of atomizer to be used in spraying the oil into the furnace in order to bring about the most efficient combustion and at the same time develop the furnace capacity to a maximum. In general, three different methods of atomization are now in common practice. One method is to spray the oil into the furnace by means of steam, while a second method involves the use of compressed air, and the third makes use of some mechanical device to accomplish atomization.

In essential features the mechanical atomizer burner consists of a nozzle containing a conical-shaped orifice through which the oil is forced at high pressure, the oil being first heated to a temperature approaching its flash point, while within the nozzle means are provided to give the oil a whirling motion of sufficient intensity to make it fly into a spray on account of the centrifugal force as soon as it leaves the nozzle.

In practically all of the large central-station plants on the Pacific Coast, where the use of fuel oil has been developed to a remarkably high degree of efficiency, atomization by steam is in use. From 2 to 4 per cent of the steam generated is blown into the furnace to accomplish this result. Hitherto mechanical atomization has found its greatest application aboard ship, where it has proved unusually effective. It would appear, however, that certain definite advantages in the increasing of furnace capacity by means of mechanical atomization should lead those contemplating a change-over from coal to fuel-oil-burning plants to give careful consideration to the type of atomizer that is to be used.

The Vision of the West

FROM the East to the West over the trails of the miner of '49, now obscured by modern means of transportation, go annually hordes of sightseers, a mixed group of nature lovers, business men, opportunity seekers and the like, each with a home-made impression of Western industry and the social life and customs of those who have created it. The influence of prose and verse and the tales of those who have returned have frequently made scoffers and unbelievers. The knocker, however, finds life uncongenial in the West. Somebody is sure to tell him that the mule makes no progress while he is kicking, or he will be shown some work of the human brain and hand that, except through the evidence of the eye, would seem utterly beyond the range of economical possibility.

Good roads and the automobile have done much to reveal the true vision of the Western pioneers, for transportation by this means makes it possible for those interested in things electrical, when visiting the large water-power developments of the High Sierras and following the 240 miles of 150,000-volt transmission circuits into the city of Los Angeles, to pass through the huge tropical fruit gardens of central California. The large annual returns from these so-called gardens or fruit ranches are the demonstration that the difference between the barren dessert and production at $500 to $1,000 per acre is water and that the most economical agency for its distribution is the motor-driven pump.

Persistence coupled with ingenuity may be observed this year, with a precipitation and run-off far below normal and coal unobtainable, in applications of oil and gas in the southern coast section and powdered fuel and hogged fuel in the northern section in order to insure a continuity of electric service. Furthermore, though capital from financial centers of the East has been insufficient, construction can be observed supported by local funds, and plans for future work that will substitute fleets of bombing planes for motor trucks or temporary railroads in the delivery of construction material and machinery to new water-power sites over the precipitous Sierras. Here the obstacle not only of time but of money for road building to the extent of $4,000 to $6,000 per mile is being overcome.

Again, in the West, where long transmission lines and high voltage are synonymous, the application of 220,000 volts may be observed as an economic necessity because of savings that total for one long line something like the ten million dollars which a duplication of present construction would require. On the Kern River may be seen a new arrangement to serve two systems, one of 50 cycles and the other of 60 cycles, by the use of two waterwheels driving the same generator but having different speeds. Across practically the entire length of three of the Northwestern states stretches a practical demonstration of steam-railroad electrification that in economy of operation and efficiency of service has surpassed the fondest dreams of the original promoters. Opportunities for industrial development also ordinarily unassociated with the Pacific Coast are springing up in the great Northwest, which, when stimulated by proper publicity regarding the natural resources and facilities of that territory, will enable even greater utilization of potential water powers than exists at the present time. Easterners too frequently have the impression that the Westerner is addicted to ridiculous bragging concerning the future of his section, but this is unfair. He who glories in the building of congested industrial centers in the East cannot view the opportunities of the West and the future that is yet to be built without being filled with admiration for American initiative and accomplishment, be it West or East, and for the constitution which makes these sections one.

Cooling Transformer Vaults

THERE is a temperature, determined by the nature of the insulation, beyond which a transformer cannot safely be worked. Under load a certain stable temperature is attained, depending on the copper and iron losses and on the facilities for getting rid of the heat thus generated. Since the cooling of air-cooled transformers depends on the temperature difference between the cooling surface and the surrounding air, the exchange of this air largely determines the final results. Some light is thrown on this subject of ventilation by W. W. Parker in our columns this week.

In theory, ventilation is the exact inverse of electric heating, but in practice this is not the easiest way of getting results for a transformer vault. The value of Mr. Parker's experiments lies in the empirical but very convenient data obtained from a variety of existing vaults under working conditions. As a matter of experience a rise of 15 deg. C. of the air above the rated working temperature of the transformer is about all that is safe even for full loads over a rather limited time, and under average conditions Mr. Parker finds that to keep within limits 75 cu.ft. to 100 cu.ft. of air per kilowatt of transformer loss must be removed from the inclosure per minute.

This must practically be done by natural draft either by general circulation or by a chimney of height and capacity enough to do the work. The data obtained and tabulated give the required information to the engineer. The exposure of the vault with respect to prevailing summer winds is in some cases a not unimportant factor.

The solution of a concrete problem is given in some detail both with and without a deliberately planned chimney, which seems on the whole the best method of insuring really good and reliable ventilation. Such a chimney can be figured much in the ordinary way, though the height is generally small. The data given in the tables pertain to fairly sizable installations ranging from 225 kw. to 1,600 kw., such as are usually to be found in vaults. In smaller examples the loss of heat through the walls would usually be proportionately greater and hence the ventilation required a simple matter. A practical hint is given respecting the avoidance of moisture. This requires that no part of the installation shall be permitted at any stage of operations to be below the temperature of the external air. Where a switchroom is separate from the transformer inclosure there is some risk of this, and hence there should be sufficient ventilation between the two inclosures to keep the temperature above the effective dew point.



Henry Latham Doherty

Engineer, financier, utility manager, rate expert, and healer of sick public service corporations

ALWAYS seeking new problems to solve and solving them, H. L. Doherty has forced his way up through the ranks until he is now at the head of one of the largest public utility holding companies in the United States, the Cities Service Company, with properties situated in more than half the states. He was a newsboy in Columbus, Ohio, when at the age of twelve he entered the utility field as an office boy with the Columbus Gas Company. As a result of hard work and hard study he advanced rapidly in the engineering department and at the age of twenty-two became chief engineer and assistant to the manager of the Columbus plant. His work attracted attention, and when shortly afterward the Madison (Wis.) Gas & Electric Company needed some one to put it back on its feet young Doherty was chosen. What he did at Madison he duplicated at many other places in the next few years until he became widely known as a healer of sick utilities. All this time he had been working for others. At the age of thirty-four, however, he broke loose and began to acquire one after another "sick" utility which he reorganized and put back on a dividend-paying basis. From this beginning grew up his large public utility business, to which in more recent years he has attached an oil business of very large proportions.

Wherever Mr. Doherty has taken hold he has left an enduring impression. This is just as true of association work that he has undertaken as it is of his utilities. He guided the Society for Electrical Development from its beginning until a year or so ago. He has been Jupiter of the Jovian Order and in 1901 was elected president of the National Electric Light Association, the first of a long line of young men to hold that office. When he took office the N. E. L. A. was largely an engineering body. He saw the need for covering all utility work, and at his suggestion its program was broadened to include commercial and accounting activities.

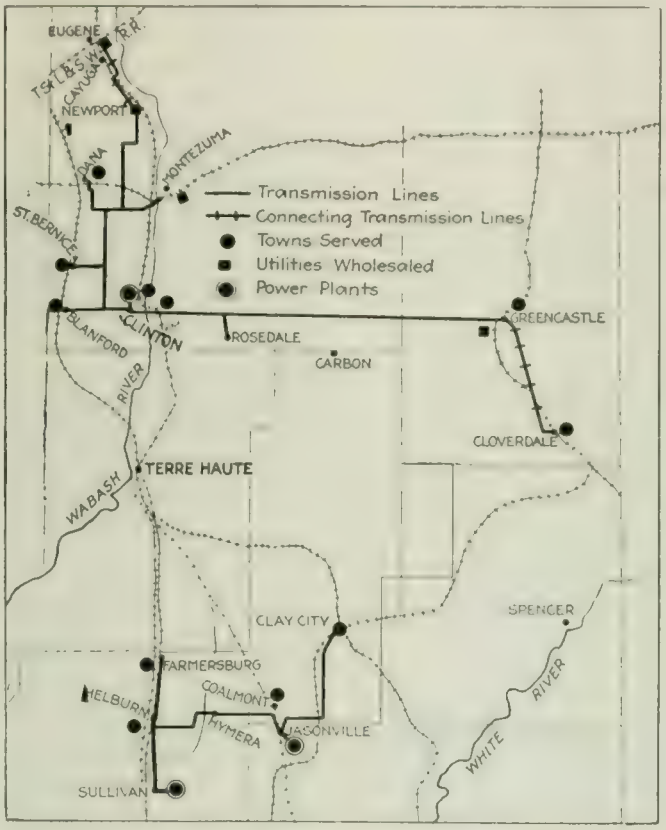
To his early method of self-education, in pursuit of which whenever he witnessed an engineering operation new to him he would study out its theory at night, the industry owes the "cadet-school" system. Following his lead other utility organizations are similarly training their future executives. In 1900 he proposed his "three-charge rate," now generally known by his name, doing much to popularize the "readiness-to-serve charge" in rate schedules.

Mr. Doherty celebrated his fiftieth birthday on May 15. His employees marked this occasion in a most fitting manner by planting a Doherty tree at each Doherty property, there to stand through the years to come as a tribute to their chief.

Interconnecting Small Cities

Data on the Costs of Present-Day Line Construction, Together with Methods of Emergency Operation, Collected from Indiana Central-Station Companies Serving Twenty-one Communities in the Hoosier State

TWENTY-ONE communities in south central Indiana ranging in size from 200 to 20,000 inhabitants are served by the Wabash Valley Electric Company and the Putnam Electric Company. Between the cities served, which are in two groups, about 125 miles (200 km.) of transmission line has been erected. The general idea pursued by the present management has been typical of the progressive tendency toward interconnection that has been necessary throughout the Middle West in order to shut down inefficient generating plants. The company's more recent experience has included construction of some new lines to operate at 33,000 volts and others to operate at 11,000 volts and the reconstruction of 6,600-volt lines to operate at 33,000 volts. This experience is of particular interest, not only because it represents present-day costs but because it shows how use is made of a rather lighter type of 33,000-volt construction that can be employed to handle comparatively light loads. The over-all average cost of the 33,000-volt construction and the reconstruction of the 6,600-volt lines, including right-of-way and substations, was about $2,510 per mile. The 33,000-volt construction cost about $1,967 per mile for labor and material.



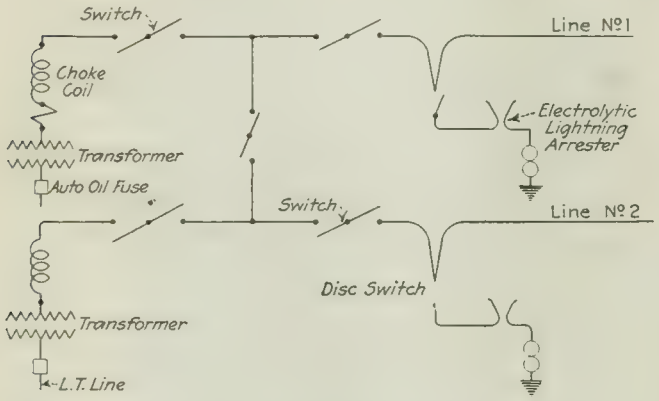
LAYOUT OF SYSTEM INTERCONNECTED

More specific information can be brought out by relating the story of two typical lines—one a 33,000-volt line from Clinton to Greencastle and the other an 11,000-volt line from Jasonville to Clay City. The need for the Clinton-Greencastle line became apparent when the company bought the Greencastle generating plant and found that to produce electricity there was very expensive. A possible solution of this difficulty lay in the building of a new plant or in the building of a transmission line over the 32 miles (51 km.) between the two cities. Over a part of the distance a 6,600-volt line was already operating from Clinton to Rosedale. It was decided to rebuild this line to operate at 33,000 volts and to use it as a part of the Clinton-Greencastle line. It was also decided to rehabilitate the Greencastle plant so that it would be available for emergency service at the end of the 32-mile (51-km.) line. The vicinity of this line also promises additional mining and small-town load.

The new construction for the 33,000-volt Clinton-Greencastle line consisted of 30-ft. (9-m.) cedar poles with 6-in. (15-cm.) and 7-in. (18-cm.) tops with brush-treated butts. These poles carried 3-ft. (6.9-m.) Keystone arms and 45,000-volt pin-type Locke insulators. The conductor for the main line was No. 6 medium hard-drawn solid copper wire. At crossings No. 2 seven-strand wire on suspension insulators was employed. The poles were set forty-one to the mile. No ground wire of any kind was used, as the Wabash Valley Electric Company's experience indicated that it was not necessary in this territory. Where new construction was required this sort of wood-pole line was erected along the right-of-way that was partly private and partly followed the highways of the country. Between Rosedale and Clinton, however, where a 6,600-volt, single-phase line had been in operation on an ordinary wooden two-pin arm, this construction was utilized partly in changing over to 33,000-volt operations. These two-pin arms were dropped and fastened to the poles at a lower point temporarily while the linemen put the metal Keystone arms on the tops of the poles. With both sets of arms on the poles the third wire was strung and tied in on the pole pin and then the two wires of the 6,600-volt line were moved up to the outer pin on the Keystone arm. This change-over was accomplished with the 6,600-volt line in operation.

The substations along the line are mostly of standard delta-star construction. At Clinton the substation consists of two banks of transformers stepping up the energy from 2,200 volts to 33,000 volts. One of these banks of transformers is rated at 600 kva. and the other at 375 kva. This substation is laid out so that either bank of transformers can be switched to either of the outgoing lines. At Lyford two 25-kva. transformers operating in open delta are used to step down the potentials from 33,000 volts to 2,300 volts for town lighting. This is an ordinary wood-pole substation. At the nearest point on the transmission line, Rosedale, another wood-pole substation, mounting a 50-kva., single-phase, 33,000-2,300-volt transformer, is used for transmitting energy at 2,200 volts 2 miles (3-km.) to the town for lighting. The substation at Greencastle consists of

three 200-kva., 33,000-2,300-volt transformers arranged for parellel operation in an emergency with the 600 kw. of generators in the power house. Along the Greencastle line three sectionalizing points have been erected at distances of about 10 miles (16 km.) apart. The loca-



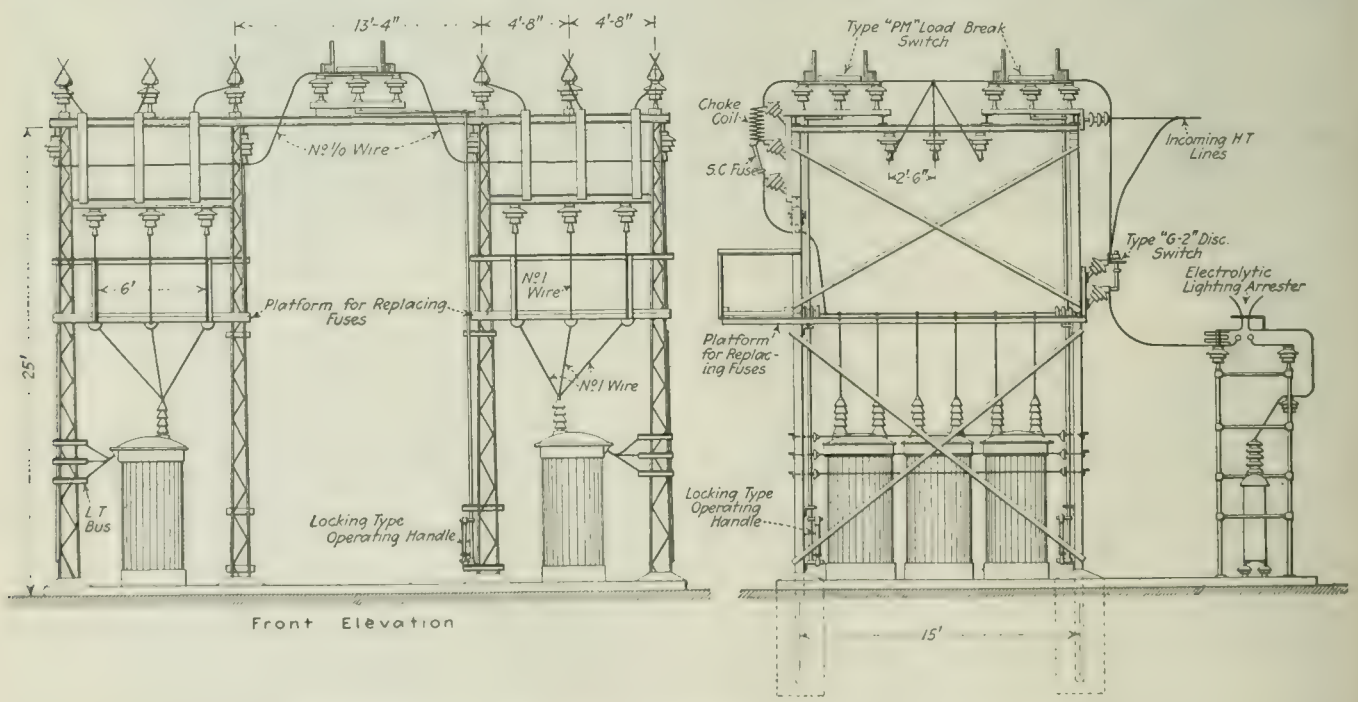
FLEXIBLE SWITCHING ARRANGEMENT FOR TWO CIRCUITS

tions for these sectionalizing points were selected partly to obtain equal spacing and partly to give easy access to them from the automobile roads. These sectionalizing points mount standard pole-top disconnecting switches.

The costs of these various substations and of the transmission lines are shown in the accompanying table. The Clinton substation, which is equipped with electrolytic lightning arresters and two banks of transformers, cost for labor and material $9,329. The short branch line to Rosedale, including the substation, cost $1,469 to rebuild. The cost of the material and labor in the line from Clinton to Greencastle totals $53,807. This includes both the cost of new constuction and the cost of changing over the 6,600-volt line for 33,000-volt operation. It had been the intention to segregate the cost of the new line from the cost of the rebuilt line, but owing to the way the work was done it was found that this was a virtual impossibility. The company has estimated, however, that the cost of rebuilding the line from Clinton to Rosedale Junction was approximately $5,600 for labor and material. This was a distance of 7 miles (11 km.), showing the cost per mile of labor and material for rebuilding to be approximately $800. This would leave the remainder of the $53,807 to be charged to the new construction; therefore the cost of the new construction would be $53,807 minus the $5,600, or $48,207. Since the poles on this line were set forty-one to the mile, and since 1,002 poles were used, this would indicate that the line is approximately 24½ miles (40 km.) long, and figuring on this basis the cost of the labor and material for the new construction would be $1,967 per mile.

All of these figures, as well as the data in the table, are to cover only labor and material and do not include the usual charge of 10 per cent for engineering and superintendence. On this basis the entire job, including only labor and material, cost $73,018, and if the charge of 10 per cent for engineering and superintendence is allowed, the total cost of building the transmission line and installing the substation was $80,320. In the table an attempt has been given to list the costs of the principal items individually and to group under the heading of miscellaneous all of the smaller items of labor and material expense that were necessarily incurred.

The 11,000-volt construction between Jasonville and Clay City was almost identical in its specifications with the 33,000-volt line between Clinton and Greencastle, except that a 15,000-volt insulator instead of a 45,000-volt insulator was used. This line was 12 miles (19 km.) long. Six miles (10 km.) of it was built on the railroad right-of-way and the remainder was built along highways between the two towns. To have hauled the poles on trucks or wagons to their respective loca-

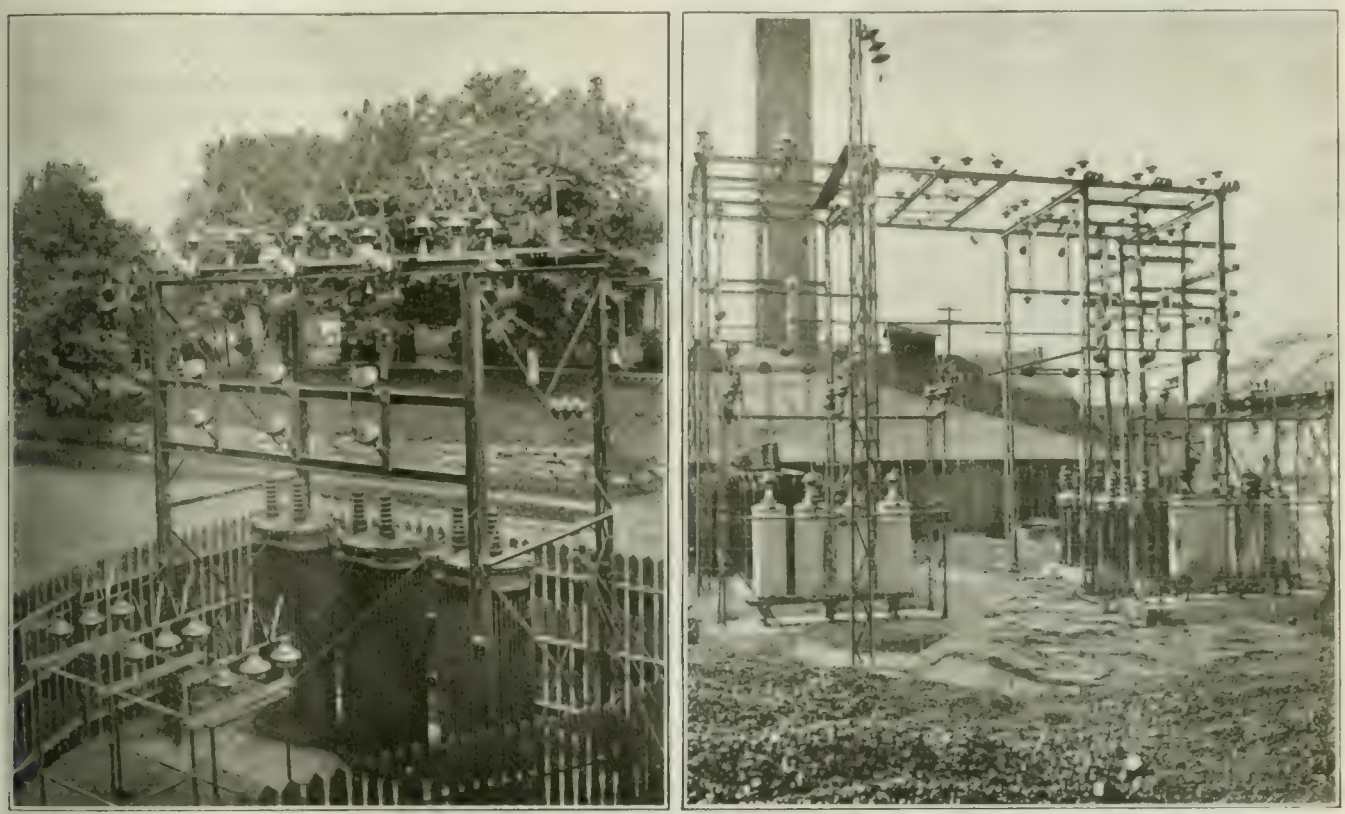


CROSS-SECTION OF ONE OF THE SUBSTATIONS DESIGNED FOR TWO CIRCUITS

tions along the railroad right-of-way would have been expensive in this case, on account of the fact that the poles would have had to be skidded to their location by teams operating either across very rough country or on an almost impassable railroad right-of-way. To obviate

this difficulty the company hired a locomotive and a couple of railroad flat cars from the railroad company and distributed the poles along the track at approximate locations and later piked them into the holes. The price charged for the use of the railroad equipment was reasonable, and the saving which the use of it effected was considerable. The cost of this line was $1,400 per mile, without transformers, and the use of the railroad equipment partly accounts for this low cost.

While the experience with the 33,000-volt construction described here has not been of especially long duration, the line had withstood the greater part of one winter's operation before this comment was prepared. Until that time one patrolman and one helper operating in a Ford car had been able successfully to take care



DOUBLE-CIRCUIT SUBSTATION AT CLINTON; 600-KW. STATION REPLACES STEAM PLANT

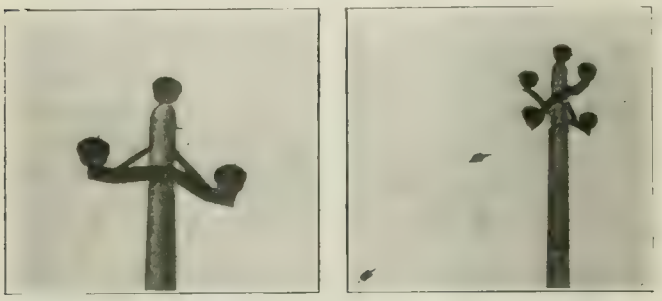
of the Clinton-Greencastle line and enough of the other lines in the company's northern territory to make the total mileage of line cared for by this crew about 75 miles (120 km.). They carry in the car a set of Johnson high-tension tools and get over the entire line about once a week. The main trouble has come from insulators which are shot by hunters. However, in spite of this annoyance the service on the line has been considered quite satisfactory.

Part of this success may be attributed to the rapid emergency service which it is possible to give the city of Greencastle from the rehabilitated power plant there. When this plant was purchased it was in very poor condition, and it is still very expensive to operate. It will, however, give service in an emergency. When the plant was purchased the overhauling processes were started in the boiler room, where a 250-hp. return tubular boiler and two 150-hp. water-tube boilers were retubed and reset. In addition to this the company installed one new 150-hp. fire-tube boiler. These are all hand-fired units. A new feed-water heater was installed to replace an old one that had been made out of a discarded condenser. The old heater was found to be entirely clogged with scale. In the engine room there are three engine-driven units. One, rated at 250 kw., is direct-connected. The two others are belted units, rated at 250 kw. and 150 kw. respectively. On the direct-connected 250-kw. unit all bearings were renewed and a new governor mechanism was installed. Steam pipes throughout the plant were covered with heat-insulating material, and steam traps and other devices were installed. The two other engine units were worked over in a similar manner, but since they are belt-driven they had depreciated to a greater extent than the first unit. They are considered, therefore, less reliable than the direct-connected unit for operation today.

During this reconstruction period in the engine room service was maintained from this plant without the assistance of the transmission line. The story of the methods used in maintaining service while this rebuilding was in progress is almost romantic. There were times when the combination operating and construction crews found it necessary to operate the plant with one man at the engine throttle and another at the switchboard because the governor mechanism on the only engine available for service was out of commission. However, by persistent effort, which was often continuous throughout twenty-four hours of the day, these men succeeded in maintaining service for the city, not only while the boiler room and the engine room were rebuilt but also while the switchboard was moved from one location to another.

The present method of operation in normal times is to supply the city of Greencastle with energy received over the transmission lines of Clinton at 33,000 volts. In an emergency, however, one 250-hp. boiler which carries 100 lb. (7 kg. per sq.cm.) of steam all of the

time can be placed on the line and can pick up the load in from three to five minutes. An engineer who is regularly employed by the company lives directly across the street from the power plant, and he is able to get the Greencastle plant on the line without help. When an emergency is to be met he throws the draft on this



33,000-VOLT CONSTRUCTION, COSTING ABOUT $2,000 A MILE
A—Pole top showing light type of construction and absence of sky wire. B—A typical corner.

250-hp. boiler and starts the 250-kw. engine-driven, direct-connected unit, and immediately upon accomplishing this puts fire under the new 150-hp. boiler, which is kept ready for firing but is not lighted until it is needed. This boiler always has coal on the grate which can be fired by carrying a few shovelfulls of live coals from the 250-hp. boiler. By the time the load begins to drag heavily on the 250-hp. boiler the 150-hp. boiler is usually ready to give some help. The 150-hp. boiler can be placed under full steam in about one hour under favorable conditions. When both of these boilers

TRANSMISSION LINE COSTS IN INDIANA (UNDER CONDITIONS IN SUMMER AND FALL OF 1919)

Clinton Substation:		
Lightning arresters	$1,293	
Tower and high-tension equipment	2,171	
Transformers, three 200-kva	4,417	
Miscellaneous material and labor	1,446	
		$9,327
Branch line to Rosedale transmission line, 2 miles	$355	
Rosedale 50-kw. substation	1,114	
		$1,469
Clinton-Greencastle Line:		
Right-of-way	$2,422	
Conductor and guy wire	9,912	
1,002 poles	7,306	
1,264 cross-arms	3,226	
4,253 insulators	8,706	
4,570 pins and bolts	2,379	
Three air-brake switches	447	
324 anchors	622	
Auto repairs, operation and tires	1,784	
Bond interest during construction	1,105	
Insurance	998	
Freight, drayage and express	1,539	
Labor	12,150	
Miscellaneous expense	1,211	
		$53,807
Greencastle Substation:		
Two 34.5-kw. induction regulators	$2,300	
One outdoor substation	874	
Three 200-kva. transformers	4,207	
Freight and drayage	222	
Miscellaneous expense	269	
		$7,872
Substation equipment at Lyford		543
Total cost of labor and material		$73,018
10 per cent engineering superintendence		7,302
Grand total		$80,320

are in operation it is possible to operate one of the 250-kw. generators and the 150-kw. generator if necessary, but it is usually found that a 250-kw. unit will carry the load.

The cost of this emergency service is about one ton of coal a day. Accidental interruption to service has been experienced only about once every two months, but the Greencastle plant is operated on the average about once every ten days or two weeks, because it is needed to help out the Clinton plant when boiler cleaning or repair work is necessary there. It is believed that after the transmission line has weathered the first winter interruptions will be less frequent.

The construction and rebuilding on these properties were carried out under the direction of their operating management, which consists of C. M. Poor, vice-president and manager of the Wabash Valley Electric Company, Clinton, and C. W. Otis, local manager of the Putnam Electric Company, Greencastle, Ind.

Tendencies in Ornamental Street Lighting

Any "White-Way" Lighting Should Conform to General City Plan—The Parkway System Is Discussed and Suggestions Regarding Installation Are Made

BY L. A. S. WOOD
Manager Illuminating Section Westinghouse Electric & Manufacturing Company

AN ORNAMENTAL street-lighting system should be considered as part of a scheme for beautifying the city as a whole and not as a means of advertising one section of a city perhaps to the detriment of some other locality. In recent years, moreover, the intensity of illumination on city streets has been materially increased and the necessity for brilliant lighting or "white ways" in individual localities has disappeared. An appreciation of this condition will help in solving the problems in connection with ornamental street lighting because it opens the way to the proper financing of the installation and the maintenance of the system when completed.

The cost of the installation of an ornamental street-lighting system might very well be borne by the property owners on the street where the ornamental system is to be installed, but the maintenance of such a system should be borne by the city as a whole.

The most satisfactory way of financing an ornamental street-lighting system is for an improvement district to be created and the adjacent property owners assessed on a front-foot basis in the same way as they would be assessed for any other municipal improvement. In general the expense to the property owner for the complete installation under a scheme of this character is very low, usually not more than $1.50 per front foot, while the cost to the individual citizen for maintenance of the improved system from which he receives material benefit is negligible.

It is thought that the central station should discourage the indiscriminate installation of ornamental posts outside business premises, and all suggestions for "white ways" should be the subject of careful consideration and consultation with the city authorities before the central station takes an active part in their promotion. "White ways" should always be considered in connection with the "city beautiful" idea and in the light of ornamental systems benefiting the city as a whole rather than as a means of advertising some particular locality.

The manufacturers of ornamental street-lighting devices may with advantage be consulted, and their

suggestions may well have very serious consideration before any ornamental system is designed, for some of the manufacturers of this class of apparatus have collected valuable data on the subject which is at the service of any city interested.

The central station is particularly interested in the maintenance of ornamental lighting systems, and from the central station standpoint as well as from the city's a series system is usually the best to adopt. If lamp renewals are covered by the maintenance contract the central station will find that the moving-coil regulating transformer will give the best results owing to its perfect regulation under all conditions. The ease with which a series system may be controlled and extended renders it particularly suitable from a central-station standpoint.

ADVANTAGES OF PARKWAY SCHEME OF DISTRIBUTION

There has been some difference in opinion as to the relative advantages of a conduit system versus "parkway" or steel-armored cable, but the general consensus of opinion is in favor of the latter. The argument in favor of the conduit system is the ease with which damaged cable may be withdrawn from the conduit, but if the installation is properly made this should not be necessary except in the unlikely event of the cable being subjected to mechanical injury, in which case the location of the fault is a comparatively easy matter.

Steel-armored, lead-covered cable should be laid in a shallow trench below the curb or in the "parkway," if there be any, and in this position it is not likely to be damaged. It is important that ends of the cable where cut should not be exposed to the weather or faults may readily be developed from moisture. All are familiar with the precautions taken by cable manufacturers to seal the ends of the cable before it leaves the factory, but unfortunately very little care is exercised in this direction when the cable is installed.

The best way to install armored cable is to lay it in a prepared trench, leaving a loop at the location of each post sufficiently long to reach the terminal of the disconnecting device in the base of the post, and to pour cement around the loop to form the foundation for the post.

This is a more satisfactory method than the usual one of making the post foundations first with the conduit elbows for the cable to be drawn through, as it leaves the cable intact until the time the connections are made in the base of the post.

A disconnecting pothead should be used in the base of the post, and this should be of such design as thoroughly to seal the ends of the steel-armored cable and efficiently bond and ground the steel armor and lead covers. It should also be designed so that the post wiring is automatically disconnected from the underground system and the circuit in the base of the post re-established by a short-circuiting device in the event of the post being accidentally broken. A device of this character was introduced about three years ago and has given very satisfactory results.



EFFECTIVE AND ORNAMENTAL STREET-LIGHTING UNITS RECENTLY ADOPTED AT SARATOGA SPRINGS, N. Y.

It is desirable that a device be used in the top of the post for relieving the terminals of the lamp socket from the strain of the weight of the cable used in wiring the post.

There is considerable difference of opinion among engineers as to the best type of glassware for street-lighting units, but the consensus of opinion is in favor of diffusing glassware for ornamental units owing to the practical elimination of glare with this type of glass. Glare within the range of vision of the pedestrian or vehicle driver should always be avoided.

Although during the war there were few developments in street-lighting units there has been great activity in this direction since, and we may look for many new devices in the near future which will materially assist efforts at making the "city beautiful" an accomplished fact in so far as the lighting of the streets is concerned. The possibilities of well-planned street lighting should be realized.

Considerations in the Burning of Fuel Oil

The Scarcity of This Fuel and the High Price of Other Fuels Make It Imperative to Give Greater Thought to Relative Economies of Oil and Coal, to Equipment and to Method of Operation than Has Ever Been Done

WITH oil becoming scarcer and scarcer and coal at a price undreamt of before the war it is worth while for every company to consider the relative economy of oil and coal in its plants and where oil is the answer to give more attention to the equipment required as well as to the best method of operating it. Even if oil does show a lower yearly expense than coal it would be unwise for any company to adopt it without considering that a greatly increased demand may make it almost impossible to obtain oil at any price. Furthermore, each company has to consider whether it is best situated to receive oil or coal shipments regularly. Limitations imposed by city ordinances on amount of oil storage also have an important bearing on the question of what fuel should be used.

As a basis for comparing the use of oil and coal the following points should be considered:

1. Oil fuel is cheaper per B.t.u. than coal in most parts of the United States.
2. Boiler room labor can be minimized.
3. Ash handling expense is eliminated.
4. Fires need not be banked and each fire is working at high efficiency.
5. Although both oil and coal may be purchased upon B.t.u. basis the tests involved in checking oil values are more easily and cheaply applied by the small companies.
6. Oil fuel can be burned more efficiently than coal.
7. Boiler rooms and surroundings can be kept neat and clean.

Assuming that fuel oil containing 18,500 B.t.u. per pound is available in competition with a high-grade coal testing 14,500 B.t.u. per pound, that the efficiency of the coal furnace is 60 per cent and that of the oil furnace 70 per cent, the theoretical equivalent for each long ton of coal would be 4.5 barrels of oil. Higher oil efficiencies than that assumed have been obtained, however, and if attainable in the average plant would materially reduce the ratio indicated.

The installation of oil-burning equipment in the ordinary plant is not very expensive. It is claimed by manufacturers of such apparatus that the saving in operating cost should pay for the changes in the average plant in two years. The burner in most common use for high-pressure work is of the steam-atomizing type. The steam projects the oil in a fan-shaped sheet of minute particles which extend from the burner mouth over the full width of the combustion chamber. Recently considerable thought has been given to the application of mechanical atomizers to stationary boilers because here is a possibility of forcing them to greater capacities than steam atomizers. Furthermore, such burners are said to make more effective utilization of furnace space.

One fireman can take care of ten oil-fired boilers, so that in large plants the decrease in labor required would be considerable. The cost of unloading coal, usually greater than that for oil, and the handling of ashes are eliminated. In the case of banked fires coal is being burned wastefully, whereas with oil-burning apparatus as soon as the load begins to decrease burners can be shut down or cut off entirely in any desired boiler or boilers and only enough fuel burned to maintain the load.

Since fuel oil is the residuum after the lighter and more inflammable oils have been distilled off it has a high flash point and can be handled with considerable safety. The flash point is usually above 170 deg. F. (76 deg. C.) (open-cup), and in the process of oil burning it is not necessary to raise the temperature of the oil above this point. The Mexican oil so extensively used in the Eastern states is a heavy dark-brown oil, ranging in gravity from 11 deg. to 18 deg. Bé.

Equipment Required

Application of an oil-burning system to any plant requires a storage tank for the fuel oil, a pumping unit for drawing the oil by suction from the storage tank and forcing it under pressure to the burners, a general piping scheme for the necessary oil and steam pipes, and the furnace changes whereby the coal-burning furnaces can be transformed to oil-burning.

The storage tank may be of either concrete or steel,

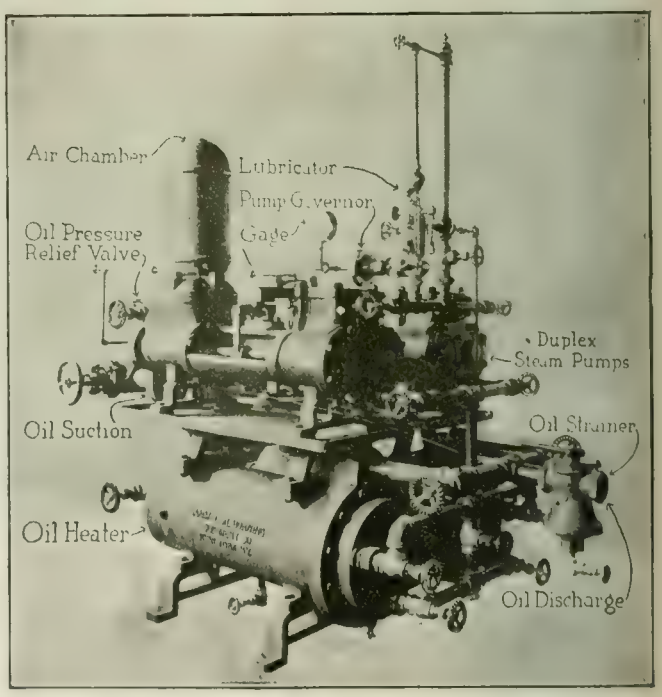


FIG. 1—COMBINED PUMPING AND HEATING UNIT FOR OIL SUPPLY

depending upon local conditions. The usual practice is to make it large enough for at least a two weeks' supply of fuel if the plant is close to an abundant source. The farther a plant is removed from an oil supply station the larger its storage should be. A safe rule is to figure 4¼ bbl. of oil of 42 gal. (156 l.) each as the equivalent of a long ton of coal. Knowing the coal consumption of a plant the size of the required oil storage can be computed. Under ordinary conditions the actual operation week by week should be much better than this approximation.

To obtain the shortest pipe lines the storage reservoir should be installed as close to the boiler room as possible, but this location should conform to any insurance or local fire regulations. Usually the reservoir is placed below ground and adjacent to a railroad siding, if oil is to be received in tank cars. As Mexican oil is extremely sluggish when cold the tank cars are equipped with a steam coil for heating the oil to a temperature high enough to permit it to flow freely. The oil outlet from the tank, which is at the bottom and near the center of the car, is either 4 in. or 6 in. (10 cm. or 15 cm.), depending upon the type of car.

There are two methods in use for unloading. Either the oil is permitted to flow by gravity into a hopper in the middle of the track or a flexible hose coupling is used to connect the car with the storage-tank filling pipe. The track hopper is the easier to manipulate. If a flexible hose is used it should be 6 in. (15 cm.) in size to accommodate the largest tank car. A hose of this size is very heavy and in cold weather becomes quite stiff and unwieldy.

For the best results the filling pipe should have as much slope as possible, because oil is extremely viscous when cold. The filling pipe should be at least 6 in. in diameter, and if the line is to have a somewhat flat slope an 8-in. or 10-in. (20-cm. or 25-cm.) pipe is preferable.

When it is impossible to install a storage reservoir where it can be filled from a railroad siding it is necessary to install an unloading pump to draw the oil through a flexible hose connection from a car and force it under pressure to the reservoir, which may be at a considerable distance. Or the tank car can discharge into a small reservoir near the siding, and from here the oil can be pumped to the main storage. In any case the long-pressure line from pump to main storage should be provided to drain the oil out when not in use, and it should be heated to keep the oil warm during pumping operations.

Pumping Unit.—Drawing the oil by suction from the main reservoir or from an auxiliary service tank, the main pump forces it under pressure to the burners. Usually this unit consists of two standard duplex-type steam pumps, specially fitted for fuel oil, and one or two heaters to give the oil the desired temperature for burning. Only one pump is required at any time, the second pump being a spare. The unit may be conveniently piped so that either or both heaters may be used with either or both pumps, and there should be included as accessories an oil strainer, a pump lubricator, an air chamber (to eliminate pump pulsation), an automatic pump governor maintaining a constant pressure for the oil discharge, an automatic oil-relief valve, a pressure gage and thermometers for indicating the temperature of the oil entering and discharging from the unit.

The exhaust steam from the pumps is used to heat the oil in the heaters, and no additional supply of live steam is necessary. The oil should reach the pump at a temperature between 80 deg. F. and 100 deg. F. (26 deg. C. and 38 deg. C.), and after passing through the heater should be between 140 deg. F. and 160 deg. F. (60 deg. C. and 76 deg. C.), which is the desired temperature for burning. Pumping units are made in various sizes to agree with the boiler horsepower of the plant. A typical pumping unit is shown in Fig. 1.

Piping System.—The general piping system consists essentially of a pump suction from tank, oil discharge from pump, oil return to tank, main steam supply and steam coils in storage tank.

To eliminate fire hazards a gravity feed should not be used, and the pump suction line should be as short and direct as possible. It is possible to have a total suction lift of about 18 ft. (5.4 m.), provided that the oil is kept at 80 deg. to 100 deg. F. and the suction distance is short. Because of the sluggish flow of the oil the suction pipe should be several sizes larger than the inlet at the pump and reduced to the proper size

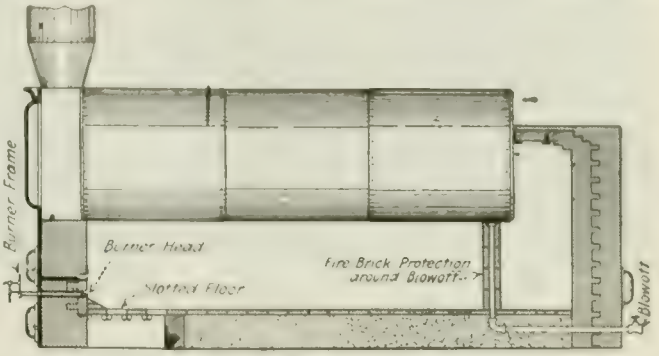


FIG. 2—FURNACE CHANGES FOR RETURN TUBULAR BOILER

near the pump. This line should be carefully tested with a vacuum gage before using to insure its being absolutely air-tight. There should be a foot valve at the suction end of the tank.

After leaving the pump the oil discharge is generally dropped below the floor level and carried in a trench along in front of the boilers, with T's at the proper places for conducting the oil to the burners. If it is desired to meter the oil a meter should be placed on the line between the pump and the first branch T at some convenient place.

As the oil return line is a continuation of the discharge line, going back to the storage tank, it should be placed in the same trench in front of the boilers. It is used to circulate the oil, especially when the system is cold and when the plant is being started after a shut-down period. This line should also carry back to the storage tank any oil which passes the automatic pressure-relief valve on the pumping unit. If a meter has been installed on the discharge line a meter should also be placed on the return line to measure any oil returned to the tank, and thus, by the difference, one may learn how much oil has been actually used.

It is important that the main steam supply should be taken from a source to insure the driest steam possible. It should have a general slope in the direction of the steam travel and should discharge into a trap at its lowest point. This main should furnish steam directly to the burners, to the pumps and to the heating coils in the tanks. If oil is received by tank car a steam line should also be extended to the railroad siding for heating the steam coils in the tank cars. Usually a reducing valve can be installed to furnish low-pressure steam for both the storage tank and the tank-car heating coils.

Steam Coils.—Every tank should have a heating coil, to maintain the oil at a temperature of 80 deg. to 100 deg. F. as it enters the pump. It is common practice to place a spiral coil incased in a hood around the foot valve of the suction pipe. This coil heats the oil where it is needed, directly around the suction pipe. Besides this spiral coil there should also be a flat coil,

made of standard lengths of pipe with open-pattern return bends, resting a few inches above the floor of the tank. This is to prevent the oil from becoming too sluggish. In some small tanks having a capacity less than 30,000 gal. (113,000 l.) it is customary to use only the flat coil. For a tank of this size a coil of twelve pieces of 1-in. (2.5-cm.) pipe, 20 ft. (6 m.) long, would heat the whole body of oil to the desired temperature, provided that the tank was below ground or otherwise protected from loss of heat through radiation.

It is quite common practice to build a box inside the storage tank with the suction pipe projecting down into one end. At the opposite end, near the bottom, should be an opening, a few inches off the floor, for admitting oil into the box. Between this opening and the suction pipe a flat heating coil should be built, so that the oil entering the box passes over the heating coil before reaching the suction pipe. Larger installations have compartment storage tanks, permitting the

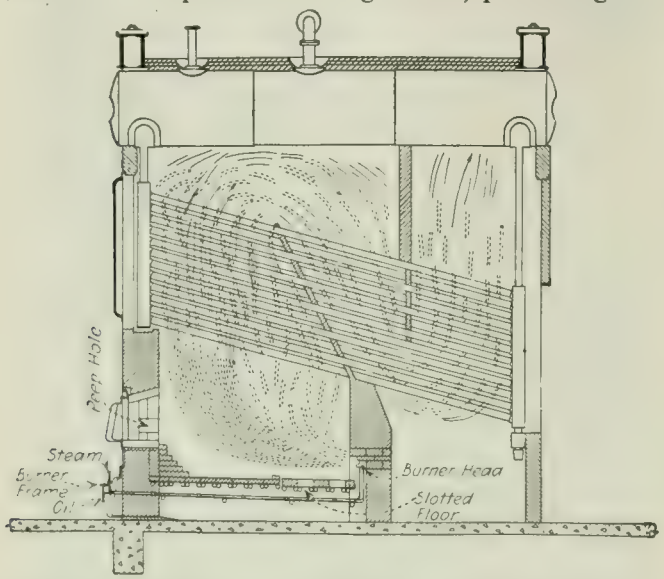


FIG. 3—APPLICATION OF OIL BURNERS TO WATER-TUBE BOILER

pumping unit to draw its oil from a different compartment from that which is being filled. In this way the oil which reaches the burners comes from the heated compartment.

Furnace Changes

To change the furnace from coal-burning to oil-burning the amount of work necessary depends upon the type of boiler. The horizontal return tubular setting, so common in small plants, is readily adaptable to oil firing, as shown in Fig. 2. The grates should be removed, the bridge wall torn down to approximately the level of the top of the ashpit door, and a new floor of fire-brick laid on pipe supports, with slots between the bricks for admitting the necessary air for combustion. This air enters through the ash-pit doors. The rear portion of the floor may be laid upon an earth fill. All the walls of the furnace should be lined with firebrick above the level of the new floor. If a burner is used which thoroughly atomizes the oil no splash walls or checkerwork of any kind is required.

To prevent the blow-off pipe from being burned away it should be well protected. It may be surrounded with close fitting firebrick or wrapped with heavy asbestos rope. The burners should project only a fraction of an inch into the furnace, through a small hole cut in the cast-iron front of the boiler. This hole should be cut low, but not so low that the new floor will interfere with the free passage of air through the ash-pit door.

To fire Babcock & Wilcox, Stirling and Aultman & Taylor boilers a back-shot furnace construction has been employed with good results. In this type of construction the flame shoots from the bridgewall toward the front of the boiler and in a direction parallel to the tubes. This arrangement insures carrying maximum capacity, with no impinging action of the flame on the tubes. For this arrangement the floor of this furnace should preferably be of firebrick, usually built somewhat lower than the level of the coal-burning grates, which necessitates the removal of these grates. The firebrick floor may be supported upon pipes running across underneath the floor and resting upon ledges of red brick built along the side walls of the ash-pit.

In these boilers the burner heads are placed in notches or recesses in the bridgewall, which protects them from the intense heat of the furnace. Slats may be provided in the firebrick at the floor level directly in front of the burner for admitting air for combustion. This air may enter through the ash-pit doors and travel under the floor to the slotted area. In the usual setting the new bridgewall should be placed as far in the rear of the boiler as possible, but in the Babcock & Wilcox boiler the area of the second gas pass should not be decreased an abnormal amount. To insure good combustion there should be from 8 ft. to 10 ft. (2.4 m. to 3 m.) distance between the front wall and the bridgewall. Within certain limits, the higher the boiler setting the better the efficiencies, especially at high overloads.

The number of burners for each boiler depends on several factors, including the depth of the furnace, width and number of ash-pit doors, loads to be carried by the boiler and other items. The relation between number of burners and boiler width follows: One burner for five to nine tubes in width (39 in. to 67 in.); two burners for ten to sixteen tubes in width (74 in. to 116 in.); three burners for eighteen or 21 tubes in width (130 in. to 151 in.); four burners for twenty-four or twenty-seven tubes in width (172 in. to 193 in.).

Longitudinal walls from the ash-pit floor to the bottom of the firebrick combustion chamber floor make the air supply for each burner independent of the others. With this construction it is possible to extinguish one or more burners, shutting off the corresponding air supply, and to operate the other burners without reduction in efficiency. This point is of greatest importance in plants carrying extremely variable loads and for boilers on "stand-by" service. However, it is best to equip a boiler so that under ordinary conditions, with its changing load, all of the burners may be operated with a corresponding changing intensity of fire, rather than to shut off entirely any of the burners when the load falls.

To facilitate cleaning a burner two unions may be used between the burner frame and the rest of the oil piping system, so that by turning the frame sideways both burner and frame can be slipped out of the ash-pit door.

As an oil fire develops a more intense heat than coal it is advisable to use the very best of firebrick, with a fusing point at least 3,000 deg. F. (1,634 deg. C.). These bricks should be laid without the use of a trowel. Each brick should be dipped in a thin mixture of fireclay and rubbed into place, making the fireclay joint as thin as it is possible to get it.



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Developing Niagara Falls Without Marring Its Beauty

Seven Methods of Utilizing an Additional Diversion of 20,000 Sec.-Ft., Showing Comparative Costs—573,000 Hp. to 787,000 Hp. Can Be Developed Under These Plans—Submerged Weirs Proposed as Remedy

By COL. J. G. WARREN
Corps of Engineers, U. S. A.

THE destruction or serious defacement of Niagara Falls, or any part of it, for power development or commercialization of any kind would be held almost universally—and should be beyond doubt—to be intolerable vandalism. However, there is much to be said in favor of Niagara power and its great benefits to the United States and to the world. The development already existing has made possible the growth in this country of chemical industries so important that it is difficult to see how they could possibly be dispensed with. It might almost be said that the war could not have been won without them. It is true also that some of the hydro-electric developments now existing at Niagara Falls furnish a spectacle of beauty, grandeur and sublimity almost rivaling the falls and the rapids themselves. The problem is to develop a policy which will insure preservation of the natural scenery and at the same time conserve the present power development and provide for future industrial needs.

On first thought it would seem that no harmony between these objects was possible, that power development must give way to scenic preservation. A careful study of all the facts[1] makes it clear that this is not the case; that the utmost harmony can readily be made to prevail between the two apparently conflicting interests, and, strange as it may at first seem, that scenic preservation may be promoted by a further development of power with its greater enhancement of commercial advantages.

This very satisfactory conclusion arises because of the peculiar character and growth of the Horseshoe Falls. Although they discharge sixteen times as much water as the American Falls and have a crest line two and six-tenths times as long, yet they are often held to be inferior as a spectacle to the lesser American Falls. The crest line forms a deep curve which makes it impossible to see more than about one-half of these falls at a time except from one viewpoint in Canada. In the central 1,000 ft. (300 m.) of the crest line, situated deep in the curve, more than 80 per cent of the flow over the falls plunges down over the cliff behind a thick cloud of mist. This part of the water fall is seldom more than partly visible, and then only under favorable conditions of wind, causing the spray to be blown to one side. It seems to be a fact that perhaps more than one-half of the water flowing over this cataract adds nothing at all to its grandeur, unless it be by increasing the volume of sound, while it greatly injures the scenic effect by causing a cloud of spray which hides a large portion of the falls almost perpetually. The ends of the crest line are never well covered with water and frequently are bare.

One remedy would be to construct a submerged dam or weir in the center of the rapids just above the crest of Horseshoe Falls. This would spread the water

[1] Statements as to the changed appearance of the falls are sometimes made by persons whose utterances carry weight. However, few, if any, of these observers have taken into account the changes in stage of Lake Erie at Buffalo, largely due to wind, which cause the volume of flow over the falls to change from hour to hour, day to day and year to year.

TABLE I—COMPARISON OF CONSTRUCTION COST AND TIME OF DEVELOPMENT, PROPOSED NIAGARA RIVER DEVELOPMENTS OCTOBER, 1918

	Cu.Ft. per Sec.	Gross Head, Ft.	Net Head, Ft.	Total Hp. on Busbars	Hp. per Ft.-Sec.	Construction Cost	Construction Cost per Hp.	Time of Development, Years: First Power	Time of Development, Years: Complete
1. Power canal	20,000	313.8	302.8	591,000	29.6	$43,579,000	$73.70	2½	5
2. Pressure tunnel	20,000	312.5	301.3	588,000	29.4	50,803,000	86.40	3	5
3. Tail race tunnel	20,000	312.5	299.0	584,000	29.2	52,220,000	89.40	3	5
4. Simple two-stage	20,000	312.2	297.5	580,000	29.0	61,227,000	105.60	2	4½
Upper stage only	20,000	215.2	208.2	406,000	20.3	31,528,000	77.73	2	4½
Lower stage only	20,000	97.0	89.2	174,000	8.7	29,699,000	170.78	2	4½
5. Compound two-stage	20,000	312.0	298.4	573,000	28.6	55,481,000	96.80	1	4½
Upper stage only	20,000	219.0	214.4	409,000	20.4	21,183,000	51.80	1	3½
Lower stage only	20,000	93.0	84.0	164,000	8.2	34,298,000	209.10	2½	4½
6. Ship canal:									
300 ft. wide, 40 ft. deep	20,000	316.4	312.9	611,000	30.6	198,412,000	324.70	7	10
400 ft. wide, 30 ft. deep	20,000	316.4	312.9	611,000	30.6	203,000,000	332 20	7	10
200 ft. wide, 33 ft. deep	20,000	316.4	309.9	605,000	30.2	170,000,000	281.00	6	9
Portion of works of 300-ft. canal necessitated by the power development	.....	.....	....	.....	.. .	93,000,000	97.50	7	..
7. Erie and Ontario sanitary canal	26,000	326 4	310.2	787,000	30.3	401,760,000	510.50	..	...

away from the center onto the ends, thereby checking center erosion and enhancing the beauty of the falls. With this done the inequality of flow over the two falls could be partly remedied without detriment to the Canadian Falls by dumping rock into the river to form a low submerged weir between the upper end of Goat Island and the Canadian shore.

If the remedial works whose design has been outlined above are provided, it is believed that a total diversion of 80,000 sec.-ft. (2,240 cu.m. per second) may be made around the falls and 40,000 cu.ft. (1,120 cu.m.) per second around the Whirlpool and Lower Rapids without injury to the scenic beauty and without injury to the ice-discharging capacity of the falls or rapids, these diversions to be divided equally between Canada and the United States. After these diversions have been effected, it is quite possible that observation will show that further diversion is permissible, especially should the possibility of utilizing further diversion at medium or high stage only be considered.

The effects at low-water stages are the critical considerations. Under the very infrequent condition when the total river flow is 130,000 cu.ft. (3,640 cu.m.) per second, the flow over the Falls would be 50,000 cu.ft. (1,400 cu.m.) per second, of which 5,000 cu.ft. (140 cu.m.) would pass over the American Falls. The flow over the Horseshoe Falls would then be about twice as great per foot of crest line as the flow over the American Falls under average conditions and more than three times as large as during this very abnormal low-water condition. This 45,000 cu.ft. (1,260 cu.m.) per second flowing down the rapids above the Horseshoe Falls would provide 50 per cent more water per foot of width of channel than past experience has shown to be necessary in the American channel leading to the American Falls for the prevention of ice jams. The possibility of dangerous ice jams forming in the Whirlpool Rapids or Lower Rapids appears much greater than in the rapids above the falls.

It is very important also that the scenic beauty of the lower rapids should not be injured at very low stages. A careful study of photographs, profiles, gage records and other evidence leads to the conclusion that the diversions around these rapids should be limited to 40,000 cu.ft. per second until the effects of this diversion can be observed.

In the attempt to operate large hydro-electric plants very close to an authorized limit of diversion, occasional accidental peak loads may cause an unintentional overstepping of the limit. If these are not permitted, the plant must habitually be operated at less than the allowed load, thus reducing the total output of power. For this reason it would seem that the treaty and the permits issued under it should not penalize such occasional accidental excess diversions.

TABLE II—ESTIMATED ANNUAL CHARGES FOR POWER DEVELOPMENT, EXCLUSIVE OF FIXED CHARGES ON ORIGINAL OVERHEAD AND DEVELOPMENT EXPENSES

Based on use of a diversion of 20,000 cu.ft. per second October, 1918

No.	Proposition Name	Ninety per Cent of Maximum Continuous Output in Horsepower	Fixed Charges per Horsepower per Year	Operation Charges per Horsepower per Year	Cost of Power on Busbars per Horsepower per Year
1	Power canal	532,000	$8.20	$1 80	$10.00
2	Pressure tunnel	529,000	9 60	1.70	11.50
3	Tailrace tunnel	526,000	9.90	1.70	11 60
4	Simple two-stage	522,000	11.70	2.20	13.90

* The compound two-stage proposition is omitted from this table, as it is only applicable to the use of the diversion authorized by the existing treaty.

Extent of Territory Involved

The territory involved in a comprehensive consideration of this diversion is the entire drainage area of the Great Lakes above St. Regis, N. Y., 66 miles (106 km.) above Montreal, the place at which the St. Lawrence passes entirely into Canada. This area is approximately 300,000 square miles (768,000 sq.km.), of which 59.5 per cent lies on the United States side of the international boundary line. The total area is somewhat larger than that of Texas and about one and one-half times the size of France. The land area on the United States side includes virtually all the State of Michigan and portions of Minnesota, Wisconsin, Illinois, Indiana, Ohio, Pennsylvania and New York. The land area on the Canadian side comprises a large part of the Province of Ontario. The water surface alone is 95,205 square miles (243,725 sq.km.), or 64 per cent of this is in the United States. The main shore line involved exceeds 8,300 miles (13,350 km.) in length. The population of the basin area is estimated to be 15,000,000, of whom 2,000,000 are in Canada. At least sixteen cities of 50,000 population or more each are contained within its boundaries.

The total developable water power of the basin is estimated at 10,000,000 hp., far more than half of which is in the United States. The water power already developed within this area is roughly 1,000,000 hp. in the United States and 1,500,000 hp. in Canada.

Present diversions of water from the Niagara River at Niagara Falls for power development are given in Table IV. Since the above data and Table IV were compiled the Hydro-Electric Power Commission of Ontario has constructed an addition to the Ontario Power Company's plant increasing the diversion of that plant to about 13,300 cu.ft. (378 cu.m.). The commission also has under construction a new plant to utilize a diversion of 10,000 cu.ft. (280 cu.m.) of water per second under a head of 300 ft. (90 m.). All the other plants enumerated generate power under gross heads of 220 ft. (64 m.) or less, diverting water from the river not more than 1¼ miles (2 km.) above the falls and returning it to the river within less than a mile (1.6 km.) of the foot of the falls.

TABLE III—COMPARATIVE COST OF STEAM AND HYDRAULIC POWER AT NIAGARA FALLS, N. Y., OCTOBER, 1918
(20,000 cu ft per second; 526,000 hp.)

	Cost in Dollars per Hp.-Yr. Steam-Electric	Niagara
Coal, 6 tons at $4.50	$27.00	$0.00
Other operation and maintenance	8.00	1.90
Fixed charges (Niagara, 10 per cent; steam-electric, 13 per cent)	12.60	14.00
Profit, 3 per cent on construction cost	2.90	3.10
Selling price	$50.70	$19.00
Selling price (reduced to cents per kw.-hr.)	78	29
Saving per hp.-year		31.70

Possible Methods of Development

Consideration of several plans for the further development of power from the Great Lakes drainage basin by the diversion of additional water from the Niagara River have shown the feasibility of three major types of development: (1) By a power canal, (2) by a pressure tunnel and (3) by a tailrace tunnel. Four other developments have also been investigated (see Table I), but all of them are higher in first cost and more complex in engineering requirements.[1] The power-canal development would involve diverting water just south of Connors Island and conveying it to a power plant below Riverdale cemetery where the draft-tube discharge elevation would be low enough to give 312.5 ft. (95.1 m.) gross head. The pressure-tunnel plan would require an adit just upstream from Grass Island and would run to a plant situated similarly to the one first mentioned. The tailrace-tunnel plant would involve a plant just upstream from Grass Island with a gross pressure head of 299 ft. (91.1 m.) and a tailrace tunnel extending to the lower river, raising the gross head to 312.5 ft. (96.5 m.). The two-stage developments are based on utilizing the total head in two steps of about 215 ft. and 97 ft. (65.5 m. and 29.5 m.) respectively, one plant being near the International Bridge and the other in the lower river. The simple two-stage development differs from the compound in that it contemplates an entirely new development for the use of diversion authorized by a new treaty, while the compound two-stage development is a scheme for the most efficient use of the existing diversion, utilizing the more modern portions of the Niagara Falls Power Company's present plant. The other propositions are indicated by their name.

TABLE IV—WATER DIVERSION FROM NIAGARA RIVER AT NIAGARA FALLS

Side of River	Name of Company	Diversion Cu.Ft. per Second	Totals Cu.Ft. per Second
United States	The Niagara Falls Power Co.:		
	Niagara Plant	8,600	
	Hydraulic Plant	10,900	
	Pettebone Cataract Paper Co.	270	19,770
Canada	Hydro-Electric Power Commission of Ontario Power Co. plant	11,200	
	Toronto Power Company	12,400	
	Niagara Falls Power Co., Canadian Plant	9,600	
	International Railway Co.	125	33,325
Grand total			53,095

From the tables it will be seen that the first cost of the canal proposition, omitting costs of promotion and finance, is lower than that of either tunnel proposition, being $73.70 per horsepower as compared with $86.40 and $89.40 for the tunnels. The cost of operation and maintenance would, however, be greater, but upon the assumptions in the estimates not enough to overbalance the additions in fixed charges. The tailrace-tunnel plan has several inherent disadvantages which make it of very doubtful advisability. These are the expected presence of considerable ground water in the low-level tunnel during construction, the difficulty of unwatering the tunnel in case of accident or needed repairs and the difficulty of regulating surges in the tunnel. The most important objection to the tunnel plan is that it will be necessary to shut down the entire plant for a short time and drain the tunnel in order to repair or remove obstructions from the upstream valves. This difficulty is not regarded as controlling. It could be obviated by extending the tunnel up to a surface forebay and using long penstocks, or by other means. The only formidable objection to the power-canal plan is the presence of an open canal through or near the city and the uncertain costs of maintenance due to climatic conditions. There is no reason, however, why it should not be made less unsightly than the present canal, and in fact it might even be attractive in appearance. It would, however, partly prevent the use of valuable land for other purposes, would form a dividing line disadvantageous to streets and sewer systems, and would cause the city or the company expense for building and maintaining bridges as the city grew.

A comparison of the probable cost of power at the busbars corrected to equalize distribution conditions shows that the power-canal project should show a cost of $10 per horsepower per year, as compared with $11.50 and $11.60 for the pressure and tailrace tunnels respectively.

Objections to the scheme of the Erie & Ontario Sanitary Canal Company of diverting more water from Niagara River are that all of the roads leading into Buffalo from east, west and south would be crossed. This would require about seventy movable bridges, and the consequent obstruction to traffic would be enormous. It would lower the level of Lake Erie 1.18 ft. (0.4 m.), and remedial works would be very expensive. Besides, it would produce excessive currents in the Black Rock ship canal, and there would be difficulty in crossing the New York State Barge Canal.

[1] Of course, all the proposed schemes are predicated on the ability to secure more diversion—20,000 sec.-ft. (560 cu.m.)—through international agreement.

Table I—Capacity of Generators and Prime Movers Installed in the Central Stations of the United States

State	Capacity of Dynamos, Thousands of Kw.					Steam Engines and Steam Turbines, Thousands of Hp				Steam Engines, 1920, Thousands of Hp.	Steam Turbines, 1920, Thousands of Hp.	Gas and Oil Engines, Thousands of Hp					Waterwheels, Thousands of Hp.				
	1902	1907	1912	1917	1920	1902	1907	1912	1917			1902	1907	1912	1917	1920	1902	1907	1912	1917	1920
Alabama	4 5	17 1	24 5	128 5	147.4	7 6	19 4	24 6	79.2	31 0	83 6	0	0	0 1	0 7	0	0 6	1 2	27 8	102 9	80.6
Arizona	1 8	4 9	14 8	27 0	56 4	1 9	6 9	12 8	23.9	9 9	26.1	0.7	0 1	0	3 6	3 0	0	0 8	9 3	11 2	39 0
Arkansas	6 0	9 7	16 3	24 9	54 3	8 2	13 6	22 6	31 5	26 6	42 4	0	0 1	0 2	2 6	1 6	0 2	0 3	3 0	2 5	2 2
California	83 8	238 5	588 3	817 0	883 4	55 2	159 6	414 2	450 2	32 3	403 7	0 6	16 6	2 0	2 2	2 6	78 9	208 4	432 1	729 0	810 3
Colorado	21 8	53 1	71 7	94 8	133 4	25 5	56 5	56 9	65 5	20 4	92 2	0	0 3	0 1	0 5	0 2	12 8	25 6	77 0	74 0	78 3
Connecticut	15 5	18 0	19 4	152.6	187 9	21 4	37 5	89 4	162 0	18 5	169 2	0 4	0 7	0 9	0 8	0 7	6 6	18 0	19 4	32 4	40 5
Delaware, D. of C., and Maryland	21 6	63 0	87 1	131 2	225 6	29 5	83 6	108 0	199 9	34 7	280 0	0 1	0 1	1 1	1 2	0 9	0 3	1 6	4 0	3 0	15 3
Florida	4 7	7 8	23 6	37 8	57 5	6 1	14 3	27 6	50.5	22 9	53 4	0	0 1	0 5	2 0	3 7	0	0	5 7	5 7	7 0
Georgia	7.6	35 4	56 2	84 3	246 6	6 5	18 2	35 3	50 1	41 6	80 3	0	0 1	0 7	0 5	3 3	6 1	36 3	52 0	75 1	223 4
Idaho	2 8	7 1	35 7	37 1	101 8	1 5	2 2	4 5	2 7	4 5	0	0.1	0	0	0 1	0 1	3 9	11 5	51 9	53 6	126 6
Illinois	100 3	209.2	450 0	737 6	987 0	117 1	287.9	605 2	982 7	161 4	712 3	0 2	0.9	3 0	4 7	2 7	9 5	10 5	37 4	59 0	114 0
Indiana	38 1	81 6	135 8	227 8	343 8	52 0	95 9	159 9	270.2	68 0	317 6	1.1	1 3	1 7	3 3	6 0	1 1	19 6	23 9	27 7	28 8
Iowa	24 9	32 1	53.2	184.5	301 5	36 7	42 3	67 4	90 7	65 7	124 0	0.4	0 6	2 7	7 3	4 4	2 4	3 8	7.0	165 9	160 4
Kansas	8 6	30 3	69 2	143 3	138 1	12 2	38 0	82 4	167 9	41 9	106 9	0	1 7	7 1	22 0	19 3	1 0	8 7	8 8	18 0	26 1
Kentucky	15.0	29 1	54 1	69.4	113 4	21.3	42 0	81 1	96 1	26 8	120 2	0.1	0.1	0 6	2.3	1.5	0.1	0	0	0 4	0 2
Lousiana	7 8	15 2	19 2	25 8	87 4	13 7	22 9	26 2	29 3	37 4	73 0	0	0 4	1.0	6 8	4 1	0	0	0	0	35 2
Maine	15 3	39 3	58 8	63 2	122 8	11 8	18 1	19 6	22 5	16 8	16 9	0	0	0 1	0 2	0 3	13 0	39 8	69 9	75 6	186 0
Massachusetts	90 6	135 9	252 7	478.9	763 6	115 2	170 5	323 1	555 2	68 7	773 6	0 1	1 1	3.2	6 3	0 6	8 9	16 8	24 5	119 0	139 2
Michigan	44 2	101 7	247 8	450 7	529 4	48 6	97 9	250 5	411.6	44 2	427.5	0 1	0 6	1 6	3 0	1 8	16 1	85 7	125 1	198 0	216 5
Minnesota	21 0	78 5	93 5	162 8	229 9	28 1	48 7	63 2	119 0	34 0	139 2	0 7	1 4	4 8	8 1	7.5	6 0	71.7	80 2	98 4	157 7
Mississippi	5 1	9.9	21 9	23.2	42 5	7 7	15 5	30 5	32 2	20 3	30 2	0	0 1	0 1	1 0	1 1	0	0	0	0	0
Missouri	32 1	68 5	122 8	166 8	347 2	44 3	108 5	177 7	200 0	59 7	392.9	0	0 9	2 5	7.4	5 7	1 0	2 0	1 9	18 7	27 3
Montana	22 1	39 6	74 4	182 1	146 4	7 9	11 8	12 8	8 1	11 6	2 5	0	0	0 1	1 4	1 3	24 0	57 0	102 9	334 9	303 4
Nebraska	8 4	20 0	34 6	78 2	85 7	10 4	26 2	42.5	89 1	25 5	68 3	0.1	0 8	3 8	12 5	10 4	1 8	3 0	5 9	10 5	12 5
Nevada	0 8	5 7	10 5	12.4	21 2	0 3	0 2	2 2	1 1	0 9	1.9	0	0 5	0 7	0 6	0 4	1.4	6 3	12 5	15 1	15 4
New Hampshire	17 8	31 9	57 8	65 6	52 4	12 6	20 3	25.4	34 8	23 0	21 0	0 1	1 1	1 9	1 2	1 1	15 4	25 4	56 9	57 3	46 0
New Jersey	46 1	70 6	179 5	249 5	320 3	67 3	90 5	235.6	353 0	74 7	351.6	0.4	1 3	2 4	12 7	2 9	1 0	1 8	1 6	2 1	1 3
New Mexico	1 0	3 8	8 0	12 7	10 5	1.7	4 0	8 4	13 2	7 0	3.9	0	0	1.8	3 3	2 8	0 1	0 5	0 8	0 6	0 6
New York	187 3	482 0	772 0	1,211 9	1,466 4	192.6	413 4	638 9	1,052 3	90 6	1,335.9	2.0	3 3	6 5	5 9	5.2	128 8	306 0	512 4	694 9	738 8
North Carolina	4.1	13 9	43 1	144.0	191.1	4 6	10 7	15 0	68.2	21 3	81 3	0	0	0 1	0 4	0 3	1 9	10 0	50 0	150 7	169 6
North Dakota	2 0	5 8	10 8	20 0	23 1	3 8	10 0	15 9	24 7	19 4	6 4	0	0.2	0 3	4 4	3 7	0 1	0 1	0	0	0
Ohio	69 8	126 5	244.2	420 4	1,046 9	101 3	171 4	317 2	556 2	138 8	1,050 0	0 8	5 6	11.3	11 9	11 3	1 7	2 0	8 9	13 6	40 7
Oklahoma	3 0	15 5	38 3	57 8	79 5	4 4	22 4	45 9	66 8	44 2	43 5	0	0 2	6 0	12 9	11 5	0	0	2 1	1 4	1 8
Oregon	11 2	32 6	32 4	47 9	132 2	6 6	24 6	15 9	27 1	18 9	47 5	0	0 2	0 3	0 6	0 3	11 2	102 1	29 8	41 1	132 0
Pennsylvania	121 4	212 5	427 3	910 4	1,078.6	166 7	264.2	466 0	1,104 1	162 5	1,062.1	1 8	7.5	17 7	19 5	12 6	7 0	30 9	132 3	166 6	205.1
Rhode Island	12 1	21 0	38 5	106 0	145.3	15 7	24 7	46 9	131 0	6 0	183 8	0	1 0	1 1	1 1	1 1	1 9	2 3	2 4	3 7	2 7
South Carolina	13 4	51 3	32 4	167 9	222 5	10 8	8 5	39 5	27.1	10.6	28.0	0	0 2	0 5	0 6	0 4	10 4	75 4	178 6	248 1	279.6
South Dakota	2 9	10 0	20 0	24 2	29 1	4 0	10 3	16 0	15 8	7.9	14.6	0.2	0.5	4 8	10 0	10 8	0 8	2 2	6 9	6 4	7 0
Tennessee	14 7	20 9	49 6	145.3	173 8	18 4	27 5	40 8	69 7	16.4	91.6	0	0	0 5	0 6	0 4	0 6	1 2	27 8	131 7	98 0
Texas	26 1	48 6	84 6	133.9	199 0	33 7	66 1	113 6	156 8	60 5	175 9	0.1	3 1	9 5	24 7	28 3	1 1	2 8	3 5	3 4	4.1
Utah	13 9	33 6	37 9	147 4	81.8	2 1	1 3	1 0	34.2	11 9	21.3	0	0	0	0	0	18 4	34 7	59 6	192.4	95 6
Vermont	11 4	21 8	29 5	51 8	87 2	7 4	9 9	15 0	17 3	7 8	12 6	0.1	0 2	0 1	0 1	0 1	16 3	28 5	35 3	56 4	106.5
Virginia	3 8	9 2	40 5	65.9	165 3	4.2	5 0	15 1	40 2	13 1	158 2	0	0 1	0 2	0 9	5 6	1 2	9 6	44 3	49 9	49 9
Washington	13 7	66 3	57 3	99 9	331 3	5 7	11 0	18 1	36 3	18 3	60.5	0	0 1	0 2	0 6	0 4	17 2	56 1	77 6	114.2	341 4
West Virginia	7 0	14 7	29 8	103 6	202.1	10 1	16 9	34 1	114 1	16.3	196.0	0.6	0 9	3 1	10 1	19 2	0 1	3 6	6.0	6 5	3 5
Wisconsin	23 1	40 7	98 8	252 6	342 4	27 0	37 8	72 1	219 5	79 9	196 1	0.9	2 1	4 5	4 6	4 7	7 8	19.0	68 8	144 1	204.6
Wyoming	1 8	3 2	8 2	20 6	25 9	2 7	4 4	10 1	22 8	6.9	15 8	0 5	0	0 1	1.9	1 6	0.1	0 8	1.3	2 7	2 7
Sections																					
New England	162 8	289 4	514 9	918.1	1,359 2	184 2	280 9	519.4	922 8	140 8	1,177.1	0.7	4 1	7.3	9 7	3 6	62 2	130 7	208 5	344 4	520.9
Middle Atlantic	354 8	765 1	1,378 8	2,371.8	2,865 3	426 7	768 1	1,340 5	2,509 4	327.8	2,749.6	4 2	12.1	26 6	38 1	20 7	136.8	338 6	646 3	863 6	945.2
South Atlantic	62 3	195.3	412 8	2,734 7	1,310 7	71 9	157 3	274 5	550 1	160.5	877 2	0.7	1.4	6 1	15.7	33 4	20 1	136 5	340 5	539 0	748 3
North Central	375 5	805 1	1,580 7	2,868 9	4,404 1	485 6	974 9	1,869.9	3,160 4	746 4	3,555 8	4 6	16 7	48 1	99 2	88 6	49 4	228 3	374 7	760 3	995.6
South Central	82 2	166 0	308.4	608 8	897.3	115 1	229 3	385 2	561.6	263 2	660 4	0.2	3 8	17 8	51 6	48 5	1 9	11 3	46 3	242 3	222 1
Mountain	66.0	151 0	261.1	534 1	577 4	43 5	87 4	108.8	171 5	73.1	163 7	1.2	0 9	2.7	11.4	9 4	60.7	137 0	315 3	684 5	661 6
Pacific	108 7	337.4	678 0	964.8	1,346.9	67 5	195 2	448 2	513.6	69.3	511.7	0 6	16.9	2 5	3.4	3.3	107.4	366.6	539.5	884 3	1,283 7
United States	1,212.2	2,709 2	5,165.4	9,001.9	12,760.9	1,394.4	2,693.3	4,949.8	8,389 4	1,781.1	9,695 5	12.2	55.8	111.0	229.1	207.5	438.5	1,349.1	2,469.2	4,318 4	5,377 4

Central-Station Capacity Increasing Fast

Analysis of Central-Station Developments Indicates a Total Installation of 12,760,900 Kw. on Jan. 1, 1920 — Gain During 1919 Reaches Approximately 9.8 per Cent — Prime Movers in Central Stations Total 17,061,600 Hp.

ONE of the most fundamental axioms in the physical world is that unless the heart of a being is functioning regularly and efficiently that being cannot be considered as a healthy normal organism. This principle is applicable to the industrial world as well as to the physical. The central station is the mother of the electrical industry, and prime movers and generators may well be considered as respectively its lungs and heart, their general health being therefore indicative of the prosperity of the electrical industry as a whole. Continual growth is an essential element of the industry if it is to attain its rightful place in the commercial world. In an endeavor to ascertain the growth of central-station installation in the last twenty years the ELECTRICAL WORLD has compiled the data to be found in the table on page 332. The figures for the years 1902, 1907, 1912 and 1917 are taken from census reports of the United States Census Bureau. The figures for 1920 are for the most part taken from the 1920 edition of the McGraw Central Station Directory and Data Book, which is to be issued this month.

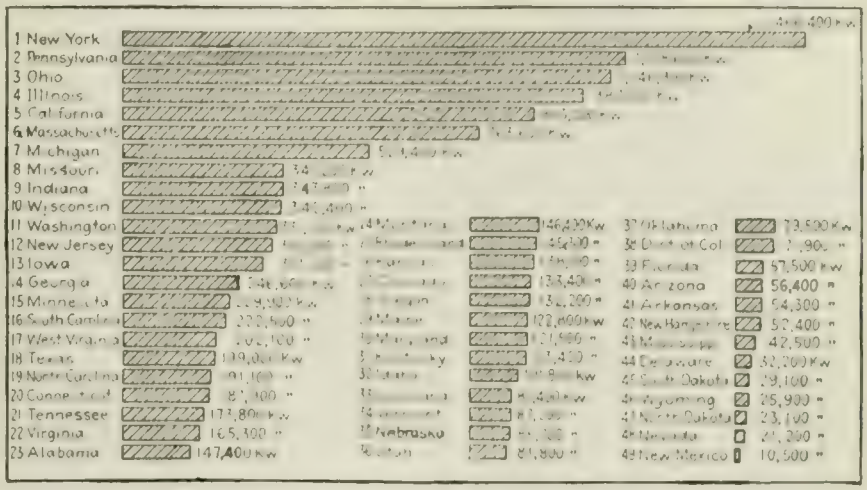


FIG. 1—RELATIVE STANDING OF THE SEVERAL STATES AS TO CENTRAL-STATION INSTALLED CAPACITY

The table is an astonishing revelation of the growth of the central station. The total installed generator capacity of the central stations in 1902 was only 1,212,200 kw., while the total capacity at the opening of 1920 was 12,760,900 kw., an increase in eighteen years of about 953 per cent. The increase in generator installation during the past year was about 1,149,000 kw., or 9.8 per cent. This increase in installed capacity has been very general throughout the country, although the South Atlantic States have far outstripped the others in percentage growth since 1902. This section shows an increase during that period of more than 2,000 per cent, or from 62,300 kw. to 1,310,700 kw., and what is more significant, the new installations in this section during the past three years have been greater than in any other section of the country with the exception of the North Central States. The South Atlantic States present a most thriving field for electrical operations. According to the *Manufacturers' Record*, which collects detail statistics on industrial growth in the South, plans for the first half of 1920 throughout the cotton-growing states involved the installation of 928,619 spindles, indicating an investment of more than $44,707,450, as compared with 769,609 spindles in 1919 with an invest-

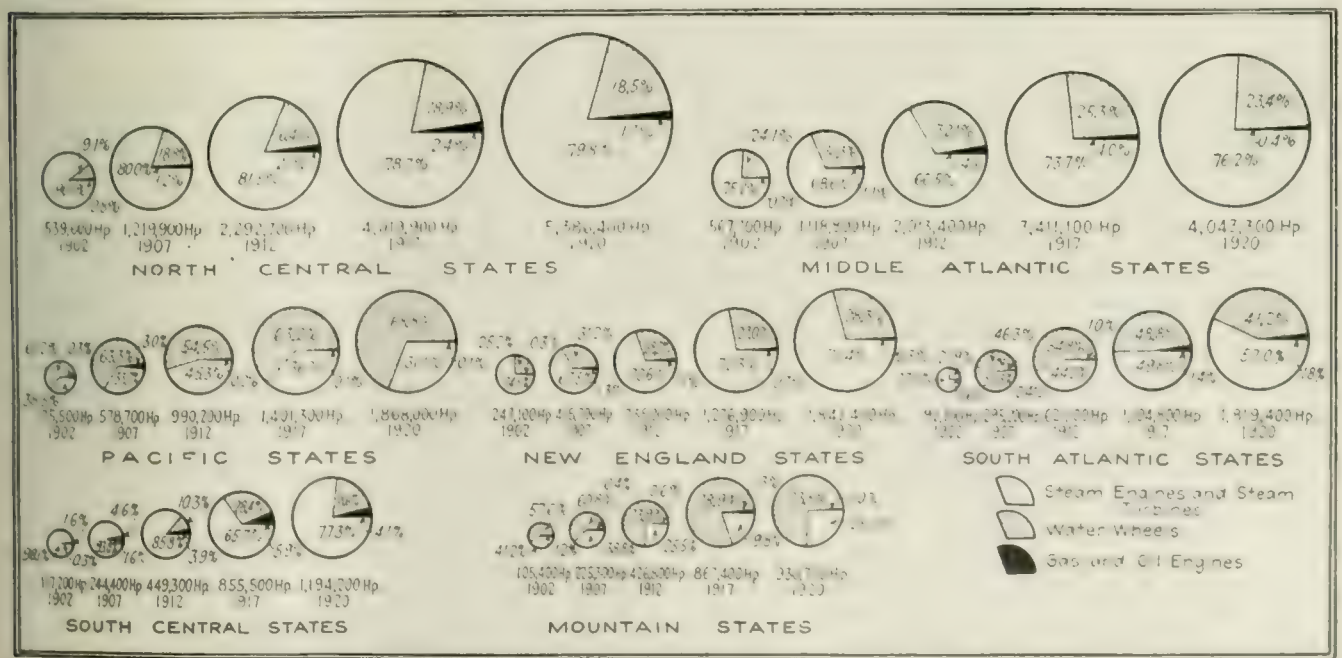


FIG. 2—GROWTH OF THREE TYPES OF PRIME MOVERS IN THE VARIOUS SECTIONS OF THE COUNTRY

ment of about $53,000,000. The looms for the first half of 1920 exceed the total for 1919 by more than 7,000. This equipment of looms called for an investment of $5,520,600, as compared with $3,325,000 for the 11,084 looms reported during all of the year 1919. At least 90 per cent of these textile mills, it is stated, will be electrified.

The North Central States have continuously led the remainder of the country in total installation since 1902. The new central-station installation in this section since 1917 was about 1,535,200 kw., which is about three times more than is reported for any other section of the country. The output of this section for May of this year was 1,148,000,000 kw.-hr. This was considerably larger than the output of any other section.

Fig. 1 indicates the relative standing of the various states as to central-station installed capacity. The leadership of New York has been continual since 1902, but since 1917 Ohio has increased some 620,000 kw., and if the growth rate of 190,000 kw. recorded by Ohio during the past year is maintained, it will be only a short time until that state will have passed New York in this respect.

Fig. 2 indicates the growth of the three types of prime movers in the various sections of the country. The relative extent of adoption of steam and falling water as sources of motive power in the central stations of the country is clearly indicated by the diagrams. Steam-engine and steam-turbine installations predominate everywhere except in the Mountain and Pacific States, where the total installed waterwheel capacity is about two and one-half times the rating of steam-driven movers. Taking the country as a whole, it is intesresting to note that at every period given in the table the total steam-engine and steam-turbine installation is approximately twice the total waterwheel installation. The rapid growth of the electrical industry in the South Atlantic States during the last few years has resulted in the total steam installation passing the waterwheel installations, but this is the only instance in which during the period under consideration the predominant installation has switched from one type to another.

Ohio leads the Union in total steam-engine and steam-turbine installation, but New York with its large developed water powers easily leads in total capacity of prime movers.

California leads in total water-power development by central stations and has continuously led the other commonwealths in this type of motive power throughout the eighteen years indicated.

Gas and oil-engine installations have decreased in most states during the past three years. About the only states in which this type of motive power has increased in recent years are the South Atlantic States and Texas. The total for the country is not large in comparison with either steam or water.

Probably one of the most interesting facts to be deduced from the tabulation is the large increase in installation during the past year despite the high cost of material and scarcity of funds. Nothwithstanding these adverse conditions, the demand for electrical energy has been insistent and the returns to the public utilities have been sufficiently attractive to warrant new installations on a par with those of previous years, if not in excess of them. What the new installations would have been during 1919 under normal financial conditions can only be surmised.

Calculating Transformer Vault Ventilation

Relation Between Cubic Feet of Vault Capacity, Temperature Rise and Transformer Losses—How to Calculate Size of Ventilator Openings and Height of Chimney—Method of Solving a Typical Problem

By W. W. PARKER
Testing Engineer Commonwealth Edison Company

OWING largely to the fact that transformer vaults are not under the constant supervision of an operator, the tendency at first with some central-station companies was to crowd transformers and switching equipment into as small a space as possible, with very little attention to the place so selected. It was quickly found, however, that installations thus created were liable to extreme temperature conditions; in fact, the room temperature in some cases became so high as to make it unsafe to operate transformers with any load at all. In other installations conditions, owing to pure accident, were not so bad. Where the temperature ran too high attempts were made to improve conditions by knocking holes in the walls. Sometimes the improvement was very noticeable, but often it was not.

About January, 1916, a series of tests was begun to determine the relations between the factors entering into vault cooling, such as the relation between installed capacity, or kilowatts lost, and the size of the room, the size of the ventilation openings, the material of which the vault was constructed, the location of the vault with respect to other buildings or other parts of the same building, and the prevailing winds. Tests were made on ten different types of vaults, and all factors were taken into consideration.

Vaults can be cooled by forcing air into them, by removing air from them by means of exhaust fans, by natural draft through the use of a chimney, or by sufficient openings to permit the required amount of cooling air to pass through the rooms. The amount of cooling through walls, windows, etc., while considerable during the winter, is insignificant as a rule during the summer period, when ventilation is extremely important, and is therefore not considered. It would have been extremely difficult under the various test conditions to determine the difference in cooling due to the use of concrete, hollow tile and brick. Corrugated-iron vaults give trouble from moisture condensing and dropping on the buses and insulators. There was only one of these vaults, and it seemed to be extremely cold in winter and unusually hot in summer. No tests were made at this vault because load conditions were very unsteady.

In order to determine the advantages of vaults con-

structed of various materials, it would have been necessary to construct various test vaults where external temperature conditions could have been maintained constant or controlled at will. It is recognized that it is possible to calculate more or less exactly the cooling effect of the floors, ceiling, roof and windows, and thus determine the amount of waste heat to be removed for any predetermined power installation, and then calculate the size of ventilator opening required to permit the requisite amount of heated air to be removed. But such results could only be applied to one particular vault, unless all vaults were standardized as to size, material and architecture. The effects of the material used must be small in comparison to the cooling due to ventilator openings; hence these tests deal only with ventilation.

In determining the ventilation or cooling desired, it is necessary to consider that during the winter period the vaults must not be cooled too much or the oil will congeal in the oil wells and prevent operation of the oil switches. The permissible rise of room temperature above outside air temperature must be such that the transformers under rated load will not have a maximum temperature greater than 85 deg. C. to 90 deg. C., at which point fibrous insulations begin to deteriorate. Thus on hot summer days, when the outside air temperature is around 104 deg. Fahr. or 40 deg. C., the room temperature should not be greater than 50 deg. C. or 10 deg. C. higher than outside air. Generally the extremely high temperature mentioned occurs for only a brief period and a temperature of say 95 deg. Fahr. or 35 deg. C. is as high as need be considered. Such a temperature will permit a room or vault temperature rise of 15 deg. C. without danger of operating the transformers, which usually have a specified rise at full load of less than 40 deg. C. at a dangerous temperature. Such a rise appears to any one entering the vault as excessively high, because the vault feels too hot, yet owing to the purpose of the vault comfort is not a factor to be considered. A 15-deg. rise, however, should be considered the limit. To keep the temperature at this point 75 cu.ft. to 100 cu.ft. of air per minute per kilowatt transformer loss must be removed from the room.

The use of fans either to force air into the room or exhaust it from the room would be an easy and effective way to keep the temperature down, but it would be expensive, and the fans would require frequent attention, thus losing the chief advantage of a vault. So, except in cases where an electrician is present at the plant at all times, a fan arrangement would not be recommended. Of the other two methods, the chimney method is the best and is recommended for practically all vaults. The vault which is isolated or exposed to prevailing winds can be satisfactorily ventilated by permitting air to blow through and remove the heat.

TYPICAL TEST DATA FOR VAULT NO. 1

In the summary are given the results of tests of nine other vaults.

Wall	Material	Area (Sq Ft)	Remarks
East	Brick	160	No windows
West	Brick	160	12 sq ft windows
North	Brick	800	No windows
South	Brick	800	56 sq ft doors 47 sq ft. windows 14 sq ft. ventilator
Roof	8-in. concrete	720	
Floor	8-in. concrete	720	

Vault is in a pocket; tall building is 20 ft. south; railroad tracks elevated at rear and on both sides; windows on west end were at level of tracks.

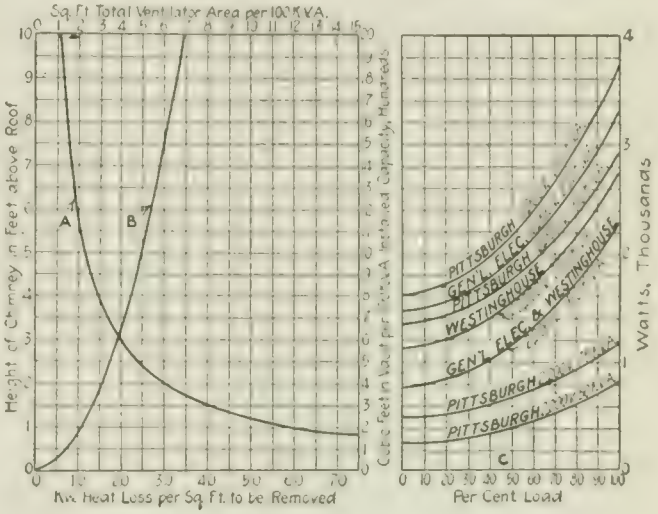
Total radiating surface (floor included)	3,360 sq ft.
Total radiating surface exposed to weather	1,700 sq ft.
Net volume of vault (deducting transformers)	9,220 cu.ft.
Area of ventilator openings (south wall only), 7 sq.ft. at floor level, 7 sq.ft. nr. roof	
Usual vault day load	700 kva.
Number of transformers	Six 200-kva., one 150-kva.
Iron and copper losses (day)	17,500 watts
Iron and copper losses (night)	11,000 watts
Vault capacity	1,350 kva.
Vault capacity per 100-kva. capacity	720 cu ft.
Ventilation area (total) per 100-kva. capacity	1.03 sq ft.
Radiating surface per 100-kva. capacity (total)	250 sq ft.

	Test 1	Test 2	Test 3
Deg. C. rise of vault above outside air	18	11	10
Watts loss per deg. C. rise per cu ft. capacity	0.105	0.106	0.17
Watts loss per deg. C. rise per sq ft. radiating surface	0.29	0.29	0.47

Test 1—Usual load, light cold north wind, sprinkling rain.
Test 2—No load, light northwest wind.
Test 3—Usual load, west wind.

IMPORTANCE OF PREVENTING PRECIPITATION OF MOISTURE

In many cases the switch rooms are constructed independent of the vault, in a separate building of room, or in a space partitioned off from the transformer room.



VENTILATION REQUIREMENTS MAY BE SAFELY CALCULATED FROM THESE CURVES

A—Relation between ventilator area and cubic feet of vault capacity. B—Relation between height of chimney in feet and kw. of heat loss per square foot of chimney area for a 15-deg. rise in the vault. C—Iron and copper loss for various type of transformers. These curves are typical but should be used only for approximations.

In these cases it is important to see that the switch room is well ventilated and is warmed in the winter. The best plan is to have sufficient openings between the switch room and the transformer room to permit a free flow of air between the two rooms. This recommendation does not apply in cases where the air thus circulated would be full of moisture or ammonia or acid fumes. The idea is to keep both transformer vault and switch room at a temperature above the external air temperature. In some cases it will be necessary to resort to artificial heating. It is necessary to have the switch room warm during the cold weather, because if it is not, when the weather turns warm suddenly, as it frequently does, the warm outside air coming into the vault and in contact with the cold switch frames, marble switch panels, switches, etc., precipitates moisture which may cause trouble from leakage.

Trouble is especially liable to result in the case of those vaults where a large amount of coal dust and dirt is present, with which the water mixes, forming a conducting medium. Precipitated moisture alone is not a very good conducting medium, but the effect is to decrease insulation resistance, even on clean insulators, and to increase static discharges. Hence provision must be made to prevent precipitation of moisture.

Ten vaults of different physical characteristics were tested as shown in the typical record of vault No. 1. These data are summarized as to the main points in

the tabulation. It is to be noted principally from this tabulation that for the vaults showing a rise of approximately 15 deg. C. the relation between cubic feet per 100 kva. capacity and the watts loss per degree rise per cubic foot of vault capacity is such that the resulting curve would form a rectangular hyperbola of the form $XY = k$.

It is also found that the points plotted for the relation between the vault capacity per 100 kva. and the ventilator area in square feet per 100 kva. of installed capacity for vaults within the temperature limits fall approximately on a curve whose equation is $XY = 2{,}400$, where X and Y are respectively the variables enumerated above. The results of various tests indicate that the figures plotted on curve A can be safely used in determining the amount of ventilation space required to ventilate any vault so located as to be exposed to some extent at least to the prevailing winds.

SUMMARY OF RESULTS OBTAINED FOR TESTS OF TEN VAULTS OF VARIOUS TYPES OF CONSTRUCTION

Vault No.	Total Kva. in Vault	Cu.Ft. per 100 Kva.	Ventilator Area per 100 Kva.	Load During Test Kva.	Average Increase in Temperature Deg. C.	Watts Loss per Degree Rise per Cu.Ft. Capacity	Watts Loss per Degree per Sq.Ft. Radiation	Maximum Rise for Full Kva. Load in Vault Deg. C.	Remarks
1	1,350	720	1.03	650	18.0	0.105	0.29	26.0	25,100 watts, full-load loss
			1.03	0	11.0	0.106	0.29		
			1.03	600	10.0	0.170	0.47		
2	505	448	2.6	400	9.0	0.323	0.612	....	7,000 watts, full-load loss
			1.69	200	6.0	0.369	0.685		
			1.69	200	9.0	0.246	0.467		
			1.69	430	15.0	0.197	0.374	16.4	Chimney ventilator in roof
	1,600	1,047	1.74	0	8.0	0.093	0.37	....	29,600 watts, full-load loss
			1.74	950	12.0	0.096	0.38		
			1.74	100	9.0	0.083	0.31	19.3	Normal ventilation conditions
			0	850	26.0	0.045	0.18	39.2	Ventilator closed
4	750	2,290	2.85	400	4.5	0.071	0.28		Roof ventilators closed; day load
			2.85	150	12.0	0.034	0.14	21.9	Roof ventilators closed
			3.72	400	5.5	0.100	0.40	7.5	12,800 watts, full-load loss
5	1,350	1,248	2.06	575	10.0	0.100	0.400	14.9	25,100 watts, full-load loss
6	4,575	755	7.89	125	11.0	0.096	0.223	26.7	8,850 watts, full-load loss, subway
7	300	428	0.13	0	13.5	0.099	0.155	36.8	4,670 watts, full-load, loss
8	225	240	1.3	190	23.0	0.256	0.321	25.3	3,500* watts, full-load, loss
			8.0	190	13.5	0.437	0.548	14.8	
9	275	213	0.60	200	33.0	0.187	0.237	39.8	4,360* watts, full load loss
			8.22	200	20.5	0.331	0.382	22.5	
10	470	743	6.9	275	8.0	0.180	0.625	11.4	7,160 watts, full load loss

* Increased ventilation.

METHOD OF SOLVING A TYPICAL PROBLEM

For example, suppose that 600 kva. in transformer capacity is to be installed in a room 12 ft. x 20 ft. x 135 ft. high (3.6 m. x 6.1 m. x 41 m.). Determine the amount of ventilation required to limit the rise to 15 deg. C. under full-load conditions. $12 \times 20 \times 13.5 = 3{,}240$ cu.ft. (91.6 cu.m.) vault capacity. Assume 340 cu.ft. (9.6 cu.m.) to be the displacement of the three 200-kva. transformers. The cubic feet in vault is therefore 2,900 (82 cu.m.); then

$$2{,}900 \div 6 = 483 \text{ cu.ft. (13.7 cu.m.) per 100 kva.}$$

Referring to curve A 483 cu.ft. (13.7 cu.m.) capacity per 100 kva. requires 5 sq.ft. (1.55 sq.m.) ventilation area per 100 kva., or a total of 30.6 sq.ft. (0.34 sq.m.) of ventilator area distributed half at the floor line and the rest at the ceiling line. The upper ventilators must be as nearly as possible at the highest points in the room. A monitor on the roof is an ideal arrangement.

As mentioned before, the best method of ventilation is by means of a chimney as nearly as possible directly over the transformer bank. The curve and formula given herewith take no account of the size of the vault but only of the amount of heat to be removed. Consequently the chimney will probably be larger than necessary for a vault where the cubic feet of space per 100 kva. is large—exceeding 1,000 cu.ft. (28.3 cu.m.) for example—but not too small for extremely small vaults—less than 200 cu.ft. (5.6 cu.m.) per 100 kva. This formula is

$$X = 1.1\sqrt{h},$$

where X is the kw. of heat loss removed per square foot of chimney area of a height "h" and is derived as follows: Allowing 25 per cent for friction losses, the velocity of air through a chimney is:

$$V = 360\sqrt{\frac{h(T_1 - T_2)}{T_2}},$$

where T_1 and T_2 are absolute temperatures of the air at the base of the chimney and the external air respectively. 1,650 cu.ft. (46.7 cu.m.) of air will have its temperature raised 1 deg. C. per minute by 1 kw. Allowing a 20-deg. rise at the base of the chimney, then 82.5 cu.ft. (2.3 cu.m.) of air will be removed for each kw. of loss. For a chimney 1 ft. (0.304 m.) high and 1 sq.ft. (0.093 sq.m.) in cross-section, with an outside temperature of 30 deg. and a rise of 20 deg. at the base, the quantity of air is $360\ 1(20/303) = 92.5$ cu. ft. per minute. One square foot of cross-sectional area will therefore take care of 92.5/82.5 or 1.1 kw. of heat loss. Substituting,

$$\text{kw. loss per square foot} = 1.1\sqrt{h}$$

To apply the above to a vault to determine the ventilation required by means of a 5-ft. (1.5-m.) chimney, assume a vault with three 200-kva. transformers installed. Assuming 98 per cent efficiency, the kw. loss at full load would be 12 kw. Referring to curve B it will be seen that a 5-ft. chimney would remove 2.46 kw. of heat loss per square foot of area. Hence the area of the chimney would need to be 12/2.46, or 4.88 sq.ft. (1.5 sq.m.), or a chimney about 30 in. in diameter. An equivalent area of ventilators would have to be distributed about the four walls at the floor line. In addition to the two curves mentioned, a curve is included which will give the iron and copper losses of the various transformers used in the vaults for any percentage of load.

It is believed that the problem of determining the proper amount of ventilation for a transformer vault can be quickly solved by the use of the curves. It is probable also that these figures could be successfully applied to the ventilation of substations. Vaults of the subway or manhole type should, if possible, be ventilated by means of a chimney.

Readers' Views and Comments

Canadian Water Powers

To the Editor of the ELECTRICAL WORLD:

SIR: I note in your July 3 number a map showing the water powers of North America on which Canada is credited with an installed capacity of less than 1,800,000 hp. According to recent official returns, the total water power installation in Canada, Jan. 1, 1920, was 2,417,896 hp.

JAMES WHITE,
Assistant to Chairman.

Commission of Conservation, Ottawa, Canada.

The International Electrotechnical Commission

To the Editor of the ELECTRICAL WORLD:

SIR: When the International Electrotechnical Commission organized in London in 1906 by delegates from most of the civilized countries of the world I had the honor of being a guest in the home of Colonel Crompton, the father of international standardization, which he first proposed at the St. Louis Electrical Congress in 1904. Lord Kelvin, Sir William Preece, Ayrton, Perry and Sylvanus Thompson, also Mr. Herdt, the Canadian delegate, were all friends of mine, I am proud to say. So that, being myself descended from American ancestors of English stock, British and American co-operation was assured. But the French, Belgian, Swiss, Italian, Spanish, German and Austrian representatives were inclined to hold aloof. This was very natural when it is remembered that this organizing meeting was largely arranged by English and Americans and was held in London. Any such attitude on the part of the continental Europeans, however natural, would undoubtedly have caused a deadlock, or at best little would have been accomplished, if C. O. Mailloux, the other American delegate, had not possessed very thorough knowledge of the subject and of the various national temperaments, which in an international conference are often more important than facts. Not only did he understand the points of view of the different nationalities but he could make explanations to and convince any of the foreigners in the foreigner's own native language, were he Frenchman, Belgian, Swiss, Italian, Spaniard, German or Austrian. Such a combination of knowledge and talent is most remarkable and practically irresistible. Hence the first meeting in 1906 was a success and a very satisfactory organization was effected, as is proved by the fact that the commission has functioned very well ever since then.

Mr. Mailloux not only acted as interpreter between the English-speaking delegates and the continental Europeans but was also able to serve in that useful capacity between the different non-English-speaking nationalities. In other words, he was a universal interpreter. Moreover, he could correctly translate and convey not only the words but the ideas and principles involved, and very good principles, ethical as well as technical.

It is most appropriate, therefore, that Mr. Mailloux should now be president not only of the American committee but of the entire International Electrotechnical Commission. Practically all countries of any importance are represented on the commission by duly appointed representatives, with an honorary secretary, who is, of course, Colonel Crompton, and a very efficient general secretary, C. Le Maistre, with a permanent central office in London. No one ever deserved such an honor more surely than Mr. Mailloux deserves to be president of the I. E. C.

My object in writing this letter is not only to record an interesting and significant event in electrotechnology but it is also to give some measure of recognition to the invaluable services of Mr. Mailloux in starting and maintaining the activities of the I. E. C.—really the first important international body to carry into effect engineering co-operation and uniformity as to terms, standards, methods and similar particulars in the various countries.

Moreover, in an article which appeared in your issue of July 10 more credit was given to me than I deserve, especially in this matter of international standardization, and Mr. Mailloux's name and the great credit due to him were not mentioned. As I had nothing to do with publishing the article referred to I cannot be accused of stealing Mr. Mailloux's thunder, but I do not want to be guilty of even shunting a portion of it.

New York City. FRANCIS B. CROCKER.

The Value of Rainfall Records

To the Editor of the ELECTRICAL WORLD:

SIR: Nearly every public utility company which operates hydro-electric stations is keeping some rainfall records for its own particular benefit. Many are also keeping records of flow of various streams for present and future use. Some of these records are being kept in co-operation with the United States Weather Bureau and the United States Geological Survey, the State Engineer's department or the Conservation Commission. All of them would be of much greater value if they could be brought together and published by one central authority in a publication covering the entire state.

In the present state of things there is no particular advantage in holding these records under cover, as it is possible with the accumulation of data now available to make a fairly close estimate of rainfall and run-off in a particular locality. At the present time the New York State section of the United States Weather Bureau is publishing rainfall records from approximately eighty stations scattered throughout the state and also temperature records from the great majority of these stations. There are undoubtedly half as many more rainfall records being kept by private persons or interests throughout the state which would add greatly to the value of the data, if reported with the eighty-odd records now being published by the Weather Bureau. It would seem as if the various persons or companies keeping these records might well arrange to keep and report them in co-operation with the organizations mentioned and thus increase the value of the service to themselves as well as to others. It is probably through a lack of appreciation of the benefit that would thus be insured that many of these records are not so kept and published.

BYRON E. WHITE,
Utica, N. Y. Engineer.

Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Raising Poles with Insulators Attached Saves Time

BY COMPLETELY assembling the cross-arms and insulators on transmission poles and towers before they are raised into position considerable time is saved in the line construction operations of the Utah Power & Light Company. This assembling is done while the



TIME SAVED BY ASSEMBLING CROSS-ARMS AND INSULATORS BEFORE RAISING POLE

structure is on the ground, and then the entire structure with fittings is erected as a unit. This practice applies to all types of structures—single-pole, two-pole, A-frame or steel towers. The photograph shows the method of erecting a single-pole 44-kv. structure with insulators attached.

The saving in time results from the fact that it is much easier to handle the insulators while standing on the ground than it is at the top of a pole or tower. Moreover, the time and trouble of lifting up cross-arms, insulators, fittings and tools is eliminated.

PAUL P. ASHWORTH.

Utah Power & Light Company,
Salt Lake City, Utah.

Comparison of First Cost of Fuel Oil and Coal-Burning Plants

IN COMPARING the first cost of a coal-burning plant with that of an oil-burning plant, the cost of stokers and ash-handling equipment must be balanced against the cost of oil-storage tanks. The use of fuel oil avoids the necessity of the purchase of mechanical stokers and auxiliary equipment, which might range in cost from $8 to $14 per rated boiler horsepower. The fuel oil also avoids the necessity of equipment for handling coal and ashes, which would cost about $8 to $10 per rated horsepower. This would make a total of about $20 per horsepower.

As an offset to these items fuel oil requires storage tanks, oil pumps and heaters, which will cost anywhere from $10 to $30 per horsepower, depending upon the amount of reserve oil which is to be kept in storage.

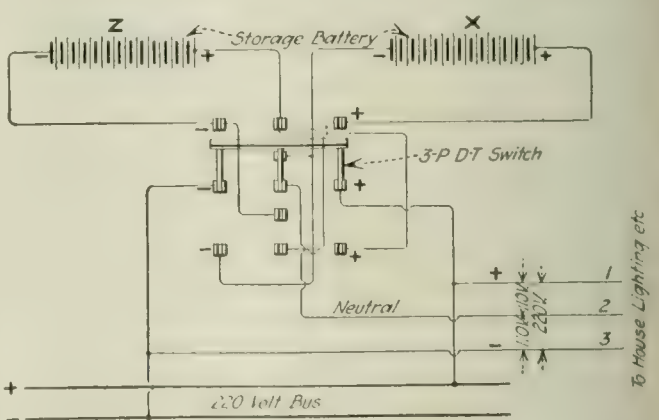
For a central station of 5,000 hp. capacity the complete oil-burning equipment with storage tanks for five months' supply of oil has been estimated at $250,000. This would be at the rate of $50 per horsepower. An industrial plant could, of course, get along safely with much less than a five months' supply of oil on hand, but in almost any plant there will be little if any decrease in first cost in favor of fuel oil.

F. H. DANIELS,
Sanford Riley Stoker Company, General Manager.
Worcester, Mass.

Equalizing Battery Discharge on Unbalanced Load

TO OBTAIN even discharge on both halves of a battery feeding an unbalanced three-wire system, a three-pole, double-throw switch with two extra jaws on the middle blade is employed by an Eastern central-station company. This battery feeds a 220-volt bus used in emergency to supply excitation for synchronous condensers, etc., and the three-wire, 220/110-volt bus used to supply house lighting and pilot lights and to operate remote-control circuits, etc. The load on this latter bus is unequally divided on each side of the neutral. This necessitated installing the switch so that the heavy load may be carried alternately by different halves of the battery.

As can be seen from the diagram, the polarity of either of these circuits is the same for either position of the double-throw switch. In the "up" position of



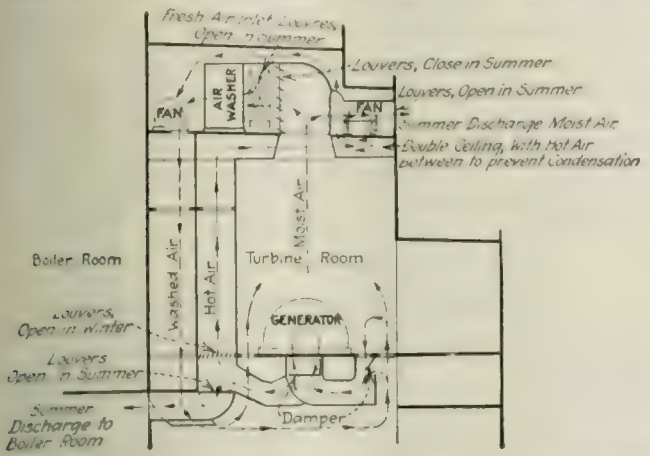
EXTRA JAWS ON THREE-POLE SWITCH INSURE EVEN BATTERY DISCHARGE TO UNBALANCED LOAD

the switch, however, the half of the battery (*X*) is across 1 and 2 of the three-wire bus, and in the "down" position it is across 2 and 3. By reversing this switch once a day it is possible to obtain a perfectly even discharge of the whole battery.

Ampere, N. J. EUSTACE C. SOARES.

Ventilating System Which Prevents Condensation in Turbine Room

TO PREVENT the condensation of escaped steam from the No. 10 unit in the Delray plant of the Detroit Edison Company a double ceiling has been built into which hot air is forced. Ordinarily in a turbine room the steam which escapes from valves and glands of the turbine rises and spreads through the room, condensing on the surface of the windows and ceiling, from which it falls back through the turbine room. By means of the system installed at the Delray plant the ceiling and the upper part of the room are heated so that the moisture in the air will not be condensed but



WARM AIR CIRCULATED WITHIN THE DOUBLE CEILING OF TURBINE ROOM PREVENTS PRECIPITATION OF MOISTURE

will be drawn out through the opening in the ceiling by the ventilating fans. The other objects of this ventilating system are: (1) To cool the generator with washed air; (2) to collect and remove water vapor escaping from the turbine; (3) to furnish hot air to the stokers in summer; (4) to heat the turbine and condenser rooms in winter and cool them with washed air in summer.

The operation of the system in the summer, as may be seen from the accompanying drawing, is as follows: A ventilating fan above the room sends down washed air below the floor of the room, part of the air passing through the generator and from there to the stokers in the boiler room and part passing up into the generator room and through the opening in the ceiling, where it is discharged by the exhaust fan (at the right in the drawing) to the outside of the building. In the summer the ventilating fan draws air through the air washer from the outside through the fresh-air inlet near the top of the building. This cool air keeps the generator and the generator room from becoming too warm. In the winter the washed air is sent through the generator and turbine rooms as before, but the air which has passed through the generator now passes upward through a pipe instead of into the boiler room. This pipe leads to the interior of the double ceiling, thus warming the ceiling and preventing the precipitation of moisture. From the ceiling it passes back into the ventilating fan. The moist air from the turbine room, instead of passing into the open air as in summer, is again drawn in through the air washer and sent back through the ventilating fan. The fresh-air inlet at the top of the building is closed in winter to prevent the entrance of cool air. By means of the louvers and dampers shown the system can be regulated for any condition of winter or summer temperature.

A somewhat similar system has been designed for the Marysville station of this company. This differs from the Delray system principally in the substitution of a curtain of hot air, which is blown across the ceiling, in place of the double ceiling with the air space as shown in the drawing

SABIN CROCKER.
Detroit Edison Company,
Detroit, Mich.

Thickness of Cable Insulation Differs Widely with Different Companies

THICKNESS of insulation of cables for different voltages as installed by a number of the larger operating companies is shown in the accompanying table. This table shows data on three-conductor and four-conductor cable for 750 volts to 26,400 volts and on single-conductor cable from 250 volts to 13,000 volts. The data include the size of conductors used and the insulation thickness for the conductor wrapping and the outside belt insulation. These figures represent the most recent practices of the respective companies. It will be noted that in some cases the thickness of outer belting has been reduced until it is possible to transmit peak loads as high as 10,000 kw. over one cable with an over-all diameter not exceeding 3 in. (7.5 cm.).

These data were compiled for the recent Pasadena convention of the N. E. L. A. by the committee on underground systems.

INSULATION THICKNESSES AND OPERATING VOLTAGES OF CABLES OF VARIOUS COMPANIES

THREE-CONDUCTOR AND FOUR-CONDUCTOR CABLES

Name of Company	Operating Voltage	Size A.W.G. or C.M.	Insulation, 64ths Inch: Conductor	Belt
Milwaukee	26,400	No. 00	18	18
Baltimore	26,000	No. 0000	18	10
Boston	25,000		18	12
N. Y. Edison	25,000	350,000	17	8
Detroit	24,000	No. 00	18	14
Toledo	23,000	300,000	18	14
Cleveland	22,000	No. 2	20	20
Chicago	22,000	350,000	19	7
Pittsburgh	22,000	250,000	18	10
Los Angeles	20,000	No. 0000	16	16
N. Y. Edison	15,000	350,000	14	14
San Francisco	15,000	No. 0000	13	13
Milwaukee	13,200		14	14
Louisville	13,200	250,000	14	14
Toledo	13,200	133,000	12	10
Baltimore	13,000	No. 0000	13	4
Chicago	12,000	500,000	13	6
Los Angeles	12,000	No. 0000	14	14
Cleveland	11,000	No. 0000	16	4
Pittsburgh	11,000	No. 0000	14	12
N. Y. Edison	8,000	350,000	10	10
Louisville	7,500	No. 8	8	8
Baltimore	6,600	No. 0000	10	8
Toledo	6,600	250,000	8	8
San Francisco	5,000	No. 0000	8	8
Detroit	4,800	200,000	10	10
Cleveland	4,600	No. 0000	8	8
Louisville	4,000	250,000	10	10
Baltimore	4,000	No. 0	8	6
Chicago	4,000	No. 0	6	5
Louisville	4,000	No. 0000	6	6
Los Angeles	2,500	No. 0000	6	6
San Francisco	2,500	No. 0000	6	6
Cleveland	2,300	No. 0	6	4
Pittsburgh	2,300	No. 0000	8	6
San Francisco	750	No. 0000	4	4
SINGLE-CONDUCTOR CABLES				
Baltimore	13,000	1,250,000	20	
San Francisco	750	1,500,000	8	
Los Angeles	600	1,000,000	6	
Toledo	600	1,000,000	10	
Louisville	600	1,000,000	6	
Chicago	300	No. 0000 to 1,500,000	8	
N. Y. Edison	300	1,000,000	10	
Cleveland	300	1,000,000	8	
Detroit	250	1,000,000	8	

Industrial Applications

The Economical Utilization of Electrical Energy
in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

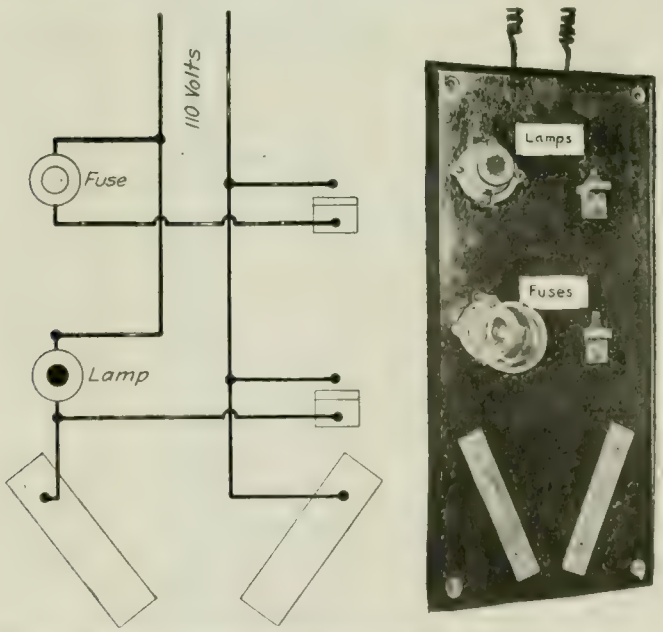
The Best Way to "Take Speed"

THE use of a speed indicator for counting the revolutions of a shaft in a given time is very simple, but the best results are seldom obtained. One man should hold both the watch and the speed indicators; then there will be no time lag at the start and finish. Since he can read only one thing at a time, let it be the watch. He will not need to look at the indicator while taking speed as he can count the hundreds of revolutions as the little knob on the disk passes under his middle finger. By attaching a large rubber tip on the end of the counter a grip is provided for the thumb and forefinger which permits of accurate releasing and stopping of the indicator as the second hand of the watch touches the dot. The number of revolutions above the last hundred are read from the disk after the indicator has been withdrawn from the shaft.

Pittsburgh, Pa. D. W. BLAKESLEE.

Board for Quick Tests of Lamps and Fuses

FOR quickly testing lamps and fuses, the test board shown in the accompanying illustrations has proved very useful. The lamps, plug fuses and cartridge fuses are tested by simply touching them for



BOARD FOR QUICKLY TESTING LAMPS, PLUG FUSES AND CARTRIDGE FUSES

a second to the proper contact points. The contacts for lamps and plug fuses consist of a brass flat-head screw for one terminal and a ledge made of scrap brass for the other. When the screw terminal of a lamp is laid on the brass ledge the center terminal of the lamp strikes on the flat-head screw. A fuse is connected in series with the contacts to prevent damage by a short-circuited lamp. The contacts for testing plug fuses are similar to those for testing lamps.

For the cartridge fuses two copper strips are mounted on the board at such an angle to each other that all sizes of cartridge fuses in use may be tested by simply placing them across the strips. A lamp is connected between the line and both sets of fuse-testing contacts.

F. KRUG,
Acting Electrical Superintendent.
New York & Honduras Rosario Mining Company,
San Juancito, Honduras, C. A.

Reducing 1,430 Hp. in Motors to 1,250 Hp. Saves $1,000 a Year

A SAVING of $1,000 per year by reducing the connected load of a mill from 1,429.5 hp. in motors to 1,252 hp. is an example of the benefits which have resulted to industrial plants from an investigation that has been carried on by the New England Power Company among its customers. The average load on the motors was 789 hp. This change raised the load on each motor so that the average efficiency was increased from 87 per cent to 90 per cent and the power factor was raised from 76.5 per cent to 88.5 per cent, resulting in a saving in motor losses of $1,000 per year as stated. Raising the power factor was the primary object of the company in making these investigations. Overmotoring was shown to be chief cause of low power factor. The investigation showed that the power factors in eight classes of installation varied from 71 per cent lagging to 95 per cent leading as the accompanying table shows.

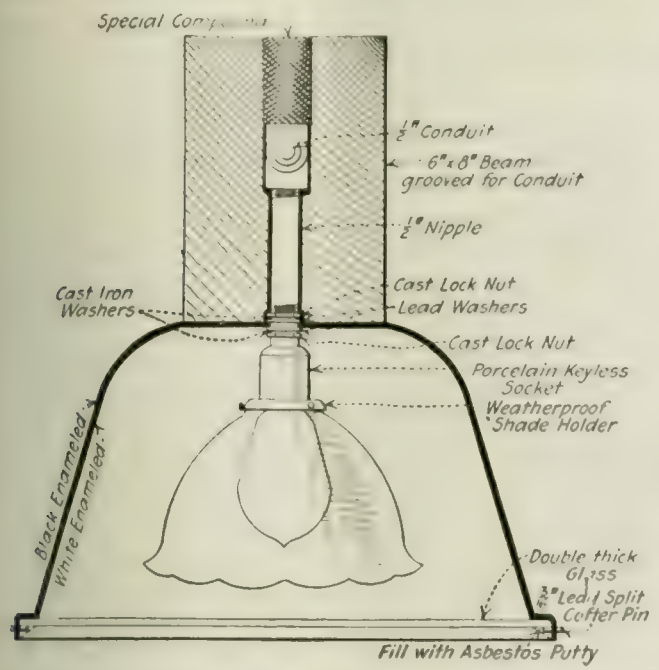
POWER FACTOR OF VARIOUS CLASSES OF INDUSTRIES

Classification	Connected Load, Kw.	Power Factor
Textile manufacturing	4,480	0.78 lagging
Paper manufacturing	3,670	0.71 lagging
Wire manufacturing	1,850	0.76 lagging
Small central stations supplied	9,860	0.72 lagging
Machine shops	1,050	0.73 lagging
Metal trades	3,560	0.90 lagging
Street railways	350	0.95 leading
Miscellaneous	3,915	0.86 lagging

The most flagrant offenders were mills operating a large number of induction motors, particularly at partial ratings. As a result of the power-factor survey many changes were made in the motor installation. In one mill purchasing 1,400 kw. it was found that two 400-hp. synchronous motors could be substituted for induction motors. This change will increase the power factor of the mill from 71 to 85 per cent, and this reduction will decrease the feeder and transformer losses enough to cover the additional cost of the synchronous motors in about one year.

Acid-proof Construction for Conduit and Lamps

FOR protecting conduit runs and lamps against acid fumes in the plants of du Pont de Nemours & Company the construction shown in the accompanying drawings has proved very efficacious. The conduit is pro-



ACID-PROOF REFLECTOR AND METHOD OF PROTECTING CONDUIT USED IN ACID PLANTS

tected by running in a groove cut in the 6-in. x 8-in. (15-cm. x 20-cm.) wooden beam. After the conduit is laid this 4.2-in. (11-cm.) groove is filled with a special compound called rubrax. The whole of the exposed surface of the beam is then given a coating of the rubrax. The lamps are inclosed in a heavily enameled reflector, which is closed at the bottom by a double-thick clear glass. This glass is held in the reflector by means of lead split cotter pins. The cracks between the glass and the rim of the reflector are closed by a fillet of asbestos putty. A weatherproof shade holder and a porcelain keyless socket are employed. For fastening the reflector on to the nipple leading from the conduit cast-iron lock-nuts and washers, in conjunction with lead washers, are used. W. B. TODD.

E. I. du Pont de Nemours & Company,
Wilmington, Del.

Rewinding a 220-Volt Induction Motor for 550 Volts

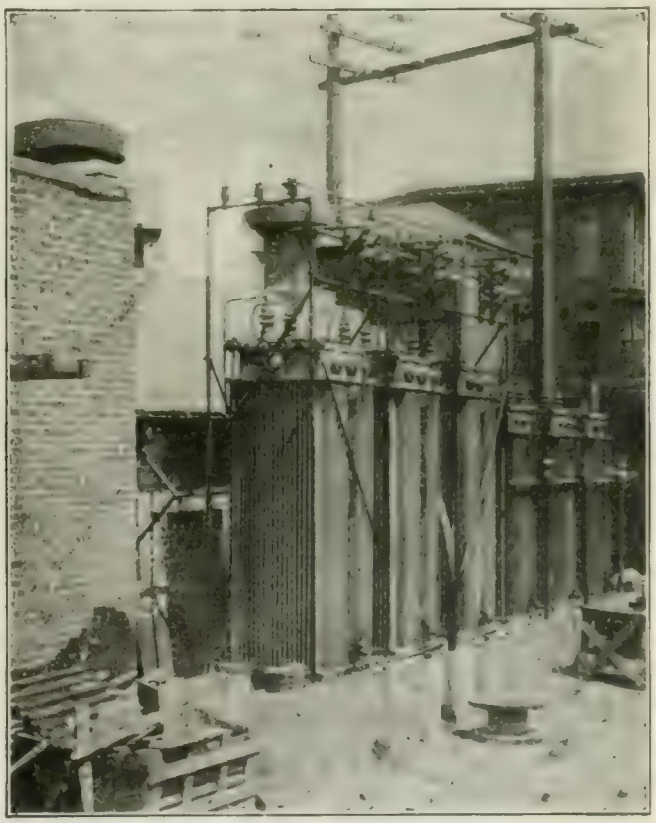
A 220-VOLT induction motor was recently sent into a repair shop in an Eastern city to be changed for operation at 550 volts. This motor, which was a 25-hp., two-phase, 60-cycle, eight-pole machine, was connected two-parallel, but if it were reconnected in series it would be good for only 440 volts, which is 25 per cent less than the required voltage, and therefore the motor had to be rewound.

The 220-volt two-parallel winding, which may be considered as a 440-volt series winding, consisted of ninety-six coils of six turns of 0.152-in. x 0.091-in. double-cotton-covered ribbon wire, wound flat with a coil pitch of one-and-ten. Considering this as a 440-volt winding, the turns per coil required for the 550-volt winding would be equal to $6 \times 550 \div 440 = 7\frac{1}{2}$ turns. If a seven-turn coil with a pitch of one-and-ten were used, the horsepower would be decreased, and therefore, in rewinding the coil pitch was increased to one-and-twelve. The one-and-ten pitch cord factor was 0.9239, while the one-and-twelve cord factor was 0.9914, and a seven-turn coil with this cord factor is equivalent to a seven-and-a-half turn coil with the original cord factor, as shown by the equation $7(0.9914 \div 0.9239) = 7.5$. The cross-section of the copper wire was decreased 25 per cent by decreasing its thickness from 0.091 in. to 0.068 in. The motor was then rewound for 550 volts with ninety-six coils, consisting of seven turns of 0.152-in. x 0.068-in. double-cotton-covered ribbon wire per coil wound flat with a pitch of one-and-twelve, and the coils were connected in series. This winding proved satisfactory under loads which it had been carrying for some time.

Bronx, N. Y. C. A. JOHNSON.

Compact Industrial Substation in Narrow Space

AS ONLY 20-ft. x 4-ft. (6-m. x 1.2-m.) space was available for a substation of a Massachusetts industrial plant, the six transformers were mounted as shown in the illustration in a single row on concrete piers elevated about 15 in. (38 cm.) above the ground. Primary connections to one bank are made to insulated buses at the top, carried on pipe framing. The other bank is



SIX TRANSFORMERS IN A ROW IN NARROW OUTDOOR SUBSTATION

fed through underground cables terminating in potheads at the transformers. The secondary leads are run into the brick building at the rear, which contains metering and switching equipment controlling various industrial-plant feeders in the district served.

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

Central Station and Contractors Share Soliciting Expense

AT THE beginning of the present year the new-business department of the Buckeye Power Company at East Liverpool, Ohio, set out to increase the residential lighting load in that city. Owing to the high cost of building material there were few newly built houses to be connected, and most of the department's efforts were directed toward wiring old houses. The results for the first three months of the present year show a net gain of 214 residential consumers against a total of 334 for the whole of 1919.

The campaign is carried on in co-operation with the contractor-dealers. By an agreement the company pays one-half of the solicitors' salary plus a commission on the first month's light bill, the contractor paying the balance of the salary plus a commission on total new business secured by the solicitor. This plan is proving highly satisfactory, and the overhead cost of soliciting has been cut in two.

Charges for Reconnection of Service

CHARGES covering the cost of connecting service for a short period of time, moving meter to a new location and reconnecting service after disconnection for non-payment are made by the Helena (Ark.) Gas & Electric Company. Regulations governing these charges, which have been approved by the Public Utility Commission of the State, are printed on the reverse side of receipts for meter deposits and are a part of the service application signed by the customers. The provisions read as follows:

In consideration of the application on reverse side hereof, I agree:

1. In case I vacate said premises without written notice to the Helena Gas & Electric Company, said deposit shall be forfeited in full.

2. In case I discontinue said service within one year, $2 of said deposit shall be forfeited to pay expenses incidental to rendering service for a short period of time.

3. In case meter is requested to be moved to another location within one year, to pay $2 for said change before the meter is moved.

4. In case meter is disconnected for non-payment of bills, to pay $2 for the cost of reconnecting before service is again rendered.

5. In case of failure to pay any indebtedness when due, this deposit shall be used forthwith, and without notice, to pay said indebtedness, in full or in part, and that service may be discontinued until the amount forfeited is repaid to the company.

6. It is expressly understood that the amount of service rendered shall be determined by meter, ownership of which is retained by the company; and further, that the company does not guarantee a constant supply of gas or electricity and shall not be held liable for damages caused by any interruption of variations in said service.

7. It is further understood that this receipt must be returned for cancellation upon discontinunce of service and demand for refund of the deposit covered by this receipt; also that this receipt is not negotiable or transferable.

Canvass of Customers Shows Company's Service 98.9 per Cent Perfect

TO CHECK up on the condition of its service and correct any causes for complaint, the Northern Connecticut Light & Power Company, Thompsonville, Conn., made a canvass of its customers by means of return postal cards. On one-half of the card the words "For the Good of the Service" explained the company's object. Customers were asked to fill out the return card advising the company of any complaint concerning the service or dissatisfaction in their relations with the company. The statement to customers and return card read as follows:

FOR THE GOOD OF THE SERVICE

To our Patrons:

Along with all public utilities we lost the services of many of our old employees during the war and we were obliged to carry on our business with a material shortage in our forces.

Opportunities for employment in other branches at unusually high wages since the close of the war have also made many changes in our employees.

Probably the efficiency of our service has thereby been affected, and it is our aim to correct this condition in every way.

As a guide in this matter and to help us give you the best service possible, we ask you to return to us answers to the questions on attached card, also any suggestion that you have to offer.

We solicit your co-operation and would appreciate any complaint that you may have not covered by these questions, as it is our desire to render service as nearly perfect as skill and constant attention can make it.

Yours respectfully,

WALTER P. SCHWABE,
Vice-president and General Manager.
Northern Connecticut Light & Power Co.

RETURN CARD

Is your electric service satisfactory?

.....

Is your gas service satisfactory?

.....

Is the treatment received at the hands of our employees satisfactory?

.....

Have you any complaint about the attention given you by any particular department?

.....

If your answer to any of the above is "No," please state your complaint in detail and also any suggestion that you have that would correct this matter.

DATE..... NAME.....
ADDRESS.....
.....

Commenting on the results, Walter P. Schwabe, general manager of the company, states that 3,400 cards were mailed to cover approximately 5,000 gas and electric customers. The number of cards returned stating that service was satisfactory in every respect was 318; the number returned with complaints, 60; showing that only 1.1 per cent of the customers had any complaint to make and that the company was giving 98.9 per cent perfect service.

Power-Factor Penalty Applied to Kilowatt-Hours Consumed

POWER contracts of the properties operated by the American Gas & Electric Company for demands of more than 100 kva. carry a power-factor clause whereby a percentage of correction for power factors above or below 85 is made on the kilowatt-hours used. This correction is appplied by means of a table of constants based on the average power factor for the month. The power-factor provision reads as follows:

The rates in this tariff are based upon the maintenance by the consumer of an average power factor of 85 per cent for each month as shown by integrating instruments. When the average monthly power factor is above or below 85 per cent, the kilowatt-hours as metered will, for billing purposes, be multiplied by the following constants:

Effective Monthly Power Factor	Constant	Effective Monthly Power Factor	Constant
1.00	0.951	0.70	1.0835
0.95	0.965	0.65	1.1255
0.90	0.981	0.60	1.1785
0.85	1.000	0.55	1.2455
0.80	1.023	0.50	1.3335
0.75	1.050		

Constants for other than the effective power factors given in the table are determined from the same formula used to determine the given constants.

Thus for an average power factor of 85, which is taken as standard, the customer will be billed for the amount of energy consumed as shown by the kilowatt-hour meter. But when the power factor is below or above 85 the metered kilowatt-hours are multiplied by the constant corresponding to the power factor. For example, suppose that the true energy used during the month was 100,000 kw-hr. and an average power factor of 75 was maintained. Multiplying 100,000 kw.-hr. by 1.050, the constant for 75 per cent power factor gives 105,000 kw.-hr. for which the customer would be billed. Had an average power factor of 95 been maintained, the constant 0.965 would have been used and the bill rendered for 96,500 kw.-hr.

In this manner the customer is penalized by the correction of the energy consumption to include a portion of the reactive volt-ampere-hours when the power factor is below 85 and compensated for maintaining a power factor above that point. This method has the advantage of being applied directly to the metered kilowatt-hours, where it belongs, and does not take the form of a discount or addition to the bill after the demand and energy changes have been computed regardless of power factor.

Industrial Lighting Offers Increased Revenue for Central Stations

CENTRAL stations as a rule have been very lax in acting in an advisory capacity to their customers on matters pertaining to industrial illumination, the manufacturers looking upon them merely as sources of power supply. While light is indispensable and at the same time one of the cheapest commodities on the market today, factories are frequently underlighted. Higher intensity of illumination has effected marked increases in factory production and the additional lighting uses more energy. What this means to the central station supplying power to a large industrial load can be appreciated from the fact that heretofore mills and factories using one-half watt or less per square foot of floor surface are now changing over to an illumination intensity of 1.5 watts to 2 watts per square foot—an increase of from 200 to 300 per cent.

It may seem that the companies furnishing electrical supplies and power are pushing the idea of high-intensity illumination for purely selfish motives; but this is far from being the case. Good lighting is about the cheapest thing in plant operations, as the following figures on a normal cost will show.

Cost of lamp (list, subject to discount)	$1.10
Cost of enameled-steel reflector (list, subject to discount)	3.60
Estimated cost of wiring per outlet	6.00
Total first cost	$10.70
Interest on investment at 6 per cent	$0.64
Depreciation on reflector and wiring at 12½ per cent	1.20
Power, at 5 cents per kilowatt hour	12.00
Cleaning, at 3 cents per cleaning, twice a month	.72
Renewal of lamp, 2.4 per year, at $1.10	2.64
Total	$17.20
Wages for eight hours per day, 300 days, at 75 cents per hour	$1,800.00
Ratio of cost of lighting per man to wages	$17.20-1,800.00
Per cent	0.955

This table is worked up on the assumption that a 100-watt tungsten lamp, lighting 100 sq.ft., is furnished for each workman and that it burns eight hours per day for 300 days.

These figures, which are based on assumed conditions less favorable than ordinarily found, show that satisfactory lighting furnished continuously throughout the entire working day costs less than 1 per cent of a man's wages, and that if he saves five minutes' time per day owing to correct lighting the entire operating cost of the system is paid for.

Cafeteria for Company Employees

IN ORDER that its employees may obtain satisfactory lunches at a low cost, the Southern California Edison Company of Los Angeles has installed a cafeteria-type lunch room for the exclusive use of male employees. The



EMPLOYEES' LUNCHROOM, OPENED JULY 13

scale of prices for food is very low, as part of the cost is paid by the company. The arrangement provides a very good, inexpensive lunch and as it affords quick service the employees have a considerable part of their lunch hour to themselves for shopping and recreation.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Lamps and Lighting

The Lighting of Piers and Warehouses. — A. L. POWELL and R. E. HARRINGTON.—The importance of adequate lighting of piers and warehouses in connection with the movement of manufacturers' products is dealt with in this article. The speeding up of shipment of goods by improved lighting is accomplished in the following ways: (1) Greater actual speed of trucking, etc.; (2) markings more easily read; (3) fewer mis-sent shipments occur; (4) reduction of spoilage and thefts; (5) improved relations with the public. Examples of good lighting of piers and warehouses also appear in this article.—*Bulletin L. D. 111, Edison Lamp Works,* May, 1920.

Light and Safety.—A. B. ODAY.—Attention is called to the large number of fatal accidents which occur in industrial plants or are due to automobiles. It is pointed out that many of these accidents might be avoided by the use of adequate illumination.—*Bulletin L. D. 112, Edison Lamp Works,* May, 1920.

Edison Miniature Lamps, Standard Versus Special.—L. C. PORTER.—A great fund of data and experience has been accumulated regarding miniature lamps for such purposes as automobile lighting, flashlamp and hand-lantern service, decorative lighting, miners' safety lamps, etc. For such service the best lamp has been worked out and standardized. These lamps are being manufactured in quantity, and they are sold at a lower price and will give more uniform performance than special lamps. It is urged, therefore, that it is advantageous to use standard lamps wherever possible. —*Bulletin L. D.* 113, *Edison Lamp Works,* May, 1920

Generation, Transmission and Distribution

A New Water-Turbine Design.—REINDL.—Systematic researches have led Dr. Kaplan to design a new type of water turbine, remarkable because of the high values of specific velocity which may be reached while maintaining good efficiency. A model turbine of 26 kw. has been tested and gave a hydraulic efficiency of 86 per cent at a specific velocity of 667 r.p.m. Even at a specific velocity as high as 1,000 r.p.m. the efficiency was about 75 per cent. The efficiency was found to remain almost constant from full to less than half load. The Kaplan turbine, it is claimed, is simple and cheap in construction, and its high velocity permits the use of small and cheap high-speed generators. The cost per kilowatt of a Kaplan turbo-generator therefore should be considerably lower than that of a corresponding set with a Francis turbine.—*Elektrotechnische Zeitschrift,* Feb. 19, 1920.

Losses in High-Tension Cables.— RENNESSON. — A special mirror wattmeter, with a silver-strip suspended moving coil and a total of 366,666 ohms in the pressure circuit, enabled the author to make rather accurate determinations of the losses at 50 cycles in a 20-m. (60-ft.) piece of 10,000-volt lead-covered three-phase cable at different temperatures and voltages. The iron sheathing was removed from the cable and single-phase voltage was impressed between the three conductors and the lead cover. The cable had a paper dielectric. It was submerged in a tank with transformer oil, and accurate track of the temperature was kept. The losses at any given temperature were found to be approximately proportional to the square of the voltage between 5,000 volts and 10,000 volts, but proportional to the 2.5th power of the voltage between 10,000 and 15,000. Runs were also made at fixed voltages while letting the cable go through very slow temperature cycles between 14 deg. C. (57 deg. Fahr.) and 60 deg. C. (150 deg. Fahr.). A decided minimum of loss was observed at about 34 deg. C. (93 deg. Fahr.), the total loss at this temperature being about 3 watts, while at 12 deg. C. (53 deg. Fahr.) the loss was about 4.5 watts, and at 60 deg. C. (140 deg. Fahr.) about 6.3 watts. The dielectric appeared to have a decided hysteretic tendency, it being impossible to reproduce exactly the loss value under given conditions after carrying the cable through a temperature cycle, however smoothly and slowly the temperature was changed. The hysteresis effect, however, being of a lesser order of magnitude than the temperature effect, did not mask the latter.—*Revue Générale d'Electricité,* May 1, 1920; also noted in *Comptes Rendus,* March 8, 1920.

Installations, Systems and Appliances

Unit Voltage Duties in Long Suspension Insulators. —HARRIS J. RYAN and HENRY H. HENLINE.—Following an elaborate study of the voltage duty of the individual units of suspension strings, which included cap and pin, bomb and link and core and tine types of insulator units, the authors state their conclusions as follows: (1) Suspension insulator units in common use can be satisfactorily employed for the make-up of insulators for 250 kv. lines. (2) Increase in the number of strings in the suspension insulator will permit the use of a limited increase in line voltage. (3) Static shields in requisite forms will lower maximum unit voltage duties so as to permit the satisfactory insulation of lines for the use of voltages far above 150 kv.—*Journal A.I.E.E.,* July, 1920.

Automatic Sectionalizing Devices.—P. CHARPENTIER. —Some time ago a number of sectionalizing devices were described by Rosebourne *(Revue Générale d'Electricité,* Nov. 29. 1919) in which the operating relays are operated by two coils or two transformers which just hold a balance when the system to be protected is working normally and currents and voltages are symmetrical. The present author deals with the same problem, but looks upon the whole question from a more general point of view. He shows how all devices operating upon these principles may be derived from the fundamental ideas of the Merz and Price protective

system. If a transmission line or a cable is to be protected the balancing coils must be put one on each end of the line, and an auxiliary cable then is used to link them up. Another way is to split the power conductor in two equal parts, using one as it were for auxiliary conductor. The wiring then may be made particularly simple, and the system may be directly applied also to direct-current installations. The tripping magnets here are provided with two opposing windings, one for each of the two parallel parts of the transmission line, thus giving no magnetical action during normal working. A short circuit, however, or a break on one conductor, would upset the balance, and the breaker would go out immediately, thus disconnecting the faulty line.—*Revue Générale d'Electricité*, April 10, 1920.

Electrophysics and Magnetism

Permanent Magnets in Theory and Practice.—S. EVERSHED.—This is an attempt to put in one paper the modern theory of permanent magnetism which will give some basis for numerical predetermination. The first part of the paper outlines the theory of permanent magnetism which is preferred by the author, and equations are given. In the second part examples of predeterminations are worked out.—London *Electrician*, May 28 and June 4, 1920.

Electric Transmission Along Non-Uniform Lines.—RAVUT.—The author considers a general case of steady alternating-current transmission along lines where the "linear constants" are no longer constant but are functions of the position along the line. The differential equations cannot be generally solved in such cases. A discussion of the properties of their solutions reveals, however, in accordance with a well-known theorem stating that every network may be characterized by three independent constants, that also in this case of a non-homogeneous line the solutions will come out in form of linear expressions for voltage and current, involving three constants, termed by the author P (propagation constant), Z (surge impedance) and S, the latter one indicating the lack of symmetry of the line. It is shown that if the ordinary home-end impedance measurements are made, with the far end freed and grounded for determination of the linear constants, incorrect values are obtained if the physical constants vary along the line. It is also shown how P, Z and S may be determined from three observed impedance values.—*Revue Générale d'Electricité*, May 8, 1920.

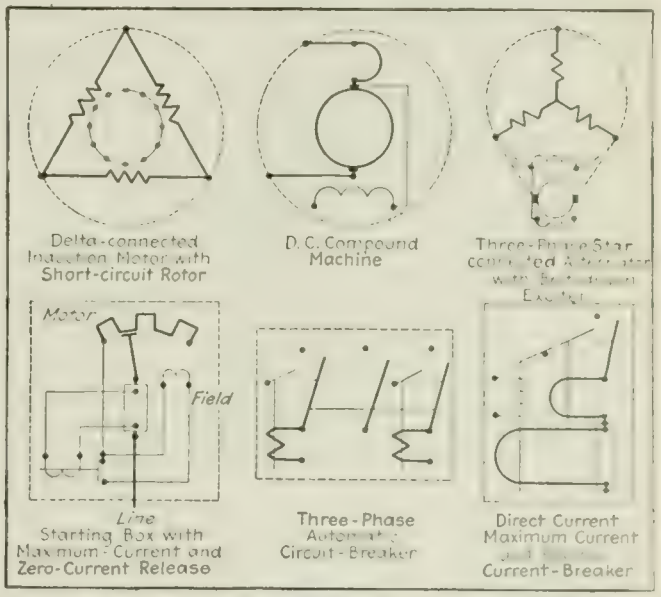
Telegraphy, Telephony and Signals

Use of Aluminum in Telegraph and Telephone Plants.—U. MEYER.—The scarcity of copper caused the German telegraph administration to investigate the possibility of using aluminum for signaling plants. Difficulties were experienced in finding methods for making reliable joints in cables, resistances of several ohms being often observed on carefully made twisted joints. For busbars, however, aluminum appeared to be just as good as copper. Telephone condensers up to 2 mf. in capacity were made with aluminum-foil and paper, with the same exterior dimensions as the ordinary tinfoil-and-paper condensers. On alternating-current tests the aluminum-foil condensers were found to have much smaller losses than tinfoil condensers, the power factor of the new condensers being only one-fifth to one-eighth that of the ordinary type.—*Elektrotechnische Zeitschrift*, Feb. 26, 1920.

Poulsen System of Radiotelegraphy.—C. F. ELWELL.—A history of the development of arc methods. Beginning with the invention by Dr. Valdemar Poulsen in 1902, the development of the Poulsen arc generator for generating undamped waves for wireless telegraphy are traced to the present state of development. It is shown that Poulsen arc stations make it possible to send messages around the world and practically to every continent. Some of the recent stations employing 250-kw. arc generators are described.—London *Electrician*, May 28, 1920.

Miscellaneous

Symbols for Electrical Machinery and Apparatus.—A. HAYET.—The conventional signs and symbols published by the *Société Française des Electriciens* in 1907 having become rather inadequate owing to the rapid advancement of the art. The author set himself the task of developing a complete system of symbols, embracing light and power installation items and also taking up signs for all such units as machinery, transformers, starting boxes, relays, fuses, automatics and hand-operated circuit breakers, etc., needed in high-power installation diagrams. All the proposed symbols may be quickly drawn with a pair of compasses, a T-square and two triangles, one 30-60-90 deg. and one 20-70-90 deg.



SYMBOLS FOR ELECTRICAL APPARATUS PROPOSED FOR FRANCE

For all direct-current windings the author uses semicircles, while alternating-current windings are drawn as zigzag lines with +20-deg. or —20-deg. slope with respect to the horizontal, if the length axis of the winding is vertical, and vice versa. Resistance is drawn as a rectangular zigzag line, like the oscillogram of an interrupted direct current. The article gives detailed instructions regarding best arrangement of schematic and space-true diagrams, and includes twelve pages of tracings, illustrating the new system of symbols. We reproduce here a few more complicated symbols, indicating the way to combine the elementary symbols so as to represent any particular piece of apparatus. The length of corresponding captions shows that a remarkable amount of information may be crowded into such a combined symbol, without introducing prohibitively great complications.—*Revue Générale d'Electricité*, April 3, 1920.

TRADE continues to exhibit midsummer quietness everywhere, but sales volumes are satisfactory and optimism prevails. In the Intermountain States, however, the demoralization of the wool industry has caused unfavorable business conditions, although labor troubles are less acute and a hopeful tone is evident.

EASIER transportation conditions and better deliveries are now the rule, but the car shortage in the South and Northwest is still serious and vital supplies of lumber and grain are held up. Residence construction is falling off, as money for that purpose is tight and building material high. An exception is reported in San Francisco, where more building jobs than ever before are under way. Fairly good collections are reported, and the industry is optimistic.

EAST of the Mississippi relief from the general shortage of rigid conduit is reported, but farther west it still exists.

FIBER-CONDUIT production is billed well into the fall months, and there has been good buying of the larger sizes of lead-covered cable. Sales of commutator segments are proceeding at a normal rate, with deliveries at from six to twelve weeks.

DESPITE local feeling to the contrary, both on the Western coast and in the East, electrical manufacturers do not exercise any geographical discrimination, it is asserted, and all sections are treated fairly and all customers as nearly alike as transportation conditions allow.

THE PRESENT supply of coal on hand at public utility plants is the lowest ever known, totaling only enough for three weeks and one day on June 1, the last date for which figures are available. No gain is thought to have been made since that time.

RAILROADS are refusing to assign coal cars to utilities with a surplus supply of fuel, and an order from the Interstate Commerce Commission may be necessary to adjust the situation. Some utilities with car assignments have been refused coal at the mines. The Public Service Commission for the First District of New York State has asked that the order granting priorities to public service companies, which expires Aug. 19, be extended. The N. E. L. A. has made a similar request. The I. C. C. is not in favor of broadening the order to include storage. An embargo on cross-town movement of coal cars has been asked by the American Railroad Association.

TOTAL electrical exports for the first six months of 1920, excepting locomotives, were $46,724,126, or about 4 per cent less than in 1919. Motor and generator exports were in excess of those for the same period last year, as were heating and cooking appliances.

News in Brief

Summary of Market Conditions and of Recent and Approaching Happenings of Importance to the Industry

AN ISSUE of $2,000,000 in five-year 8 per cent gold notes is being made by the Southwestern Power & Light Company at 98, to yield 8½ per cent.

DECISION not to proceed with the construction of the proposed auxiliary steam plant at Niagara Falls has been made by the Hydro-Electric Power Commission of Ontario owing mainly to the high cost.

REORGANIZATION of the Nela Research Laboratories has been brought about, and in future there will be two divisions, a laboratory of pure science and a laboratory of applied science.

WIGGINGTON E. CREED has succeeded Frank G. Drum as president of the Pacific Gas & Electric Company.

TEN MANUFACTURERS of Shelby, Ohio, have petitioned the City Council to discontinue the municipal electric plant and purchase energy from the Ohio Light & Power Company, whose transmission lines now reach the city.

TECHNICAL, commercial, accounting and public policy sessions will make up the program of the four-day convention of the New England Section, N. E. L. A., to be held at Kineo, Me., Sept. 13-16.

CHANGES in the rules governing joint-pole use designed to remove sources of controversy have been made in the National Electric Safety Code by the Bureau of Standards.

THE N. E. L. A. executive committee will meet in New York on Sept. 1. The Public Relations Section of the association will organize next week.

ANNOUNCEMENT is made that the Federal Power Commission will be housed in the new Interior Department Building at Washington. The form of water-power permit is now being discussed.

THE TENTATIVE program for the Cleveland convention of the Illuminating Engineering Society has been issued.

ELECTROLYSIS mitigation is undergoing investigation by the Bureau of Standards.

RAPID progress in the electrification of Swiss railroads is reported.

NEW LONDON, Conn., has been selected for the thirty-fifth annual meeting of the Association of Edison Illuminating Companies on Sept. 13-16.

CONSTRUCTION work is half completed on installation of a 500-hp. Stirling three-pass boiler at the station "L" steam plant of the Portland (Ore.) Railway, Light & Power Company. This boiler will burn either "hog fuel" or oil and will serve as an auxiliary.

THE ATTORNEY-GENERAL is expected soon to announce the "fair price" for coal arrived at as a result of his investigations. Rumors that the President will appoint a fuel administrator are disbelieved.

ELECTRICAL experts in various lines will address the meeting of the National Association of Electrical Inspectors at Philadelphia on Oct. 12 and 13.

ELECTRIC service rates at the Groton (Conn.) municipal lighting plant have been reduced from 15 to 12 cents net per kilowatt-hour.

THE GROWTH of central-station service and decline of isolated-plant operations led last week to the recommendation that electrical engineers be admitted to the Universal Craftsmen Council of Engineers, which convened at Springfield, Mass.

BY THE consolidation of electric utilities on Cape Cod and Martha's Vineyard it is expected that the economic benefits of large power production at New Bedford, Mass., will be extended to that district.

A SECOND 45,000-kva. turbo-generating unit with condensing equipment has been purchased by the Narragansett Electric Lighting Company, Providence, R. I.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Form of Water-Power Permit Now Being Discussed

REGULATIONS pertaining to the form of permit to be used in applying for water-power privileges were discussed in Washington Thursday among representatives of the Federal Power Commission, the Government departments, the National Electric Light Association and various private interests.

On Friday the federal officials conferred with the representatives of Harris, Forbes & Company, the Guaranty Trust Company, the Electric Bond & Share Company, Lee, Higginson & Company, Stone & Webster and other financial interests.

The Commissioners of the District of Columbia, the Public Utilities Commissioners of Virginia and of Maryland, the Potomac Electric Power Company and others interested in the Great Falls water-power project on the Potomac have been invited to attend a hearing on Aug. 24 to be conducted by the Federal Power Commission. Each of the railroads entering Washington has been asked to send a representative to the hearing.

Utilities with Car Assignments Unable in Some Instances to Get Coal

PUBLIC service corporations are taking advantage of the Interstate Commerce Commission Order No. 9 granting them assignment of coal cars, but in some instances the order apparently is missing fire. When it was promulgated the commission did not anticipate that coal mines would be able to receive coal cars enough to take care of all of the output.

There have been instances, however, where electric light and power companies with assignment orders have been unable to obtain shipment. Two cases were reported this week, one in the Virginia coal fields and the other in the Oklahoma coal fields, where electric utilities had tried without success to obtain coal with assigned cars. In each case the utility was without contract, and the mine because it had plenty of free cars simply ignored the assigned cars.

N. E. L. A. Requests Continuance of Coal Car Priority Order

THE National Electric Light Association has been holding meetings and making a survey of the country with respect to coal supply. After a conference of the officers of the association early in the week, a telegram was sent to the Interstate Commerce Commission asking a continuance of the coal-car priority order for utilities after Aug. 19 and also requesting an interpretation of the commission's order whereby utilities will be allowed to begin laying in coal for winter storage. The telegram reads as follows:

"At a special meeting of the officers of this association held today I was instructed to wire you in behalf of the electric light and power companies of the United States earnestly urging that Interstate Commerce Commission Order No. 9 be renewed on Aug. 19 and recommending that term 'current use' be so construed that electric light and power companies may under the terms of the order obtain and have on hand at all times coal not in excess of thirty days' supply, or that the order be so modified that electric light and power companies may now begin to store coal for winter use with proper limitations, in accordance with recommendations of United States Bituminous Coal Commission. A general survey of the United States shows that electric light and power companies have been able to continue to serve the public largely because of Order No. 9, and under no circumstances should this priority order be canceled if electric light and power companies are to function through fall and winter months."

Coal Priority Order Extended Thirty Days

PRIORITY in the assignment of coal cars for public utility use was assured until Sept. 19 by the action on Wednesday of the Interstate Commerce Commission in extending its service orders Nos. 7 and 9 for a period of ninety days beginning June 21. In spite of efforts that were made to convince the commission that the order should be broadened so as to permit utilities to secure assigned cars for coal which is to be stored, the commission was apparently distinctly opposed to making such an order. It was pointed out, however, at the office of the Interstate Commerce Commission, that the public utilities are at perfect liberty to buy coal in the open market for storage purposes. The commission did not state, however, whether or not it would order the railroad to honor assignments of cars for utilities having a surplus.

Joint-Pole Use Versus Overbuilding or Conflicts

A RECENT instance of the effort of the Bureau of Standards to assure as far as possible the reasonableness of the rules of the National Electric Safety Code and to relieve them of any controversial character is its proposal to omit Rule 230d and change Rule 230c as follows:

Wording in 1916 edition. Rule 230 (old 270a). Two parallel pole lines either of which carry supply lines (see definition 41) shall, where practicable, be so separated from each other that neither conflicts with the other. If this cannot be done, the two pole lines shall be separated as far as practicable (see Rule 245).

It is recommended that overhead lines which cannot readily be so separated from each other as not to conflict be placed on a single common-pole line unless the high voltage

of certain of the circuits or the large number of conductors makes the use of a single-pole line undesirable or impracticable.

Rule 245 contains certain special requirements where one conflicting line very closely approaches another. The bureau rearranged the rules to the extent of making the above change from Rule 270a to Rule 230c and omitted the second sentence of the first paragraph entirely. The telephone interests later requested the bureau to add another paragraph specifying certain high voltages above which joint-pole use was generally not recommended. This proposed wording was as follows:

230c—Limitation of Joint Use.—The joint use of poles by signal lines and supply lines of more than 7,500 volts (or 4,400 volts to neutral or ground) and constant current circuits of more than 10 amp. is not recommended except where it is impracticable to separate the lines sufficiently to avoid conflicts.

Between 5,000 and 7,500 volts (or between 2,900 and 4,400 volts to neutral or ground), or between 7.5 and 10 amp. for constant current circuits, conditions in particular cases will determine whether or not joint use of poles should be permitted.

This was strongly objected to by power companies, but the objections urged were not accepted by the bureau as sufficient to warrant its action until the last few weeks. Meanwhile certain minor amendments have been secured by power companies to make the recommendation against joint-pole use for higher-voltage supply lines somewhat less strong. Recent consideration by the bureau of the fact that it may in some cases be more desirable to have separate lines across a street than to have the two lines combine in one, and recognition of the fact that the wording of the rule should not be such as to permit an inference which would call for lines to be placed outside of conflict distances when joint poles are not used (which in narrow streets might drive one of the lines off the street) led the bureau to change Rule c as follows and omit Rule d entirely:

Rule 230c—Avoidance of Conflict.—Two parallel pole lines either of which carries supply conductors shall, where practicable, be so separated from each other that neither conflicts with the other. If this is impracticable, then the conflicting line (or lines) shall be built of the grade of construction required by the rules for a conflicting line or the two lines shall be combined in a single-pole line (see Rule 234).

This expresses no preference for joint-pole use as against conflict, it being expected that conditions under which preference should be shown one or the other type of construction can be worked out more satisfactorily than in the proposed Rule 230d above noted and such a requirement inserted in a future edition of the code.

Railroads Refusing Coal Cars to Utilities with a Surplus

A DOZEN or more utilities report that they have been unable to obtain coal-car assignments from the railroads because they have a surplus supply on hand. One Massachusetts electric light and power company had an eighteen days' supply on hand. Its local road assigned it cars, but the road going into the coal fields refused to honor the order. In each of the cases reported the Interstate Commerce Commission has upheld the railroads in their stand.

On the other hand, the I. C. C. has wired a number of different state utility commissions that utilities may go into the open market to secure a surplus supply of coal. In view of the above action of the railroad, however, it is doubtful if public utilities would go into the open market and purchase spot coal at prevailing prices to build up a surplus when the railroads will refuse car assignments on the basis that the utility has already a surplus.

This situation is coming before the I. C. C., and it is expected that an interpretation doing away with the equivocal condition will be made shortly.

Attorney-General's Fair Coal Price Expected Soon

ATTORNEY-GENERAL PALMER is expected to announce in a few days what he considers a fair price for coal. It was stated at his office that he is studying the returns of coal operators to the Federal Trade Commission showing production costs.

Rumors to the effect that the President had decided to appoint a fuel administrator are not being taken seriously in most quarters of Washington.

Utility Coal Supply Lowest Ever Known

STOCKS of bituminous coal held by public utility plants are the lowest they have been in the past two years, according to figures collected by the Geological Survey These figures do not include coal belonging to artificial-gas plants or railroads.

According to the figures, which are expressed in weeks' and days' supply, at the current rate of consumption at the time of stock taking the utilities had four weeks and three days' supply on hand July 15, 1918; five weeks and six days' supply, Oct. 1, 1918; six weeks and two days', Nov. 11, 1918; seven weeks and one day, Jan. 1, 1919; seven weeks and one day, April 1, 1919; three weeks, March 1, 1920; three weeks and one day, June 1, 1920.

In view of the increasing difficulties in coal transportation since the first of June there is no reason to believe that the supply on hand has increased.

New York Commission Asks I. C. C. to Extend Its Coal Order

SO THREATENING appears the fuel situation that confronts the public utilities of New York City that Alfred M. Barrett, acting head of the State Public Service Commission, First District, has sent a telegram to the chairman of the Interstate Commerce Commission asking that the order of the latter body granting priority to public utilities, which expires on Aug. 19, be extended. Mr. Barrett's telegram says that the companies are obtaining barely the absolute minimum of coal necessary to keep them going and are unable to store a pound for use in the coming winter.

Embargoes Asked on Cross-Town Coal-Car Movement

ALL carriers have been asked by the American Railroad Association to place embargoes on cross-town movements of coal cars at terminals. A permit system is recommended to take care of exceptional cases. In order to economize coal cars and to relieve congestion, it is expected that coal will be unloaded at the point where the car is originally spotted.

Edison Association Convention Sept. 13-16 at New London

THE thirty-fifth annual meeting of the Association of Edison Illuminating Companies will be held at the Griswold, Eastern Point, New London, Conn., Sept. 13 to 16 inclusive. A comprehensive program of entertainment is being arranged by the committee, including dancing, golf, tennis and other forms of amusement. A preliminary program of the business sessions follows:

TUESDAY, SEPT. 14

Morning.—President's address; report of executive committee; report of treasurer; report of committee on standards, W. C. L. Eglin chairman; report of committee on metering and service methods, P. H. Bartlett chairman; report of committee on electricity distribution and use, L. L. Elden chairman; paper, "Storage-Battery Practice in Central-Station Service," by J. Lester Woodbridge.

Evening.—Report of committee on steam turbines and generators, H. P. Liversidge chairman; address, "Turbine Characteristics," by E. W. Rice, Jr.; address, "Problems of Synchronous Operation Arising from Use of Power-Limiting Reactors," by C. P. Steinmetz.

WEDNESDAY, SEPT. 15

Morning.—Symposium on system troubles: Introductory remarks by John W. Lieb; report of committee on symposium, Philip Torchio chairman. Troubles in generating stations: Baltimore, F. E. Ricketts; Boston, R. E. Dillon; Chicago, W. L. Abbott; Detroit, G. W. Cato; New York, W. H. Lawrence; Philadelphia, N. E. Funk. Troubles on direct-current distribution systems: Boston, L. L. Elden; Chicago, D. W. Roper; New York, Philip Torchio; Philadelphia, Thomas Sproule.

Evening.—Report of lamp committee, John W. Lieb chairman; address, "Central-Station Financing," by H. M. Addinsell of Harris, Forbes & Company, followed by a general discussion by leading men of the industry; film, "Revelations."

THURSDAY, SEPT. 16

Morning.—Report of committee on rates, Alex Dow chairman; paper, "Commercial Aspects of Power Factor, Its Measurement and Correction," by C. J. Russell, discussion opened by L. L. Elden and A. S. Knight; paper, "Large Commercial Customer Problems," by E. W. Lloyd; paper, "Standard Methods of Handling Electric Welding and Furnace Loads," by C. F. Hirschfeld.

Program of Cleveland Convention of I. E. S.

FOLLOWING is the tentative program of the fourteenth annual convention of the Illuminating Engineering Society, to be held at the Statler Hotel, Cleveland, Ohio, on Oct. 4 to Oct. 7:

MONDAY, OCT. 4

Morning.—Registration.

Afternoon.—President's address, S. E. Doane; report of general secretary, Clarence L. Law; "Progress as Reported in the Literature of Illuminating Engineering," committee on progress, F. E. Cady chairman; "The Society's Educational Program," committee on education, F. C. Caldwell chairman; "I. E. S. Headlighting Specifications, Regulatory and Design," committee on automobile headlighting specifications, C. H. Sharp chairman.

TUESDAY, OCT. 5

Morning.—"Modified Views on the Theory of Light," by E. F. Nichols; "Some Applications of the Photoelectric Cell," by W. E. Story, Jr.; "Knowns and Unknowns of Light Production," by G. M. J. Mackay; "Optical Principles in Illuminating Engineering," by P. G. Nutting; "Measurements of Reflection Factors," by C. H. Sharp and W. F. Little.

Afternoon.—"Knowns and Unknowns of Illuminating Principles," auspices committee on papers; "Effect of Variations of Intensity of Illumination on Functions of Importance to the Working Eye," by C. E. Feree and Rand; "Notes on Department-Store Lighting," by J. Daniels.

Evening.—"Pleasing Proportions of Direct and Diffused Light," by J. R. Cravath; "Home-Lighting Demonstrations," auspices National Lamp Works.

WEDNESDAY, OCT. 6

Morning.—"The Problem of Brightness," by Bassett Jones; "Central-Station Methods for Securing High Lighting Standards in Stores and Homes," by O. R. Hogue, J. J. Kirk and E. D. Tillson; "Some Out-of-the-Ordinary Applications in Mill Work," by S. G. Hibben; "An Improved Method for the Illumination of Motion-Picture Theaters," by L. A. Jones; "Recent Applications of Color in Lighting," by A. D. Curtis and J. L. Stair.

Afternoon.—"The Society's Work Among Other Organizations," committee on reciprocal relations, Ward Harrison chairman; "The High Cost of Poor Lighting," by R. E. Simpson; "A New Form of Light Meter," by Davis Tuck; "Further Statistics on Street Accidents," not definitely assigned.

THURSDAY, OCT. 7

"Central-Station Experience in the Improvement of Factory Lighting," by J. B. Wilson, "Lighting of Shoe Factories," by A. L. Powell and J. H. Hurlander; address of president-elect, Gen. George H. Harries.

Additions may be made to this program, and if so they will be announced later.

Service Charge Urged in Massachusetts

REPRESENTATIVES of the principal central-station and gas plants, including municipal lighting departments, appeared recently before the Massachusetts Department of Public Utilities in support of a service charge, advocating the repeal of the existing law prohibiting the imposition of a meter charge where the consumption of energy exceeds $9 per year. E. C. Mason, Boston, pointed out that thirty-eight states now allow a service charge and with other speakers contended that only by its use can equitable rates be applied among different groups of customers.

It was pointed out that in the case of the Greenfield Electric Light & Power Company 1,061 customers use less than 8 kw.-hr. per month, or under $1 worth of energy, and that 22 per cent of the customers use only 4 per cent of the energy sold. At Newburyport 37 per cent of the customers use 5.5 per cent of the energy sold, and in Easthampton 64 per cent of the customers use 24 per cent of the energy. E. LeRoy Gardner, Chester Electric Light Company, stated that this company's average rate is about 25 cents per kilowatt-hour. All energy in excess of fifty hours' use of the demand is sold at 9.5 cents. This yields a profitable long-hour business and at the same time the short-hour customer pays only what the service is worth to him.

New Quarters for Federal Power Commission

THE Federal Power Commission will be housed in the new Interior Department Building. A definite promise of space has been made by Secretary Payne. Oscar C. Merrill, executive secretary of the commission, is expected to move his office to the new quarters next week. Major L. W. Call of the Judge Advocate General's office has been transferred to the Federal Power Commission and will serve as its chief counsel. For the present the disbursing office of the Interior Department will look after the commission's disbursements

N. E. L. A. Executive Committee Meeting Sept. 1

THE executive committee of the N. E. L. A. will meet in New York on Sept. 1. It is anticipated that the presidents of all of the geographic divisions will be present and will bring their budgets for the year. The chairmen of the four national sections are expected at that time to announce their programs. President Martin J. Insull will announce appointments of several new committees to take up present-day problems.

New President for Pacific Gas & Electric Company

FRANK G. DRUM resigned July 30 as president of the Pacific Gas & Electric Company after holding office for fifteen years. He will still be connected with the company as a director and as a member of the executive committee. Wiggington E. Creed, attorney, president of the Hooper Lumber Company and president of the East Bay Water Company, who has had a wide experience in the public utility field, was elected president. Mr. Creed reorganized the People's Water Company of Oakland and formed the Columbia Steel Company of Pittsburg, Cal. Mr. Drum, who has been inactive for some time, gave as the reason for his resignation press of business affairs. The change in officials is said to forecast no change in the other personnel or in policy.

New England Section, N. E. L. A., Completes Program

TECHNICAL, commercial, accounting and public policy sessions will be the features of the twelfth annual convention of the New England Section of the National Electric Light Association at Kineo, Me., Sept. 13-16. On Monday evening, Sept. 13, registration and a reception will take place at the Mount Kineo House, the headquarters of the convention. At 10 a.m. on Tuesday the convention will be opened with the address of President C. R. Hayes. M. H. Aylesworth, executive manager of the N. E. L. A., will present the greetings of the parent body, and the rest of the session will include the reports of the treasurer and secretary and committee reports as follows: Accident prevention, B. J. Cook chairman; advertising and publicity, O. R. Underhill chairman; electric vehicles, Day Baker chairman; membership, J. J. Buckley chairman. In the afternoon there will be a technical session, at which will be considered reports of committees on underground systems, prime movers, electrical apparatus and overhead systems.

Accounting will be discussed at a morning session on Wednesday, the program including the report of the accounting committee, G. W. Hurn chairman, and the following papers: "Credits and Collections from a Public Service Company's Standpoint," by W. E. Dorsey; "The Importance of a Reliable Investment Account," by A. E. Lamb; "The Good-Will Value of an Efficient Accounting Organization," by I. S. Hall; "The Graphic Presentation of Statistics," by W. H. Blood, Jr.; "The Sale of Company Securities," by P. H. Whiting. In the evening there will be a public policy session, the program including an address by a public utility commissioner, a talk by a banker upon "The Financial Aspect of Public Utility Operation," and an address by Mr. Aylesworth on "What the N. E. L. A. Proposes to Do for Member Companies." Representatives of the New England public utilities commissions have been invited as guests.

Commercial matters will occupy the entire program on Thursday, the schedule following: Introduction of commercial committee's report, R. D. Cutler chairman; commercial relations division report, J. T. Day chairman; contact committee report, William Gould chairman, followed by discussion by W. F. Abely, representing jobbers, J. E. Wilson, contractors, and F. J. Allen, manufacturers; merchandising division report, R. E. Holden chairman; "The Fundamentals of Merchandising," by George H. Guest; lighting division report, C. A. Dean chairman; illustrated lecture on "Industrial Lighting," by W. D'Arcy Ryan. Afternoon session: Ranges and water-heating division report, R. J. Patterson; power division report, V. M. F. Tallman chairman, followed by a lecture by F. C. Hard, Boston, on "Industrial Heating."

Public Relations Section, N. E. L. A., to Organize Next Week

THE adjourned meeting of the Public Relations Section of the N. E. L. A. is to be held on Lake Erie on board a yacht leaving Toledo, Ohio, next Thursday, at which time all members of the executive committee, including the representatives from each of the thirteen geographic division public relations sections, will be present. The Canadian Division will be represented by D. H. McDougall, who has just been chosen chairman of the Canadian public relations section. At this meeting all of the committees will be appointed, one of the most important of which will be on organization of state committees on public utility information. It is planned to organize such a committee in every state before the end of the year. There are now eleven such state committees as follows: Illinois, Indiana, Michigan, Kansas, Nebraska, Kentucky, Iowa, Ohio, Georgia, Massachusetts and Wisconsin. These committees are going ahead on the basis that the electric light and power industry is the public's own industry. At this meeting also the entire publicity program of Director of Publicity George F. Oxley will be outlined, including the publicity through member companies, manufacturers, contractor-dealers, investment-bankers and insurance companies.

Experts to Address Electrical Inspectors

AMONG those who will address the National Association of Electrical Inspectors at its Philadelphia meeting on Oct. 12 and 13, it is announced, will be W. J. Canada, expert of the National Electric Light Association; Dana Pierce, vice-president of the Underwriters' Laboratories; A. R. Small, superintendent of label service, Underwriters' Laboratories; P. H. Bartlett, superintendent of installation, Philadelphia Electric Company; M. E. Arnold, president of the Electric Club of Philadelphia, and perhaps Dr. M. G. Lloyd of the Bureau of Standards. Many interesting points as to code interpretations will be discussed and other subjects of great importance will come up. The meeting will be held in the auditorium of the Middle Department of the association at 216 Walnut Street.

On the evening of Oct. 12 there will be a banquet, when E. J. Cattell of Philadelphia will speak

Sliding Scale of Rates Asked on Basis of Oil Costs

IN AN application to the Railroad Commission of California for an increase in rates the Western States Gas & Electric Company suggested that the commission, in granting the increase in rates asked for, should fix the rates on an elastic basis, "so that if hereafter the cost of oil is increased a certain amount the rates will automatically be increased and similarly if the cost of oil be reduced the rates will be reduced." The company asserts that such an order would obviate the frequently recurring applications for rate increases.

Swiss Railroad Electrification Near

EVERY important railroad in Switzerland will have been electrified in the near future, in the opinion of Dr. Charles Lathrop Parsons, secretary of the American Chemical Society, who has just returned from a three months' trip to Europe. He says the coal shortage has given the Swiss no alternative but to electrify the remainder of their roads and the work is being pressed vigorously. In Italy also Dr. Parsons found that electrification of railroads is being extended rapidly.

The Swiss government a month ago sold $25,000,000 of 8 per cent bonds, the proceeds to be used in this country as a part of its program for the electrification of the government railway system.

Manufacturers Urge City to Replace Municipal with Purchased Energy

TEN manufacturing establishments in the city of Shelby, Ohio, have petitioned the City Council to discontinue the municipal electric plant and purchase energy from the Ohio Light & Power Company, whose transmission lines now reach the city limits. The petitioners assert that it costs the city 4 cents a kilowatt-hour to manufacture energy, whereas it can be purchased from the power company for approximately 1.6 cents a kilowatt-hour; that it would cost no more to install the necessary equipment to bring the company's product to the switchboards for distribution than to buy new boilers now needed in the municipal plant if it is to continue business, and that the growth of the city will in a few years necessitate a new plant on a new site if the present system is to be continued—a great expense which can be obviated by resorting to the purchase of electricity.

Reorganization of Nela Research Laboratories

LARGE extensions of work have brought about a reorganization of the Nela Research Laboratories at Cleveland, Ohio. The laboratories were organized in 1908 under the directorship of Dr. Edward P. Hyde as the physical laboratory of the National Electric Lamp Association. The name was changed to Nela Research Laboratory in 1913, when the National Electric Lamp Association became the National Lamp Works of General Electric Company. For some years the laboratory was devoted exclusively to the development of those sciences on which the art of lighting has its foundation, but in 1914 the functions of the laboratory were extended by the addition of a small section of applied science, which had an immediate practical objective.

This section is now being largely extended as a separate laboratory of applied science under the immediate direction of M. Luckiesh, who became director of applied science, and a new building is being constructed to house this branch of the work, which will be carried forward with a staff of several physicists and others.

Dr. Ernest Fox Nichols, formerly president of Dartmouth College and more recently professor of physics at Yale University, will assume the immediate direction of the laboratory of pure science, under the title of director of pure science.

The laboratories of pure science and of applied science will together constitute the Nela Research Laboratories and will be co-ordinated under the general direction of Dr. Hyde, who becomes director of research.

Ways of Lessening Electrolysis Being Investigated

DURING the last four months the Bureau of Standards reports that it has carried out in co-operation with the American Committee on Electrolysis, which represents the national utility associations, a number of somewhat extended investigations in the field of electrolysis mitigation in several Middle Western cities. This work has been confined largely and almost exclusively to the effect of pipe drainage on underground systems, especial attention being given to the possibility of joint electrolysis on high-resistance joints and interchange of current between drained systems. Some attention has also been given to the three-wire systems of power distribution and also to automatic substation installations as a means of electrolysis mitigation.

Receiving a Telephone Message Over High-Tension Line



BY MEANS of directed radio or wired wireless, the American Gas & Electric Company has successfully communicated over its 11,000-volt lines between Ocean City and Atlantic City, N. J., a distance of twelve miles. The terminal apparatus may be connected with any part of the electric system—110-volt lamp socket or 2,300-volt buses. More complete details were given in the ELECTRICAL WORLD for July 17.

Madrid Has Underground Railway.—An electric underground railway, which, though less than 3 miles in length, is built according to modern specifications, has for some months been in operation in Madrid, bearing testimony to Spanish enterprise, for Madrid's population of 600,000 is less than that usually held requisite to warrant local underground passenger traffic.

Joint Outing in St. Louis.—The St. Louis Electrical Board of Trade, the Associated Engineering Societies of St. Louis, the St. Louis Railway Club and the Twelfth United States Engineers enjoyed a moonlight excursion together when they met on the steamer J. S. on the evening of Tuesday, July 27. Eighteen hundred and forty-eight members of the different organizations and their friends were present, and the combined entertainment committee provided an excellent program.

Municipal Plant Sells Out.—The village of River Rouge, Mich., has voted to sell its municipal lighting plant to the Detroit Edison Company for approximately $90,000. For this amount the Detroit Edison Company is to get the plant equipment, distribution system, etc., and a thirty-year franchise. The village had outgrown the capacity of the plant, which had been run at a loss for some time, and the municipality was confronted with the alternatives of selling the property or investing about $225,000 in order to bring the plant up to the requirements of the community.

Five-Million-Dollar Electric Pumping Plant.—At an expenditure of approximately $5,000,000, says a dispatch to the *Manufacturers' Record,* the Oil Belt Power Company is building a large electric plant about 3 miles southeast of Eastland, Tex., to supply power for oil-well pumping and the oil-field industry on a scale never before attempted. Energy will also be furnished to half a dozen towns and camps in that vicinity. Five hundred men are now constructing a dam across the Leon River and erecting the power house and transmission lines. The plant will have an ultimate capacity of 10,000 hp. A sufficient initial installation to pump 500 wells is under way and will probably soon be in operation.

Electric Heating in London.—The ever-rising price of fuel is likely, according to the *Electrician* of London, to shake the popularity of the time-honored open-grate coal fire in that city. Already the use of electric radiators in city offices has become so common that an estimate of the heating load for 1919 places it at 5,000,000 kw.-hr. In private homes no such progress has been made, and the natural tendency is to turn for relief first to gas; but the greater advantages of electricity are expected eventually to win precedence for it. For the electric companies, of course, the problem is not so much how to advertise their product as how to overcome the inherently bad load factor incidental to heating appliances.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Cemeteries and Newspapers as Utilities.—Though "public utility" is intentionally a comprehensive term in the eyes of the law, few would think of a cemetery as coming within the category. Yet in a bond suit brought by a citizen of Sapulpa, Okla., against the municipality the Supreme Court of Oklahoma has declared that a cemetery to be purchased by the city and open to public use is rightly so termed. The Public Service Commission of the state in another instance was asked to take jurisdiction of a complaint against a newspaper accused of unlawful discrimination among advertisers, but the commission held that the newspaper, not being a virtual monopoly, was not subject to its authority.

Cottages for Subway Operators.—Four cottages were recently purchased from the United States government by the Central Power Company of Newark, Ohio, for erection at the site of its substations in Mount Vernon, Lancaster, New Lexington and Logan for the use of the substation operators at those places, thus insuring the presence of an attendant twenty-four hours a day, the wife being at home while the husband is away on other duties. No rent is charged for the cottages, which contain six rooms and bath, are lighted by electricity and have hot and cold water and a furnace. They are substantially constructed and well designed. Those at Mount Vernon and Lancaster are already in place, the former being erected on an extremely high foundation as a safeguard against the flooding prevalent at that point.

Tree Trimming for a Big Electric Company.—In *Synchroscope,* published by the Detroit Edison Company, some notes have been published covering the tree-trimming operations necessitated by the system's 7,000 miles of overhead line in town and country, running for the most part along tree-shaded streets and highways and serving sixty-two municipalities. About 2,000 trees are trimmed at least once a year. As few as possible are felled. Getting permission from municipalities and private owners is no sinecure, and two instances are related in which farmers steadfastly refused to allow a branch to be touched until the company consented to cut down and convert into firewood in one case a clump of trees and in the other a single very large one, thus supplying the owners with a fine stock of merchandise—forty-five cords in the latter instance—at no cost to themselves.

Atmospheric Versus Solar Electricity.—A German scientist has a plan for utilizing atmospheric electricity by which he holds that the same land that grows food can collect electricity from the air in quantities sufficient to drive motors, thus conserving fuel while at the same time operating to protect farmers from loss by hail and lightning. This plan, attractive as it seems, has, however, to overcome the opposition of a brother Teuton who favors sun motors instead, pointing out that solar energy averages "0.8 kg. calory of power per square meter of surface per minute." Neither Herr Planson, the atmospheric pioneer, nor Herr Remain, the solar champion, can see any merit in the other's pet scheme. To the future must be left the vindication of one or both.

San Francisquito Plant No. 2 Put Into Operation. — The city of Los Angeles has recently put into operation San Francisquito Plant No. 2, which has at present a capacity of 35,000 kva. The new plant is in San Francisquito Canyon below plant No. 1 and uses water from the Los Angeles aqueduct. There are two generators in the plant, each having a capacity of 17,500 kva., directly connected by the same shaft to 20,500-hp. Francis turbines using 300 second-feet of water. The penstocks are 7 ft. in diameter, 1,430 ft. long, with a static head of 530 ft. The generator voltage is 6,600 and is stepped up through a bank of three transformers rated at 5,833 kva. to 110,000 volts. Two circuits of No. 0000 stranded copper wire about one mile in length connect the power house to the main line running from San Francisquito plant No. 1 to Los Angeles.

Rate Increases in Many Sections.—New and slightly increased electric lighting rates adopted by the gas and electric department of Norwich, Conn., are 12 cents a kilowatt-hour for the first 100 kw.-hr., 10 cents for the next 350 kw.-hr. and 6 cents for consumption in excess of that. A 20 per cent surcharge on street lighting has been put into effect by the Hartford (Conn.) Electric Light Company. The Scranton (Pa.) Electric Company has increased commercial lighting rates 20 per cent, effective Sept. 1. The Penn Central Light & Power Company has filed increased schedules for Huntingdon County, Pa.; the West Penn Power Company for Washington County, Pa., and the Philadelphia Suburban Gas & Electric Company for Chester and Montgomery Counties, Pa. The Public Service Commission of Oregon has allowed an increase in charges to the Douglas County Light & Water Company, serving electrical energy to six cities. The Public Service Commission of West Virginia has granted rate increases to the West Virginia Light & Traction Company, operating in Kanawha, Fayette and Raleigh Counties. The order granting 40 per cent increase issued Nov. 11, 1919, has been annulled, and a new order entered granting 55 per cent increase over rates in effect prior to that time.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Power-Factor Clause Approved.—The Wisconsin Railroad Commission has authorized the Burkhardt Milling & Electric Company to base its rates for electricity on the maintenance by the consumer of a minimum power factor of 80 per cent and to impose an additional charge for power factors lower than this.

Free or Reduced-Rate Service to Employees Strongly Condemned.—The Montana Public Service Commission recently declared the practice of a gas company in furnishing its employees with its product at a 50 per cent discount and its resident officials free to be "grossly discriminatory" and ordered its discontinuance.

Election Favoring Acquisition of Plant by Municipality Not Voided by Technicalities.—In Town of Milton vs. McGowan Water, Light & Power Company the Wisconsin Railroad Commission refused to declare void a municipal election that favored the acquisition by the town of a utility plant because of technical questions raised concerning the method of conducting the election, holding that there was nothing in the record to indicate that the result might have been different had other formalities been observed.

Irrigation Service as Byproduct of General Electric Service.—In establishing a power-rate schedule for the Eastern Oregon Light & Power Company and permitting it to reduce its prompt-payment discount from 10 to 5 per cent the Oregon Public Service Commission discussed the principles underlying charges for irrigation service, which it held to be rightly considered a byproduct of general electric utility service, especially so long as the demands for irrigation service do not require plant capacity in excess of that required for general service during the winter months. "Power for irrigation," the commission continues, "is, as a general proposition, in competition with gravity irrigation, and the return derived from power-irrigated lands will not justify the burden of a rate as high as that necessary for general service. The obtaining of an irrigation load at the proposed irrigation rate will, however, increase the company's revenue in a greater proportion than the increased cost of such service, and consequently the consumers of electric service as a whole are benefited by this lower irrigation rate. A seasonal minimum charge must be provided in order to insure an income on special extensions for irrigation service."

Considerations Affecting Rates of Utility Operating Several Departments.—As the result of a thorough investigation the Montana Public Service Commission granted to the Helena Light & Railway Company increases in the rates of its gas and street-railway departments while reducing the rates of its electric department. Among other principles laid down by the commission was that in ascertaining the reproduction cost of a utility operating several departments as great an allowance should not be made for the preliminary organization of each department, including the cost of procuring franchises, as if the department were owned and operated by a single utility, where all of the plants were constructed at approximately the same time and the franchises procured at the same time. The principle that where more than one utility is operated in the same community by a single company each utility must stand alone was held to be impracticable to its full extent in case of a company operating gas, electric and street-railway departments where rates of the gas and street-railway departments sufficient to earn a fair return on the investment would be prohibitive of anything like a sufficient return because the service would not be worth to the consumers the rate that would have to be charged.

Elements of Cost.—In granting to the Wisconsin-Minnesota Light & Power Company an increase in gas rates, the Wisconsin Railroad Commission made the following observations on the character of the cost incurred in rendering service to the public: "A great deal of confusion has resulted from failure to understand the nature and measure the extent of some of the elements of cost. Costs which are incurred in order that the obvious functions of the business may be carried on from day to day and for which labor and materials or other elements enter directly into the operations of the business are quite generally understood and recognized. Similarly the interest which must be paid on borrowed money is definitely measurable and not an element of cost which causes much confusion. On the other hand, such costs as that of protecting the utility against depletion of its assets due to wear and tear, or to causes such as inadequacy or obsolescence, or such costs as that of securing the capital to carry on its business, are very often misunderstood. In this case it becomes necessary to measure these costs as accurately as possible in order to fix the total cost of service which must be considered in establishing rates. Adequate provision for depreciation and adequate compensation for capital reasonably employed constitute part of the cost of service. To make the allowance for these elements either inadequate or excessive would be as unfair as to allow either less or more than the cost of labor necessarily employed in carrying on the business."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Powers of Trial Judge in Jury Case Involving Alleged Injury from Erection of Dam.—The Supreme Court of Florida has upset the action of the court below in refusing a new trial to the Florida Power Company, against which a suit for damages from the erection of a dam was decided. The trial judge, while virtually expressing the belief that no damage to the plaintiff's property had been caused, allowed the case to go to the jury, which held differently. The Supreme Court holds that, even though he saw fit to deny a directed verdict, the judge, deeming the verdict returned to be against the weight of evidence, was in error in refusing a new trial. (84 S. 921.)

Where Facts in Damage Case Are Undisputed, Degree of Care Shown Is Question of Law.—The Southern Sierras Power Company having been mulcted in damages because of the burning of hay set on fire by sparks from a burning pole belonging to the company, this pole having become ignited through a short circuit arising from the failure of two insulators, appealed to the California District Court of Appeals. The court upset the verdict on the ground that no negligence had been shown and that where the facts in a damage case are undisputed and the course which common prudence dictates can be readily discerned the question whether a due degree of care was exercised by the defendant becomes one of law. The court held that the law did not impose the duty of an insurer upon the company and that a non-suit should have been granted. (190 P. 478.)

Recovery of Damages Denied Where Company's Negligence Was Not Proximate Cause of Injury.—In an action against the Ozark Power & Water Company for damages because of the death of a laborer who had assisted in felling a 50-ft. tree situated 40 ft. from the power company's line, this tree having in falling struck and brought down heavily charged wires with which the man subsequently came in contact, it was testified that the wires were uninsulated, the original covering having rotted away. The Missouri Court of Appeals sustained the action of the trial court in dismissing the case, holding the claim that the accident—one the electric company could not reasonably have been expected to foresee—would not have had fatal results had the wire been insulated was merely conjectural and that insulation would have been little likely to stand the impact.

Men of the Industry

Changes in Personnel and Position— Biographical Notes

C. S. Ruffner, who took office on Aug. 1 as a vice-president of the American Institute of Electrical Engineers, is vice-president of the North American Company, with headquarters in New York. Mr. Ruffner has served as a manager of the Institute and last year was chairman of the committee devoted to the economics of electric service. Before going to New York Mr. Ruffner was located in St. Louis as vice-president and general manager of the Union Electric Light & Power Company of St. Louis, which is controlled by the North American Company. He was born in Chicago in 1880 and graduated



C. S. RUFFNER

from the University of Missouri with the degree of bachelor of science in electrical engineering. His start in engineering work was with the Telluride Power Company and the Central Colorado Company in transmission work. Since 1900, however, he has been associated with subsidiaries of the North American Company, of which he became vice-president last year.

Dr. Cary T. Hutchinson, a well known consulting engineer of New York, has been appointed a division engineer in charge of matters pertaining to railroads in the super-power zone investigation. Mr. Hutchinson was born in St. Louis and received his education at Washington University in that city and at Johns Hopkins University in Baltimore. In his early experience he was associated with the Sprague Electric Railway and the Edison General Electric Company. Later he was a member of the engineering firm of Sprague, Duncan & Hutchinson. Since 1892 he has practiced alone as a consulting engineer. He was chief engineer for the McCall Ferry hydroelectric plant of the Pennsylvania Water & Power Company at Holtwood, Pa., on the Susquehanna River. He was also in charge of the work connected with the electrification of the Cascade tunnel on the Great Northern Railroad in Washington. Mr. Hutchinson is the secretary of the Engineering Foundation and also of the National Research Council.

G. H. Hagar, until recently associated with the Vallejo Light & Power Company, has recently been made assistant division superintendent with the Great Western Power Company. Mr. Hagar will be stationed at Nappa, Cal.

Dr. E. P. Hyde, who organized the Nela Research Laboratory in 1908 as the physical laboratory of the National Electric Lamp Works at Cleveland, has been advanced, through a reorganization of that laboratory in preparation for an expansion in its work, to the position of director of research. A new laboratory of pure science and a laboratory of applied science will together constitute the Nela Research Laboratories, and the work will be co-ordinated under the general direction of Dr. Hyde. Dr. Hyde is a graduate of Johns Hopkins University, from which he also obtained his Ph.D. degree in 1904. For eight years thereafter he was connected with the National Bureau of Standards at Washington, devoting much of his attention to the photometry of incandescent lamps and supervising the design and installation of the bureau's new photometric laboratory. In 1905 he visited a number of European laboratories on behalf of the bureau to investigate photometric methods abroad, but in 1908 he resigned as as-



DR. E. P. HYDE

sociate physicist of the bureau in order to take charge of the new physics laboratory of the associated lamp interests at Cleveland. Dr. Hyde is a charter member of the Illuminating Engineering Society and served as its president in 1910.

H. F. Jackson, vice-president of the Pacific Gas & Electric Company, San Francisco, Cal., and formerly the president of the Sierra & San Francisco Power Company up to the time of the leasing of its properties by the former company, has resigned his position to become general manager of the Great Western Power Company. Mr. Jackson was born in Kansas City, Mo., in 1871, and graduated from the United States Military Academy with the class of 1896. He went to Cuba for service during the Spanish-American war and later conducted important engineering work for the government. Mr. Jackson



H. F. JACKSON

resigned from government service in 1906 and was identified with the construction and operation of the Stanislaus hydro-electric development, working up through the ranks to general manager and to the position of president of the Sierra & San Francisco Power Company and the Coast Valleys Gas & Electric Company.

R. S. Reading has been appointed electrical engineer of the Galveston-Houston Electric Railway Company, the Houston Electric Company and the Galveston Electric Company.

F. M. Roberts, formerly manager of the Keokuk (Iowa) Electric Company, has resigned to enter the coal and builders' material supply business at Port Chester, N. Y.

J. C. Thompson, secretary of the California-Oregon Power Company, will succeed George J. Walton as superintendent of the Klamath division of the company at Klamath Falls, Ore.

W. G. Hoyt, district engineer for the Geological Survey at Madison, Wis., has been assigned as hydraulic engineer to make a survey of Snake River from Huntington, Ore., to Lewiston, Idaho.

T. H. Arnold has resigned as chief electrician of the mining department of the Arizona Copper Company, Ltd., with headquarters at Morenci, Ariz., to become electrical engineer for the Southwestern Portland Cement Company of El Paso, Tex., and Victorville, Cal.

Trade and Market Conditions

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

Trade Optimistic Although Collections Are Slower

IN SPITE of the stringency of credit and reports of slower collections, business conditions in the electrical industry give no cause for alarm. In fact, leading interests in the industry express very optimistic views as to the outlook for the electrical trade.

The tightness of money is causing some embarrassment to electrical jobbers because of the length of time they must wait to collect their bills, but even here the situation is not absolutely bad. Reports from the metropolitan district vary. Some jobbers express satisfaction with their accounts, others are having difficulty, but the general tenor seems to characterize conditions as fairly good.

Collections in New England are poorer, it is true, industrial customers there having gone to ninety days' payment instead of the sixty desired by leading houses. In the Middle West, however, collections, by the exercise of persistence, are remaining fairly good. In the Northwest they range from good to excellent throughout the entire district, though credit is being extended sparingly because of the fear of general inflation. On the Pacific Coast collections, while slower than last year, are not especially tight, averaging at present fifty-five days, against forty-five days for 1919. The payment of bills in the South is not proceeding altogether satisfactorily, but with the harvesting of the good cotton crop in sight money is expected to ease up. Reports from the Intermountain section state that collections are disappointing. This is proving to be a stressful period for dealers and distributers there who have large debit balances on their books, but the saving feature is the general tolerant and optimistic frame of mind that everywhere prevails.

Fiber-Conduit Production Booked Well Into Fall Months

BUYING of fiber conduit in the larger sizes has been very noticeable of late. Much of the material now going through and on order is of the 4-in. size, and some is going to 4½ in. In line with this there has been good buying of the larger sizes of lead-covered cable. At the same time it is known that as much duct ventilation as possible is desired.

Manufacturing output as a whole is booked up well into the last quarter of this year, October being well covered and much running into November. Here and there, however, a few small amounts may be taken care of late in September. At the same time, a good bit of business has been placed for 1921 delivery, and from the nature of the cable buying which has been going on this summer, it is rather expected that within the next few months fiber-conduit production will be well cared for for delivery running several months into the next year.

Demand is good all over the East and the Middle West, but there is not enough capacity to supply it quickly. The raw-material situation is in fair shape, but prices on pulp and compounds have advanced, along with the rates paid to mill workers all along the line to the finished conduit. Consequently, advances in price were made on the finished pipe during June and July, amounting to about 15 per cent. Labor is still unsteady and hard to obtain, and turnover is all too frequent. Because of this considerably more attention is being paid to the inspection of the product in its various stages of manufacture, with a consequent higher cost of production. Extra night shifts are particularly difficult to get and to keep.

Export demand is good, but shipping rates are almost prohibitive. There is not enough fiber conduit made to supply both foreign and domestic trades, so the foreign allotments are liable to suffer.

Analysis of Exports of Electric Fans for the Year 1919

DURING 1919 a total of 76,457 electric fans, valued at $1,421,160, were exported from the United States. The highest monthly value was recorded in May, amounting to $269,934. The average monthly rate of exportation was $118,430. The value of this class of exports was considerably below the monthly average during the latter half of the year, reaching the low point in December, when a value of only $32,648 was recorded.

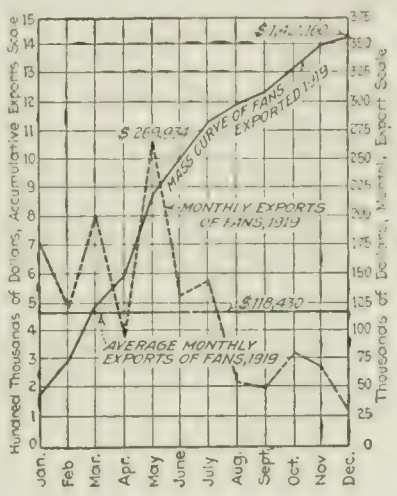


FIG. 1—MONTHLY VARIATIONS OF EXPORTS

Data compiled by the ELECTRICAL WORLD indicate that 28 per cent of this class of exports were consigned to British India, with a total of $321,901. Canada and China were second and third, with $289,319 and $277,965 respectively. Fig. 2 indicates the extent of these exports to various foreign countries. England is the only European country and Argentina the only South American country to import American fans valued at more than $25,000. The neighboring countries of Canada, Mexico and Cuba took about 27 per cent of the total exports of this class of electrical goods, valued at $389,849. Taking into consideration only such countries as imported $25,000 or more of this class of American electrical goods, continental America accounted for $480,790 worth, or about 34 per cent, and the Far East, which includes British India, China, Hongkong, Philippine Islands and Australia, took 53 per cent, valued at $752,981.

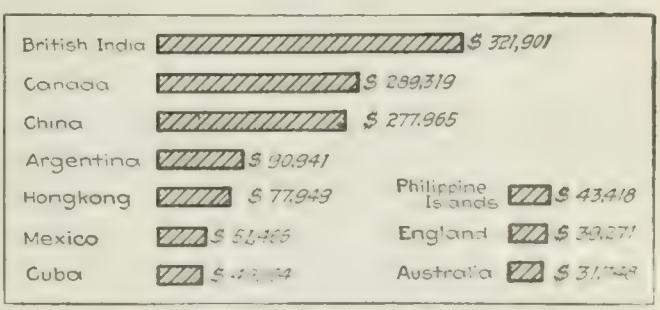


FIG. 2—ANALYSIS OF EXPORTS BY COUNTRIES

No Geographical Discrimination in Shipments

THERE is a feeling among some Pacific Coast buyers that manufacturers have been neglecting them in favor of Eastern firms, but an investigation shows that buyers in the East think it is they who are being discriminated against. During the switchmen's strike the East had some cause for complaint because the far West received more than its share of electrical apparatus from Middle Western manufacturers for the reason that railroads would not accept shipments consigned to the East. Local buyers in cities where the factories are established also complain that others are getting more goods than they. However, no one in the field seems to have been able to obtain all the supplies that were needed, and this appears to have been at the root of the trouble rather than any discrimination in favor of or against any geographical group of buyers. Furthermore, there is every indication that deliveries in most lines are improving and that they will continue to grow better for some time to come.

Almost all the principal manufacturers of electrical devices and apparatus allot a certain percentage of their output to each section of the country, and this allotment is based on the records of previous requirements. Every effort seems to have been made to treat all customers alike, and there has apparently been no idea of diverting shipments from representatives or customers on the Pacific Coast. During railroad embargoes, however, it is a case of making shipments according to the dictates of the transportation companies.

Normal Buying of Commutator Segments

MANUFACTURERS of commutator segments report that sales are proceeding at about a normal pace but that demand is not extraordinarily heavy. Segments for railway motors have probably been in a little heavier demand as the result of necessary repairs to the many motors which were damaged by the severe storms last winter.

With the supply of copper in as easy a position as at present, raw material is not a question to worry producers especially, but considerable complaint is heard against transportation as a factor in lengthening deliveries, which are quoted by several representative manufacturers at from six to twelve weeks. These same companies report a normal volume of production that is gradually catching up with those orders which in some cases have fallen behind as a result of long deliveries. No orders have been canceled, however.

Labor troubles are here and there experienced, but as a whole the situation in that respect is considered good. Prices at present are steady, and while some companies look for further increases, those that think the market will remain firm seem to be in the majority.

Collections are rather slow and accomplished with difficulty according to the credit manager of one of the largest manufacturers of this material. Public utilities appear to be the worst delinquents in this respect, but with financial relief being more and more accorded in the form of rate increases improvement is looked for.

Arc Lamps Again Showing Good Demand

ARC-LAMP sales for municipal street-lighting service have picked up considerably since the end of the war, and at present the business being booked exceeds that of last year up to this time by about 75 per cent. Prices are not far from 50 per cent above pre-war figures in this class of equipment. Deliveries range from two to three months, notwithstanding the difficulties of the transportation situation. Factory stocks are very satisfactory as regards electrodes, but the shortage of sheet iron and other sheet metal, combined with long deliveries on magnet wire, have not yet been sufficiently overcome to enable stocks to be built up in finished lamps.

A good deal of street-lighting extension work held back by the war has been carried forward of late, but it has not been brought strongly before the trade. Much interest exists today in regard to the definition of fields of maximum usefulness and economy for both arc and gas-filled series lamps, and the enormous growth of the latter in outlying-district illumination has not by any means driven the magnetite arc lamp from its position in so-called downtown lighting. Recent improvements in the manufacture of electrodes under higher pressures will soon enable their user to enjoy an increase of about 50 per cent in electrode life, and this fall it is expected that considerable new business will be developed from this source.

A noticeable increase in exports of arc lamps is noticeable in the export returns of the month of June. During that month arc-lamp material to the value of $7,743 was shipped from the country, which is more than two times in excess of that of any other month this year, and greater than that of any other month during 1919. The figure is not large, but shows that the arc-lamp export market is growing, inasmuch as the total value of exports for this class of goods was but $14,139 for the entire year of 1918 and only $16,893 in 1919.

Metal Market Situation

QUIETNESS is still the prevailing feature of the copper market, with producers holding for 19 cents, and they are apparently under no great pressure to sell in spite of the light demand. Domestic consumers are showing very little interest in future positions in the face of uncertain conditions, but small sales are being made at 19 cents for August, September and October delivery, showing that producers are absorbing the advance in freight rates which will be in effect the latter part of this month.

In the outside market sales are also light, but no great offerings are pressing. Some sales have been made at 18.50 cents, but 18.75 cents is generally asked for September and October shipments. The foreign market presents a dull tone, probably under pressure of the delicate international situation, but it is evident that no great exportation of copper will occur while the exchange rate continues so heavily against Europe as it does at the present time.

Although zinc advanced 12½ cents during the last week, no great activity is evidenced. The market is quiet but firm, with a very small amount being offered. A slightly heavier market prevails in tin, with several concerns anxious to sell for prompt delivery, but there is little demand for spot tin.

Business in old metals has been fairly good, but embargoes, freight congestion and shipping difficulties have interfered with the turnover of goods. No change in prices has been recorded the past week.

NEW YORK METAL MARKET PRICES

	August 3	August 10
Copper	£ s d	£ s d
London, standard spot	92 10 0	93 10 0
	Cents per Pound	Cents per Pound
Prime Lake	18 62½	18 75 to 18 85
Electrolytic	19 00	19 00
Casting	18 00	18 00
Wire base	22 50 23 00	22 50 23 00
Lead, trust price	8.50	8.50
Antimony	7 25	7 00
Nickel, ingot	43 00	43 00
Sheet zinc, f.o.b. smelter	12 50	12 50
Zinc, spot	8 02½	8 15
Tin	48 25	48 25
Aluminum, 98 to 99 per cent	33 00	33.00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	15 50 to 16 00	15 50 to 16 00
Brass, heavy	9 25 to 9 50	9 25 to 9 50
Brass, light	7 25 to 7 75	7 25 to 7 75
Lead, heavy	7 25 to 7 50	7 25 to 7 50
Zinc, old scrap	5 50 to 5.75	5.50 to 5.75

THE WEEK
IN TRADE

ALTHOUGH quieter trade is everywhere reported in the electrical industry, as a whole sales volumes are generally satisfactory and an optimistic feeling seems to prevail. The Intermountain district presents the worst business condition as a result of the demoralization of its important wool industry, but recent labor troubles in that section are subsiding and a hopeful tone is evident there. Crop prospects everywhere seem bright, and the resultant money released to circulation following harvests will mean increased electrical sales, it is expected.

Stocks in most lines are very much freer as reports of easier transportation and better deliveries continue to come in. The car shortage in the South and Northwest is still serious, however, holding up vital supplies of lumber and grain in the latter district.

Residence construction seems to be falling off in nearly every part of the country as money for construction purposes remains tight and prices of building material continue high. This condition even prevails in districts like New England, which previously had reported great building activity. As a result of this the sales of house-wiring material show some dropping off, though an exception to this rule is found in San Francisco, where the number of jobs under way is greater than ever before.

A break in the general shortage of rigid conduit appears as territory east of the Mississippi reports signs of relief, but points further west are still meeting famine conditions.

NEW YORK

Uneven trade conditions are reported in the electrical business the past week. Several jobbers say that their business is as good as it ever has been and that they have as yet experienced no let-up. Others, however, are finding a considerably slackened volume of trade, and one representative house even characterized the situation as "rotten."

Stocks, however, in general are undoubtedly improving in the face of lessened demand and more regular shipments, but certain items, such as pipe, porcelain and some of the steel material like outlet boxes, are still very short.

The lack of residence construction is having its effect uopn the electrical trade though the big contractors are very optimistic. House construction represented only 18 per cent of the total building contracts for July in this district, which is a large decline from the figures for the month of June.

Transportation has eased up to some extent, although jobbers are still complaining about both incoming and outgoing shipments. No trouble is experienced with express shipments, however. Orders that are now being delivered are mostly ones which have been on the books for a long time.

Stocks of flexible armored conductor are much better, and the rigid-conduit supply also shows some slight signs of improvement. A shortage of heating appliances and flush switches is looked for in some quarters later on.

Outlet Boxes.—Some shortage is reported in the face of a good demand with very low stocks the rule. Shipments are irregular.

Metal Molding.—This is in fair demand and stocks seem to be in good shape. Certain fittings are not so plentiful as the molding itself.

Rigid Conduit.—The situation is undoubtedly bad, but some signs of easing up are appearing. One jobber has a large stock and another is almost overstocked on small sizes of black conduit. Shipments are very irregular, however, and where any stocks exist they are mostly light. Demand holds up well. Prices for ½-in. black range from about $90 to $105 and for the ¾-in. black from $128 to $135 per 1,000 ft.

Knife Switches.—Demand in general seems to be off though some jobbers report a good call. Fairly good stocks are on hand. Shipments for some are coming in well and others are reported poor.

Flexible Armored Conductor.—The trade continues to find a much easier situation here. Demand has slackened and shipments are a bit more regular, although here and there jobbers are still short, but on the whole fair stocks are accumulating. From around $110 to $115 is being quoted, though in one case the price ranged as low as $105 and in another as high as $121 per 1,000 ft.

Weatherproof Wire.—An easy supply is reported, with good stocks and no difficulty as to shipments. Demand is only average. A representative firm quotes No. 14 at about 60 cents a pound.

Sockets.—One jobber has no stock of any type, and though another has been short on keyless, stocks on the whole seem to be substantial and able to fill the fairly good demand without difficulty.

Heating Appliances.—Shipments are very slow and irregular, back orders of six and seven months' standing just arriving for some jobbers and easing up present supplies, but a big shortage seems to be generally anticipated for the holiday trade. A good summer demand is reported.

Fans.—A few jobbers who stocked light are jubilant over prospects of emptying shelves, but by far the majority will have to carry over a great many more fans than they would like to.

Flush Switches.—In some quarters a scarcity is looked for this fall, but at present stocks are good and demand fairly steady though some jobbers are finding it light because of the dearth of residence construction.

Heaters.—Some jobbers are already stocked up, but others are holding off ordering to see how the coal situation breaks and because of the uncertainty of the weather outlook.

CHICAGO

There are no present indications of any real resumption of the construction industry in this section. Permits issued during July totaled only $6,700,000 and for the first week of August $841,000. Architects and engineers are one in stating that they have many jobs "on the boards," but they are uniformly delayed pending arrival of more favorable conditions.

Jobbers are busy, and with the easing up of traffic conditions, which now so far as the movement of freight is concerned are approaching normal, considerable supplies of all materials are being received and orders long on the books are being filled. Inquiries continue numerous, but the actual placing of orders is light compared with business in the spring. There is considerable difficulty experienced in obtaining cars, but with the speeding up of cars in transit this condition should improve, and many interests that were seriously inconvenienced by shipping delays now announce themselves in better condition. Price conditions are stable, no changes of moment being noted.

Wire.—Difficulty on the part of manufacturers in getting cars has led to a reduction in stocks in the local market. Deliveries have been considerably slowed up thereby, bare copper requiring up to thirty days. Prices, while unchanged, are very firm, and the feeling is that a slight advance may be looked for soon.

Galvanized Strand.—The shortage in this commodity is severe, local stocks being practically exhausted. It is impossible to obtain definite promises of delivery and prices have been withdrawn, orders being booked for the price ruling at time of shipment.

Rigid Conduit.—Receipts have fallen to a minimum in the last week and deliveries are made uncertain thereby. Factories report ample supplies, and upon the relief of freight car troubles local supply conditions should be speedily improved.

Line Material.—The car shortage has curtailed receipts, but rate increases have put many utilities in the market for material and inquiries are now very brisk. Line hardware and porcelain insulators are almost unobtainable, while poles and cross-arms are scarce on account of shipping troubles. Locust pins are obtainable with less difficulty.

Schedule Material.—Stocks are well maintained, principally owing to light demand, as new construction work is off. Rosettes, sockets, etc., are obtainable from stock and receipts from factory are ample.

Heating Appliances.—Warmer weather has improved retail sales and jobbers are all busy in filling back orders. New orders do not amount to much at present. Some concerns report cancellations from industrial centers which have experienced industrial depression, but such cancellations do not amount to any great sum.

Ranges.—Much interest is being displayed by the country trade, particularly in the Northwest, in ranges for fall delivery. Fair stocks are held in Chicago, but at the rate orders are being placed deliveries will soon have to lengthen.

High Tension Equipment.—New discounts on unit-type high-tension Delta-Star Electric Company equipment are covered by discount sheet No. 14, dated Aug. 1. Prices have advanced approximately 10 per cent.

BOSTON

Quieter business marks the mid-vacation season in trade. The larger jobbing houses report well-sustained buying, but the smaller establishments note a decided curtailment. Stocks are gradually increasing in size, except in porcelain material and motors. Building and engineering contracts in New England to Aug. 5 this year total $210,835,000, compared with $113,087,000 for the same period last year, but recent contract totals do not maintain this increase. Contractors are very busy on industrial wiring. The appliance business is relatively quiet. A new seven-hundred-thousand-dollar telephone exchange will be built in Boston shortly, and a large amount of manufacturing plant extension work is being carried forward at present.

Fans.—Notwithstanding recent extremely hot weather jobbers' stocks of fans are still unexhausted. Poor fan weather early in the season is responsible. A representative make sells at $42 list in the 16-in. oscillating type and $37 list in the 12-in. size, a discount of 25 per cent being given dealers on lots of twelve.

Motors.—Increased manufacturing facilities combined with a slight recession in demand are enabling stocks to be built up to a small degree in some of the smaller sizes. On alternating-current motors of 1-hp. to 10-hp. rating a leading agency quotes deliveries of twenty-eight weeks' average. On direct-current motors twenty-two to twenty-four weeks' delivery is quoted. Prices are steady.

Wire.—Stocks are now well built up, although magnet wire is still very difficult to obtain. Rubber-covered wire, No. 14, sells for $11 per 1,000 ft. in 5,000-ft. lots. Weatherproof base is 29 cents, with bare base 24 cents.

Non-Metallic Flexible Conduit.—Prices are easier, the ½-in. size selling this week for $33.50 per 1,000 ft. in 1,000-ft. lots and the ¾-in. size at $36.50. Buying is falling off somewhat. Stocks are reasonably full.

Porcelain Tubes.—All porcelain material is very scarce. When obtainable 3-in. tubes are quoted at $11.35 per 1,000 in barrel lots.

Rigid Conduit.—Conflicting reports are received as to the supply, but in general some improvement can be seen. Stocks are spotty. Substitutions are frequently necessary in order to complete jobs, one contractor having used 2-in. and 4-in. elbows in face of a shortage of 1¼-in. units last week. Occasional carload shipments are being received and old customers' orders are being filled in this way as far as possible.

Storage Batteries.—Trade continues brisk, with firm prices and good local stocks. A leading distributer reports increased business over last year and is making excellent deliveries as a result of forehanded shipments.

Ranges.—The demand holds up well, despite the lack of any concerted sales campaigning in retail circles. Shipments from factory stock can be obtained on a representative well-established design, while three months' delivery is quoted on a design specially suited to apartment-house service. Raw material is coming to hand in relatively larger quantity than hitherto.

Flatirons.—A sustained demand is being experienced. A leading factory is still considerably behind on orders, but is getting out production on a very satisfactory basis.

ATLANTA

Underlying business conditions throughout the district showed little change during the past week, and jobbers report a continuation of the dullness that has been referred to heretofore. Business conditions, however, are in a healthy state, and the slump of orders is largely to be accounted for by the summer season. Building permits for Atlanta for the month of July were $1,608,000, as against something over $2,000,000 for the month of June; but construction in the smaller cities shows an increase for the month of July. Agricultural reports for the section show that all crops are in excellent condition, and the outlook throughout the rural district is very bright, provided that there is not an unusual spell of bad weather between now and fall.

Jobbers report an improvement in the receipt of material, and this, together with a general slackening of orders, is permitting the accumulation of small stocks in some classes of material. The congestion in transportation is still acute and is interfering materially with the completion of buildings under construction. Of course this is holding off the installation of electric wiring and apparatus and contributes its share to holding down the receipt of orders.

Metal Molding.—Difficulty in obtaining rigid conduit has served to stimulate the movement of metal molding, though it has not become so popular as the shortage in rigid conduit would have led one to believe. Stocks are reported on hand in sufficient quantities to meet all reasonable demands.

Rigid Conduit.—The situation is reported as considerably better than for some months past, fair stocks of some sizes being on hand. Great difficulty is experienced, however, in obtaining galvanized pipe straps; in fact, there are no stocks in the territory and jobbers can offer no hope of an early relief.

Lamps.—Dealers are placing orders for fall stocks in very fair quantities. One of the largest jobbers predicts that considerable difficulty will be experienced in meeting the demand, insufficint quantities of 100-watt type C lamps already being reported.

Wire.—Several very large shipments of wire were received the past week and stocks are in fair shape. A sharp break in wire prices is to be noted, in one or two extreme cases weatherproof being quoted on 26½ cents base; rubber-covered, 30 cents base. The demand is holding up well in all sizes.

Safety Switches.—The tendency to substitute this device for the old open type is on the increase and demand continues very brisk as a result. Deliveries have been coming through satisfactorily and stocks are reported in very fair condition. A price advance of approximately 10 per cent on sizes of 60 amp. and over is to be noted. In quantities of $600 two-wire, 30-amp. are quoted at $1.77; three-wire, $2.65.

Flexible Non-Metallic Conduit.—There is still a shortage, though jobbers are expecting to receive a large supply in the near future. The demand continues very brisk with quotations for ⅜-in. at $4.62 per 100 ft.; ½-in., $4.24 per 100 ft.

Fuses.—A normal movement is reported, with stocks in fair condition throughout the territory. There is a very general shortage of plug fuses in 15-amp. sizes. Prices, plug fuses, lots of 500 and over, 5 cents each.

Flexible Armored Conductor.—There has been little let-up in demand, and poor shipments have prevented the accumulation of any stocks. Such supplies as are received are redistributed on an allotment basis. Prices on two-wire, No. 14, lots of 1,000 ft. to 2,500 ft., $11.60 per 100 ft.

SAN FRANCISCO

The contractors' committee is still considering the request of the electrical unions for higher wages. It is claimed that $10 a day for electricians and $9 a day for fixture hangers will add appreciably to the cost of jobs and that the public will hesitate about paying the increases. There are more large jobs under way at present than there have been in many years, and other work also continues brisk. The value of the building permits issued in the three principal California cities for July, 1920, is: Los Angeles, $5,121,000; San Francisco, $4,311,000, and Oakland, $1,374,000. The 1919 figures were respectively $1,887,000, $1,832,000 and $596,000. While freight shipments from the factories are slower than they were last year they are more regular and stocks are in better shape than they have been for some time.

Sewing Machines.—Higher retail prices for garments have caused a noticeable increase in the sale of sewing machines. As an evidence of better merchandising ability on the part of electrical dealers it is reported that jobbers have surplus stocks of the cheaper vibrating types, whereas they are constantly short of the higher-priced rotary styles.

Flashlights.—During the last week of the Everyready picture title contest it was reported that a total of more than 1,000,000 blanks and 500,000 miniature pictures had been distributed along the Pacific Coast, with gratifying sales by jobbers and dealers alike.

Batteries.—Although various causes are gradually cutting down the sale of single dry batteries there is a marked increase in the sale of manufactured combinations of batteries such as the "Hot Shot." Wherever dealers have displayed such lines a good increase in orders has resulted.

Farm Plants.—Well-advertised affairs to be held during the autumn will give exhibitors splendid opportunities for demonstrations of various types. Annual fixtures such as the Sacramento State Fair in September and the Fresno County Fair in October will result in many sales, it is expected.

SEATTLE—PORTLAND

Practically the same conditions in the electrical business as outlined for several weeks past still obtain in Seattle and the Puget Sound territory. In towns and communities in this district, except Seattle, sales volumes, generally speaking, are satisfactory. In Seattle, however, sales continue on the decrease, and this applies to nearly everything electrical that is sold. Especially is the decrease noted in the movement of schedule materials owing to the dropping off in residence building. With but one or two exceptions stocks are in good condition and are improving daily. Shipments from Eastern factories are much freer, enabling jobbers to fill all demands and still build up stocks. Since the price increase of recent date, touching nearly every line, prices have been holding firm at a new high mark. Signs of resumption of building activity on a large scale have been noticed the past week. At the present time every available freight car on the Northern Pacific system is being sent into the Northwest in order to give relief to lumber operators and permit them to ship all unfilled orders before the new advance in freight rates becomes effective the latter part of this month. Nearly all lumber mills and logging camps in Oregon and Washington which were closed down for repairs early in July are now operating again, many of them running two shifts. There is a scarcity of labor in the camps but mills seem to be fairly well supplied.

Schedule Materials.—With the exception of a very few items comparatively satisfactory stocks are reported in the Puget Sound district. Seattle jobbers as a whole have large stocks owing to the decreasing demand the past month. Shipments are coming through satisfactorily and prices hold firm.

Small Motors.—Hope for relief has been given up entirely. Demand is constantly increasing and is very strong from fruit canneries, garages and small industrial plants.

Lamps.—Practically every concern in the Puget Sound district reports excellent stocks in all sizes. However, this is the off-season and demand is negligible, mainly for replacements.

Flashlight Batteries and Lamps.—The usual vacation season demand is being met with no particular difficulty. Stocks, generally speaking, are in fair shape and shipments are coming through satisfactorily.

Fuses.—Seattle jobbers report ample stocks for a demand which is below normal and decreasing gradually. What call there is is about equally divided between renewable and non-renewable types. Shipments are good and prices steady.

Conduit Fittings.—With the exception of some few items which are short owing to raw-material difficulties, stocks are in fair shape. Demand is only fair. Prices are fluctuating, but no particular change is noted.

Switches.—In the face of sub-normal demand which shows no great sign of improving stocks of snap and push-button types are in good shape. Stocks of knife switches are ample to care for the light demand.

Ranges.—Both central stations and jobbers report that demand for ranges continues strong in spite of recent advances in price and the fact that no campaigning is being carried on. There is a shortage in nearly all types. Deliveries are far from satisfactory.

SALT LAKE CITY—DENVER

The demoralization of the wool industry is having a serious effect on merchandising conditions in the Intermountain States. Millions of dollars that would normally be in circulation from this source must this year be counted lost. This is one of the big contributing causes to the semi-slump that now exists, as a setback to the wool industry has a far-reaching effect on commerce and trade.

Transportation continues slow and uncertain. Eight to nine weeks are required to get shipments from Eastern factories, though deliveries are improving. A serious congestion of freight is anticipated next fall when the increased freight rates take effect. Factories are urging jobbers to place orders for immediate deliveries to obviate being caught in the probable rush.

Building and construction show little improvement. A lot of big construction is projected, but just now deferred operation is the rule. It is next to impossible to obtain money for any sort of building activity. Labor troubles, too, have a deterring effect. The situation there, however, is improving. It is conceded that the unions have lost in their fight against the "American plan" and that hundreds of union men are going back to work. Much delayed construction will now be resumed.

With the beginning of the crop movement there is a slight indication of improvement in general market conditions. It is believed that the big and real alleviation will come with the harvesting of the sugar-beet crop, which puts in circulation many millions of dollars. Electrical merchants are optimists. Despite the handicaps under which they are operating just now they foresee better days soon.

Fans.—At the closing of the active fan season jobbers report little stock on hand. The demand has shown a marked decline in the past week as there is little market for fans here after Aug. 1.

Porcelain and Pole-Line Hardware.—Extreme difficulty is experienced in getting deliveries. Shortage of factory labor is given as the cause. Several big construction jobs are under way in the Mountain States, and there is consequently a big demand for these lines.

Rigid Conduit.—No stocks are available. The condition seems general, and appeals to jobbers for release of their contracts at a premium are being received from points as far away as Cuba.

Rubber-Covered Wire.—There is a decided shortage here. Jobbers are looking forward to an advance in price.

Steel Plates.—Material for switchboards is almost impossible to get. Factories are away behind in their orders.

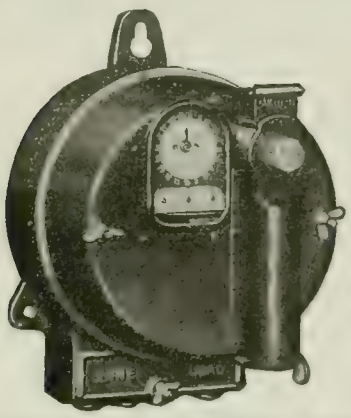
Lamp Cord.—The lamp-cord situation is decidedly bad. Many dealers are cleaned out, with small prospect for delivery in the future.

NEW APPARATUS & APPLIANCES

A Record of Latest Developments
and Improvements in Manufacturers' Products
Used in the Electrical Field

Prepayment Attachment for Watt-hour Meter

For supplying energy to small consumers and a shifting population, the type OA prepayment attachment for type OA single-phase watt-hour meters has been manufactured by the Westinghouse Electric & Manufacturing Company. The meter may be changed back to standard by replacing the



PREPAYMENT UP TO SIXTEEN COINS MAY BE USED

standard register and cover. The attachment mechanism is mechanical and operated by a 25-cent piece. The turning of a knob winds a spring which is unwound by the gears at a speed depending on the rate per kilowatt-hour for which the attachment is furnished. From 4-cent to 25-cent rates, full-cent values, may be used. Integrating dials may be attached.

Electrically Operated Advertising Sign

For displaying advertising cards in shop windows, a motor-driven card-display machine is being manufactured by the United Advertising & Sales Company, San Francisco, Cal. Twenty-four cards of standard street-car size can continuously rotate in this machine, individual cards sliding into view at definite intervals. Chains at both ends are driven by a Westinghouse type CA, 1/20-hp., 110-volt, 1,750-r.p.m. motor through a horizontal shaft, worm gear and belt.

Clothes Washer

A new reversing, revolving-cylinder-type washing machine, the Rotapex, has been placed on the market by the Apex Electrical Distributing Company, Cleveland, Ohio. The Armco iron or copper cylinder is driven 23 r.p.m. and reverses once in every five and one-half revolutions. An 11¾-in. power-driven, safety-release wringer is used, and the ½-hp. inclosed motor is ventilated. The machine occupies 26½ in. by 25½ in. of floor space.

Audion Control Cabinet for Radio Work

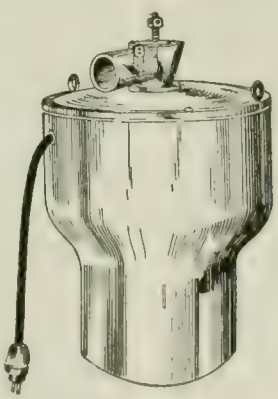
The audion control cabinet, type A1, made by the K. & G. Wireless Supply Company, 152 Chambers Street, New York City, measures 8 in. x 5¾ in. x 6 in., is of mahogany finish, and contains the following instruments: Vacuum tube receptacle, filament rheostat, grid condenser, grid leak and filament switch. The tube receptacle will take any standard four-prong bulb. The plate-battery space is designed to take two batteries of the standard 22½-volt type. The filament rheostat is interior-mounted and adapted for either 4 volts or 6 volts.

Electro Trouble Detector for Automobiles

An instrument for measuring current and detecting trouble in the electrical apparatus of any make of automobile is being marketed, under the name of "Hyrate," by the Service Station Supply Company, 30 East Larned Street, Detroit, Mich.

Player-Piano Power Plant

A motor unit, known as the "Aerex," which can be attached to any player piano to play electrically, has been put



ELECTRIC PIANO MADE FROM MECHANICAL PIANO

on the market by H. W. Yeager & Company, Inc., 154 North Eleventh Street, Philadelphia. After the device is installed, it is necessary only to connect the piano to the house circuit by a cord. Control is by push button. About 100 watts is consumed in operation.

Automatic Safety Bowl Heater

For guarding against danger of fire or scorching, a new heater is being brought out by the Edison Electric Appliance Company, Inc., New York City, with certain safety features. An automatic gravity switch is mounted in the base of the heater, and when the latter tips over, face down, the switch disconnects the circuit. When the heater is righted the current is automatically turned on again. The bowl is also so hinged that it cannot be



CURRENT DISCONNECTED IF HEATER FALLS OVER

tipped down far enough for the heat rays to strike the floor. In the Hotpoint line the heater is called the "Hedlite-Automatic," and in the Edison line the "Edison Glow-Automatic."

Battery Testing Voltmeter

A battery-testing voltmeter (model No. 443), designed for the car owner, battery service station and garage men, has been developed by the Western Electrical Instrument Company, Waverly Park, Newark, N. J. Features of the instrument are its compactness, acid-proof case and legible scale. In addition to its normal scale of zero to 3 volts, the instrument is calibrated so that part of the scale (to the right and left of zero) is specially divided for making the cadmium test.

Notes on Recent Appliances

Time Clock

The Warren time clock, a synchronous motor operating a clock movement to compare speed of synchronous generator with exact time, is being manufactured by the General Electric Company.

Electric Drier

An electric shoe sole drier is being manufactured by the S. U. E. Company, 89 Beach Street, Boston, Mass.

MANUFACTURERS' ACTIVITIES

Record of Changes Affecting Sales and Distribution
Together with Trade Personals and Notes on Foreign Trade,
Jobbers' News and New Trade Literature

THE PORCELAIN INSULATOR CORPORATION, Lima, N. Y., recently incorporated with a capital stock of $250,000, is planning to erect a new plant on the old site of the plant of the Locke Insulator Manufacturing Company, which was destroyed by fire more than a year ago. The new company will manufacture high-voltage porcelain insulators and electrical appliances, starting with a four-kiln capacity. It is expected to have the plant in operation by January, 1921. W. F. Harvey is president, D. H. Finucan vice-president, B. A. Plimpton secretary and V. E. Taylor Treasurer.

THE REPUBLIC ELECTRIC MANUFACTURING COMPANY, 1820 East Eighteenth Street, Cleveland, Ohio, will soon open bids for the erection of a three-story factory and office building, 50 x 50 ft., on East Eighteenth Street and Chester Avenue, to cost about $100,000. L. Griesser is president

THE EXIDE BATTERY COMPANY, 5125 Perkins Avenue, Cleveland, Ohio, has awarded contract for alterations to factory, to cost about $60,000.

THE OHIO ELECTRIC CONTROLLER COMPANY, 5900 Maurice Avenue, has awarded contract for erection of an addition to its factory, to cost about $60,000.

THE DETROIT INSULATED WIRE COMPANY, Wesson and Albert Streets, Detroit, Mich., has awarded contract for erection of a three-story addition to its factory, 40 ft. x 80 ft., to cost about $80,000.

THE FRANK ADAM ELECTRIC COMPANY, 3640 Windsor Place, St. Louis, has awarded contract for erection of a one-story factory building, 147 ft. x 190 ft., to cost about $150,000.

B. F. RUREY, formerly in charge of the electrical department of the George H. Smith Steel Casting Company, Milwaukee, Wis., has been appointed electrical superintendent for the Milwaukee Rolling Mills Company, which was organized about a year ago. Mr. Rurey has been engaged in electrical maintenance and construction work for the past ten years.

THE ELECTRICAL MATERIAL COMPANY, 822 West Jackson Boulevard, Chicago, has established an appliance department for handling a number of electrical household appliances, including Torrington cleaners and the Rutenber products. The company has also taken over the distribution of the "2-in-1" washer manufactured by the Minier (Ill.) Manufacturing Company in Michigan, Indiana, Illinois and Iowa. Charles E. Kile is in charge of this department.

THE O'ROURKE CRANE & ENGINEERING COMPANY, 366 Fifth Avenue, New York City, recently incorporated, will establish a plant at Hudson, N. Y., for the manufacture of overhead electric traveling cranes, derricks and hoists for industrial plants, docks, terminals, etc. F. E. O'Rourke is president and general manager, P. R. Moses vice-president, and John N. Trainer treasurer.

THE ELECTRIC STORAGE BATTERY COMPANY, Nineteenth Street and Allegheny Avenue, Philadelphia, has filed plans for its proposed new plant at Rising Sun and Adams Road. Seven buildings will be erected, to cost about $224,000. The company recently increased its capital stock by $12,000,000, of which a large portion will be used for expansion.

THE AMERICAN BOSCH MAGNETO CORPORATION, Springfield, Mass., shows that sales at present are running at the annual rate of about $12,000,000, compared with about $6,000,000 in 1919. In the five months ended with May 180,000 instruments were shipped by the company, whereas in the entire year 1919 the total output was 207,000 instruments. Unfinished orders at the end of May, 1920, totaled $8,000,000, which shows a substantial increase over the $7,000,000 of unfinished orders held at the beginning of February, 1920, the increase being at the rate of $3,000,000 per annum.

EDWARD W. HARRY, electrical engineer of the National Tube Company, McKeesport, Pa., left the electrical department on July 17 to become chief electrical engineer with the Pittsburgh Steel Company at Monessen, Pa., Mr. Harry started with the electrical department in 1910 as a lineman and while there took a course in electrical engineering in the Carnegie Institute of Technology, from which he was graduated in 1915.

THE MERMAID ELECTRIC DISHWASHER COMPANY, Middletown, Conn., announces that H. W. Karstens has been appointed sales manager. Previous to joining the Mermaid organization Mr Karstens was sales manager of the electrical jobbing house of the Elliott-Lewis Company, Philadelphia. His earlier experience was gained with the Franklin Electric Manufacturing Company and the Holophane Works of the General Electric Company, for both of which he traveled in the western states.

L. D. DUNTLEY has become associated with the Black Swan Company, 1100 Marshall Street, Minneapolis, Minn., where he will assume active management of sales. He was formerly general sales manager of the Bluebird Appliance Company, St. Louis, Mo.

HENRY PRICE BALL has become consulting engineer of the Redtop Electric Company, 8 West Nineteenth Street, New York City, manufacturer of elctric stoves, Mr. Bell was for several years with the General Electric Company as engineer of the electric heating device department.

THE WESTINGHOUSE LAMP COMPANY, 165 Broadway, New York City, has purchased a site on Arlington Avenue, Bloomfield, N. J., directly opposite the Watsessing branch of the company. The site consists of 2.6 acres and will provide for future extensions.

RALPH B. COLEMAN, formerly of the Chicago offices of the Maloney Electric Company, has joined the sales forces of the Consolidated Wire & Machinery Corporation, 519 West Van Buren Street, Chicago. Mr. Coleman has been in the West for the past twenty years and has a wide acquaintance among central-station men in that section.

BERT ROTH, formerly the Yale Electric Company, West New York, N. J. announces the removal of offices to 98 Springfield Avenue, Newark, N. J., where he will continue in electrical advertising business.

THE ELECTRIC CONTROLLER & MANUFACTURING COMPANY, 2700 East Seventy-ninth Street, Cleveland, Ohio, has opened a new office in the Witherspoon Building, Philadelphia, in charge of H. K. Hardcastle.

THE DETROIT INSULATED WIRE COMPANY, 641 Wesson Avenue, Detroit, has awarded contract for a one-story addition to its plant.

THE WESTERN AUTO ELECTRIC COMPANY, Los Angeles, Cal., has completed plans for the erection of a two-story plant, 141 ft. x 155 ft., at the corner of Sixteenth and Hope Streets. The company manufactures electrical accessories for automobiles.

DEWEY, STRONG & TOWNSEND, Crocker Building, San Francisco, Cal., announce the entry of William A. Loftus, Thomas Castberg, James M. Abbett and John H. Herring into the firm, which will be known as Dewey, Strong, Townsend & Loftus. Mr. Herring will have charge of the trademark and foreign department; Mr. Abbett will specialize in chemical and electrical patent matters; Mr. Castberg will devote his attention to engineering and industrial cases, and Mr. Strong, after more than fifty years of active practice, will retain his association in an advisory capacity.

THE STUART PRODUCTS CORPORATION, manufacturer of batteries, is now established in its new quarters at 665 Washington Boulevard, Chicago. The company has organized a sales promotion department to co-operate with its jobbers and dealers.

WESTINGHOUSE CHANGES — The Westinghouse Electric & Manufacturing Company announces that L. D. Canfield, assistant district service manager at the New York office, has been appointed district service manager to succeed L. G. Richards, who has been transferred to East Pittsburgh. G. O. Noble has been appointed special representative, and R. A. Hopkins, manager of the power and marine division in the Los Angeles district office of the company.

THE BENJAMIN ELECTRIC COMPANY, Chicago, is planning to erect a one-story power house, 77 ft. x 147 ft., at its Desplaines plant. The company is offering for sale $1,500,000 in 8 per cent gold notes, the proceeds to be used to take up outstanding indebtedness to banks.

HARVEY HUBBELL, INC., Bridgeport, Conn., has filed plans for the erection of an addition to its plant, one-story, 80 ft. x 85 ft., with wing extension, 16 ft. x 80 ft.

LANDERS, FRARY & CLARK, INC., New Britain, Conn., have filed articles of incorporation under the laws of the State of New Jersey with a capital stock of $6,000,000.

THE CHAMPION IGNITION COMPANY, Flint, Mich., has completed plans for the installation of a new power plant at its works, to cost about $60,000.

THE SANFORD RILEY STOKER COMPANY announces the removal of its Worcester (Mass.) office from 25 Foster Street to 9 Neponset Street.

THE CHICAGO PNEUMATIC TOOL COMPANY, Chicago, announces that, effective Aug. 1, its publicity department will be in the Chicago Pneumatic Building, 6 East Forty-fourth Street, New York City.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., has purchased from the State of New York a section of the old Erie Canal bed, about 3 miles long, extending from Schenectady to the Boston & Maine Railroad bridge at Rotterdam Junction. The company plans to build a railway connecting its Schenectady plant with Rotterdam Junction so as to make a direct connection with the Boston & Maine Railroad and the West Shore Railroad.

THE LOCKE INSULATOR MANUFACTURING COMPANY, Victor, N. Y., announces the resignation of B. A. Plimpton, sales manager, effective Aug. 15. For the present his duties will be taken over by D. H. Osborne, acting sales manager at Victor, N. Y.

Supply Jobbers' Notes

THE WESTINGHOUSE AGENT-JOBBERS' ASSOCIATION held a meeting at Hot Springs, Va., from July 26 to 29, which was attended by approximately 100 members of the associated members and Westinghouse officials and representatives. At the business meetings plans for improving merchandising methods were discussed and the value of advertising and its relation to merchandising was clearly emphasized. Although much time was given to entertainment during the afternoon, important business problems were discussed during the morning and evening sessions. F. E. Stow, treasurer and general manager of the H. C. Roberts Electric Supply Company, Philadelphia, was re-elected president; J. J. Gibson, manager of the supply department of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., was elected vice president. C. C. Blackwell, secretary, and J. E. McCleron, treasurer, were re-elected.

Foreign Trade Notes

GERMAN OVERSEAS ELECTRIC COMPANY ACQUIRED BY SPANISH INTERESTS.—Through the American Embassy at Madrid it is learned that the control of the German Overseas Electric Company, commonly known in the United States as the D. U. E. G., has passed into Spanish hands through the acquisition of its outstanding claims by representatives of the banks of Madrid, Barcelona and Bilboa. The transfer of the assets of the company was unanimously voted at a special meeting of the stockholders held in Berlin June 7. The Spanish bankers will transfer the assets of the German company to a Span-

ish society which, it is understood, will be formed in Madrid soon with a capital stock of 120,000,000 pesetas in shares, 180,000,000 in bonds and probably 25,000,000 in "obligaciones." The company controls electric light plants and street railway systems in Argentina and Chile, South America.

SWISS ELECTRICAL IMPORTERS.—A list of importers of electrical and household appliances in Switzerland has been prepared by the United States Bureau of Foreign and Domestic Commerce. The list may be obtained from the bureau or its district and co-operative offices by reference to file No. Eur.-13,000.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An official of a state government in Mexico (No. 33,417) desires to purchase 500 rolls of telegraph wire, 500 rolls of telephone wire, 30,000 wooden dowels, 15,000 telegraph insulators, 15,000 telephone insulators, 1,000 kilos of 2 in. nails for dowels and 5,000 kilos of sulphate of copper.

A firm of mechanical and electrical engineers in India (No. 33,421) desires to receive quotations from manufacturers on a large number of motors and generating sets.

A general merchant in China (No. 33 440) desires to secure the representation of firms for the sale of electrical goods, etc.

A commercial agent in Spain (No. 33,547) desires to purchase and secure an agency for the sale of electrical material, etc.

A firm of merchants and commission agents in India (No. 33,462) desires to secure agencies for the sale of electrical goods, etc.

A hardware merchant in Mexico (No. 33,463) desires to purchase electric flashlights and batteries, etc.

Trade Publications

GLASS INSULATORS.—The Hemingray Company, Covington, Ky., is circulating catalog No. 31, entitled "Hemingray."

ELEVATOR CONTROLLERS.—The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has issued a twenty-four page booklet entitled "Elevator Controller," known as publication 840.

HEATING, VENTILATING AND HUMIDIFYING.—The Buffalo Forge Company, Buffalo, N. Y., has issued catalog No. 700, entitled "Buffalo Fan System of Heating, Ventilating and Humidifying." The book contains 115 pages and gives engineering data and developments.

METAL REFLECTORS.—The Ivanhoe-Regent Works of the General Electric Company, Cleveland, Ohio, has issued catalog No. 320, covering the "Ivanhoe" metal reflectors and fittings for industrial illumination.

PLUGS AND RECEPTACLES.—The Albert & J. M. Anderson Manufacturing Company, Boston, has issued bulletin No. 34, describing its "A. B. C." plugs and receptacles, and bulletin No. 35, covering the Anderson charging plugs and receptacles.

HEADLIGHT EQUIPMENT.—"Keystone Locomotive Headlight Equipment" is the title of Bulletin No. 166, published by the Electric Service Supplies Company, Philadelphia.

ILLUMINATION.—"Lighting for Eye Comfort," serial 283, is being issued by the National X-Ray Reflector Company, Chicago, Ill., along with serial plates, numbered 53 to 56.

SCIENTIFIC INSTRUMENTS. — The Standard Scientific Company, 147-153 Waverly Place, New York City, is distributing its 1920 catalog, covering its scientific instruments and laboratory supplies, etc.

FARM-LIGHTING PLANTS.—The Delco Light Company is circulating three booklets, entitled "Delco-Light Electricity," "The Delco-Light-Water System" and "Delco-Light."

ELECTRODES. — The National Carbon Company, 30 East Forty-second Street, New York City, has published a booklet entitled "The Carbon Electrode."

PORTABLE CRANES AND HOISTS.—"The Handiest Tool in the Shop" is the title of a booklet published by the Canton Foundry & Machine Company, Canton, Ohio.

New Incorporations

THE NORTH WISCONSIN HYDRO-ELECTRIC POWER COMPANY, Port Wing, Wis., has been incorporated with a capital stock of $100,000 to construct a hydro-electric power plant at Orienta Falls on Iron River. T. N. Ekerstrom is president of the company .

THE AUTOMATIC LIGHT SWITCH COMPANY, Louisville, Ky., has been incorporated with a capital stock of $50,000 to manufacture electrical switches and other kindred supplies. The incorporators are J. W. Roberts, C. I. Pickrell and W. L. Scott.

THE ART DISPLAY LIGHTING COMPANY, New York City, has been incorporated by M. M. Mittlemark, A. W. Jenkins and G. Singer, 2683 Briggs Avenue, New York City. The company is capitalized at 25,000 and proposes to manufacture electric lighting novelties, etc.

THE TRAVER-BLAIR COMPANY, Oneonta, N. Y., has been incorporated by W. J. Blair, B. A. and A. Traver, 318 West Twenty-fifth Street, New York City. The company is capitalized at $100,000 and proposes to manufacture motors and electrical machinery.

THE IVINS-LAMBORN ELECTRIC COMPANY, West Chester, Pa., has been incorporated with a capital stock of $25,000 to manufacture electrical appliances and devices. Walter S. Grosh is treasurer.

New England States

BRUNSWICK, ME.—The erection of an electric light plant at Bowdoin College, to cost about $25,000, has been arranged for by the board of directors of the institution.

SACO, ME.—The Garland Manufacturing Company contemplates electrical operation of its factory in place of the steam operation now in use. Motors, other machinery and apparatus will be required.

RUTLAND, VT.—At a recent meeting the Vermont Public Service Commission decided to grant the request of petitioners to form a public utilities corporation for the purpose of furnishing light and power for cottages on Lake St. Catherine.

WOODSTOCK, VT. — The Maplewood Lumber Company contemplates the construction of an addition to its power house.

BOSTON, MASS.—The Washington-Essex Building Trustees, 723 Scollay Building, has awarded contract to George B. H. Macomber, 44 Bromfield Street, for the construction of a theater to cost about $1,500,000. Electric lighting equipment will be required.

CAMBRIDGE, MASS. Plans are under way for the construction of a power house, 20 ft. x 40 ft., for the A. R. Hyde Company, 432 Columbia Street. James A. Tuck, 34 School Street, Boston, is architect.

LAWRENCE, MASS.—Preliminary plans are under way by the Lawrence Gas Company for the establishment of a "white-way" street-lighting system along Essex Street and Broadway.

NORTHAMPTON, MASS. — The Nonotuck Silk Company has plans under way for the erection of a substation at its mills.

PITTSFIELD, MASS. During the next five years the Pittsfield Electric Company contemplates an expenditure of $1,000,000 for additions to its power plants and lines, and of that amount the company plans to spend $400,000 within the next year.

WORCESTER, MASS. — H. W. Trulson, 35 Berksmans Street, will soon award the contract for the construction of a garage to cost about $150,000. Electric light and power equipment will be installed.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

PAWTUCKET, R. I.—The Tubular Woven Fabric Company contemplates the installation of electrical equipment to include thirty-eight motors from 2 hp. to 25 hp., transformers, new lighting arrangement, wiring, etc. The present voltage will be changed from 220 to 550.

BRISTOL, CONN.—Bids will soon be received by the Board of Education for the erection of a high school to cost about $750,000. Wilson Potter, 22 East Seventeenth Street, New York, N. Y., is architect.

NEW BRITAIN, CONN.—Contract has been awarded to the Collins-Lotz Company of Hartford by the Hart & Hutchinson Company, Corbin Avenue, New Britain, for the construction of a power plant at its metal works, to be used in connection with a factory addition to be erected.

NEW HAVEN, CONN. — Contract will soon be awarded by the Yale University for the erection of a dormitory building to cost about $400,000. Electric light equipment will be installed.

WEST HARTFORD, CONN. — Bids will be received by the Board of Education until Sept. 1 for the erection of a high school to cost about $500,000. Electric light equipment will be installed. W. T. Marchant, 36 Pearl Street, Hartford, is architect.

Middle Atlantic States

BATAVIA, N. Y. — The Public Service Commission has granted permission to the Genesee Light & Power Company to issue $56,700 in stock to be used for new construction and equipment at its power plant and for improvements to its distribution system.

HINCKLEY, N. Y.—The Oswego Falls Pulp & Paper Company of Fulton is considering plans for the erection of a new power house for works service at its plant at Hinckley.

NEW YORK, N. Y.—The United Zinc Smelting Corporation, 233 Broadway, plans to install a 250-kw. generating unit, two 100-hp. motors for fans, two 20-hp. motors for kiln, three 10-hp. elevator motors, etc.

SYRACUSE, N. Y.—Plans are under way for the erection of a power plant on Free Street to cost about $60,000 for the Jones Oil Engine Company, 227 Walton Street.

BAYONNE, N. J.—The installation of an ornamental street-lighting system on Avenue C was discussed at a recent meeting of the Avenue C Merchants' and Taxpayers' Association, and it was decided to put the matter before the City Commissioners.

CAPE MAY, N. J.—The City Commissioners contemplate the establishment of a municipal electric light and power plant.

DOVER, N. J.—Arrangements have been made between the Board of Water Commissioners and the New Jersey Gas & Electric Company for the installation of new electrical pumping machinery at the local waterworks.

EAST ORANGE, N. J.—The lighting committee of the City Council, Joseph M. Brown chairman, is negotiating with the Public Service Corporation for replacing the present street gas lamps with improved electric lamps.

HACKENSACK, N. J.—Plans are under way by the building committee of the Hackensack General Hospital, Third Street, for the construction of a power house at the institution to cost about $40,000. Crow, Lewis & Wick, 200 Fifth Avenue, New York, N. Y., are architects.

PASSAIC, N. J.—An Uptown Merchants' Association is being formed for the purpose of installing an ornamental street-lighting system in Passaic.

PERTH AMBOY, N. J.—Extensions and improvements to the fire-alarm and police-alarm systems in various parts of the city are contemplated. Jay B. Franke is city electrician.

POINT PLEASANT, N. J. — Bids are being received by the Lakewood & Coast Electric Company for furnishing material for the erection of a 13,200-volt, three-phase, three-wire transmission line from Point Pleasant to Seaside Heights, a distance of 15 miles. S. W. Borden at Summit is general manager.

TRENTON, N. J.—New bids will be received by the City Commission for one 25,000,000-gal pump and one 1,000-hp. steam turbine-driven generator for the municipal waterworks.

WEST ORANGE, N. J.—Bids will be received by the Thomas A. Edison Company, Lakeside Avenue, about Aug. 25 for the construction of an addition to the power house at its electrical plant, to cost $80,000, and about Sept. 1 for equipment to be installed. Lockwood, Green & Company, 101 Park Avenue, New York, N. Y., are engineers.

ELMHURST, PA. — The Greek Catholic Society of America has plans under way for the construction of an orphanage to cost about $350,000. Electric light equipment will be installed. Morris & MacHale, Burr Building, Scranton, are architects.

KITTANNING, PA.—The power house of the Kittanning Brick & Fire Company has been destroyed by fire, causing a loss of about $50,000. The plant, it is understood, will be rebuilt at once.

PHILADELPHIA, PA.—Bids will be received by William S. Twining, director, Department of City Transit, eleventh floor, 1211 Chestnut Street until Aug. 17 for furnishing about 800 gross tons of special 70-lb. conductor rail (contract No. 547) for the Frankford Elevated Railway.

PHILADELPHIA, PA.—The Pennsylvania Iron & Coal Company contemplates the erection of a power plant at North Philadelphia, to cost about $500,000

PHILADELPHIA, PA.- The power plant of the Philadelphia Electric Company at Oak Lane has been destroyed by fire, causing a loss of about $20,000.

PHILADELPHIA, PA. — Contract has been awarded to T. Reilly, 1616 Thompson Street, by the Sacred Heart Convent, Mascher Street, for the construction of an addition to the power house at the institution to cost about $25,000.

PORT ALLEGANY, PA.—Bonds to the amount of $26,000 have been voted for the purpose of erecting and maintaining an electric lighting system in this borough.

READING, PA. — Dives, Pomeroy & Stewart, 600 Pennsylvania Street, have awarded contract to L. H. Focht & Sons, Inc., 529 Court Street, for the construction of a power house to cost about $15,000.

SUNBURY, PA.—Plans are under way by the Sunbury Trust & Safe Deposit, care of Verus T. Ritter, North American Building, Philadelphia, Pa., for the erection of a bank and office building to cost about $600,000. Electric light equipment will be required

BALTIMORE, MD — The West Construction Company, 907 American Building, has been awarded the contract by the Prest-O-Lite Company, Inc., 30 East Forty-second Street, New York, N. Y., for the construction of an acetylene plant at Violetville, to consist of eight buildings, at a cost of about $125,000. Electric light equipment will be installed.

INWOOD, W. VA.—The construction of an electric power plant in Inwood for industrial service is being planned by H. C. Musselman of Biglerville, Pa.

SPENCER, W. VA.—The plant of the Wieland Electric Company has been purchased by the Spencer Water & Ice Company. It is proposed to move the dynamos, engines, etc., from the Wieland company's power house to that of the Spencer company and to make additions of all necessary new and modern machinery.

NORFOLK, VA.—The Norfolk & Western Railway is planning for the installation of electric machinery at its piers at Lamberts Point. J. E. Crawford is chief engineer.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Until Aug. 20, Hampton Roads, Va., Schedule 6620 generators South Charleston, W. Va., Schedule 6641—motors and controllers, Portsmouth, Va., Schedule 6649 —tubes and condenser. Until Aug. 31, Mare Island, Cal., Schedule 6633—electric cable. Until Sept. 3, Mare Island, Cal., or Brooklyn, N. Y., Schedule 6636—electric material. Applications for proposal blanks should designate the schedule desired by number.

North Central States

DETROIT, MICH.—Contract has been awarded to A. W. Kutsche, 623 Ford Building, by the Detroit Insulated Wire Company, Wesson and Albert Streets, for the construction of a factory and office building to cost about $80,000. Electric lights and motors will be installed.

DETROIT, MICH.—Contract will soon be awarded by the Zenith Carburetor Company, Hart Avenue, for the erection of a factory to cost about $70,000. Electric light and power equipment will be installed.

DETROIT, MICH.—William and Louis Berman, care of the Berman-Dwyer Realty Company, 1317 Dime Bank Building, contemplate the erection of an office building to cost about $500,000. Electric light and elevator equipment will be installed.

LAWTON, MICH. — The J. Hungerford Smith Company contemplates the erection of a power plant.

WARREN, OHIO.—The Board of Education has awarded contract to the Shustrump Company, Youngstown, for the erection of an addition to the West Technical High School, to cost $450,000, and an addition to the East Technical High School, to cost $400,000. Electric wiring and domestic science room equipment will be installed in each.

PALMYRA, ILL.—A certificate of convenience and necessity has been issued to the Palmyra Light, Heat & Power Company to extend its electric transmission line from a certain point on the Chicago, Peoria & St. Louis Railroad to Roher station to supply residents of that place.

PRINCETON, ILL.—An appropriation of $17,000 has been made for the purchase of a new unit to be installed in the municipal electric light plant, to develop 100 hp

BROCKTON, ILL.—Plans are under way for the installation of a new electric street-lighting system in the city.

SPRINGFIELD, ILL. — Montgomery, Ward & Company, Chicago Avenue and Larrabee Street, Chicago contemplate the construction of a power house at their local plant to cost about $20,000

SPRINGFIELD, ILL.—The purchase of a condenser to be installed at the municipal electric plant to cost about $10,000 has been authorized by the City Council.

COLFAX, WIS. — The Colfax Light & Power Company has awarded contract to the St. Paul Electric Company, 145 East Fifth Street, St. Paul, Minn., for furnishing switchboard and motors to cost about $11,000.

CUDAHY, WIS. — The Worthington Pump & Machinery Company has received bids for the erection of a machine shop, 60 ft. x 170 ft. Electric motors will be installed.

GLENWOOD CITY, WIS.—Contract has been awarded by the Apple River Milling Company to the St. Paul Electric Company, 145 East Fifth Street, St. Paul, Minn., for furnishing transformers to be used in connection with the erection of a transmission line from Glenwood City to Emerald, a distance of about 10 miles.

MILWAUKEE, WIS. — The Columbia Rubber Mills, 176 Sixteenth Sreet, contemplate the erection of a factory and power house to cost about $75,000.

PESHTIGO, WIS.—The Peshtigo Pulp & Paper Company has awarded contract to the Jorgenson Construction Company, Denmark, for the construction of a hydro-electric power plant and dam, about 5 miles from Peshtigo. L. A. DeGuere Grand Rapids, is engineer.

SHEYBOGAN, WIS. — The Sheybogan Clinic Association, Dr. W. Gunther, president, 902 North Eighth Street, has preliminary plans under way for the construction of a clinic building to cost about $100,000. Electric wiring and X-ray apparatus will be installed.

TWO RIVERS, WIS.—Bids will soon be received by the Board of Education for the erection of a high school and power house to cost about $400,000. John D. Chubb, Dearborn Street, Chicago, Ill., is architect.

ALBERT LEA, MINN.—The electric lighting plant of the Minnesota Gas & Electric Company, it is reported, has been recently destroyed by fire. Herbert L. Nichols is manager.

BEMIDJI, MINN. — A proposal has been submitted by the Minnesota Electric Light & Power Company to the City Council for the installation of an ornamental street-lighting system on the two main business streets at a cost of between $18,000 and $20,000.

FAIRMONT, MINN.—The Martin County Electric Service Company, Inc., has plans under way for the erection of 28 miles of transmission line from Fairmont to Dunnell, passing through Welcome and Ceylon, to cost about $28,000. W. E. Skinner, 3241 Aldrich Avenue, South Minneapolis, is engineer.

INDEPENDENCE, MINN.—At a recent village election it was voted to extend the electric transmission lines of the Wisconsin-Minnesota Light & Power Company, 178 Center Street, Winona, to Independence. Work will be started at once.

MILACA, MINN.—The city officials contemplate changing the municipal service from direct current to alternating current. A new generator will be installed.

DES MOINES, IOWA.—The State Board of Commissioners, Capitol Building, will soon receive bids for the construction of a power plant to cost about $200,000. The Canfield Engineering Company, Flynn Building, is engineer.

GRANT, IOWA.—A special election for the purpose of voting bonds for an electric light plant in Grant is under consideration.

ST. LOUIS, MO.—The Swift Company of Chicago has had plans prepared for the construction of an addition to its power plant at St. Louis to cost about $100,000.

ST. LOUIS, MO. — Contract has been awarded to Joseph Stewart & Son, Boatman's Bank Building, by the Davis Rankin Junior School, 4431 Finney Street, for the erection of an addition to its power house to cost about $15,000. Eames & Young, Arcade Building, are architects.

WENTZVILLE, MO.—The erection of an electric light and power plant to cost about $30,000 is contemplated by the city officials E. T. Archer & Company, 609 New England Building, Kansas City, are architects.

SIOUX FALLS, S. D.—Improvements to the electric lighting system to cost about $175,000 are contemplated

Southern States

MONOCURE, N. C. — The Monocure Manufacturing Company, recently organized with a capital of $200,000, contemplates the development of water power on the Deep River for the purpose of furnishing electricity to Monocure, Pittsboro and other places.

PILOT MOUNTAIN, N. C.—Surveys are being made of the Ararat River near Pilot Mountain with the view of constructing a power plant and dam.

ENGLEWOOD, TENN. — The Eureka Cotton Mills, J. L. Ferguson, treasurer and manager, contemplate complete electrification of their plant.

HUNTSVILLE, ALA. — The Margaret Mills are planning for the electrification of their entire plant. T. B. Reynolds is superintendent.

CLEVELAND, MISS.—Notice of an increase in its capital stock from $10,000 to $40,000 has been filed by the Home Light & Ice Company for extensions to its electric light plant.

LITTLE ROCK, ARK.—The Dixie Power Company, Walter Powell president, has applied to Congress for approval of the erection of a dam 200 ft. high, across the White River for power purposes. Henry A. Allen, Chicago, Ill., is engineer.

SPRINGDALE, ARK.—The local electric light and power plant has been purchased by Goss & Early of Fayetteville, who contemplate improving and remodeling it.

AMARILLO, TEX.—The Electric plant of the Amarillo Gas & Electric Company has been destroyed by fire, causing a loss of about $100,000. Repairs will be made and new electric generating equipment installed at once.

MEMPHIS, TEN. — The plant of the Texas Gas & Electric Company was recently destroyed by fire, causing a loss of about $75,000. The plant will be rebuilt and new machinery installed at once.

Pacific and Mountain States

SEATTLE, WASH.—The Puget Sound Power & Light Company has applied for a fifty-year franchise to extend its transmission lines into new territory covering thirty roads in Whatcom County, Washington.

PORTLAND, ORE.—Plans are being prepared by E. Kroner, architect, Worcester Building, for the erection of a nurses' home, power plant and laundry at the Emanuel Hospital, Stanton and Commercial Streets, to cost about $75,000.

ELINK, CAL.—The local substation of the Southern California Edison Company, it is reported, has been destroyed by fire.

LONG BEACH, CAL.—Plans are under way for the installation of a lighting system on Ocean Boulevard. Standards will be placed on both sides of the street from Alamitos Avenue to Termino Avenue.

LOS ANGELES, CAL.—The Los Angeles Railway Company contemplates an expenditure of $150,000 for improvements. Plans include the overhauling and replacing of the three existing transformers at the Plaza substation and the installation of two new 15,000-kw. transformers. Other equipment will be installed at Avenue 28 and Huron Street.

OGDEN, UTAH.—The City officials are considering the calling of a special election for the purpose of submitting to the voters a proposal to issue bonds for the erection of a municipal light plant and water system.

PHOENIX, ARIZ.—Plans are under way by the Paradise-Verde Irrigation District of Phoenix for the erection of a power plant on the Verde River to cost between $16,000,000 and $20,000,000.

DENVER, COL.—The extensive program of the Mountain States Telegraph & Telephone Company provides for an appropriation of $7,500,000 for new exchanges, toll and local lines and equipment in the Rocky Mountain States, covering a construction period of five years.

DENVER, COL.—The Mountain States Telegraph & Telephone Company will erect an office and exchange building to cost about $350,000. Automatic switchboards will be installed.

DENVER, COL.—Bids will be received by the school board of the city and county of Denver until Sept. 15 for the construction of a school to cost about $420,000. Electric motors will be installed. W. N. Bowman, Central Savings Bank Building, is architect.

DEMING, N. M.—Plans are under way for the establishment of a power plant capable of developing 22,000 hp. at Elephant Butte dam. The cost of the project is estimated at about $4,000,000.

Record of Electrical Patents

Notes on United States Patents

(Issued July 27, 1920)

1,347,495. AUTOMOBILE ALARM; George M. Campbell, St. Louis, Mo. App. filed July 28, 1919. Theft alarm.

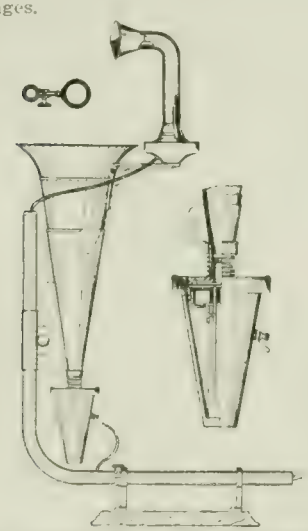
1,347,511. IGNITION SYSTEM; William O. Kennington, London, England. App. filed Sept. 21, 1918. For preventing ignition upon the reverse rotation of the engine.

1,347,546. ELECTRIC SYSTEM; Everett P. Larsh, Dayton, Ohio. App. filed June 21, 1915. Automatic generating system.

1,347,577. SWIVEL-PLUG CONNECTOR; Edward DeWald, Sr., Cincinnati, Ohio. App. filed Dec. 26, 1919. Edison base plug.

1,347,580. PRINTING TELEGRAPH; George S. Hiltz, Brooklyn, N. Y. App. filed Oct. 24, 1918. Utilizing three current strengths.

1,347,584. AUTOMATIC TELEPHONE SYSTEM; Talbot G. Martin, Chicago, Ill. App. filed Feb. 14, 1917. For private branch exchanges.



No. 1,347,850. Despatcher's Telephone Apparatus

1,347,588. ELECTRIC STORAGE BATTERY; Frederick W. Radell, Glenside, Pa. App. filed Dec. 27, 1919. Separator rearrangement.

1,347,590. ELECTRICAL CONNECTOR; Maxwell W. Robertson, Belle Harbor, N. Y. App. filed Nov. 19, 1917. Clamped in recess in brush.

1,347,647. DYNAMO-ELECTRIC MACHINERY; John H. St.H. Mawdsley, Dursley, England. App. filed March 12, 1917. One interpole per pair of main poles.

1,347,710. SANITARY TELEPHONE ATTACHMENT; Ella M. Potter, New York, N. Y. App. filed July 28, 1919. Detachable disinfecting guard.

1,347,715. SELECTIVE CONTROL SYSTEM; Axel U. Särnmark, Stockholm, Sweden. App. filed Sept. 9, 1916. For telegraph typewriting.

1,347,718. IGNITING DEVICE; Carl H. Shuford, Dallas, Tex. App. filed Feb. 7, 1919. For gas burner.

1,347,738. CURRENT-CARRYING PLUG; Harry [illegible], Bronson, Mich. App. filed Oct. 11, 1917. Spring-held butt contacts.

1,347,751. CONTROL OF INDUCTION MOTORS; Robert H. McLain, Schenectady, N. Y. App. filed [illegible], 1917. Speed variations

1,347,760. MOTOR-CONTROL SYSTEM; Claude C. Runner, Schenectady, N. Y. App. filed March 14, 1918. Low-current actuated contactors.

1,347,767. OVERLOAD RELAY; Eugene E. Valk, Los Angeles, Cal. App. filed Nov. 21, 1917. Excitation control.

1,347,769. CASING FOR ELECTRICAL APPARATUS; James Wilkinson, Schenectady, N. Y. App. filed Oct. 29, 1917. Pneumatically supported column of oil reaching the top of the casing.

1,347,770. ACCUMULATOR ELECTRODE GRID; Sigmund Willner, London, England. App. filed Sept. 4, 1918. Bar construction.

1,347,772. PROTECTIVE MEANS FOR SYSTEMS OF DISTRIBUTION; David Basch, Schenectady, N. Y. App. filed Sept. 12, 1917. For protection of parallel feeders.

1,347,776. ELECTRODE HOLDER; Ralph H. Chadwick, Fort Wayne, Ind. App. filed Sept. 23, 1919. For holding hand-manipulated carbon electrodes.

1,347,781. CONTROL OF ELECTRIC MOTORS; Benjamin W. Jones, Schenectady, N. Y. App. filed May 20, 1918. Automatically controlled starting resistance.

1,347,783. ALTERNATING-CURRENT MOTOR; Willem C. Korthals-Altes, Schenectady, N. Y. App. filed April 30, 1918. Ninephase.

1,347,832. ELECTRODE FOR SECONDARY OR STORAGE BATTERIES; James M. Allen, St. Louis, Mo. App. filed Aug. 18, 1919. Specially shaped plates.

1,347,838. METHOD OF TREATING METALS; Reginald H. Bulley, Syracuse, N. Y. App. filed April 24, 1916. Heroult type.

1,347,849. SIGNALING CIRCUIT; Paul J. Hackett, Seattle, Wash. App. filed June 21, 1919. Two-way communication.

1,347,850. DESPATCHER'S TELEPHONE APPARATUS; Paul J. Hackett, Seattle, Wash. App. filed July 3, 1919. Loud-speaking.

1,347,863. MOTOR CONTROLLER; Wilmar F. Lent, New York, N. Y. App. filed June 21, 1916. Drifting prevention.

1,347,873. BATTERY GRID; Paul B. Rabe, Chicago, Ill. App. filed April 30, 1919. Paste retained by tapering walls.

1,347,879. CONTROL FOR EXPLOSION-PROOF ELECTRICAL APPARATUS; Charles W. Starker, Pittsburgh, Pa. App. filed Feb. 8, 1918. Located within motor casing.

1,347,880. CONTROL APPARATUS; Charles C. Whittaker, Wilkinsburg, Pa. App. filed Dec. 2, 1916. Liquid rheostat.

1,347,894. VACUUM-TYPE INVERTED CONVERTER; Lewis W. Chubb, Edgewood Park, Pa. App. filed Nov. 29, 1915. High voltage.

1,347,895. ELECTRIC FURNACE FOR HEATING RIBBONS AND BARS; Ora A. Colby, Larimer, Pa. App. filed Sept. 16, 1918. Continuous heating.

1,347,896. DOUBLE HOT-CHAMBER FURNACE; Ora A. Colby, Irwin, Pa. App. filed Dec. 14, 1918. Electric resistance furnace.

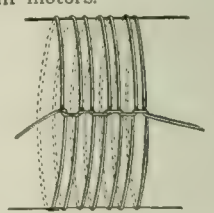
1,347,900. RESISTANCE UNIT; Carl R. Englund, East Orange, N. J. App. filed April 18, 1919. Substantially non-reactive.

1,347,903. SYSTEM OF CONTROL FOR DYNAMO-ELECTRIC MACHINES; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed Feb. 4, 1916. Acceleration of alternating-current commutator motors of the compensated type.

1,347,904. REGENERATIVE CONTROL FOR ALTERNATING-CURRENT COMMUTATOR MOTORS; Rudolf E. Hellmund, Swissvale, Pa. App. filed Jan. 10, 1917. Drooping-voltage characteristic.

1,347,905. SYSTEM OF CONTROL; Rudolf E. Hellmund, Swissvale, Pa. App. filed March 9, 1917. Regeneration to zero speed.

1,347,908. AUTOMATIC CIRCUIT INTERRUPTING DEVICE; Arthur du Pasquier, Hale, England. App. filed Dec. 1, 1916. For rolling-mill motors.



No. 1,347,900. Resistance Unit

1,347,910. TRANSFORMER FOR USE WITH ROTARY CONVERTERS; John F. Peters, Edgewood Park, Pa. App. filed April 29, 1915. Both high and low reactance.

1,347,970. WINDMILL-OPERATED GENERATOR; Frank A. Overstreet, Fort Summer, N. M. App. filed Oct. 7, 1916. Overloading prevented.

1,347,995. BED-WARMING DEVICE; Nathaniel W. Dendy, Asheville, N. C. App. filed Oct. 4, 1919. Easily and quickly regulated.

1,348,000. FORMATION TANK; David H. Fleming, Boston, Mass. App. filed April 7, 1920. To avoid danger of short-circuiting battery plates.

1,348,016. AUTOMATIC VALVE-CONTROLLING MEANS; Herman H. Lee, Brooklyn, N. Y. App. filed Jan. 31, 1919. Automatic control of steam pumps.

1,348,037. DYNAMO-ELECTRIC MACHINE; Alfons H. Neuland, San Francisco, Cal. App. filed Nov. 24, 1916. Shunt member rotates against force of a spring.

1,348,052. CONTACT; Thomas B. Rider, Los Angeles, Cal. App. filed Feb. 9, 1918. Relay switch.

1,348,098. AUTOMATIC SWITCH; Carl W. Eisenmann, Nebraska City, Neb. App. filed June 16, 1916. For use in battery charging.

1,348,104. ELECTRIC SIDELIGHT; Richard S. Giese, Pittsburgh, Pa. App. filed Feb. 26, 1919. One-piece glass structure.

1,348,106. BRAKE; James T. Halsey, Philadelphia, Pa. App. filed Aug. 15, 1913. Susceptible of gradual application.

1,348,128. ELECTRICAL CONNECTION; John H. George, Bridgeport, Conn. App. filed June 17, 1918. To connect and disconnect battery terminals.

14,927 (reissue). APPARATUS FOR ELECTRIC WELDING; Frank L. Sessions, Lakewood Ohio. App. filed May 5, 1919. Welding of juxtaposed edges.

Electrical World

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For Better Public Relations

REALIZING that whatever helps the industry will in a measure benefit every company forming part of it, the Western Electric Company has published a series of advertisements in the interest of the electrical industry, particularly the public utilities. We cannot commend this spirit too highly, and what one manufacturer and jobber has done in a large way ought to be done by every individual connected with the industry in proportion to his interest and means. The electric utilities have been singled out because after all is said and done their prosperity is the index for prosperity all along the line. Moreover, only as the industry attains popular understanding and esteem will permanent prosperity ensue. There is no doubt that the publicity will go a long way toward building up good will for the industry, but the task is too great for any one company. It merits and demands the hearty co-operation of the entire industry.

Engineering Scrutiny of Accounts

UNLESS central-station accounting reveals significant information, its right to occupy ledger space should be sharply questioned. For instance, it cost a representative company 7.3 mills for fuel recently for every kilowatt-hour generated in its steam plant. The accounts showed a fuel cost of 6.3 mills, and upon inquiry it was found that the coal expense and all other operating costs at the plant are regularly determined on the basis of the total generated and purchased energy. Examples of this kind reveal the opportunity which exists for accountants and engineers to get together in the interest of standardizing data of real technical significance—data which will mean something because of their correct engineering foundation and not convey false impressions of operating efficiency when laid before the management month after month for use in checking plant performance.

Traction Companies as Customers

ELECTRIC railways are turning more and more to the central station for power supply as the cost of fuel and the difficulty of obtaining it increases. This class of business has the advantage of large annual volume in many cases, combined with excellent power-factor regulative possibilities through the use of rotary converters or synchronous motor-generator sets in transforming the transmitted energy for traction needs. While each case and each contract require separate investigation, the economics of the situation broadly favor the purchase of power derived from concentrated and perhaps from interconnected generating units of high efficiency, with the shutting down of relatively small direct-current steam plants which are today unequal to the demands of the best engineering operation. In Massachusetts, for instance, there have been realized within the past decade extraordinary savings in fuel consumption resulting from the supply to electric railways, from one end to the other almost, of energy from interconnected hydro-electric and steam stations operated by electric service companies. The good work still goes forward, and in the near future it will be strange if other groups of scattered plants now handicapped by coal shortages and high costs do not swell the total of satisfied Bay State central-station customers. Interconnection minimizes the bad effects of the fluctuating railway load, and a simplified and more reliable fuel supply is a telling argument in times like the present.

Developing World Trade

IT OUGHT to be apparent to every thinking American that the country's foreign trade is of direct significance to him personally. Every man, whether he makes his home in the agricultural districts of the Far West or in such industrial centers as Pittsburgh or New York, has a selfish interest in cargoes carried in American ships to all corners of the globe. The South can only prosper when there is an export demand for all the cotton it can produce, and prosperity in the Northwest is linked in large measure with the export of lumber. As no city lives unto itself or is sufficient unto itself, neither is any state or country, and to give a reason why sound thinking and co-operative action should necessarily be limited exclusively to one's country and not shared with the rest of the world is at times baffling. That the condition exists none can deny, and thus it will continue to exist until American manufacturers throw over their policy of exclusion and see in the markets of the world legitimate outlets for their products. The country is burdened with enormous war debts which must be liquidated through taxation, and if these debts are not to overwhelm us production must greatly exceed consumption. But we cannot dispose of the excess unless we develop world trade, and this applies to every industry that can turn out goods of a character or at a price that will be in large demand beyond our borders.

Home Rule in Denver

THE destruction of life and property which attended the strike of the Denver Tramway Company employees may be attributed in a measure to the peculiar regulatory system existing in Colorado. In a test case before the Colorado Supreme Court brought by the municipal authorities at Denver it was held that that city and other home-rule cities in Colorado could regulate their public utilities to the exclusion of the state authorities. However, when local regulation became effective in Denver trouble ensued. Lower fares were fixed by ordinance, necessitating a lower wage scale, and naturally a strike resulted. Cars stopped

running, business was paralyzed, and newspapers which had theretofore proclaimed home-rule regulation as a victory for the people reversed themselves and urged the recall of the Mayor. Conditions became normal again in Denver only with the restoration of the higher wage scale and the 6-cent fare. The causes of the recent disturbance were not very different from those which precipitated the previous strike, and they call attention anew to the fallacies of home rule and municipal regulation. The moral is very plain, and the prayer of every public utility manager should be, "From the machinations of local politicians and municipalities good Lord deliver us!"

Danger in Valuations at Present-Day Figures

ATTEMPTS for rate-making purposes to value at present-day prices physical properties wholly or almost wholly constructed during the low-price periods before the war are likely to be the means of expending valuable energy that will not accomplish results and may produce bad feeling against utilities. The remedy for increased operating costs must to some extent be increased economies, though under existing conditions the chief remedy must be increased rates. Increased construction costs affect not only additions but also replacements of existing property that must be made through depreciation accounts.

Increases in rates due to increased operating costs bear no relation to investment and must therefore be justified on operating facts alone. Fixed charges which are determined by investment in the business can be taken care of in two ways, one by arbitrarily increasing valuation figures to a point where certain fixed percentages will provide the necessary returns, the other by permitting investments to stand at whatever figures the records of construction costs justify and increasing fixed-charge percentages to meet conditions. Any rule must work both ways, and it must be assumed that if properties are valued at costs during high-price periods they must be similarly valued during low-cost periods. The second method has the advantage of justification on the basis of figures that are prevalent in the market and which cannot be a matter of opinion.

The weakness that exists in many cases, however, is the inability of utilities to prove what their properties have actually cost because construction records have been so carelessly kept that obvious errors destroy confidence in them. The remedy for such a condition is reform in the methods of keeping construction records. The sooner utilities face the fact that returns calculated on investment and varied to meet the conditions existing at any particular time are the surest way to obtain the necessary results, the easier the solution will be.

It will be argued that public opinion cannot be brought to realize the necessity for changes with sufficient promptness to meet emergencies. If the game is played in a clean, aboveboard manner that will secure public confidence, there is nothing to fear. It is arguing for methods that arouse public suspicion that makes the task difficult, and the valuation question is particularly susceptible to handling in such a manner. Concrete facts about construction costs are a much better foundation to build on than expert opinions. There is plenty of room for argumentative ability in the field of intangible values, if argument is sought.

Brush Reliability

BRUSHES constitute one of the most important details of motor equipment affecting the reliability of operation, and hence must be selected with considerable care if the highest continuity of service is expected. That no one appreciates this more than the manufacturer is shown by John S. Dean in a very complete discussion of carbon-brush testing in this issue. In order to give intelligent consideration to the selection of brushes, the user should be conversant with their essential characteristics and should have a thorough understanding of the best methods of determining their strength, hardness, density, specific resistance, contact drop, coefficient of friction and thermal conductivity. Information on these subjects is given in the article mentioned. The brush user is dependent to a great extent on the manufacturer for uniformity of product, and that this faith is not misplaced is shown by the elaborateness of tests which are used by one company to check the various brush properties.

Revision of Bureau of Standards Safety Code

CO-OPERATION of the National Electric Light Association with the Bureau of Standards in the development of the National Electrical Safety Code has been one of the outstanding instances of the co-operation of an industry with a governmental body preparing requirements largely restrictive of the practices of that industry itself. As might be expected, the requirements of the safety code, even after some years of this co-operation, are by no means satisfactory in all respects to the association members. The period of co-operation has, however, given both to the bureau and to the association membership a mutual appreciation of the difficulties involved in the preparation of rules which shall be reasonable and well balanced among themselves so that undue stress shall not be laid on some one feature to the comparative neglect of other features of perhaps greater importance. It is largely because of such difficulties that certain state commissions in their rules have incorporated changes in one or more rules of the safety code, which was otherwise quite closely adhered to.

Tendencies to undue severity in certain rules were early noted as arising out of the pressure of other interests to secure safety code requirements bearing with particular severity on power companies where the service of these other interests was even slightly affected by the power company's construction. With the amount of hazard often difficult to evaluate or to separate from the idea of service which these other interests have largely in mind, the bureau, in its tentative proposals in previous code editions, in many cases included requirements which were without doubt unwarrantably severe on the power companies, tending unduly to curtail power service extension.

Careful surveys and collection of records brought about proper modification in many of these proposed requirements and in other cases have shown the necessity and paved the way for further and more extended studies, as in the case of transverse strength requirements for wooden poles. Other interests have sometimes actively opposed modifications but have usually acquiesced in decisions arrived at by the bureau backed by proper records of experience and test data.

This year the formation by the N. E. L. A. of an engineering department has made possible a more continuous and effective conduct of studies of this kind. It appears to be the anticipation of both the bureau and the N. E. L. A. that not only will the present and more outstanding differences of opinion yield to the results of the various studies to be undertaken during the next few years, but that these outstanding rules can be clearly recognized in the forthcoming edition of the safety code as proposed standards of practice less adequately supported by judgment and experience and less suitable to mandatory adoption and application than other rules to which no such serious objections are taken.

Assuring Reliable Mine Signal Systems

ON GENERAL principles all electrical installations in mines involve special difficulties, none more so than the all-important signaling system for the hoists which in deep-shaft mining are so vital. Our readers will therefore be interested in the valuable discussion on the subject by R. H. Bacon in our columns this week. While dealing directly with the situation in mines, the principles are the same that are requisite to reliability in any important signaling equipment. The underlying principle followed is that any signal must be repeated back to the sender so that a slip may be detected and corrected. The particular case considered is that laid out for a shaft nearly a mile deep where ordinarily a dispatcher sends all signals to the hoisting engineer but provision had to be made for operation direct from under ground as well. The signals used include bells, buzzers and lamps, the last named for checking-back purposes and in groups for reserve against a burn-out. At every stage the connections are made so as automatically to check back the signal, quite independently of a complete telephone connection which is kept entirely clear of the signal system, not even being in the same conduit.

In some mines are found two distinct signal systems, one specifically directing the hoisting and a second of wider distribution for signaling station tenders and calling the mine telephones. The source of energy varies, but Mr. Bacon prefers the regular alternating-current lighting current. The amount of available power required is not inconsiderable since powerful solenoid single-stroke bells are desirable, some of them carrying gongs up to 18 in. (45 cm.) diameter, and the buzzers are of a very solid construction. The wiring system is naturally very far from common bell-circuit practice. Conduit circuits wired with rubber-covered wire up to No. 8 are in frequent use, as are also leaded cables of similar capacity.

In either case oil switches are widely used. It is a case of signaling that falls almost into the power distribution class. Mr. Bacon gives the cost of equipping one 3,000-ft. (900-m.) shaft as very little short of $2,000—an amount quite justified by the added security given. Mine signaling, in fact, is a task somewhat resembling railway signaling, with the same necessity of certainty of action and the same requirement of giving no chance for failure of a kind not immediately apparent. It is instructive to realize how apparently simple wiring tasks may develop in these days into real engineering problems that require no little skill and forethought.

Preaching the Gospel of Production

FOR many ages the gospel of work has been preached with much simulated zeal and few real proselytes. The primeval curse has blocked the path of ready acceptance, and to the vast majority of mankind toil has been but a hateful necessity. Men have worked to live, not lived to work. Save in their spasms of ideal morality, not their stretches of labor but their intervals of relaxation have really made life sweet. Play, repose, wanderlust, *dolce far niente*, the open road, the loafing invitation to the soul, the subarboreal book of verses with the classic, if now forbidden, jug of wine—let us confess it, these things, and not the inexorable whistle of the factory or the cock's shrill clarion commandeering for the plow, have ever been those to which the unregenerate heart has thrilled. The exceptions have arisen where work and play are synonymous terms; that is, where men have been gardeners or sailors, artists or preachers, inventors or engineers, by the compulsion of nature and not of fate.

The gospel of work has erred in putting its emphasis in the wrong place. Not in work but in production lies the real happiness of humanity. Not in hoeing the grain but in seeing it ripen, not in laying the bricks but in watching the house take shape, not in filling the molds with molten metal but in contemplating the finished machine, dwells contentment with laborious days. Therefore governments and industrial exhorters and public utilities in their efforts to get larger results from labor are right in putting the stress not on the work that must be performed but on the production in which it culminates. No spasmodic urge back to the paleolithic age can root out the acquisitive instincts of our modern civilization. Every man has wants he yearns to fill—with the least possible exertion, assuredly, but with as much exertion as must be.

Only the occasional man, of course, can aid directly in producing for himself the objects he wants, but all men can aid in producing something that others want, and by the easy process of exchange they can thus supply their own desires. A man produces potatoes and changes them into an autocar; another makes, conjointly with his fellows, an autocar and receives in exchange a suit of clothes; a third tailors a suit and fills his family bin with potatoes. Thus the never-ending cycles with their intricate convolutions go around.

The gospel of production does not connote a reciprocal gospel of contentment with little. On the contrary, the larger an honest man's imperative wants the more willing he becomes to contribute to the general fund from which they must be filled. The more each produces in fair competition the greater the product to which each is entitled. The new gospel should strive to make certain that title is followed by acquirement. This has not always been the fact. Nor has full advantage of Nature's forces ever been taken to reduce human effort. The true gospel of production means added incentive, lessened fatigue. Work for work's sake is an unattractive doctrine. Work for production's sake, with electricity and water power and steam to bear the brunt, is the doctrine of the future, when mankind, with vastly increased wants, will perhaps satisfy them more easily than our remote ancestors satisfied the mere cravings of their stomachs. This is where the visions of the poet and the man of affairs approach each other—where the dreamer and the engineer shake hands.



A. G. Wishon

Pioneer builder of water powers in the High Sierras, whose work in furnishing electric service for irrigation is inseparably connected with the development of the San Joaquin Valley

LONG before the transmission of electrical energy even for very moderate distances was considered feasible, A. G. Wishon had made surveys and construction estimates for water powers in the High Sierras that have since proved to be among the most noted hydro-electric developments in this country and one of the sources of power for the highest transmission voltage. In those early days Mr. Wishon visualized the part that electric service might play in developing the desert lands of the San Joaquin Valley. The thousands of acres of veritable gardens that have since been created are the product in large measure of the persistence and undaunted courage with which he has sought and successfully secured capital for power developments. With the assistance of John Hays Hammond in 1898 he founded the Mount Whitney Power Company and built two of the stations that are now a part of the Southern California Edison Company's system and tied in with the 150,000-volt transmission line leading into Los Angeles. In 1902, however, before the completion of the second plant, he became identified with W. G. Kerckhoff and A. C. Balch, capitalists of Los Angeles, in the purchase of railway, water and power properties in the city of Fresno. This led up to the formation of the San Joaquin Light & Power Corporation, the management of which he still retains. From a single station of 1,150 kw. Mr. Wishon has built up a system of thirteen hydro-electric stations, including the new Kerckhoff station started last Sunday, which aggregate 62,675 kw., supplemented by four steam stations of 26,875 kw. These stations feed a transmission network covering 34,944 square miles of the fertile San Joaquin Valley. This network irrigates over 250,000 acres of farmland.

That the early vision of Mr. Wishon in this development work has already materialized is evident from the fact that for 1903 the company's revenue was $126,315.13. For 1920 it is estimated at $4,500,000, representing an annual increase of nearly 100 per cent since 1915. And still the power needs of the San Joaquin Valley, noted for its extensive vineyards, are only partially provided for, and further agricultural development is dependent upon and waiting for additional water power, while additional water power in its turn waits on additional capital. The recognition of this fact by the public and its readiness to assist in furnishing the needed capital are a well-deserved tribute to the small group of men, among whom Mr. Wishon has always been a leader, who builded better than they knew in the days of their adversity, less than twenty-five years ago, when capital fought shy of a section that was then little more than a barren desert. Mr. Wishon was born at Coppeges Mill, Mo., Nov. 6, 1858. Further details of his career appear on page 402.

Carbon-Brush Testing

To Insure Uniformity of Product, a Consideration of Great Importance to Its User as Well as to the Manufacturer, Strength, Hardness, Accuracy of Dimensions and Specific Resistance Are Important Characteristics

By JOHN S. DEAN
Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

ONE of the most important factors associated with carbon brushes, and one in which both the consumer and the manufacturer are vitally concerned, is the uniformity of the product. This is of the utmost importance from the operator's standpoint. After deciding to use a certain grade of carbon which best meets his operating conditions as determined by a long series of service tests on sample carbons, he depends entirely upon the manufacturer to continue to supply this grade of carbon with similar characteristics on all future shipments. If for any reason this is not done and some of the carbons in service do not measure up to the samples furnished, there is a strong inclination on the part of the operator to discontinue using this brush and look to another manufacturer. Some knowledge of brush composition, together with their test characteristics, is therefore essential to the user if an intelligent selection of brushes is to be made.

Depending upon their composition, brushes may be divided into seven classes, as follows:

1. *Carbon Graphite.*—Known as the ordinary carbon brush and consisting of amorphous carbon in the form of coke, with a small percentage of graphite and binder.

2. *Graphite Carbon.*—With either a mixture of a large percentage of artificial graphite, some coke and binder, or with a mixture of a large percentage of natural graphite, some coke and binder.

3. *Electro-graphitic.*—Consisting of (1) and (2) graphitized by special electrical treatment.

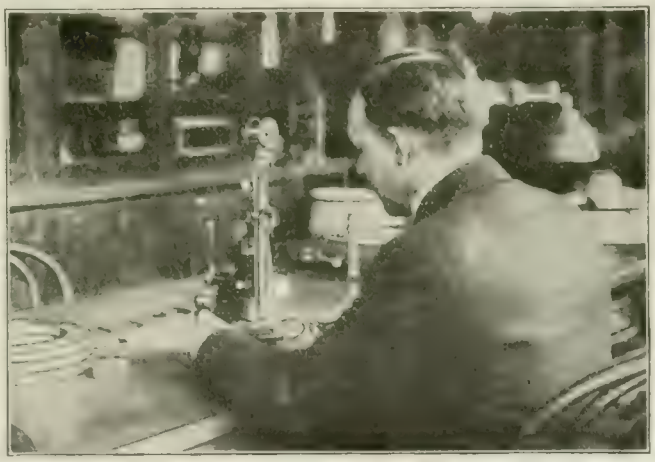
4. *Graphite.*—Made of natural graphite and binder.

5. *Impregnated.*—Consisting of carbon graphite brush treated with a lubricating material.

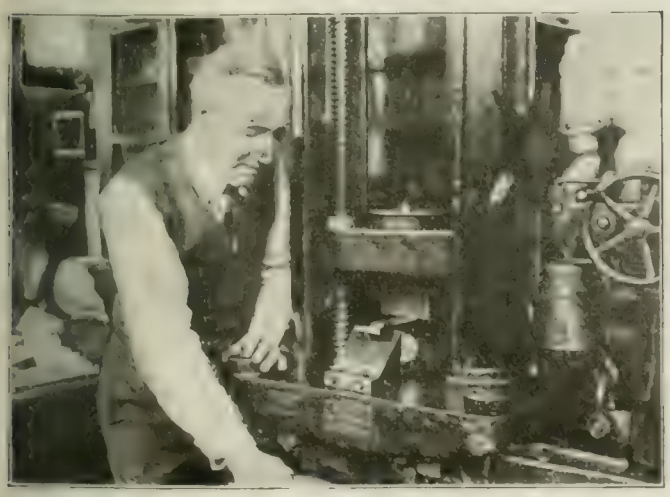
6. *Metal Graphite.*—Made of a mixture of graphite, powdered metal and binder.

7. *Compound Brush.*—Consisting of alternate layers of carbon and metal.

The two most common methods of manufacturing carbon brushes are termed the extruded or squirted method and the molded or machined method. In the former of these the material in the form of pulp is forced through a metal die under pressure and then cut off to the desired length and baked at a high temperature to carbonize the bond and permanently set the material. This method is used in making the cheaper grade of carbons, which do not have the strength to resist the breaking and chipping in service. The "molded or machined" method consists in molding the material into blocks under heavy pressure and then baking it. Carbons are cut from these blocks and machined to exact size. The manufacturer takes all precautions to insure a uniform product in the various grades of carbons that are manufactured.



To accomplish this a careful inspection and test must be made of the raw material as it is received and during the processes of manufacture as well as of the finished carbons. These





CONTINUED UNIFORMITY OF BRUSHES CAN BE ASSURED ONLY BY CAREFUL TESTING OF SAMPLES

The scleroscope shown in the upper picture is used for testing the hardness, and the brushes are graded accordingly. Strength tests are made with the machine shown in the lower picture on the left. Thickness is the most important dimension of a brush, and care must be taken to see that this dimension does not exceed the allowable tolerances.

In the right-hand picture is shown the method used for the purpose of gaging dimensions.

tests are made on samples taken from approximately 10 per cent of the material and finished carbon.

Specific Resistance.—The specific resistance of a brush is the electrical resistance of an inch cube of the material measured between opposite surfaces, expressed in ohms. For measuring this a testing outfit, consisting of the well-known Wheatstone bridge, with the carbon test piece as one leg and the standard resistance as a second leg, and the adjustable divisions of a one-meter resistance wire as the other two legs in the bridge, is used. The test specimen consists of a ½-in. (1.27-cm.) square section of carbon 2½ in. (6.35 cm.) long, having, therefore, a resistance ten times that of an inch cube.

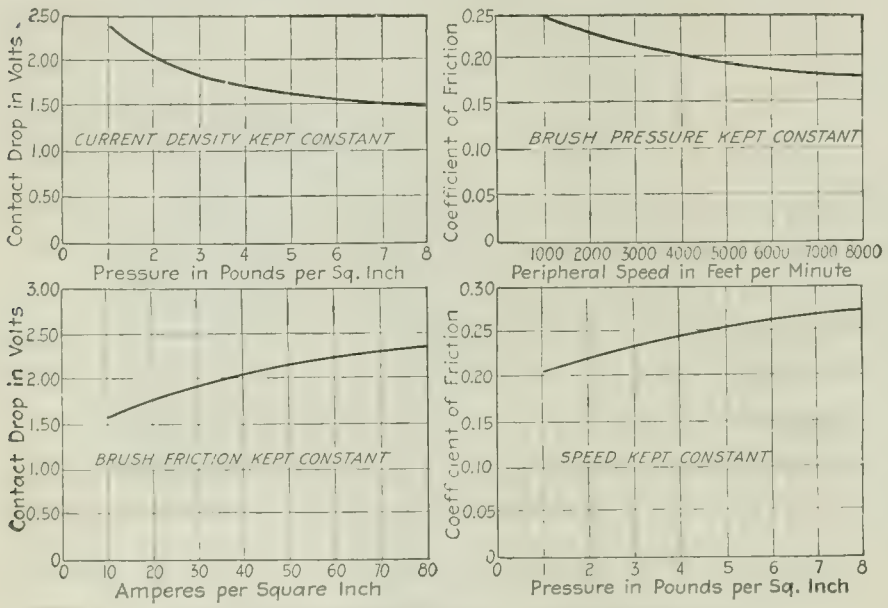
The specific resistance depends on the composition of the brush and varies from 0.0025 ohm to 0.0001 ohm. The specific resistance of a good grade of electro-graphite brush suitable for railway work should measure about 0.0015 ohm.

Contact Drop.—The electrical contact drop of a brush is the sum of the difference in voltage between the positive brush and commutator surface and between the commutator surface and the negative brush. This contact drop is determined by means of special apparatus consisting of a motor-driven flat copper disk and two brushes in contact with the vertical face of the rim. The current passes through the positive brush to the wheel and out at the negative brush. The voltmeter leads are connected one to each brush as near to the brush face as possible. The voltmeter then reads the drop between the brushes.

The size of the test piece will vary in accordance with the general design of the holder. The use of a piece of brush with a cross-sectional area of 1 sq.in. (6.45 sq.cm.) will simplify the computation to a considerable extent. Special brushes are required for this test, each of which must have two pigtails, for connection to the ammeter and the voltmeter circuit respectively.

The test specimens are inserted in the holders and the apparatus is operated for some time with the current flowing until a characteristic surface has been formed. The brush pressure, current density and peripheral speeds are then adjusted and readings are taken giving the contact drop from brush to brush at the current density, brush pressure and peripheral speeds used.

The value obtained for the contact drop is determined largely by the material in the brush, the pressure between brush and commutator, the current density and the condition of the surface of the commutator and the brush face, and will vary from 1.25 volts to 2.75 volts.



BRUSH CHARACTERISTICS SUCH AS CONTACT DROP ARE DEPENDENT ON MANY VARIABLES

These curves show the results of tests to determine the relation between contact drop, brush pressure, current density, principal speed and friction

What Is Brush Current-Carrying Capacity?

The current-carrying capacity of a brush is the density of the current that the brush can carry continuously without serious heating, expressed in amperes per square inch of contact surface. Not only the actual load current of the machine is considered in this connection but also the short-circuit current that the brush must carry.

There is no laboratory method of testing a brush for this characteristic. It is dependent on so many factors that a test other than operating under service conditions would have but little meaning. Fundamentally the carrying capacity of a brush is limited by the temperature reached at the contact face, and all conditions having influence on this temperature affect the carrying capacity in a given instance. It is the practice of carbon manufacturers to rate brushes in this respect in accordance with what they have observed the brush will carry in service without distress. Ratings given are for continuous service, so that intermittent service such as is encountered on railway motors will permit the use of higher current density than the standard rating of the brush would indicate.

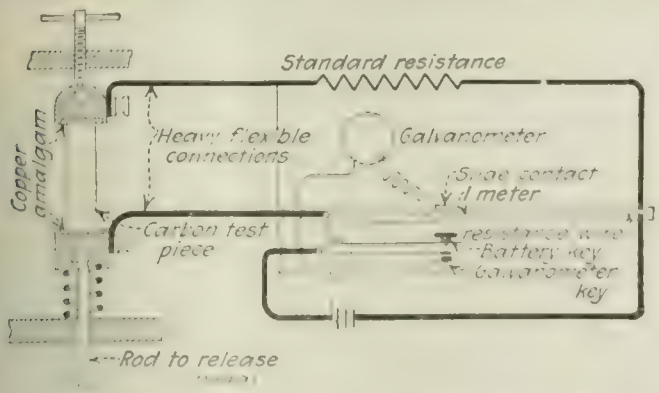
The current-carrying capacity depends upon the composition of the brush, specific resistance, contact drop, coefficient of friction, thermal conductivity of the brush itself and the radiation factor of the machine in operation. It will vary from 35 amp. to 70 amp. per square inch, the value for a good grade of electro-graphite brush suitable for railway work being about 50 amp.

Coefficient of Friction.—The coefficient of friction of a brush is the ratio of the force preventing rotation (the tangential pull exerted by the commutator upon which the brushes bear), due to friction of the brushes, to the force pressing the brushes (radial pressure applied at the brush face) down upon the commutators; that is, to the total pressure on the brushes.

The machine used for measuring contact drop is also used in measuring the coefficient of friction. In this machine the brush holders are placed on a counterbalanced arm to which is attached a vertically hung spring balance which registers the pull due to the brush friction.

The test specimen used for the contact drop test is utilized for this also, preferably with 1 sq.in. (6.45 sq.cm.) across sectional area. In this test pigtails are not necessary. In making the test brushes are placed in the holder and the motor is operated until the brushes are well seated. It is advantageous to run this test immediately after the contact drop test, as it is then

unnecessary to remove the brushes from the holder. With the above apparatus it is possible to hold the current density and brush pressure constant while data for a curve between coefficient of friction and peripheral speed are made, or by holding the speed constant



SPECIFIC RESISTANCE IS MEASURED BY THE WHEATSTONE BRIDGE METHOD

data for a friction pressure curve may be obtained. From the readings on the spring balance the dragging force is calculated by the law of moments as follows:

$$F = R\ r \times P,$$

where

F = dragging force.

R = radius at which dragging pressure on vertical spring balance is measured.

r = radius at which brush makes contact on revolving disk.

P = pull on vertical spring balance.

By using this value of F and the brush pressure on horizontal spring balance F_1 the coefficient of friction is readily calculated by the following formula:

$$\text{Coefficient of friction} = \frac{F = \text{dragging force}}{F_1 = \text{total brush pressure}}$$

The coefficient of friction is subject to a wide variation due to the peripheral speed of the commutator, brush pressure and composition of the brush, as well as the process of manufacture. This value will vary

TABLE I—PHYSICAL CHARACTERISTIC OF BRUSHES

Characteristics..	Electrical.....	Specific resistance Contact drop Current-carrying capacity
	Mechanical....	Coefficient of friction Hardness Toughness or strength Abrasiveness Density Thermal conductivity Dimensions

from a little above zero to 0.75. On account of this wide variation brush engineers have, for convenience, classified brushes as "high," "medium" and "low," depending on the coefficient of friction. Accompanying graphs show the variation of the coefficient of friction due to a change in peripheral speed and the effect of a change in brush pressure on the coefficient of friction. The coefficient of friction of a good grade of electro-graphite brush suitable for railway work should measure about 0.22.

Hardness.—The hardness of a brush relates to the compactness of the mass of the brush as a whole and depends on the cohesion of the particles on its surface as determined by its capacity to scratch another or to be itself scratched. It is expressed by a figure which shows a relative measure of ability of its surface to resist penetration. There is no absolute unit of hardness, and the readings obtained on the scleroscope are relative figures, which are useful only for the purpose of comparison, but which are very essential as a check on the uniformity of the product. The hardness figures as determined are usually an indication of the strength of the brush.

Results obtained vary from 10 to 75 for brushes, depending upon the material and methods of manufacture. Brushes are graded according to their scleroscope readings as follows:

Scleroscope Readings	Degrees of Hardness
0-15	Very soft
16-30	Soft
31-45	Medium
46-60	Hard
61-75	Very hard

A good grade of electro-graphitic brush suitable for railway work should have a hardness figure of about 60.

TOUGHNESS IS ESSENTIAL

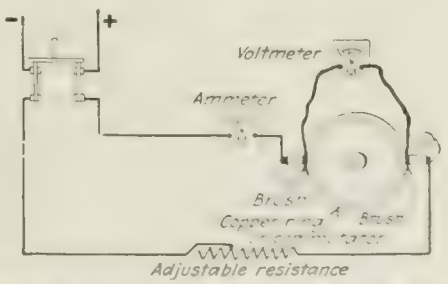
Toughness.—A brush is tough or strong when it will endure the application of force without breaking or yielding, possessing the quality of flexibility without brittleness. The strength of a brush determines its ability to withstand chattering in the carbon box without chipping or breaking. It is expressed in pounds per square inch.

A special testing machine is used for making this test and test carbons are cut ½ in. (1.27 cm.) square and 6 in. (15.24 cm.) long. The test piece is placed on two knife-edge supports, 4 in (10 cm.) apart, and the load is gradually applied at the center until the piece breaks. The strength is computed in pounds per square inch by means of the following formula:

$$S = WcL/4I,$$

where S = strength in pounds per square inch, W = load in pounds, c = one-half the thickness of the test piece, L = distance between supports, I = moment of inertia, 1/192 in this case.

Typical test results vary over a considerable range from 1,000 lb. to 8,000 lb. (70 kg. to 560 kg. per sq.cm.) depending upon the material entering into the mixture as well as the method of manufacture. The strength of a good grade of electro-graphite brush suitable for



CONTACT DROP IS DETERMINED BY READING THE VOLTAGE DROP BETWEEN THE TWO BRUSHES

railway work should be about 5,500 lb. per square inch (385 kg. per sq.cm.).

Abrasiveness.—Resistance to abrasion or scouring action of the carbon brush is the ability to withstand the wear due to friction. This term should not be confused with hardness. Hardness relates to compactness

of the mass as a whole, while abrasiveness relates to the cutting action given a brush due to more or less gritty particles in the brush mixture.

There are no reliable tests for abrasiveness. Efforts have been made to develop an apparatus to test this characteristic, but these have failed to produce results that check with actual experience with the different grades of carbons under service conditions. This is attributed to the influence of the commutating currents on disintegration at the brush face, which cannot be reproduced on the testing machine. Brushes which showed decided abrasive characteristics in operation will sometimes glaze over on the test machine and run for a long period of time without wear.

Density.—The density of a brush is the quality or state of having the constituent parts massed or crowded together. The real density of a brush is the weight of the carbon exclusive of pores compared to the weight of an equal volume of water, while the apparent density is the weight of the carbon with the pores compared to the weight of an equal volume of water.

The equipment necessary for determining density is a micrometer reading to 0.001 mm. and of a size adaptable to the test specimen and an analytical balance weighing to 0.0001 gram.

The test specimen may be of any uniform size, although 2½ in. x ½ in. x ½ in. (6.35 cm. x 1.27 cm. x 1.27 cm.) is a most convenient size.

The test specimen is carefully measured for length, width and thickness and the volume is computed in cubic centimeters. This piece is then weighed and the apparent density computed by comparing it to the weight of an equal volume of water. The real density requires a more elaborate test as it is necessary to take into account the porosity of the material. To do this a sample of known volume is saturated with a liquid of known density and the weight of the saturated piece is determined, the apparent density of the sample having been previously calculated. It is then possible to make a correction for the liquid used to saturate the sample and to determine the real density of the test carbon exclusive of the pores by comparing this correct weight to the weight of an equal volume of water.

As the average real density of carbon brushes is 2, the apparent density will vary below this value, depending on the porosity of the finished carbon, which is determined by the material of the mixture and the process of manufacture. The apparent density of a good grade of electro-graphitic brush suitable for railway work should be approximately 1.5.

Thermal Conductivity.—The thermal conductivity of a carbon brush is the property of receiving and transmitting heat through its homogeneous mass from particle to particle and from one body to another when in contact. There has been no practical laboratory method developed for testing this characteristic of carbon brushes. This property depends upon the material in the brush as well as the method of manufacture. There is no practical unit of measurement of this characteristic. Graphite has a higher thermal conductivity than most forms of carbon. A good grade of electro-graphitic brush suitable for railway work should have the maximum thermal conductivity allowable.

The above allowances are in accordance with the specification as adopted by the Power Club.

In the preparation of this article the writer has been indebted to H. A. Humiston of the National Carbon Company and W. C. Kalb of the Corliss Carbon Company for very valuable suggestions and assistance supplied by them.

Designing Mine Signal Systems

Operating Factors That Affect Selection of Circuit Layout in Deep-Shaft, Metal Mines—Ruggedness of Equipment Shown in Recent Work of This Class—Costs of Modern System for a 3,000-Ft. Shaft

By R. H. BACON
Formerly Assistant Electrical Engineer Copper Range Company

FEW classes of service are more severe on electrical equipment from an operating standpoint than mining, and the signal system, vital as it is to the continuous operation, safety and speed of hoisting, must meet the severe operating conditions by proper features of design. In designing a system it would seem, therefore, that consideration should be given to the following points in the order given: (1) Safety, (2) reliability, (3) speed of operation, (4) low maintenance cost, (5) simplicity.

Safety is placed first because this is one of the weightiest arguments in favor of the electric system. It is comparatively easy while designing the system to arrange the bells, buzzers or lights so that at any place in the shaft, shaft house or engine house it will be possible to tell what is going on and for the sender of a signal to know that the signal was received correctly. If this is not taken care of in the design, one of the important features is lost. Nothing gives a greater feeling of confidence and security than to hear a signal repeated back.

Reliability is self-explanatory. Without it the system loses the confidence of the men and is a serious handicap to production if time is lost in changing over to the rope-pull bell. Reliability can be attained only through the careful laying out of all details of the equipment, as will be pointed out.

Speed of operation is essential in a busy shaft, but safety or reliability should not be sacrificed to obtain it. As a rule signals can be sent on any electric system as fast as they can be interpreted.

Low maintenance cost is not necessarily an offshoot of reliability. Sometimes reliability is attained at the expense of high maintenance costs due to continuous inspection. To cut down the cost of maintenance a system should be so designed that reliability will be attained through rugged equipment and not by constantly going over the switches, buzzers, bells, etc., to see that they are in good operating condition.

Simplicity is important because undue complications in the wiring are difficult for an electrician who is new to the job to follow. Consistent with the operating

conditions to be met, a system should be as simple as possible to accomplish the purpose for which it is designed. Necessarily a wiring layout for a three-compartment shaft with two hoists is more complicated than one for a single-compartment shaft.

SELECTING THE CIRCUIT LAYOUT

As a typical example of how the circuit layout may be chosen the work of the Copper Range Company at Painesdale, Mich., is given because of the writer's familiarity with the design of these systems, which were laid out for 5,000 ft. (1,524 m.) of depth.

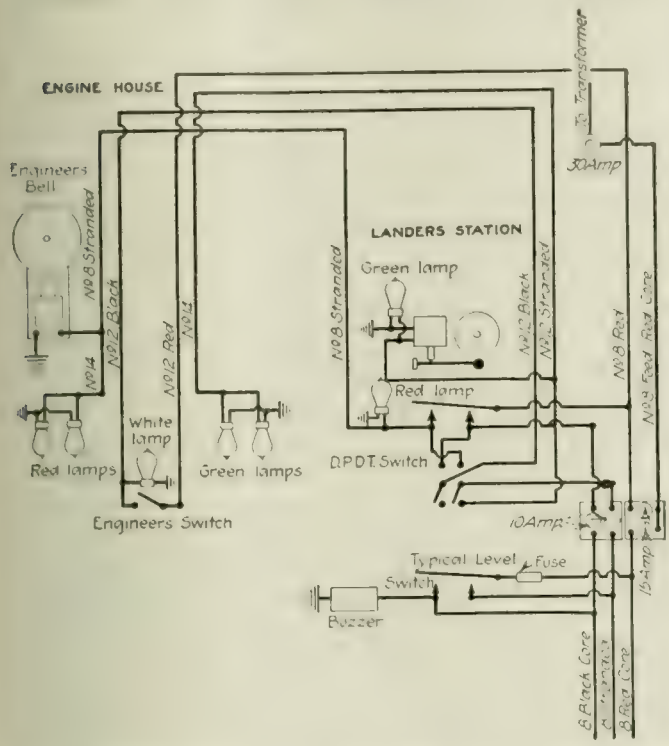


FIG. 1—SYSTEM FOR A TWO-COMPARTMENT SHAFT RINGING ON ONE SIDE ONLY

The sender of a signal hears the signal repeated back by the buzzers at each station. This system was developed by the Copper Range Company, Painesdale, Mich., all buzzers, switches and bells being built in the company shops.

In this district a "lander" is used who does all signaling to the engineer, and, with the idea of relieving the lander of Sunday work and of the possible elimination of that post, it was thought desirable to design the system for dual operation, *i.e.*, straight from underground or through the lander. In each case, however, the signals were to be repeated back underground before moving the hoisting engine.

Referring to Fig. 1, it will be seen that the underground circuit consists of three wires and a ground return. As the shaft is a two-compartment shaft with ringing for one side (*i.e.*, to ring the north side up, ring the south side down), there is one bell in the engine house and one for the lander. The wires therefore consist of a feed, a bell wire and a buzzer wire, using the ground return for both the bell and the buzzer circuit.

With the double-throw switch in the lander's station in the down position the operation is as follows: On closing the level switch buzzers on every level buzz, the lander's bell rings and a set of green lamps light up in the lander's stations. A set of four green lamps in the engine house also light up, giving the engineer a preliminary signal. On receiving the signal the lander repeats the signal to the engineer, causing the bell to ring and red lamps to light in the engine house. At the same time, however, the current flows back down the buzzer wire and all buzzers operate in the mine. As the lander rings the engineer red lamps light in the lander's station, showing him that the signal system is operating correctly. The sender of the original signal knows that his signal has been correctly sent as he hears the identical one sent to the engineer by the lander. The engineer had a check signal on his green lamps, and if the signal from the lander should not agree the error would be very evident. Three men are therefore on the job and each knows what is going on. If by any chance the signal is not correct as repeated back, the sender has an opportunity to stop the movement of the hoist.

If it is desired to ring direct from underground to the engineer, the double-throw switch in the lander's station is thrown in the up position. In this case as soon as the switch at a level is closed current flows up the bell wire directly to the engineer's bell, lighting the red lamp in the lander's station and also the red lamps in the engine house. It will be noted that in this case the green lamps are entirely cut off as the circuit is open when the switch is thrown into the up position. By following up the buzzer wire and passing through one pole of the switch it will be found that this wire also goes to the engine house, for a white light in this case. As the buzzers operate underground this light lights up, showing the engineer at once that the signal on his bell came directly from under ground. By using the switch on his stand he repeats the signal back. While the engineer thus has definite knowledge that the system is operating direct from under ground, the lander always notifies him of the throwing of the switch making the change.

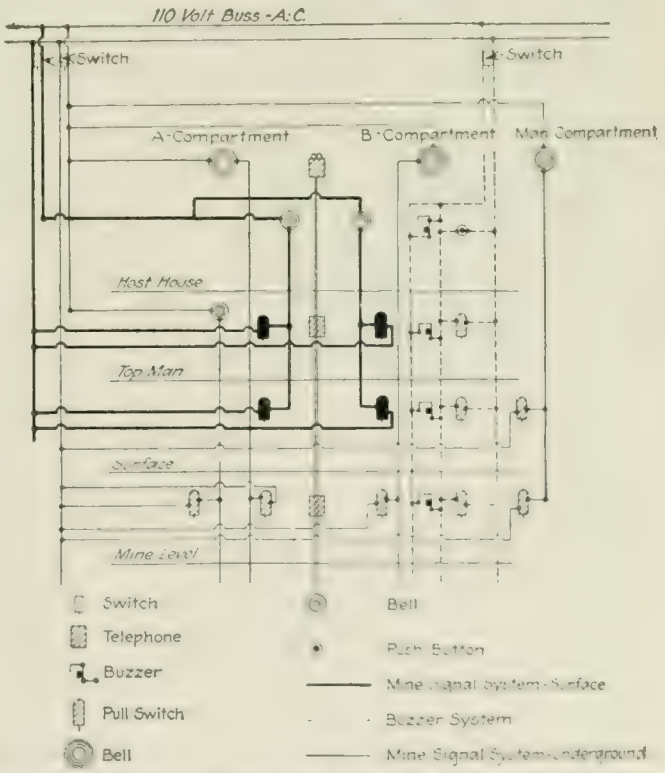


FIG. 2—A TYPICAL SYSTEM FOR A THREE-COMPARTMENT SHAFT

This system is used by the East Butte Copper Mining Company at the Pittsmount mine, Butte, Mont. There is a bell in the engine house for each compartment and two hoists. One hoist is for a single compartment of the shaft used to transport men and materials.

In this layout the telephone system has no part as it is entirely independent. In some installations the telephones are a part of the circuit system, the wires running in the same conduit or cable. It is the belief of the electrical department of the Copper Range Company that the two systems should be entirely independent and have no related functions. While there is additional expense involved in such a scheme, it does away with the possibility of electrical troubles on the signal system putting the telephone service out of commission. In the telephone system of this company it is possible to talk from any surface location to about every third level in all shafts.

In the Butte district operations are carried out differently from methods in the Michigan copper country. A typical example of a more complicated system is shown in Fig. 2 for the Pittsmont mine of the East Butte Copper Mining Company. There are in this case two distinct types of signals: (1) the signals that the station tenders use to connect with the hoisting engineer and top man and which no one in the mine except the

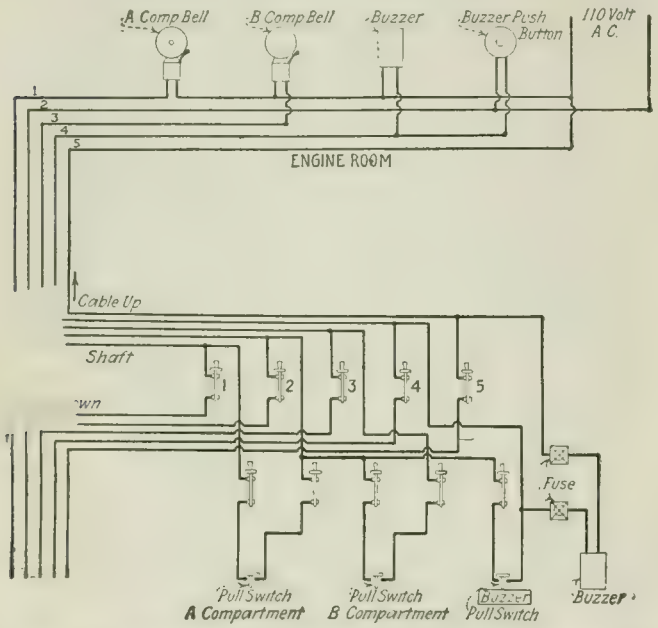


FIG. 3—ONE METHOD OF LOOPING CABLE INTO STATION JUNCTION BOXES TO FACILITATE TROUBLE SHOOTING

station tenders is supposed to use; (2) a system of buzzer signals that is used by others in the mine for the purpose of getting the station tenders and in connection with the mine telephones.

As shown in the wiring diagram in Fig. 2, there are ten wires, as follows: East shaft compartment, 1; west shaft compartment, 1; "chippy" compartment, 1; top man, 1; telephone, 2; buzzer system, 3; common return wire, 1.

Each compartment of the shaft has a separate bell in the engine house, and all pull switches operating in their respective compartments are in multiple. The buzzer system used for signaling station tenders and top men and also as a call for the mine telephone consists of one buzzer on each level, one at the surface and one in the engine room. All buzzers operate when any buzzer switch is closed.

A system for a two-compartment shaft with a separate bell for each compartment is shown in Fig. 3. This system is in use at the Butte & Superior Mine, Butte, Mont. From the sketch it will be seen that the general wiring scheme comprises one wire No. 2 as a common return wire, wires No. 1 and No. 3 as bell wires, and No. 4 and No. 5 taking care of the buzzer circuit.

Pull switches are placed upon each level and in skip pockets within easy reach of the cage tenders. There are also a buzzer and push-button on the engineer's stand. In case of a misunderstanding of signal the engineer can call for the signal to be repeated. The buzzers are independent of the hoist signals and are used for signaling cage tenders or by the engineer as stated.

Reliability of Equipment Extremely Important

Having chosen the circuit layout, the most difficult part remains, that of selecting the equipment and the proper installation. While working the circuit out on paper and laying out just what it is to do is very important, the problem of meeting the severe operating conditions is the real stumbling block. The next logical step is the selection of the voltage and deciding whether alternating or direct current is to be used.

Numerous systems are operating on direct current through motor-generator sets or storage batteries or both. There are some advantages to be gained through the use of direct current, but on the whole the use of ordinary standard 60-cycle, 110-volt lighting current simplifies the problem. With the large systems electrified as they are continuity of service is very essential to other operations as well as the signal system, and possible interruptions of the signal supply become less important if a mechanical signal is used for emergencies. In mines that do not use the wire rope pull bell as a standby but use an auxiliary electric system for emergency the point is, and should be, considered more carefully. In such a case the system can be designed to operate on either current, storage batteries being used for emergency.

Single-stroke bells seem to be far more desirable for signaling work of this class than the vibrating type. The strokes being distinct and easily read, code signals with slight time intervals can be used. In the Michi-

COST DATA FOR A 3,000-FT.-SHAFT SIGNAL SYSTEM, CHAMPION COPPER COMPANY, PAINESDALE, MICH. (1918)

Underground Feed:		
3,000 ft. 1-in. conduit, at $170 per 1,000 ft.	$510.00	
9,000 ft. No. 8 R.C. wire, at $33 per 1,000 ft.	297.00	
30 PRX junction boxes, at $3.48 each	104 40	
Fiber cleats, 30, at 20 cents each	6.00	
Labor (timber men on conduit and boxes), three men at $4.75, two shifts	28.50	
Labor (electricians, pulling main feeds), three men at $4.25, two shifts	25.50	
		$971.40
Underground Stations:		
Switch and buzzer units, 29, at $26 each	$754.00	
Labor of installing, $1.25 each	36.25	
		790 25
Lander's Station:		
Material (wire, small switches, etc.)	$3.00	
Signal switch	12 00	
Lander's bell	25.00	
Labor two men, two shifts, at $4	16.00	
		56 00
Engine-House Wiring:		
100 ft. 1-in. conduit, at $17	$17.00	
300 ft. No. 8 R.C. wire, at $3.30 per 100	9.90	
Signal switch	12.00	
Engineer's bell	30.00	
Material miscellaneous	5.00	
Labor, two men, five shifts, at $4	40.00	
		113.90
Line Work Between Shaft House and Engine House:*		
500 ft. No. 6 W. P. wire	$20.00	
2,000 ft. No. 8 iron wire	26 00	
Labor, two men, one shift, at $4	8 00	
		54.00
Grand total		$1,985.55

* Pole line already built.

gan district the half bell is used extensively, in which case the hoist is moved slowly until the switch is released and the bell plunger or core drops back. The Copper Range Company has developed a powerful engineer's bell of this single-stroke core type with an 18-in. (45-cm.) gong. The lander's bell is a smaller, slightly different type using a 6-in. (15-cm.) gong.

The weakest part of a signal system is usually the underground stations. Rugged switches for this service have been developed by the mining companies as commercial designs have not stood up under the service in most cases. There is, however, an evident need for improvement as most companies would rather buy such equipment than build it themselves.

In Fig. 4 is shown the underground switch and buzzer unit developed by the Copper Range Company. The switch makes and breaks in oil and all parts are built to stand hard service. Brass is used where corrosion might affect the working action. As shown in Fig. 4, this switch and the buzzer are mounted on a creosoted 2-in. (5-cm.) plank as a standard station unit. The switch may be held in the closed position by means of the latch *A*. While the switch is in this closed position all of the buzzers in the mine are sounding a warning that the hoist is being held. It would not be possible, however, to signal the engineer by closing any other switch.

Oil switches are used for several reasons. There is always a certain amount of arcing connected with breaking a solenoid circuit, and in time this arcing burns through the contacts. Breaking the arc in oil eliminates this source of possible trouble. The oil also lubricates the bearing surface of the plunger and prevents dust from making the switch sluggish. In case the switch is not operated for long periods of time the oil protects the contacts and spring from corrosion.

Buzzers suitable for mine use have been developed commercially within recent years. They should be very rugged and as nearly waterproof as possible. No adjustments should be required and the life of the tongue should be as long as possible. The tone should not be unpleasant. The one shown in Fig. 4 is built by the company and meets these requirements.

PROTECTING SHAFT CIRCUITS

Two methods of installation are in use for placing signal circuits in the shaft, one lead cable and the other conduit. In either case all wiring should be totally inclosed from the engine house to the last shaft station. Lead cable has the advantage of being waterproof provided that the entrances to junction boxes, buzzers and switches are also water-tight. Conduit circuits have given good service in a great many cases and afford an easier method of pulling out a section for repairs. In the Butte district the practice has been to favor the lead cable for signal use. In the Michigan mines conduit is used. By placing junction boxes at every level with a conduit union above the box sections can be taken out very easily in case of grounded circuits. Mechanical strength is essential, and partly for that reason No. 8 rubber-covered wire in 1-in. (2.5-cm.) conduit has been used in the system of the Copper Range Company.

TROUBLE SHOOTING MADE EASY

To facilitate the location of troubles arrangement should be made for sectionalizing the line. In Fig. 3 this is done by the use of single-pole knife switches in the junction boxes. Each wire may be disconnected from the lower levels and by another switch from the circuit on that level. In the system of the Copper Range Company terminal lugs are used in the junction boxes instead of switches. In case of a ground on a wire in a 3,000-ft. (900-m.) shaft the line is opened at the 1,500-ft. (450-m.) level. If the trouble remains it is evident that the location of the ground is in the upper half. By repeating the sectionalizing the point may be located within a few levels. By climbing the ladders and making an inspection of each station the trouble can usually be found quickly.

Fuses should be so arranged that protection will be

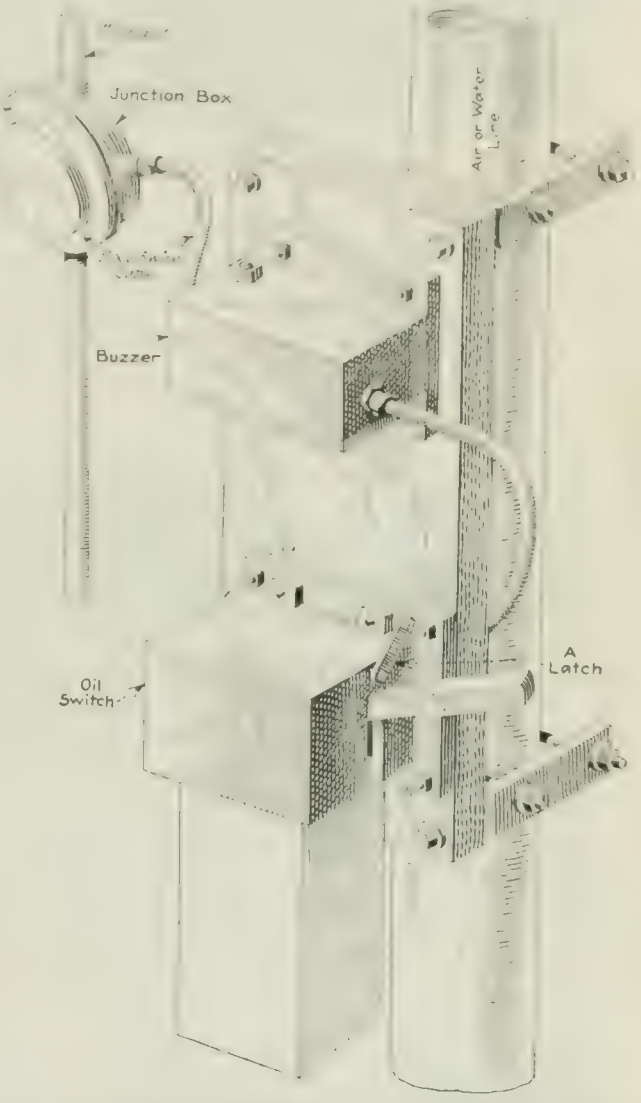


FIG. 4 — SWITCH AND BUZZER UNIT FOR UNDERGROUND SIGNAL STATIONS, SHOWING METHOD OF MOUNTING

had on all parts of the circuit and in such a way that a blown fuse will indicate which wire is grounded.

First cost of a system is usually indicative of careful thought. It may be the most economical expenditure in the course of time. The system of the Copper Range Company showed a cost of approximately $1,930 in 1918 for a 3,000-ft. shaft, including everything except a few minor miscellaneous items. All bells, buzzers and switches were built in the shops of the company and all materials were of the best. There has been virtually no maintenance expense since the first installation in 1916, with five shafts now in operation.



A Costly Experience Resulting from Political Interference

Regardless of the integrity, engineering ability and desire of the head of any municipally owned light and power system to keep his department free of politics, the engineering which may be done under this form of ownership cannot help but be influenced by politicians. Even in the Seattle municipal system, which has often been referred to as the highest type of municipal electric operation, and which has at its head J. D. Ross, a very progressive engineer, this condition has occurred and resulted in an expenditure of nearly $4,000,000, which is drawing no return. There the public and politicians were not content with the judgment of the municipal electric department and allowed interference that resulted in an unsound hydro-electric development on Cedar River, which culminated in two disastrous floods in 1918. Attempts to prevent repetition of the trouble have proved futile and costly, and the present outlook is that a large investment has been thrown away. As pointed out in the May 1, 1920, issue of the ELECTRICAL WORLD, Mr. Ross has proposed a solution which will at least enable the city to use its Cedar River power plant, but politics again is raising obstacles. A privately owned utility, which has a constant incentive to make no useless expenditures of money or unsound developments, would have avoided this situation, which the city of Seattle will now have to absorb in taxes or higher rates.







1. Cedar River dam and a portion of the basin above, the far embankment of which is a glacial moraine through which the impounded water filtered and caused two disastrous floods in 1918. Some results of this catastrophe are shown below. Attempts to seal this basin have been futile, and as a result practically no water is being stored behind the dam, which cost $1,700,000. To this cost must be added interest to the maturity of the bonds, $1,260,000; the cost of unsuccessful sealing operations, $382,000, a bond issue of $175,000 to pay the cost of the first flood, and the interest to maturity on this bond issue of $72,187.50. In addition there are suits pending for the second and most disastrous of the floods for an amount of $500,000, which, if Seattle is held liable, will cause a total loss from this municipal adventure of more than $4,000,000.

Protection of Transmission Systems—II

A Comprehensive Analysis of Abnormal Voltages Which May Occur on Transmission Systems and Methods Adopted by a Company in Sweden to Protect Station Apparatus from Insulation Break-down

By PROF. EMIL ALM

THE protection of overhead transmission systems against voltages developed by atmospheric disturbances and grounding of a line conductor and excessive voltage rise at the neutral were considered by the author in the first part of this article, published in the ELECTRICAL WORLD for Aug. 7. It is now the purpose to consider the nature of traveling waves and means of controlling them. As previously mentioned, traveling waves will be produced both when atmospheric static charges are set free, occur when an insulator string flashes over. As these are designed for a flash-over of about 250,000 effective volts, traveling waves will propagate to either side of the flash-over point (Fig. 2), having an amplitude of $(250{,}000/2)\sqrt{2} = 125\sqrt{2}$ kv. and a voltage jump of twice this value, or $250\sqrt{2}$ kv. The doubled potential change caused by the reflection of such a wave with an amplitude of $250\sqrt{2}$ kv. is usually considered as the highest voltage jump which can occur, except those due

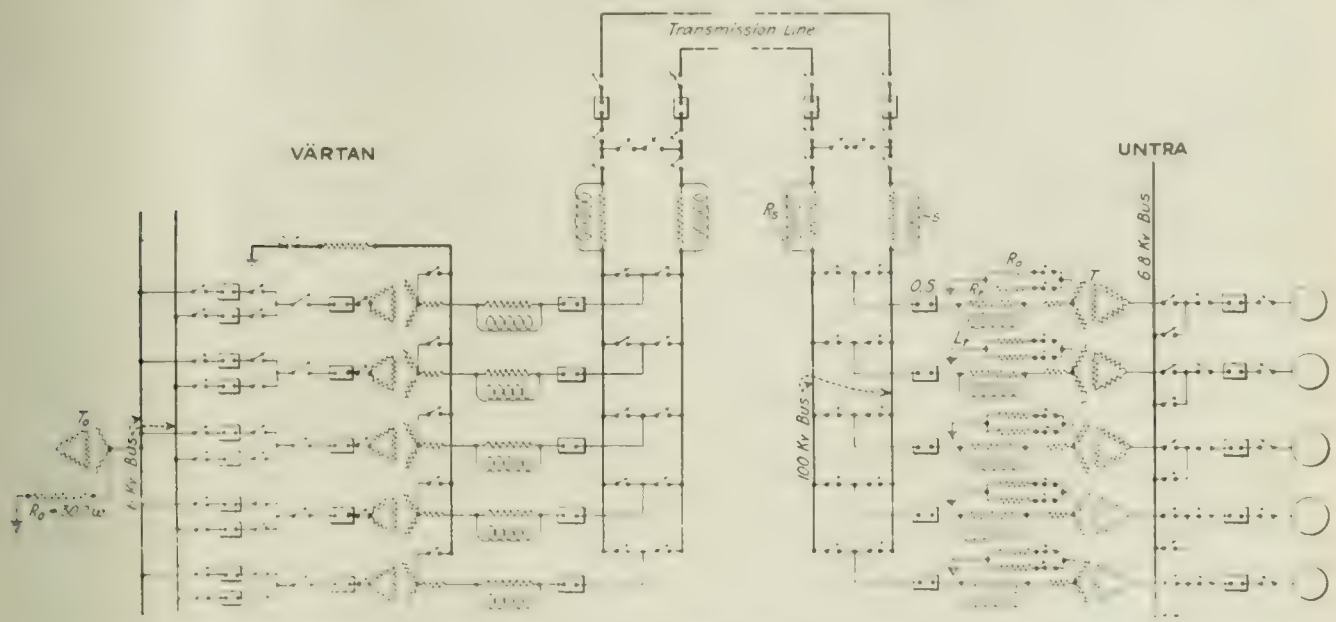


FIG. 1—CONNECTION SCHEME FOR PLANT AND TRANSMISSION SYSTEM AT UNTRA, SWEDEN

Abbreviations: *OS* oil circuit breaker; *T* transformer, L_t transformer inductance coil, R_t shunt resistance for same, L_l line inductance coil, R shunt resistance for same; R_n neutral resistance, T_n transformer neutral resistance. The generating station is connected to Värtan over 100-kw. transmission lines.

whether these are accompanied by grounds or not, and by switching, short circuits, etc. These waves travel along the lines with a comparatively steep front and when they reach the transformer windings may cause the break-down of the latter. Condensers could hardly be used as a protection against over-voltages of this nature, so that, besides a heavy insulation between the turns and layers of the windings, reactance coils must be resorted to.

For transformers of the size involved there is no difficulty in providing such a heavy insulation at a reasonable cost, and this has been considered the most important means to prevent operating disturbances caused by traveling voltage waves. Space has, however, been provided for reactance coils both for the incoming lines and for each transformer, although these coils have not as yet been installed.

EVALUATION OF DISTURBANCES CAUSED BY TRAVELING WAVES

Comparing the amplitudes of the traveling waves which can be set up from switching or other operating disturbances, it has been found that the worst results to direct lightning strokes, and the highest for which protection should be provided. The transformers are constructed with a 2-mm. paper insulation between the winding turns, and one-tenth of the winding nearest the terminals is strengthened to 2.65 mm. The distance from copper to copper in the coils nearest the terminals is 20 mm. and is thereafter reduced to 11 mm. in the ordinary coils. For a minute's test this should correspond to a dielectric strength of 60 kv. and 75 kv. respectively for the insulation between the turns and about 135 kv. and 80 kv. respectively for the insulation between the coils. For momentary stresses it may be assumed that the dielectric strength of oil is from two to three times greater than for a continuous stress, depending on the distance, and for solid dielectrics it is even greater.

Starting out from the fact that the voltage jump of a reflected wave would correspond to about 500 kv. effective, it would seem as if the insulation used would be insufficient, provided that we considered the transformer winding as a straight line of high resistance against the wave. If, on the other hand, we take the

capacity between the turns into consideration, the conditions will be more favorable, at least for the insulation between the turns. The momentary stress between the turns nearest the terminals has been calculated to approximately 60 kv. effective. The first coil will, however, take up almost the entire voltage jump of the wave, so that the weak point in a transformer will undoubtedly be found in the insulation between the coils. On this account the installation of reactance coils as a further protection has been considered, as previously mentioned.

Inasmuch as both theoretical investigations and experiments have shown that with undampened reactance coils the amplitude of the overvoltages in certain parts of the switch-house could increase considerably above the amplitude of the primary disturbance, it was from the beginning clear that some sort of damping device had to be provided. Calculations were made for a damping device consisting of a horn-gap arrester and a resistor and these showed that with suitably dimensioned resistances a fully satisfactory damping could be obtained.

As, however, horn-gap arresters for the voltage in question require a considerable space both for themselves and for the accompanying resistance, it was found that such an arrangement would be rather expensive as compared to its advantage. On this account, and inasmuch as the lines and apparatus had been designed for test voltages as high as 250 kv., the required damping was obtained by shunting the reactance coils with non-

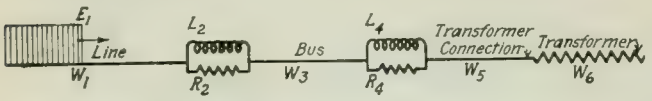


FIG. 3—EQUIVALENT DIAGRAM OF PROTECTIVE APPARATUS
(Fig. 2 appeared in the first installment of this article.)

inductive resistances (Campos arrangement). This arrangement has, however, the drawback that a considerable portion of the voltage wave, against which the coil is supposed to protect, passes through without change in the wave front. On this account space has, as previously stated, been provided for reactance coils for each line and each transformer (Fig. 1). A protective system is obtained, therefore, equivalent to that shown in Fig. 3 in which W also indicates the wave resistances.

If, in the first place, we assume the inductances L_2 and L_4 so high that the wave passing through them can be neglected, then the amplitude of the wave which goes to W_3 through the shunt resistance R_2 is:

$$E_2 = \frac{2W_3}{R_2 + W_1 + W_3} E_1$$

When this wave in turn passes the shunt resistance R_4 to the reactance coil of the transformer, then the wave passing to W_5 will have an amplitude of:

$$E_5 = \frac{2W_5}{R_4 + W_3 + W_5} E_3$$

For atmospheric disturbances we can put approximately, $W_1 = 700$ ohms, $W_3 = W_5 = 300$ ohms. The length of $W_3 = 100$ m. and of $W_5 = 10$ m., and their capacities approximate 10×10^{-10} and 1×10^{-10} farad respectively.

The resistances R_2 and R_4 should now have such values that the charging of the transformer does not take place in an oscillatory manner, but aperiodically. On the other hand, they should be as large as possible in order that the voltage let through shall not have too high an amplitude. Their size depends, therefore, to a great extent on the size of inductances L_2 and L_4. As the maximum energy of the wave is absorbed in a shunt resistance when its resistance in ohms is equal to the sum of the wave resistances on either side, we get

$$R_2 = 700 + 300 = 1{,}000 \text{ ohms.}$$
$$R_4 = 300 + 300 = 600 \text{ ohms.}$$

With the above values for W and R, we get:

$$E_3 = 0.3\ E_1$$

and

$$E_5 = 0.5\ E_3 = 0.15\ E_1.$$

When this wave reaches the transformer W_5, practically a doubling of the voltage occurs, so that the first wave which enters the transformer has an amplitude $0.3E_1$. If, therefore, E_1 equals a voltage wave of 250 kv., then the transformer winding will be exposed to a voltage of about 75 kv. On account of the capacity between the turns of the winding the stress between the turns will only be about 12 per cent of this, or about 9 kv.

Voltage Stress on Transformer End Coil

It is, however, of particular interest to get an idea of what the voltage on the first coil will be. The length of its conductor is about 120 m., and if the velocity of the propagation of the wave in the winding is about 40 per cent of what it is on the bus, then the equivalent length (with the same velocity as on the bus) would be about 300 m., corresponding to a time of 1 micro-second. If W_3 and W_5 in Fig. 3 are replaced with condensers C_3 and C_5, it would be possible to carry out the calculation by means of the so-called "operator-method" developed by Pleijel. As these calculations are very intricate, use will be made instead of the method with reflection factors, which, by making certain simplified assumptions, leads to a quicker solution. Damping in the busbars will be neglected, though it is an assumption which would be fully permissible with copper bars, and which even with the heavy iron pipes—1½ in. and 1 in. (3.8 cm. and 2.5 cm.) respectively—which are used in this case can be considered altogether unfavorable.

On W_3 the charge oscillates between R_4 and W_3 and will in one second make fifteen complete oscillations. Inasmuch as the reflection factor between W_3 and R_4 is, approximately,

$$K_{r34} = \frac{R_4 - W_3}{R_4 + W_3} \frac{W_5}{+ W_5} = 0.5,$$

and the reflection factor between W_3 and W_5,

$$K_{r35} = 1,$$

the result of the first impulse after fifteen oscillations will be

$$0.15 E_1 \frac{(1 - K_{r35})}{(1 - K_{r34} K_{r35})} [1 - (K_{r34} K_{r35})^{15}] = 0.6 E_1.$$

During ten oscillations on W_3 the charge on W_2 has made one oscillation. As the reflection factor between W_3 and R_4 is

$$K_{r34} = \frac{R_4 - W_3}{R_4 + W_3} = 0.5$$

and between W_3 and R_2

$$K_{r32} = \frac{R_2 - W_1 - W_3}{R_2 + W_1 + W_3} = 0.7.$$

the next impulse which from W_2 reaches W_0 will be:

$$0.15E_1 \times 0.5 \times 0.7 = 0.35 \times 0.15E_1.$$

After five oscillations (15 — 10) it will have a value:

$$0.35 \times 0.15\, E_1 \times \frac{2}{0.5}(1 - 0.5^5) = 0.2\, E_1.$$

The total voltage to which the first coil is subjected will therefore be about

$$E_{s_1} = (0.6 + 0.2)E_1 = 0.8\ E_1,$$

or if $E_1 = 250$ kv.,

$$E_{s_1} = 200 \text{ kv.}$$

If we take into consideration that part of the waves even enter the inductances and that a certain damping takes place when the waves pass back and forth on the busbars, the voltage across the first coil will be somewhat less. The assumptions made in order that this calculation shall be fairly accurate are, besides the neglecting of the damping effect, partly that the resistances can be considered as "concentrated" and partly that the "equivalent" conductor length of the inductances is greater than the equivalent conductor length of the first transformer coil, or, in other words, that the time it takes for a wave to pass either coil shall be more than 1 micro-second. If we assume that the velocity of propagation in the reactance coil and the transformer winding is the same, their actual conductor length must therefore be greater than the first transformer coil.

As the above value of the voltage between the first and second coils is on the safe side and as the stress is only of short duration, there is every reason to believe that the insulation provided between the transformer coils is sufficient. It is, for that matter, not necessary to make the charging fully aperiodic, as it can very well be somewhat oscillatory. On this account the size of the shunt resistances can be considerably increased (50 to 100 per cent) without materially increasing the pressure rise. If for example R_2 and R_4 were doubled, then the voltage on the first coil would be about $0.6E_1$ instead of $0.8E_1$ as in the previous case: that is, 150 kv. instead of 200 kv. The size of the inductances should then strictly be increased in proportion to the square if an aperiodic charging be still desired, but, as already mentioned, this is an unnecessarily severe condition.

Iron Piping Considered for Inductance Coils

It had originally been planned to make the inductances relatively large (10 to 20 milliheuries) and of copper. On account of the favorable influence which the capacity between the turns has proved to have on potential stresses, it is safe to say that these values can be reduced. As it has furthermore been shown that iron conductors have a much higher damping ability than copper, it is under consideration to substitute coils of iron pipe for the copper coils. On account of the increased losses and in order to get them into the compartments already provided, these iron coils would have to be made for considerably lower inductance; but, on the other hand they have a much more powerful damping effect on the traveling wave.

The resistances should, as already mentioned, have as short a conductor length as possible. It would be best if this could be made of rods of some material with high resistance, for example, "silit." Experiments have, however, shown that "silit" exposed to the pressure shocks of traveling waves to a considerable degree loses its resistance, and this material is therefore unsuitable. Another method would be to deposit spirally a thin layer of some metal with high resistance on a porcelain rod, for example, platinum. The simplest way is, naturally, to wind fine high-resistance wire on some kind of insulating rod, such as porcelain, bakelite, etc. In that case, however, the resistance conductor will be rather long. If the inductance coils are made of iron pipe, it is not out of question, however, that the damping which would be obtained owing to the high current density would be sufficient to prevent pressure rises above the amplitude of the primary disturbance.

In this connection it may be mentioned that the high-voltage oil circuit breakers are provided with charging resistances for reducing the current shocks from cutting in transformers and for reducing the traveling waves caused by switching.

Resonance Due to Harmonics in the Generator Voltage Wave

With the rotor removed each generator has a leakage reactance of 0.799 ohm. With the rotor in place the leakage reactance may be assumed to be 0.6 ohm.

With transformer ratio at Untra equal to 15, the generator reactance corresponding to the high-voltage side $= 15^2 \times 0.6 = 135$ ohms, and the inductance is:

$$L_g = 135/2\ \pi\ 25 = 0.86 \text{ henry.}$$

To this must be added the leakage reactance of the transformer, which, measured on the high-tension side, is 78 ohms, corresponding to a reactance of

$$L_t = 78/2\ \pi\ 25 = 0.5 \text{ henry.}$$

For each unit the total leakage reactance per phase is thus:

$$L = 0.86 + 0.5 = 1.36 \text{ henries.}$$

The capacity per phase of either line is figured to be 1.17 m.fd. at 100,000 volts and normal frequency, corresponding to a charging current of 10.6 amp. Neglecting the magnetizing inductance of the transformer as compared with the capacity which is permissible with frequencies higher than normal, the natural period of the system will be:

(a) With one unit and two lines = 89.5 periods.
(b) With one unit and one line = 126.5 periods.
(c) With two units and one line = 179 periods.

The natural period in cases *b* and *c* corresponds approximately to the fifth and seventh harmonics.

On account of the relatively low natural period it is important that the generator voltage wave be free from harmonics. At no load this is the case, but when loaded the armature reaction always causes a certain deformation of the voltage curve, the more so the higher the armature magneto-motive force is in proportion to the field. As the generators are designed with a comparatively strong field, the danger from this should not be great, and this is borne out by the operation.

With grounds, and especially with single-phase short circuits, a considerable deformation of the voltage wave will take place due to the unsymmetrical (single-phase) load. With single-phase short circuits the peak value of the voltage of the unloaded phase will rise considerably, especially if the transformers are Y-connected on both sides. As the transformers in this case are Y-Δ connected, the voltage rise due to the latter cause will be

somewhat reduced. If, however, the causes should bring about any troublesome deformation of the voltage wave, the generators are so constructed that an effective damping winding can readily be provided on the field and thus reduce any deformations caused by an unsymmetrical or single-phase load.

Protection Against Overvoltages Passing from High to Low Voltage Side

With a ground on one leg of a line the voltage of the other legs will rise, and if the capacity between low-tension winding of the transformers and ground is small, quite a high voltage can be statically induced on the corresponding low-tension winding. As, however, the low-tension windings both at Untra and Vartan are connected to cables with a relatively high capacity, the pressure rise that is due to this cause would be negligible.

It would be more dangerous if the voltage should strike over between the high-voltage and low-voltage windings through the transformer cover or case, for example. To avoid the triple harmonics which may occur if a three-phase transformer of high saturation has both its windings Y-connected, the transformers at Vartan have been delta-connected on the low-tension side and Y-connected on the high-tension side. There is therefore no neutral point on the 6,000-volt side which can be grounded and whereby, with flash-over between the windings, a pressure rise on the cable system may be prevented. For this reason there is connected to the 6,000-volt busbars at Vartan a Y-connected reactance coil whose neutral is connected to ground through a 300-ohm resistor, this resistance being necessary to prevent a short circuit of one phase of the reactance coil in case of a ground in the cable system.

If, owing to a flash-over from the high-tension side, the voltage of the cable system rises, currents will be set up through the three phases of the reactance coil and through the resistance to ground, and these currents will limit the pressure rise. In order, then, that the inductive voltage drop in reactance coil shall not be too great, it is besides provided with a delta-connected winding without any leads. In this manner the voltage drop in the coil will only be equal to the short-circuit voltage. In Untra, however, provision has been made for grounding the generator neutrals to prevent such pressure rises.

The foregoing is a condensed translation by Eric Lof of a lecture delivered by Professor Alm before the Electro-Technical Society of Stockholm.

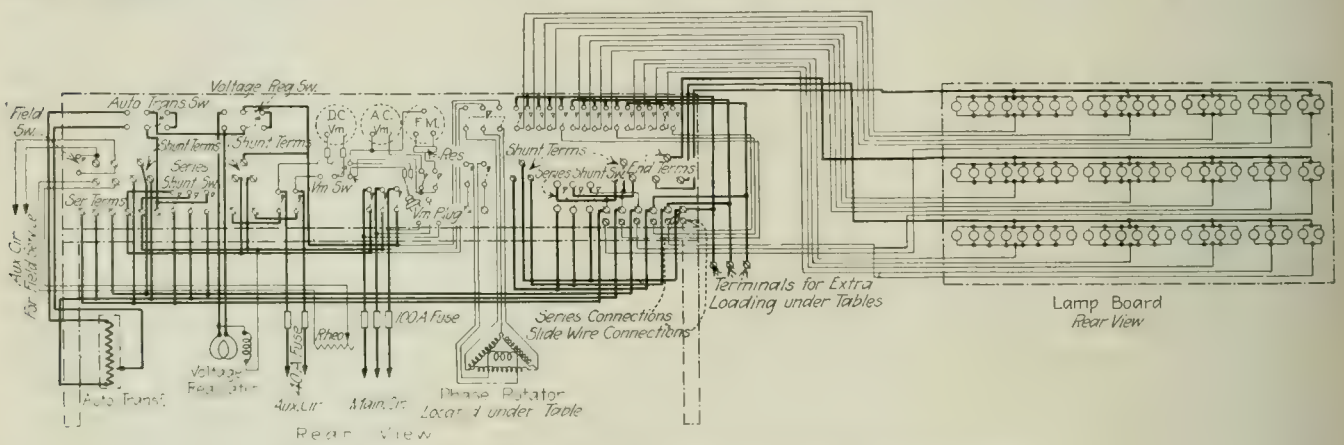
Polyphase Experimental and Instrument-Testing Table

By Means of Large and Well Designed Board All Needed Values May Be Obtained with Minimum of Space and Equipment

By H. P. Sparkes
Engineer Westinghouse Electric & Manufacturing Company

In thorough testing of electrical instruments all possible operating conditions must be reproduced in order that there shall be accuracy when the devices are placed in actual service. For alternating-current instruments there must be tests of loads, voltage, frequency and power factor. Usually a great amount of apparatus is necessary for this work and the space taken by this equipment is somewhat large. These problems have been greatly simplified by means of a testing table recently built which makes it easy to obtain all needed values. In particular, the board is specially suitable for making wattmeter tests when the power factor, voltage and load must be changed, or for the testing of power-factor instruments or other phase-indicating devices.

As shown, the table is equipped with switching apparatus mounted on vertical panels at the back with plenty of room on top of the tables for instruments to be tested. Three sections of oil-finished slate are used, each section being a standard 2-in. (5-cm.) panel. The sections are laid out so that apparatus which has related usage is grouped together. Regulators, rheostats and similar instruments are mounted under the top of the table, so that the control handles are convenient to the operator when standing near the center in a position to read the instruments or make other adjustments. The framework of the table and panel supports are of hardwood, thus making a minimum of iron. The table top is of hardwood 2¼-in. (5.6 cm.) thick, highly polished so as to present a clean surface and avoid accumulation of dust.



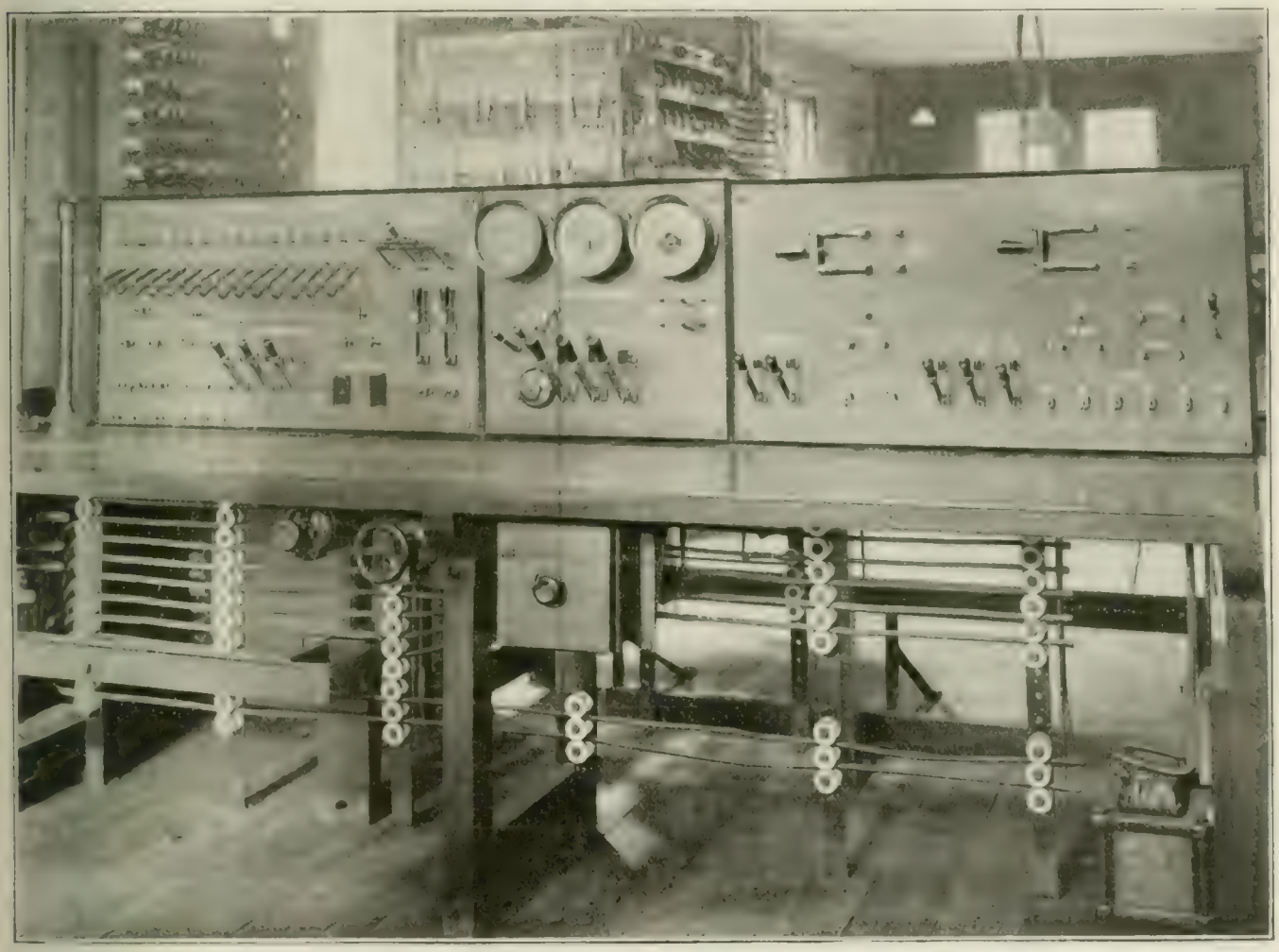
CONNECTIONS ON BACK OF POLYPHASE INSTRUMENT TESTING BOARD

The table is designed to accommodate one three-phase circuit and two auxiliary single-phase circuits. The three-phase circuit is the main testing circuit and is connected to all apparatus on the test table, whereas the auxiliary circuits are connected only to separate switches and terminals. These auxiliary circuits may be used for the field control of machines supplying power to the testing table, or where two sources of power are necessary for testing. In all cases the auxil-

iary circuits are connected to the power-supply switchboard or directly to an independent source of power.

The general connections are as follows: The energy supply is connected to the table by means of a three-phase circuit. This circuit is protected by fuses of 100-amp. capacity. At the point where the main switches are connected in the circuit are taps for the instruments mounted on the table. Each instrument is supplied with independent cutout switches, and a master phasing plug controlls all instruments. This arrangement makes it possible to determine the conditions existing in each phase before closing the main-line switches for the test. On the table side of the main switches are taps for shunt connections, and auto-transformer and voltage regulator, a set of series terminals and shunt switches, and a second set of shunt terminals is also connected. At the other end of the table the connections of the shunt and series terminal combinations are practically duplicated, with the exception that the first shunt circuit is taken off after the auto-transformer and voltage regulator. The circuit passes on through the load switches and lamp or load bank. The load is kept separate and each phase end is connected to terminals on the table called "end terminals." This makes each phase independent throughout the board, and it remains so until the three terminals are connected either in star or delta, as desired. The delta connection requires each end terminal to be connected back to the proper phase at the main-line switch. This may be done through the first shunt taps taken off. Terminals for extra load are placed under the table, making it possible to insert various loads without the fine adjustment of the load-bank combination. The first switch of each load group has terminals for connecting a slide-wire resistance in series in order to obtain very fine adjustment. The phase shifter is connected direct to the three-phase circuit; in the secondary is an extra set of terminals and switches. The rheostat is connected to terminals just below the terminals of one of the auxiliary circuits so that it may be used for controlling the source of power.

The auxiliary circuits are equipped with separate switches and terminals. One circuit has a capacity of 40 amp., making this circuit serviceable for auxiliary work in connection with a test. The second auxiliary circuit is supplied for field control or other light service.



BOARD WHICH FACILITATES POLYPHASE EXPERIMENTS AND TESTS

Referring to the front of the table, the left-hand panel contains the load switches, the phase-shifting switching equipment, two sets of shunt terminals, one set of series terminals and switches, the end terminals and the auxiliary load terminals. The middle panel, or the master-control panel, contains the frequency meter, alternating and direct current voltmeter, instrument switches, phasing plug and the main-line switches. The right-hand panel contains a switch for controlling the voltage regulator and the auto-transformer, main-line switches and terminals for 40-amp. auxiliary circuit, two sets of shunt terminals, one set of series terminals and switches, one switch and terminal for field-control auxiliary circuit and one set of terminals for the rheostat.

Establishing Simple Basis for Rates

Measurement of Kilovolt-Ampere-Hours and Kilovolt-Amperes Maximum Demand in Polyphase Circuits by the Use of Standard Polyphase Watt-Hour Meters Gives Simple Basis on Which to Figure Rates

By RAY H. WOLFORD
Assistant Engineer Meter Department American Gas & Electric Company, New York

THE recent tendency of central stations to take into consideration the power factor of their customers' loads in making rates has brought about the need of some means for arriving at a figure which could be used in such rates and which would represent the condition of a customer's load as regards the ratio of actual to apparent power.

Many power rates have been put into effect which contain power-factor clauses. Several methods have been developed to measure the power factor of loads, chief among which are the methods of measuring the reactive or wattless component of the load and computing the power factor from the readings of the watt-hour and reactive-component meters. The power factor which such methods give is the weighted average power-factor of the load over the period measured.

There appears to be a well-defined opinion existing in the industry that the power factor which is really wanted is the power factor at the time of the maximum demand of the load, since the general practice is to correct the measured maximum demand in terms of kilowatts to a basis of maximum demand in terms of kilovolt-amperes by means of the measured power-factor figure. This method requires the use of several mathematical calculations, which render the method somewhat unsatisfactory from the customer's standpoint.

The writer will describe a method of measuring the kilovolt-ampere-hours, or apparent power, and the maximum demand kilovolt-amperes in a polyphase circuit to the degree of commercial accuracy by use of a three-phase, four-wire, three-current-coil, polyphase watt-hour meter, which registers the integrated value of the apparent power. The maximum demand in terms of apparent power is obtained by the use of any of the ordinary block-interval demand meters on the market, controlled by the usual contact-making devices, or by being built directly in the integrating meter.

The manner of connecting the integrating kilowatt-hour meter and kilovolt-ampere-hour meter in a three-phase circuit is shown in Fig. 2. It may be observed that the top element of the kva.-hour meter is connected identically as the top element of the kw.-hour meter and that the shunt coil of the lower element of the kva.-hour meter is connected between Z and X instead of Z and Y, as would be the case in measuring power.

Had the phase rotation of the circuit been in the reverse direction the manner of connecting the elements would also have been reversed. The common return of the current transformers passes through the middle current coil of the kva.-hour meter where it joins the other current circuits. This common return is used in place of a third transformer as the current in it is equal to the current in the third wire of the circuit.

A constant of 0.577 (= 1.73/3) has to be used to reduce the dial reading of the standard meter to kva.-hours. However, this constant may be changed to unity by using a register on the meter having twice the ratio of the standard register and using a calibrating constant of 0.5/0.577 = 86.6 per cent of the standard constant.

The principle of the method is based on the fact that the current in the circuit may lead or lag any chosen position at which position the shunt and current fields of the meter are in a state of quadrature to the amount of 11 deg. 20 min., and in so doing only cause the meter to decrease 2 per cent in speed, the cosine function of 11 deg. 20 min. being 0.98. For example, suppose it is desired that the meter register over a range of power factor having an intermediate chosen power-factor point of 75 per cent. The angle whose cosine is 0.75 is 41 deg. 20 min. Now, if the meter is so adjusted and connected in circuit that at a power factor of 75 per cent the shunt and current fields are 90 deg. apart, or in quadrature, the meter will record volts × amperes at that power-factor. If the power factor of the circuit should change to 61 per cent or 86.6 per cent, corresponding to a shift of the current in the circuit of 11 deg. 20 min. in either direction, the meter would then

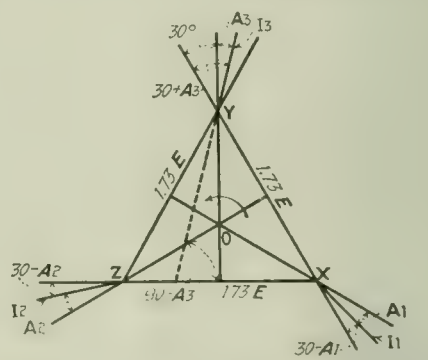


FIG. 1—VECTOR DIAGRAM OF A THREE-PHASE CIRCUIT X, Y, Z, HAVING A BALANCED DELTA VOLTAGE OF 1.73 E AND CURRENT VALUES I_1, I_2, I_3, IN THE THREE-PHASE WIRES

record volts × amperes × cos (11 deg. 20 min.) = 0.98 volt-amp., resulting in an error of 2 per cent in the registration.

The accuracy of the method when applied to several different ranges of lagging power factor is shown in Fig. 3. The meter and connection described are adapted for use over any of these ranges by adjusting the lag angle of the shunt fields of the meter. Each of the curves (Fig 3) has an intermediate power-factor point at which point the meter is adjusted so that a quadrature condition exists between the shunt and current fields when the power factor of the circuit is at that point. The odd lag angles of the shunt fields are secured by means of the quadrature adjusting device in the meter for angles larger than 90 deg. and by inserting a resistor in series with the shunt coils for angles less than 90 deg.

The five intermediate power-factor points, the corresponding lag angles of main-circuit current to the Y-voltage E, and the required shunt-field lag angles, are given in the accompanying table.

Referring to Fig 3 again, curve (3) is derived by the use of the standard meter with a lag angle of 90 deg. It will be noted that the meter has a much longer range within any chosen accuracy limits at the lower power factors. The small sharp curves represent the registration of a watt-hour meter expressed in terms of apparent power.

The registration of the watt-hour meter shown in Fig. 2 may be calculated on the basis of curve 3, (Fig. 3) as follows:

The element in X records proportional to

$$0.577 \times 1.73\ EI_1 \cos (30 - A_1) \quad 0.866\ EI_1 \cos A_1 + 0.5\ EI_1 \sin A_1.$$

The element in Y records:

$$0.577 \times 1.73\ EI \cos (30 + A) + 0.577 \cdot 1.73\ EI \cos (90 - A) \quad 0.866\ EI \cos A + 0.5\ EI \sin A.$$

The element in Z records:

$$0.577 \times 1.73\ EI_2 \cos (30 - A) \quad 0.866\ EI \cos A_2 + 0.5\ EI_2 \sin A_2.$$

Adding the registrations of the three elements, since their torques are exerted on a common shaft:

$$0.866\ EI_1 \cos A_1 + 0.5\ EI_1 \sin A_1 + 0.866\ EI_2 \cos A_2 + 0.5\ EI_2 \sin A_2 + 0.866\ EI_3 \cos A_3 + 0.5\ EI \sin A,$$

which expresses the registration of the meter.

Assume angles A_1, A_2, A_3 to be any angles of lag between 18 deg. 40 min. and 41 deg. 20 min. corresponding to power factors between 94.7 and 75 per cent whose cosines are 0.947 and 0.75 and whose sines are 0.32 and 0.66. Substituting the values of the cosines and sines for 41 deg. 20 min. in the quantity it becomes:

$$0.98\ EI_1 + 0.98\ EI_2 + 0.98\ EI_3$$

and similarly the values for 18 deg. 40 min. may be used with the same result.

The true volt-amperes in the circuit is expressed by the quantity $EI_1 + EI_2 + EI_3$ since balanced voltage has been assumed.

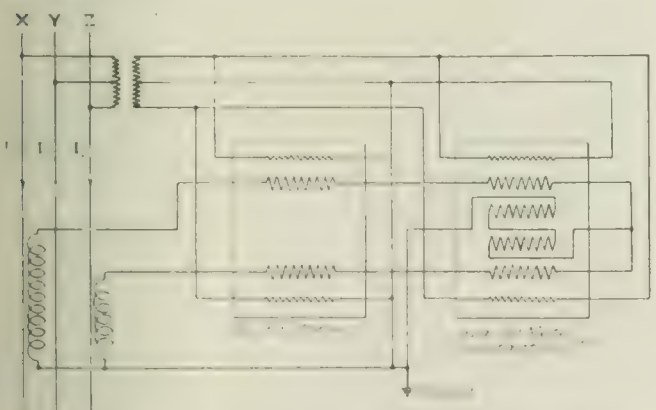


FIG. 2—METHOD OF CONNECTING STANDARD INSTRUMENTS FOR MEASURING POWER FACTOR

It is evident that at a power factor of 86.6 per cent, corresponding to a lag angle of 30 deg., the meter would register true volt-amperes. In the same manner it may be shown that at any other power factor of the main circuit, either leading or lagging, the meter may be adjusted so as to measure apparent power over a restricted range of power factor within the limits of commercial accuracy. For example, the standard meter with a 90-deg. lag angle may be used on a circuit having an intermediate power-factor point of 86.6 per cent leading by altering the method of connection of the shunt coils so that the voltage vectors will lead the current vectors by an angle of 30 deg. at unity power factor in main circuit.

Some difficulty may be experienced in connecting the meter properly in circuit as the phase rotation of the circuit must be known when making the connections. Since the meter will generally be connected in circuit along with a watt-hour meter the following check may be used on a circuit of lagging power factor. Note the fast element of the watt-hour meter and connect the shunt coil of the corresponding element to the kva.-hour meter the same as the shunt coil of the watt-hour meter. Then connect the other shunt coil of the kva.-hour meter

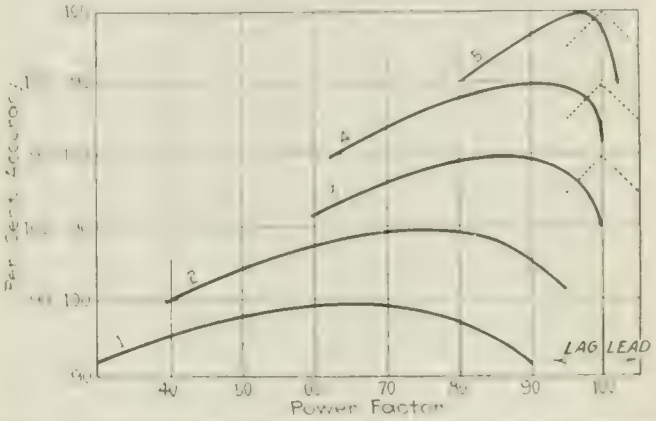


FIG. 3—ACCURACY OF METHOD AT DIFFERENT POWER FACTORS

Curve No.	Power-factor Intermediate Point	Angle of Lag of Main Circuit, Deg	Min	Shunt-field Angle Deg	Min
1	65	49	30	109	30
2	75	41	20	101	20
3	86.6	30	00	90	00
4	90	25	50	85	50
5	98	11	20	71	20

across the two-phase wires containing the current transformers. This will place the shunt and series fields of all three elements of the meter in the same relation to each other regardless of the power factor of the circuit; that is, if the current leads the potential in one element the same condition will also exist in the other elements.

An interesting point in the method is that in no case can the meter record in excess of the apparent power value, whatever error there is being negative. This feature is considered to be an advantage as there is no chance of the error operating to the advantage of the customer.

A preliminary analysis of the power-factor conditions of the load by means of a graphic-power-factor meter should enable the selection of a power-factor range best suited to the load and determine the nature of the calibration of the meter to measure the apparent power with a good degree of accuracy.

Protecting Industrial Distribution Lines

INASMUCH as Fig. 1, page 177, of the article "Protecting Industrial Distribution Lines" in the July 24 issue shows the use of reverse-current relays as the only protection for substations, the question has been raised as to how equipment in these stations is protected. While the article dealt especially with automatic sectionalizing of the double-ring bus, it is also of interest to note that each substation switch, in addition to the reverse-power relay, is provided with straight instantaneous overload relays which give these stations protection.

Readers' Views and Comments

Steel Versus Marble Switchboards

To the Editor of the ELECTRICAL WORLD:

SIR: Is not the use of marble switchboards rather a habit than a dictate of good modern engineering? It is the opinion of the writer that within a few years marble switchboards will be a thing of the past and that many of our present panels will be converted into tombstones. On the majority of boards, especially control and meter panels, nowadays it is the recognized practice to keep the potential at any point of the board down to 125 volts. At this voltage there is certainly no need for the use of expensive marble panels. It is my opinion that steel panels will replace the marble ones. A pleasing finish can be obtained on steel, and the use of bushings would eliminate the danger of breakdowns. These panels would be very serviceable and their cost should be greatly below that of marble or slate. The writer would be pleased to have the opinion of others on the subject. R. H. N. LOCKYER.

Trail, B. C., Canada.

Progress and the Application Engineer

To the Editor of the ELECTRICAL WORLD:

SIR: It is my belief that the industries have not yet fully realized all the advantages to be derived from the application of electrical energy to manufacturing processes. This is due, in a larger measure than is apparent, to an inherent opposition to change, and for this reason attention should be given to the encouragement and education of the application engineer. In many ways he has a hard road to travel. As the connecting link between the manufacturers of electrical equipment and other industries, he is indispensable to both. His training should include a broad knowledge of the physical sciences, and he should also be possessed of enough imagination to grasp a new idea quickly. Besides this, he should understand human nature and have the commercial instinct. If he lack these essentials, he will undoubtedly prove a detriment rather than a benefit to progress. The truth of this assertion is attested by every improper application, its failure creating unnecessary antagonism to the idea of subsequent change.

Some opposition to change is to be expected and should be welcomed as an incentive to greater effort, but upon the chronic opposer of all new ideas or the man utterly devoid of imagination no time should be wasted. Figuratively speaking, these men live, and will continue to live, in the past. It is a fact generally conceded that every one has to meet opposition, and sometimes ridicule, in bringing about changes of any kind. That many men oppose new ideas on general principles, while continuing to enjoy the fruits of ideas that were developed before they were born, will ever remain one of the peculiarities of the human race.

The industries of the world today rest upon the basic discoveries of the scientists. Following, and often helping, these great pioneers are the financial, business and professional men of all degrees of aptitude. The application engineer should be made to feel that he holds an important and honorable position among this latter group.

But to talk about these things and admit that they are true is not a particle of use unless something practical is done about it. What is needed is an educational campaign along lines that will open the minds of men and cause them to become receptive to new ideas and new ways of doing things. A concerted effort in this direction would benefit industry as a whole. This does not necessarily mean that every new idea should be accepted at face value, but the benefit of the doubt should be given to the new idea unless and until it is conclusively proved to be unsound in principle.

The progress of the world depends upon science and engineering, and the whole rests upon education.

Salem, Mass. JOHN J. BROPHY.

South American Operating Conditions

To the Editor of the ELECTRICAL WORLD:

SIR: Rather curious problems are met with in some parts of South America, where no attempt to regulate the voltage of central stations and mains is made. In Lima, for instance, during the first two or three hours of the evening, the voltage is far from the normal value (104) and oscillates from 70 to 80, dropping in some places as low as 60. Lack of official control over public service in Peru is responsible. However, consumers are beginning to act in a practical manner. The remedy was first suggested by an electrical repair shop of this city, which launched what they call here an "elevador," meaning a booster. Since then a great many auto-transformers, most of them made in Lima, are finding their way to the consumers' plants in order to bring the voltage to a proper strength.

Some progressive electric dealers, feeling convinced that matters cannot possibly improve for several years and thinking that the wide use of such boosters must imply their necessity, have sent orders to the United States for auto-transformers suitable to boost the line voltage all the way from 60 to 100 volts. As such apparatus will heavily overload existing transformers, the central stations will be forced at last to do what they should have done at first—to rearrange feeders and mains, install a few thousand kilowatts of voltage regulators and employ a load dispatcher.

Among the little incidents that have come to my notice in connection with the scramble for boosted voltage is the case of a retail electrical dealer who ordered through an agency a panel to be used in connection with the boosters for regulating the voltage. The panel came with more cost in switches, marble and fittings than it was worth. It was a clumsy five-foot, eight-switch affair, disconnected, and when it was examined it was found that there was a chance of short-circuiting the taps in case more than two blades should be closed. Besides, only four switches were required to obtain voltages from 95 to 60 in 5-volt steps. The manufacturer who sent the auto-transformers and this panel took pains to put a nameplate on every transformer but forgot to attach one to the panel! Would it not have been better for the reputation of the American manufacturer if the panel had never been sent? Such a shipment is likely to react unfavorably on all the manufacturers of the country whence it comes. VICTOR M. ARANA,

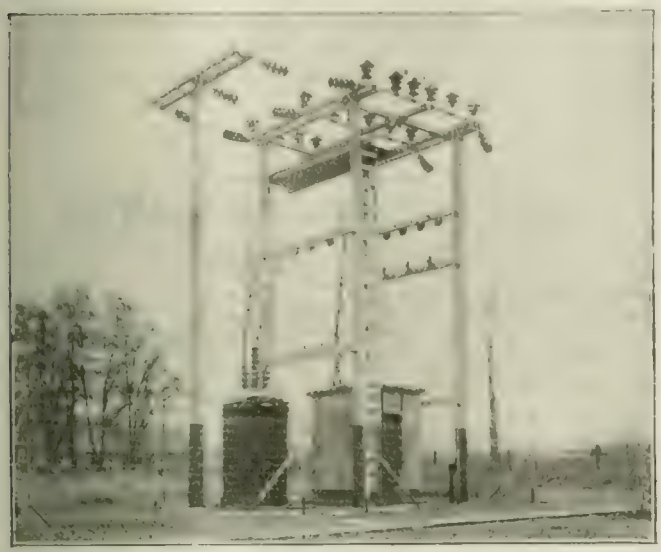
Lima, Peru. Consulting Electrical Engineer.

Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Galvanized Piping Used for Buses on Outdoor Substation

IN ORDER to provide a stiff construction, galvanized water pipe was used for the high-tension buses and for the leads to the transformer in the Denton City (Ore.) substation shown in the accompanying photograph. This 44,000-volt, three-phase transformer is



GALVANIZED IRON PIPE USED AS BUSES IN RURAL HIGH-TENSION SUBSTATION

used for supplying 2,300-volt energy to the surrounding farms. The structure is of wood poles and wood cross-members. All dead-end connections are made with five strain insulators in series. The air-break disconnecting switch is operated from the ground, but a wooden platform is provided just below the insulator frame for making repairs on the station. The telephone house is of corrugated iron and affords room for storing rakes, shovels and other implements used in cleaning up the premises. The iron construction prevents any danger of damage by fire.

LEWIS A. MCARTHUR,
General Manager.
Pacific Power & Light Company,
Portland, Ore.

Saving of Superheater Losses

TO SAVE the heat losses due to draining of superheaters after shutdowns of the boilers, the Arizona Copper Company, Ltd., has experimented with the use of a Sarco trap for draining the superheater of one of its boilers. This proved so effective in keeping condensation drained from the superheater that all oil-fired boilers are now equipped in this way.

The boilers used are Stirling oil-fired boilers with superheaters between the first and second pass, some of these superheaters being of the plain-tube type and others of the Foster type with corrugated cast-iron protections. Under the load conditions, which are such that each boiler is out of service for about eight hours each day, the loss of heat resulting from opening the superheater drains became quite a considerable item. The Sarco traps were placed near the floor level at the back of the boilers so there is 20 ft. to 25 ft. (6 m. to 7½ m.) of ¾-in. (18-mm.) pipe between the superheater outlet and the trap. This practice may not be possible on boilers which are operated at high capacities or on boilers which are fired up rapidly, but under conditions under which the boilers of this company are operated a very considerable saving in heat losses from boilers on stand-by is made.

NORMAN G. HARDY,
Chief Mechanical and Electrical Engineer.
Arizona Copper Company, Ltd.,
Clifton, Ariz.

Water-Spray System for Turbo-Generator Fire Protection

EFFICIENT fire protection for turbo-generators is assuming greater importance with increasing size of units. The system for combating fire which is installed on the 20,000-kva. generators of the Consolidated Gas, Electric Light & Power Company, Baltimore, as described here, employs water sprays from pipes mounted on the generator frame. Eight nozzles made of flattened 1¼ in. (3.1-cm.) pipe are set as shown in the drawing to direct sprays against the ends of the coils. Pipe sizes and nozzle openings are proportioned to give practically uniform flow from all nozzles. The dispersion of the nozzles is such that the spraying zones overlap, but as in practically every case the water will be on be-

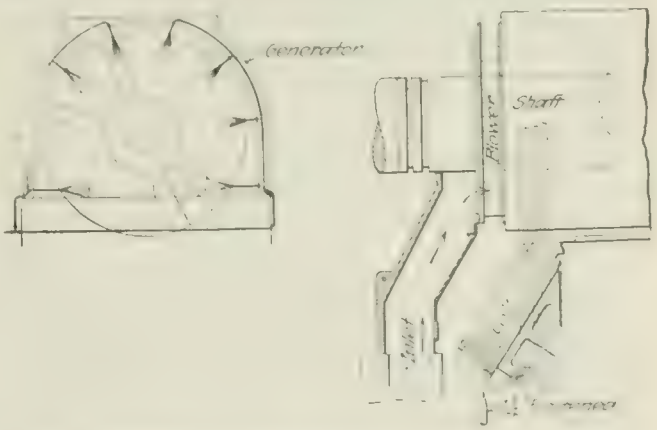


FIG. 1—WATER-SPRAY FIRE PROTECTION FOR 20,000-KVA. GENERATOR

fore the machine has ceased rotation, the rotating part can be counted upon to distribute the water over the windings. Introduction of slugs of water into the blower vanes to obtain the action of a centrifugal pump might be considered, but should be employed with caution

on account of the unbalancing effect and possible destructive action therefrom. Insulating joints prevent circulation of induced currents between the piping on the two ends of the machine.

The control arrangement consists of a lever-operated quick-opening valve in the supply pipe and a 3-in. (7.5-cm.) section of fire hose between the valve and the main to the spray headers. This hose is normally disconnected to prevent accidentally flooding the machine.



FIG. 2—MODERN BUILT-UP MICA INSULATION DESTROYED BY FIRE IN 20,000-KVA. GENERATOR

In case of fire the hose can be attached in a few seconds, as a quarter turn only is required, the hose being fitted with an Anderson patent fire coupling. The water valve is provided with a stub handle to guard against accidental opening. A socket handle for the stub is fastened on to a nearby part of the machine.

This water-spray system was adopted after a consideration of several other systems. The use of steam as an extinguisher has been rather common. The action of steam is one of smothering the fire, but the amount of combustible is so small as to require a relatively small quantity of air.

Instead of steam any gas which will not support combustion might be used. Carbon dioxide in steel cylinders, being available commercially, might be applied and would doubtless be very effective if dampers could be made tight to prevent leakage. Carbon tetrachloride and similar fluids are good as extinguishers since they readily vaporize and the vapors will not support combustion. The effect on operators and the large amounts of these fluids necessary to quench a fire are objectionable.

The chemical effect on the insulation should also be considered. Water in amounts ample to quench a fire has no chemical disadvantages, and windings which are not affected by the fire can be dried out and suffer no permanent damage.

Whatever the extinguisher used, the greatest possible benefit is that of preventing the spread of a fire and localizing the damage. Large turbo-generators must be continuously supplied with cooling air, usually at about 2 cu.ft. to 4 cu.ft. (0.056 cu.m. x 0.112 cu.m.) per minute per kva. rating, and with such large volumes of air passing through the machine a fire in the windings spreads rapidly, therefore means for suppressing the fire at the earliest possible moment should be provided. Immediately upon discovery of a fire the affected machine should be cut off, dampers closed and the fire-extinguishing agent applied. In view of the great inertia of the armature the machine will continue to rotate for some time, and hence it is important that dampers be tight to prevent the blowers on the rotor continuing to draw a new supply of air and intensifying the fire.

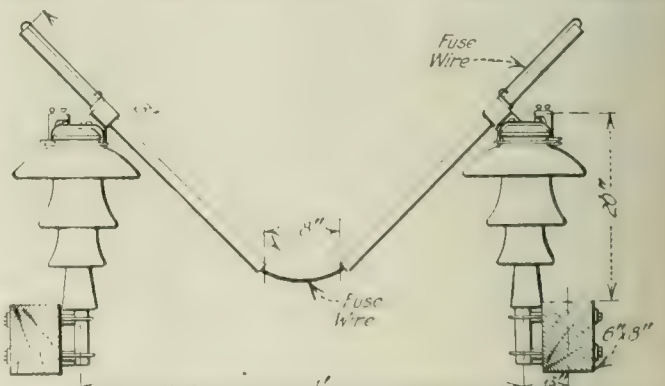
The built-up mica insulations which are largely used in modern machines appear to be almost indestructable, but recent experience has shown that under favorable conditions fire will spread with startling rapidity and virtually destroy the entire winding. Fig. 2 shows the effects of fire on the windings of a 20,000-kva. machine with mica-insulated windings.

F. T. LEILICH.
Consolidated Gas, Electric & Power Company,
Baltimore, Md.

45-Kv. and 60-Kv. Outdoor-Type Expulsion Fuses

SEVERAL hundred 45-kv. expulsion fuses of the type shown in the accompanying drawing have given splendid service for a number of years on the system of the Utah Power & Light Company. A feature of the fuses is that the gases are expelled from both ends of each tube. The fuse tubes are of 1½-in. x 36-in. (3.2-cm. x 90-cm.) micarta tubing, treated by dipping twice into a suitable weatherproof varnish.

The photograph shows the method of supporting the tubes on the insulator. A brass ferrule, fastened to the tube by means of a setscrew, slides into a socket which is a part of the insulator cap. The fuse wire—usually of bare tinned copper or "Climax" resistance



15,000-VOLT EXPULSION FUSE FOR OUTDOOR SUBSTATIONS

wire—is clamped under a screw head on the ferrule, then is passed up along the outer surface of the tube to the end, down through the center of the tube, up through the center of the other tube and down to its fastening screw. A slightly different support is used for the 60-kv. fuses. It is customary at each substation to have an extra set of tubes ready with fuses so that no time is lost in replacing a burnt-out fuse.

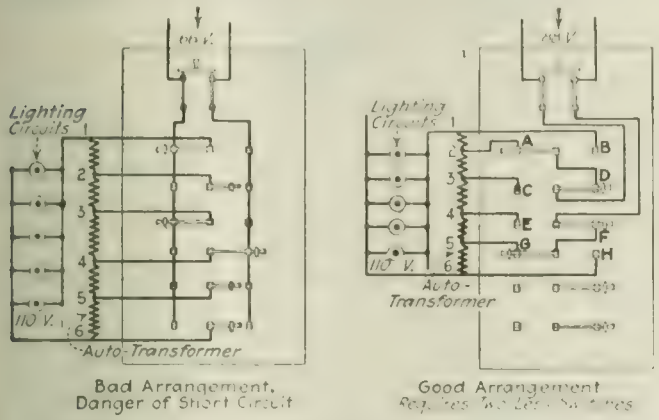
Utah Power & Light Co., PAUL P. ASHWORTH.
Salt Lake City, Utah.

Industrial Applications

The Economical Utilization of Electrical Energy
in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

Simplifying Switch Connections for Auto-Transformers

BY CHANGING the wiring connections shown on the accompanying switchboard, which is used in connection with an auto-transformer for boosting line voltage, the operation of the switches was made simpler as fewer switches are employed and the danger of short-



REWIRING OF AUTO-TRANSFORMER SWITCHBOARD WHICH ELIMINATES DANGER OF SHORT CIRCUITS

circuit which was originally present has been eliminated. The use of this auto-transformer is necessitated by the fact that the voltage on the distribution lines in Peru, South America, sometimes drops very low so that the lamps do not burn brightly. The transformer is wound with six 10 per cent taps so that 110 volts may be obtained on the lighting circuits with a line voltage of 66 volts or over.

When the panel was shipped for installation it was connected with seven single-pole, double-throw switches. With such an arrangement there was always danger of short circuit by throwing any two switches in the same direction. As shown in the diagram, the dotted switch would short-circuit 30 per cent of this voltage of the auto-transformer. The change shown eliminates this danger, and only four of the switches are now used. This gives every combination of voltage possible with the auto-transformer, and the switches may be thrown in any direction without short-circuiting.

Lima, Peru, S. A. V. M. ARANA.

Avoiding Unbalanced Operation of Two-Phase Motor

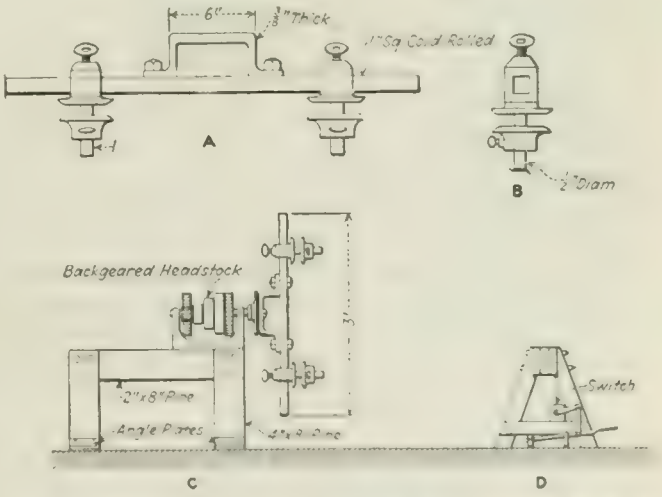
IT IS not uncommon when connecting a four-wire, two-phase motor to a three-wire, two-phase system of wiring to place the middle or common connection of the two phases on one of the outside leads instead of the middle lead of the service. When this occurs one phase of the motor receives correct voltage (say 220 volts) and the other phase receives 1.41 times correct voltage, or, if a 220-volt system, 312 volts. Further, when properly connected the two-phase voltages have an angular relation of 90 deg., but if the motor is connected as described the phase which has the high voltage is only 45 deg. away from the other phase and the result is poor torque in the motor. A motor so connected will run and carry some load and will run at correct speed, but the windings of the phase which is incorrectly connected will run hot and the motor will stall before reaching full load.

JAMES DIXON.
Reliance Electric & Engineering Company,
Cleveland, Ohio.

Machine for Winding Armature Coils

FOR winding armature coils the coil former and the winding machine shown here have been successfully employed in a large textile mill. The former, which is adjustable for almost any size coil, is made of a 1-in. (2.5-cm.) square bar of cold-rolled steel, 3 ft. (0.9 m.) long, mounted on a bracket of strap iron. On this 1-in. bar are placed brass or iron castings, machined to a sliding fit on the bar and provided with thumbscrews for securing them in place. On the pins (1) are two castings which are adjustable to suit the width of coil desired and secured to the pins by means of thumbscrews.

The winding machine was made very economically from an old back-geared lathe headstock mounted upon a wooden frame made up from four 4-in. x 8-in. (10-cm. x 20-cm.) legs supporting two length of 2-in. x 8-in. (5-cm. x 20-cm.) lumber with a space between them to



COIL FORMER AND WINDING MACHINE WHICH WERE MADE IN AN ELECTRICAL SHOP

take the mounting bolts of the headstock. These frames are attached to the floor by means of angle plates.

The former should be driven at a speed of about 20 r.p.m. The control is by means of a foot switch mounted on the frame. In this switch an extra contact is arranged in the "off" position to provide dynamic brak-

ing by short-circuiting the armature to stop the machine immediately when the pedal is released. A 0.5-hp. shunt-wound motor has been used on this machine successfully without any starting resistance, but an over-compounded motor is preferable. L. E. Wood.

Glasgow, Scotland.

Cost of Good Lighting Only 1.41 per Cent of Labor Cost

GOOD industrial lighting is estimated to cost only 1.41 per cent of the cost for labor in the typical case shown in the accompanying table, which was compiled by the National Mazda Lamp Company. This table is an analysis of a plant employing 100 men which is lighted by 100 200-watt tungsten lamps. The initial cost of the lighting installation was computed, using standard prices, and from this the fixed charges of interest and depreciation on the equipment were figured. The maintenance charges and energy charges added to these fixed charges gave the total operating cost. The wages for 100 men for fifty weeks were then compared with this operating cost, and it was found that the operating cost is only 1.41 per cent of the cost of labor. This typical case may even be improved on in an actual plant as the operating expenses were estimated fairly high, for instance, a 6-cent rate for energy was taken while the wage expenses were put low, only $25 per week per man. This analysis can be used as a guide for calculating conditions in any plant. The reasons for

COST OF LIGHTING TYPICAL PLANT

Initial Cost of Installation		
100 outlets at $10 per outlet, including labor, conduit, etc		$1,000 00
100 reflectors and holders		281 16
100 200-watt Tungsten lamps		190 90
Total installation cost		$1,472.06
Annual Operating Cost:		
Fixed Charges:		
Interest and depreciation at 10 per cent	$147 21	
Depreciation on wiring at 10 per cent	100.00	
Depreciation on reflector equipment at 10 per cent	35 15	
Total		$282.36
Maintenance Charges:		
Lamp renewals	$190.90	
Cleaning of units @ $1.00 each per year	100.00	
Total		$290.90
Energy Charge (1,000 Hours):		
Energy at $0.06 per kw.-hr.		$1,200.00
Total annual operating cost		$1,773 26
Cost of Labor:		
100 men for fifty weeks, at $25 per week		$125,000 00

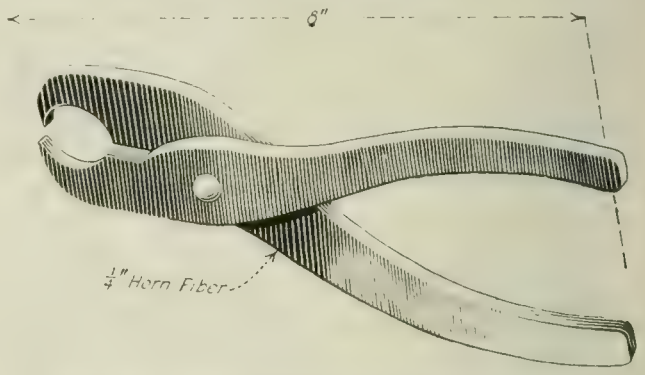
The ratio of the annual lighting cost to the pay roll is the ratio of $1,773.26 to $125,000.00, or 1.41 per cent.

compiling the table was that different reports had been received at the factory of this company stating that an increase in lighting which amounted to from 1 per cent to 5 per cent of the payroll increased production from 8 per cent to 35 per cent.

Efficient System of Motor Overload Protection

AS A RESULT of the system for protecting motors against overload in the shops of McCleary, Wallin & Crouse, Amsterdam, N. Y., there has not been a burned-out motor in five years among the 150 large group-drive motors which run six days a week in these shops. The line wires leading to these motors are fused at the compensator at twice the full-load current of the motor, renewable fuses being employed. These protect against trouble from starting, and for protection when the motor is running overload relays are provided which are set at approximately 5 per cent overload but with a liberal time limit setting based on the characteristics of the individual groups. Although the percentage overload of these relay settings is small the time limit setting takes care of the necessity of overloads for short periods. In addition to the above no-voltage releases are installed on each motor.

Fuse pullers made of ¼-in. (6.4-mm.) horn fiber are used in removing and replacing fuses. These pullers (see cut) will take any fuse from 5 amp. to 500 amp.



HORN-FIBER FUSE PULLER WHICH IS SAFE AND EASILY MANIPULATED

Every man in the electrical crew is provided with a pair.

For taking meter readings renewable fuses are adapted by removing the links and substituting leads to run to the meter. Holes are drilled through the fiber cartridge at each end, and the leads are soldered to the ferrules. This makes a simple and quick method for removing fuses and testing the current in the motor circuit. A. R. McDonald.

McCleary, Wallin & Crouse,
Amsterdam, N. Y.

Emergency Operation of Induction Motors at Low Speed

IN ORDER to turn down the rolls of a sugar mill it was necessary to operate them at 30 per cent speed, using the regular driving motor, as other forms of speed reduction, such as worm gearing, had proved quite unreliable.

The motor used was rated at 440 volts and 250 hp. and was of the slip-ring type. By connecting it to a 110-volt service and lifting the brushes on one phase to make the rotor operate single-phase the torque was reduced so that with the load obtained the speed was about correct for lathe operations. Push switches connected with the control contactors were placed on the side of the temporary lathe bed for starting, stopping and reversing. The resistance contactor found to give greatest starting torque under single-phase conditions was blocked shut, thereby making starting more positive. It was, however, often necessary to reverse the motor before starting to get out of low torque positions.

The starting current on the 440-volt generator panel was 25 amp. and the running current 15 amp. By this connection the 62½-kw. generator operated this motor at low speed and at the same time carried another load of 50 kw. C. G. Hadley,

Central Palma, General Superintendent.
Cuba.

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

For Better Public Relations in the Electrical Industry

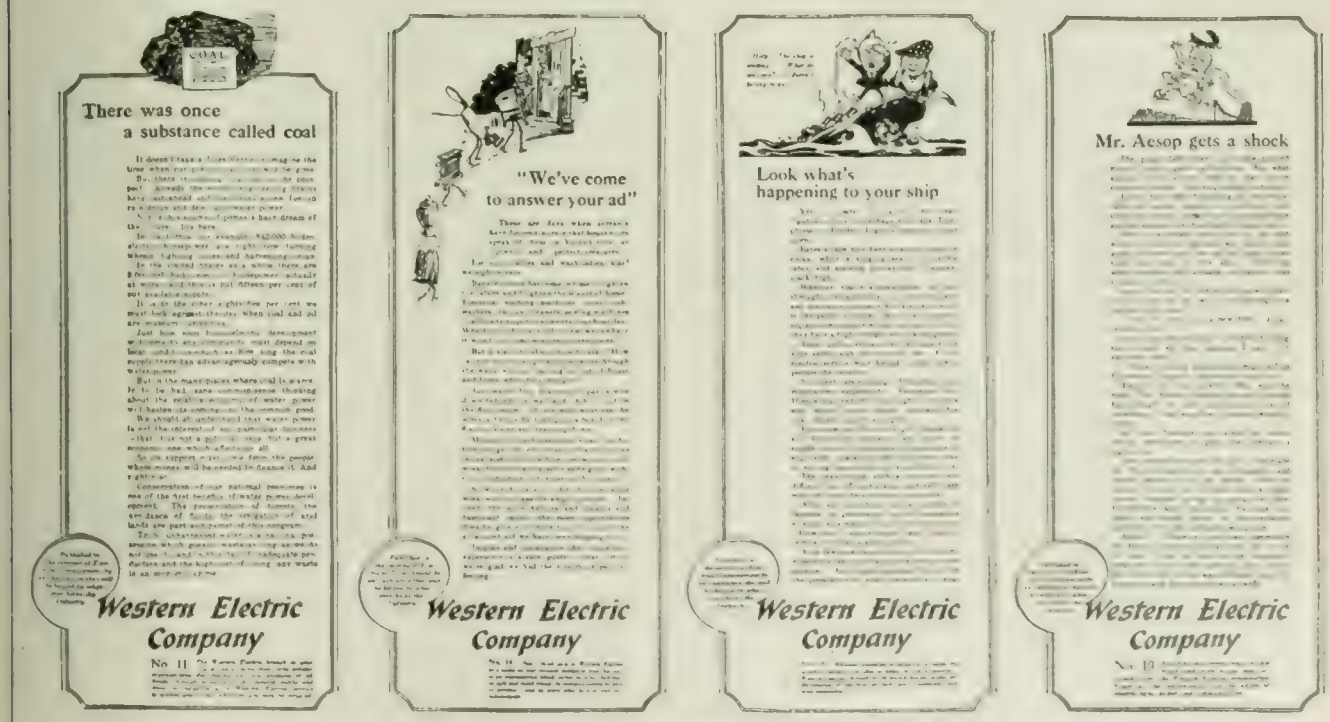
FOLLOWING up its educational campaign in the interest of the electrical industry and public utilities, the Western Electric Company has issued a second series of advertisements to appear in a number of the popular magazines. Like the first series, described in detail in the March 27, 1920, issue of the ELECTRICAL WORLD, page 739, these advertisements are designed to build good-will for the several branches of the industry. Ten messages of the second series have been prepared that carry a common-sense appeal to the average citizen for fair play and better understanding of the problems of public utilities. Four of these are shown herewith. Six others are similar, but written from the viewpoint of the street railway, steam railroad, architect, contractor and telephone company.

C. G. Du Bois, president of the Western Electric Company, in commenting on the six months' publicity program just terminated, says:

"To the man who breaks ground in an untried field words of cheer from his fellows strengthen faith that the structure he is building may prove a lasting service. Our friends in the electrical industry and public utilities have given us this commendation from the very inception of our program of institutional publicity. It is now six months since this company began to publish a series of advertisements dedicated to the interest of the industry. The campaign was based on the conviction that only as the industry attains popular understanding and esteem can any part of it hope for permanent prosperity. To promote this public goodwill all parts should work together in the common cause.

"But even granted that these principles are correct, still our own small effort to further them through the printed word would accomplish little if unaided. It was vital therefore that the principles be accepted by men in all departments of electrical work as the cue to co-operative action. So when the mail began to bring expressions of hearty indorsement from all divisions of the industry in all sections of the country, we felt warranted in believing the campaign a success."

Actual results of this educational campaign cannot be measured in terms of dollars and cents, nor will the Western Electric Company be first to realize the benefits from the publicity. It is, however, building for the future, aiding others of the industry in the hope that it will share in their ultimate prosperity. The Western Electric Company is to be commended on this service it is rendering.



FOUR MESSAGES THAT WILL INSPIRE BETTER PUBLIC RELATIONS IN ALL BRANCHES OF THE ELECTRICAL INDUSTRY

Ownership of Rural Lines

EXPERIENCE in Ohio with small rural customers on 40-acre (16-hectare) to 80-acre (32-hectare) farms has led D. L. Gaskill, president of the Greenville (Ohio) Electric Company, to advise other Ohio central-station executives to insist that farmers build, own and maintain all rural electric lines. The Greenville company requires farmers to build all their lines in accordance with the company's specifications, and all transformers must be purchased from the company in order that they may be kept uniform and interchangeable. All other line material is purchased from jobbers or dealers.

Under this arrangement the central station is not responsible for taking on additional consumers, nor is it liable for the renewal of the line or for damages due to accidents. However, the plan brought up some legal and practical questions in connection with supplying service to additional customers. These problems have been solved by allowing other consumers to connect to the line under certain specified conditions, some of which are as follows:

Extensions to the end of the line will be allowed at the expense of the party desiring service, but without any refund to the original builders.

Farmers along the line who are not original consumers may get service by paying for the cost of the service tap to their premises and paying their proportionate share of the cost of the line. This latter payment shall be refunded to the original builders of the line. For instance, if ten farmers originally built the line, the first additional farmer that wanted service would refund to the others one-eleventh of the original cost, the next customer would refund one-twelfth of the total cost, and so on.

Farmers off the line who require extensions at right angles to the main line may obtain service by paying the entire cost of the extension and paying to the original consumers a proportionate share of the expense of the main line.

Utility Sells Common Stock Above Par

IN THREE days employees sold at $112.50 per share more than $900,000 par value of the stock of the Commonwealth Edison Company of Chicago. To increase the number of its stockholders the company set aside 5,000 shares of its stock, but the demand was so great that at the end of the third day the sale was terminated.

No dividend is guaranteed on the stock, but it has been paying 8 per cent and its market price at the time of the sale was between $111 and $112. The company's price of $112.50 a share was based on an extended payment plan of $5 down and $5 per month. Purchasers were credited with the dividends and charged 6 per cent on the deferred payments.

Thirty-five teams of employees, each consisting of ten men and a captain, acted as stock salesmen. A captain was chosen from among the employees in each of the thirty-five wards of the city, and each captain was allowed to pick a team of ten from among the company's employees residing in his ward. Fifteen team prizes, ranging from $5 to $75 and totaling $600, were awarded to the team captains, who were also given a commission of 10 cents on each share of stock sold by their team. Teams were rated on a point basis, two points for each share of stock sold and one point for each stockholder. The team salesmen working under each captain were given $1 for each share of stock sold. The sale was started at 6 o'clock on a Monday morning, that hour being chosen because all soliciting was to be done outside of business hours, and at noon on Wednesday the teams were instructed to take no more orders.

So many customers claimed that they had been promised shares by employees that the original allotmen of 5,000 shares had to be increased to 9,103 shares, which were sold to 2,805 new stockholders and over 700 old stockholders.

Wilmington Company Discontinues Merchandising

IN 1919 the Wilmington & Philadelphia Traction Company of Wilmington, Del., discontinued its electrical merchandising department. The company had experienced considerable difficulty in maintaining an adequate force for the department. Service to customers in furnishing repairs and renewals to appliances could not be kept up to the desired standard and the department was operating at a loss.

As the company's office is situated in the main shopping district of Wilmington it is an excellent location for an electric shop. Negotiations were conducted with an outside dealer and an arrangement was made whereby space in the company's office was leased by the Wilmington Electric Appliance Company. The appliance company took over the merchandising business and handles all repairs and maintenance of appliances. This plan has been in operation for a little more than a year and has been found mutually profitable by both the parties.

Keeping the Consumer Informed

PARTICULAR attention is paid by the Southern California Edison Company to ways and means of maintaining relations with customers on the Golden Rule basis. Courtesy and diplomacy in dealing with the customer have been developed to a fine art, largely through the methods advocated by S. M. Kennedy, vice-president and general agent, who ably presented his viewpoints on these matters in a paper entitled "Service" read before the Pasadena Convention of the N.E.L.A. last May and the article which appeared in the ELECTRICAL WORLD for July 17 under the title "I Thank You."

The accompanying illustration furnishes an example of how the Southern California Edison Company is securing the assistance of its customers in the present power shortage and at the same time explaining the surcharge granted by the commision.

NOTICE

Owing to the shortage of hydro-electric power and the necessity for generating a large amount of power by steam, you can directly help us as well as help yourself by using your electric service on the most economical basis possible. It is our belief that if the average consumer will apply himself to this problem, the emergency surcharge of 27 per cent granted by the Railroad Commission will enable the company to pay the increased cost of developing power without being a direct burden to the same extent on the individual consumer.

Your co-operation in this matter will be greatly appreciated.

SOUTHERN CALIFORNIA EDISON COMPANY

SLIP DISTRIBUTED TO CUSTOMERS THROUGH DISTRICT OFFICES

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Safety-First Testing of Small Transformers.—A. HECKMAN.—In the routine testing of such equipment as shunt transformers at the manufacturing plants, where speed is essential in order not to interfere with production, great care must be exercised in the arrangement of testing devices for the protection of the tester. Features safeguarding the test man are given in detail. —*Electric Journal*, August, 1920.

Electrical Device for Checking the Oil Temperature of Medium-Sized Turbo-Generators.—GEORGE J. DUCKETT. —Description of a device designed to give attention automatically to the oiling systems in steam-turbine units.—London *Electrician*, July 16, 1920.

Lamps and Lighting

The Lighting of Textile Mills.—A. L. POWELL. —General rules for the lighting system of a textile mill are given as follows: (1) There must be sufficient light of the proper quality on the work. (2) Glare due to brilliant light sources or reflected from polished surfaces must be avoided. (3) Diffusion and proper direction of light are necessary to eliminate sharp shadows. Moderate light on side walls not only helps in this connection but also makes the room more cheerful. Too much light on the walls is tiring. (4) Besides the light on the work, a moderate intensity should be provided on intermediate sections so as to eliminate dark spaces. (5) Any system installed in the mill should be simple in arrangement, reliable in operation and as low in operating cost as is possible. In no case, however, should good lighting be sacrificed for such a saving, because in the long run this would be found to be poor economy. —*Bulletin L.D. 110, Edison Lamp Works*, May, 1920.

The Lighting of Office Buildings and Drafting Rooms. —A. L. POWELL.—A discussion of the elements which enter into the lighting of offices and drafting rooms, including the practical spacing of outlets and choice of lighting systems to function for the particular class of work being done in the office.—*Bulletin L.D. 108, Edison Lamp Works*, May 20, 1920.

Generation, Transformation and Distribution

Hydro-Electric Power Works at the Great Lake, Tasmania.—An interesting scheme of speed control of Pelton waterwheels is described for which it is claimed the advantages of both needle and deflector regulation are secured. It is said to be arranged so that the first action of the governor on load being reduced is to deflect the jets away from the wheel by means of a simple deflector. This same movement releases the needles and allows them to travel slowly forward, the speed being adjusted very simply so that the time required for the full stroke is any desired figure.—London *Engineer*, July 9, 1920.

Pelton Wheel Reconstruction.—PERCY PITMAN.—Structural changes are described in Pelton waterwheels, first to replace defective and broken buckets which were becoming a source of considerable danger, and second to economize water by fitting on buckets of a more modern and efficient type. It is reported that the efficiency of the wheels in question was improved about 5 per cent by these changes.—London *Engineering*, June 25, 1920.

The Selection of Oil Circuit Breakers.—W. A. COATES.—The writer discusses the rating of oil circuit breakers with reference to breaking capacity as defined by the British Engineering Standards Association. He also points out that there would be great advantage in having graphical methods of determining short-circuit current values in networks and shows a chart devised by himself which he says should be useful in this connection.—London *Electrician*, July 2, 1920.

Traction

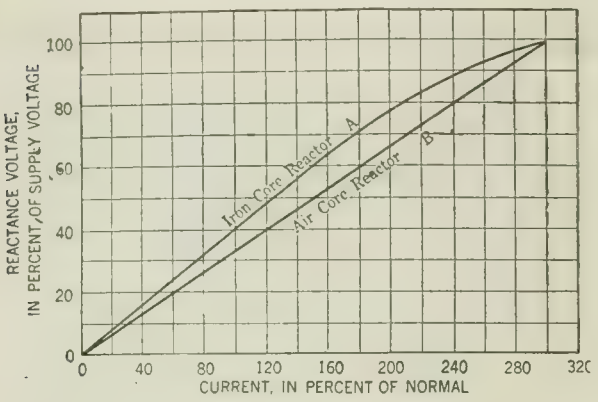
Graphical Method for Computing Voltage Drops in Distribution Networks.—A. SCHWAIGER.—The author's method appears to be built on the same principle as the Frick method for computing current distribution in networks, although the entire solution is worked out graphically, without any numerical computations. A number of simple cases are given to illustrate the operation of the graphical method, and the article also shows how the method may be applied to more complicated networks, by proceeding step-wise, as follows: (1) All knot points are considered as feeding points and the currents to be supplied at the knot points are determined. (2) It is then assumed that the net is loaded only with these hypothetical feeder currents and supplied at the actual feeding points. (3) These two solutions are superposed, the fictitious knot point currents canceling and the actual current distribution coming out as a result. (4) Since the current distribution now is known, the drop to any point may be easily computed. The virtually new feature is the graphical method of solving part two of the problem.—*Elektrotechnische Zeitschrift*, March 18, 1920.

Installations, Systems and Appliances

The Electrical Sterilization of Milk.—An account of researches conducted by Prof. J. Martin Beattie and F. C. Lewis of Liverpool University, England. It is said that the electrical method used, whatever the lethal effect may be, is a much more efficient method of ridding milk of bacteria than are the processes in common use at present.—London *Electrical Times*, July 15, 1920.

Reactors for Electric Furnace Circuits.—HARRY A. WINNE.—Various methods of introducing reactance into furnace circuits are covered in this article. It is said that the internal reactance of transformers can be increased to a maximum of about 20 per cent without excessively increasing the cost or decreasing the efficiency of the transformer. Another arrangement is to increase the spacing between transformer leads, thus increasing their inductance. When external reactors

become necessary recourse may be had to either the iron-core or air-core reactor. Air-core reactors are well known from their use in power plants. Regarding iron-core reactors, it is said that these are arranged with an air gap in the magnetic circuit. Care must be exercised to insure that the iron core will not be



CHARACTERISTICS OF REACTORS

saturated at the maximum value of current which can be forced through the circuit. If this is not done, the reactor will not be so effective for heavy overload current as for light-load currents. The working range of current, therefore, should fall below the knee of the saturation curve.—*Journal A. I. E. E.*, June, 1920.

Automatic Control of Reversing Rolling-Mill Equipment.—E. S. Lammers, Jr.—Direct-current motors are universally applied to large reversing mills, owing to the variable speed characteristics, and to its ease of control and rapid manipulation brought about by the Ilgner system. The advantages of this system are as follows: (1) It permits the permanent connection of all heavy-current circuits. (2) The entire control of the motor is effected in relatively small-current field circuits. (3) The motor automatically adapts itself to regeneration on deceleration without further complicity. (4) By regeneration the power used in acceleration is to a large degree returned to the system in deceleration and no additional power from the line is required to retard the motion of the motor. (5) All peak loads are eliminated from the power house by means whereby the stored energy of a flywheel on the motor-generator set is released during the periods of those peaks absorbing same.—Paper rear before A. I. and S. E. E., May, 1920.

Electrophysics and Magnetism

Copper a Delicate Material.—N. B. Pilling.—A discussion of the effect on the physical proporties of copper of occluded gases.—*Electric Journal*, August, 1920.

Magnetic Properties of Iron Alloys.—The series of articles on the relation of magnetic properties and electric conductivity of iron to its percentage of carbon, aluminum, silicon and manganese, etc., published by Gumlish and Goerens in the *Elektrotechnische Zeitschrift*, June 26 to July 24, and referred to in these columns on Feb. 14, is reprinted almost in full in the *Revue Générale d'Electricité* of May 1, 1920.

Reflecting Power of Monel Metal Stellite and Zinc.—W. W. Coblentz.—Data are given on the reflecting power of these metals in the visible spectrum and to 4μ in the infra-red spectrum. It was found that in the infra-red spectrum the reflectivity of monel metal is practically the same as that of nickel, while in the visible spectrum the reflectivity is slightly lower than that of nickel. A new determination of the reflecting power of a sample of stellite was 1 per cent lower than values previously given in the visible spectrum. Results show that zinc is unique in having a deep depression in the reflectivity curve at 1μ followed by an unusually high reflectivity beyond 2μ.—*Scientific Paper No. 379, U. S. Bureau of Standards*, June 10, 1920.

Units, Measurements and Instruments

Bridge Methods for Alternating-Current Measurements.—D. I. Cone.—Seventeen different bridge combinations are shown for the measurement of the characteristics of circuits containing inductance and capacity.—*Journal A. I. E. E.*, July, 1920.

Telegraphy, Telephony and Signals

Multiplex Telephony and Telegraphy Over Open-Circuit Bare Wires Laid in the Earth or Sea.—Maj.-Gen. George O. Squier.—Since it had already been possible to communicate by radio between one submarine and another, it was considered that connecting two such stations by a submerged copper wire would facilitate the propagation of the electro-magnetic waves between the stations. Following this telephone and telegraph communications were established across the Potomac River over a distance of about three-quarters of a mile (1.2 km.) by the use of No. 12 phosphor-bronze wire laid in the water to connect the stations. The transmitter consisted of an electron tube oscillator which delivered a current of about 270 milliamperes at a frequency of about 300,000 cycles. At the receiving end of the end an electron tube and a six-stage amplifier were used without any ground connections. With this equipment tuning was obtained at both ends of the line and telegraphic and telephonic transmission secured over the bare wires immersed in fresh water. Telegraph and telephone communication has also been established between two stations at Little Silver, N. J., using bare No. 16 copper wire buried in the earth to a depth of about 8 in. (20 cm.) to connect stations. The distance between the stations was three-quarters of a mile, and frequencies as high as 1,000,000 cycles were used. Similar communication has also been carried on over bare wires $1\frac{3}{4}$ miles (2.8 km.) long and laid on the surface of moist earth. It is said that the most promising hope of improving line construction for ocean cables is believed to be to abandon the present methods of design and construction and to start with the simple case of bare wires in water, giving high-frequency currents, and study the necessary changes to produce optimum transmission.—*Journal Franklin Institute*, June, 1920.

The Carbon Transmitter.—H. J. Gregory.—A simple theory is offered by the writer to show that the transmitter is similar in its mode of operation to an alternator. The output characteristic and internal impedance are shown to be quite analogous to these characteristics in alternators.—*Post Office Electrical Engineers' Journal*, July, 1920.

Miscellaneous

Organization of the Electrical Industry.—C. H. Wordingham.—The author points out the desirability that engineers of all branches of the profession shall have some body which will represent their interests when questions of both external and internal policy have to be decided. He outlines the possible organization of such a senate.—London *Electrician*, April 30, 1920.

Scientific and Industrial Research

(PRINTED IN THE THIRD ISSUE OF EACH MONTH)

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available, and Suggestions for Co-operative Work.

Conducted by PROF. VLADIMIR KARAPETOFF
Cornell University, Ithaca, N. Y.

Research in Progress and Completed

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

MEASURING INSTRUMENTS FOR CONTROLLING INDUSTRIAL PROCESSES.

One of the companies manufacturing precision instruments reports the development of an automatic potentiometer and an automatic Wheatstone bridge, both used for recording or controlling processes or a combination of the two. These automatic equipments are supplied for the control of chemical and electrochemical processes, and some installations are in actual use. For chemical and electrochemical work the automatic Wheatstone bridge can be operated on a commercial 60-cycle alternating-current circuit, and a special alternating-current galvanometer has been especially developed for this equipment. Two of the important applications of the alternating-current Wheatstone bridge equipment are the recording of surface condenser leakage in power-plant operation and the controlling of the finish point during the evaporation process in plants making condensed milk. The potentiometer equipment is also used for accurately recording and even controlling the acidity and alkalinity of solutions through the measure of the potential between two electrodes immersed in the liquid.—*A. I. E. E. Committee on Instruments and Measurements.*

PORCELAIN, NON-POROUS.

Porcelain can be and is produced today that is in an engineering sense absolutely non-porous. This statement is made after a great deal of careful research and on the strength of many porosity tests both by the impregnation method and by the method used in ceramic analysis with a psychometer and a sample crushed to a 100-mesh fineness. The impregnation test has been carried in our laboratories to very high pressures and is so penetrating that under microscopic examination of the penetration of the colorant material it has been observed in the cleavage cracks of microscopic quartz crystals.—*W. D. A. Peasley, Huntington, W. Va.* (*A. I. E. E. Journal*, 1920, *page* 445.)

STORAGE BATTERY, TESTING BY CADMIUM ELECTRODE.

The well-known method of testing the potentials of the lead plates with respect to the electrolyte with a piece of metallic cadmium often leads to contradictory results. An investigation has been made to determine the accuracy of the cadmium electrode and of the errors to which it is subjected. The most important error found was due to polarization of the electrode, but this error can be easily avoided if the electrode is used to measure the potential of the negative plate only and the potential of the positive plate is calculated from the known cell voltage.—*H. D. Holler and J. M. Braham, Bureau of Standards, Washington, D. C.*

VOLTMETER, ELECTROSTATIC.

In the ordinary types of electrostatic voltmeter the deflection produced is not proportional to the voltage for any considerable range. Great difficulty is experienced in properly shielding the charged parts of the voltmeter from charges on the surrounding walls. A null type of electrostatic voltmeter has therefore been developed which seems to be free from these disadvantages. The compensating force is applied somewhat as in an ordinary type of ammeter, the voltage being determined from the amount of current necessary to prevent deflection of the needle. The part receiving the charge at high voltage is either of the ordinary quadrant or of the attracted ball type. These parts are connected with the part to which the compensating force is applied through a rigid stem carrying a mirror. The compensating coils may be constructed in a variety of forms either singly or in pairs, or else magnetic cores may be used which move axially along a single coil. The zero position of the moving part is maintained either by fiber suspension or by a coiled spring. The damping may be either electromagnetic or by oil viscosity. By means of these and other improvements the range of operation has been more than doubled and the sensibility increased almost indefinitely.—*J. C. Schrader, East Pittsburgh, Pa.*

WAVES, ELECTROMAGNETIC, OVER BARE WIRES.

The Signal Corps has carried out certain investigations into the phenomena connected with the transmission of high-frequency electromagnetic waves over bare wires in earth and in water. Telephone and telegraph communication has been established between Fort Washington, Md., and Fort Hunt, Va., across the Potomac River, below the city of Washington, over a distance of about three-quarters of a mile, (12 km.), by the use of a bare No. 12 phosphor bronze wire laid in the water to connect the stations. The transmitter consisted of an electron tube oscillator which delivered a current of about 270 milliamperes to the line at a frequency of about 600,000 cycles. At the receiving end of the line an electron tube and a six-stage amplifier were used without any ground connection. With this arrangement good tuning was obtained at both ends of the line, and telegraphic and telephonic transmission were secured over the bare wires immersed in fresh water. Satisfactory communication has also been established, using a bare No. 16 copper wire buried in the earth to about a depth of 8 in. (20 cm.) and also laid on the surface of moist earth. Frequencies as high as 1,000,000 cycles were used.—*G. O. Squier, War Department, Washington, D. C.*

X-RAY BULBS, VACUUM REGULATOR FOR.

In X-ray bulbs and other systems in which the gas pressure is to be maintained at some value between 10^{-5} mm. and 10^{-8} mm. of mercury and in which the influx or clean-up of gases is not too great a modification of the hot cathode tube may be used to maintain any desired pressure between the limits mentioned. The tube as built is similar to the ordinary high-voltage rectifier, a somewhat simpler structure being possible on account of the absence of high voltages. The desired gas pressure is obtained by a regulation of the current through the tube. In this vacuum regulator, in any state, the logarithm of the gas pressure is a linear function of the energy supplied to the anode. Varying the energy from 0 watt to 250 watts gives a pressure variation from 10^{-8} mm. to 10^{-5} mm. The energy is supplied from a 500-volt direct-current circuit connected across the electrodes of the tube and is controlled by varying the heating current in the cathode filament. A wattmeter connected in the main circuit may be calibrated to read pressure directly.—*H. M. Ryder, East Pittsburgh, Pa.*

Suggestions for Research

MAGNET, A.-C., HEATING OF LAMINATIONS.

Designers of alternating-current solenoid magnets would like to know more about the insulation of plunger laminations, to avoid heating at and near the air gap. The flux tends to come through the laminations at the sides, causing eddy-current heating, which is much higher than is to be expected in an ordinary core. To avoid the heating we used insulation of $\frac{1}{16}$ in to $\frac{1}{32}$ in., (1.6 mm. to 0.8 mm.) thick about every $\frac{1}{4}$ in. (6.35 mm.) in the laminated plunger. This reduces the heating considerably, but it is still a troublesome problem. I realize that by building the plunger out of wire we could get rid of this heating, but wire plungers are rather difficult to manufacture.—*A. M. Holcomb, Cleveland, Ohio.*

RADIO, RESONANCE WAVE COIL.

The development of types of resonance wave coils, both open at one end and open at both ends, for general radio work offers an interesting field for investigation. This involves the study of the electron tube as a potentially operated device. The application of such coils properly designed for specific purposes may lead to the practical solution of a number of radio problems such as directional effects and wave-coil antennas of very small dimensions.—*G. O. Squier, War Department, Washington.*

REACTIVE COILS WITH IRON.

Reactive coils used for the protection of large generators and feeders against short circuits are made without iron cores, in order to be instantly effective no matter at which point of a cycle a short circuit occurs. Residual magnetism in a large closed iron core might cause an excessive rush of current at the first instant of a disturbance. It would be of interest to try the effect of an iron core of small cross-section, both open and closed, on sudden short circuits. It is possible that a moderate amount of very high-grade iron might not impair the effectiveness of the coil and yet permit appreciable reduction in size.

REACTIVE POWER, DISPATCHING OF.

With large interconnected power stations it becomes highly desirable for the chief load dispatcher to apportion to each station not only its share of load in kilowatts but the amount of reactive kilovolt-amperes as well. Otherwise large quantities of idle power would unnecessarily circulate in the system, causing disturbances and losses. There seems to be no standard practice in existence as to the proper method of dispatching of reactive power, and a careful investigation of the problem is desired with the view of arriving at certain general conclusions by which load dispatchers in large systems may be guided.—*Editorial Suggestion.*

SELF-STARTERS FOR AIRPLANE ENGINES.

With the increase in the size and power of engines the need of mechanical starters is becoming more and more clearly defined. The self-starter is now a recognized feature of seaplane equipment and is attracting increasing interest as a feature for land machines. Both electric and compressed air forms have been developed to a certain degree of efficiency. There is room for improvement as regards (1) size, (2) weight, (3) reliability.—*W. F. Durand, Secretaire Attache, American Embassy, Paris.*

WELDING MACHINES, RATING OF.

A considerable number of competitive direct-current welding machines are on the market, and the time has arrived for establishing a rational and uniform basis for their rating, a basis truly indicative of the work which a machine is capable of performing day after day. The rating on the basis of a continuous-current output is too severe, while the rating based on from thirty to sixty minutes' welding service is inadequate. The rating founded on kilowatts in the arc is unsatisfactory, because with the same current the required arc voltage depends upon the nature of the electrodes (metal or carbon). Objections have also been raised against rating in heat units available for welding purposes and against a rating expressed in the number of pounds of metal deposited per hour. All these points are discussed by R. E. Kinkead in his paper before the annual A. I. E. E. convention of 1920, and a strong sentiment is expressed in favor of an equitable and uniform method of rating of electric welding machines. A careful experimental study of the performance of various welding machines under comparable conditions is needed before the elements of such an equitable and just rating can be agreed upon.—*Editorial Suggestion.*

News in Brief

Summary of Market Conditions and of Recent and Approaching Happenings of Importance to the Industry

SALES of electrical material in almost every district are reported as considerably higher than usual at this period of the year. Exceptions are noted, however, in the Puget Sound and Intermountain sections, where the midsummer slump is more strongly felt.

INCREASING tightness of money is reported, and collections are slowing up in all sections. Good crops are in evidence, and when they are harvested the credit situation will improve.

CONSTRUCTION is in good shape only in the South, scarcity of material and high prices still operating to retard it elsewhere. Commercial building, however, is going forward in the East.

MANUFACTURERS of household appliances are preparing for a heavy foreign trade and are looking for new devices to stimulate still further the domestic market, now thought to be at its peak.

DESPITE reports to the contrary, there still seems to be a sufficient supply of raw material for lighting-fixture glassware. Shipments of ordinary commercial glassware to fill large orders can be made in three to six weeks.

UNEVEN conditions exist in the industrial reflector market, but producers generally are optimistic. Stocks of finished reflectors are in poor shape.

A MOVEMENT in the direction of standardizing plugs and receptacles is under way, promoted by the regulations and standards committee of the Association of Municipal Electrical Utilities of Ontario.

ADDITIONAL hearings on the coal situation by the Senate committee on reconstruction and production have been held at Baltimore and Philadelphia, and one will be held in Boston on Aug. 30.

THE COAL supply of the New York utilities shows a slight improvement over last week.

CONFERENCES between the Federal Power Commission and members of the water-power committee of the N. E. L. A. and others were held at Washington this week. S. Z. Mitchell expressed the opinion that the law must be amended or else liberally interpreted to attract capital.

ELECTRICAL merchandise will be handled by a chain of stores to be opened by the Winchester Repeating Arms Company in a number of states.

THE THIRTEENTH annual convention of the Northwest Electric Light and Power Association will be held at Spokane, Wash., Sept. 8 to 11.

AT A MEETING of the International Bureau of Weights and Measures to be held at Paris in September the enlargement of the functions of the bureau to include other standards and values will come up for consideration.

TACOMA (Wash.) city officials persist in their policy of selling electric ranges direct to consumers, despite protests from local dealers.

SPECIFICATIONS for rural-line construction are being prepared by the Railroad Commission of Wisconsin.

DISSEMINATION of information concerning public utilities as undertaken by the state committee organized for that purpose will receive especial attention at the meeting of the Nebraska Section, N. E. L. A., at Omaha on Sept. 8 and 9.

A DECISION of the Massachusetts Department of Public Utilities refused to put upon the Boston Edison company the burden of extending a three-phase feeder more than half a mile to serve the electric elevator of a single residential customer.

COMMERCIAL and press messages to European and South American countries are now being transmitted by the navy radio service under authority of an act passed at the last session of Congress.

A PARTY of European electrical engineers representing France, Belgium and Italy is now traveling in the United States inspecting the operation of power plants with a view to giving orders for equipment to be used in reconstruction in their respective nations.

SOUTH DAKOTA voters will probably be asked to vote on the Mobridge hydro-electric project next spring.

JOINT sessions on matters of general interest and separate business sessions will be held by the Rocky Mountain Section, N. E. L. A., and the Colorado Electric Light, Power and Railway Association at their Glenwood Springs convention, Sept. 13-15.

ON AUG. 15 the new Kerckhoff project of the San Joaquin Light & Power Company of Fresno, Cal., was put into operation at Auberry, Cal., before 2,500 enthusiastic guests, thus ending a three years' dearth of power in that region.

OBJECTIONS made by the N. E. L. A. and others interested in the National Electrical Safety Code will be incorporated by the Bureau of Standards in the new edition of the rules, together with the bureau's reasons for not altering the rules at this time.

HOGGED fuel is to be used to save coal at the plant of the Albuquerque (N. M.) Gas & Electric Company.

STORAGE-BATTERY buses are being successfully used by the Tramway Company of Rio de Janeiro, Brazil, to assist in passenger transportation.

REGULATIONS for the Federal Power Commission are being whipped into final shape with the assistance of a committee of the N. E. L. A. and others interested in water-power development.

THE ORDER giving coal mines the first call on open-top cars has been extended by the Interstate Commerce Commission for an additional thirty days.

EMPLOYERS are being warned by the Industrial Commission of New York State to comply with the provisions of the workmen's compensation law.

POWER requirements for the new battle cruisers which are to be electrically operated are comparable to those of the largest central stations, their generators being rated at 160,000 kva.

A GREAT increase in the coal costs of utility companies will be caused by the 40 per cent raise in Eastern freight rates which goes into effect next week.

FOR THE first seven months of 1920 the energy output of the Narragansett Electric Lighting Company, Providence, R. I., was at an annual rate nearly three times the output of 1916. High prices and coal scarcity are causing industrial concerns throughout its territory to turn to central-station service.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Asks Amendment of Water-Power Act to Attract Capital

DECLARING that under strict construction of the water-power act it will be found virtually impossible to finance any large undertaking, S. Z. Mitchell, president of the Electric Bond & Share Company, told the Federal Power Commission at a hearing given prior to complete organization that either the commission must interpret the law liberally or it must be amended.

"In projects which require five years or more to build," Mr. Mitchell said, "the companies must be allowed to amortize earnings from the day on which they receive their capital from investors. No company could afford to pay interest on the millions involved in construction unless it were allowed to assess rates when the operation was completed which would make up the deficit incurred during the construction period. The law makes no provision for this form of amortization."

Secretary of the Interior John Barton Payne declared that he did not like the tendency of the water-power interests to lean upon the commission for support.

"The water-power companies must stand upon their own bottoms," he said. "They are not the children of the commission. Our function is to give all possible leeway to private enterprise and not to block it. The companies must work out their own financial problems in the assurance that the government will treat them fairly."

New Outlet for Electrical Merchandise Through Chain Stores

ARRANGEMENTS have been made by the Winchester Repeating Arms Company of New Haven, Conn., to open a chain of retail stores in all of the principal cities. These stores will handle electrical merchandise in addition to the Winchester and general hardware lines that are carried in the four stores at present operated. The stores now in operation are at Providence, R. I.; Boston, Mass.; New Haven, Conn., and Troy, N. Y.

Within the next two months stores will be opened at Springfield, Mass.; Pawtucket, R. I.; Summer Street, Boston, Mass., and Lawrence, Mass. Definite plans have also been made for opening stores at Fall River, Mass.; Norfolk, Va.; Jacksonville, Fla.; Syracuse, N. Y., and Worcester, Mass.

It is not the intention, said J. L. Ackerson, vice-president, to carry a complete line of electrical goods, but rather to round out the stock of household necessities that the retail stores now carry. Vacuum cleaners, washing machines, flatirons, heating appliances, flashlamps, etc., will be placed in stock. Ornamental goods such as floor lamps will not be carried, according to present plans

Regulations and Rules of Federal Power Commission

FOLLOWING conferences between representatives of the Federal Power Commission, the water-power committee of the National Electric Light Association and other interests, the rules and regulations for the administration of the water-power act are being whipped into final shape. Most of the regulations were approved in the exact language in which they were drawn. As the conference was interested more in general principles than in exact language, many of the controverted regulations are being redrafted with a committee of the outside interests sitting in at the meetings.

The following members of the N. E. L. A. water-power committee were present: Franklin T. Griffith, chairman; W. A Brackenridge, vice-chairman; Morris Cohn, Harris B. Freeman, Thomas W. Martin and G. W. Talbot. Chief Engineer Thurlow of the Alabama Power Company is associated with the committee. Among others who attended or were represented at the conferences were Secretary Baker, Secretary Meredith and Secretary Payne; Secretary Merrill of the commission and his assistant, Mr. Randall; the Judge Advocate General, Major General Enoch H. Crowder and Major L. W. Call of the Judge Advocate General's department, who is acting as counsel for the commission.

As already announced, the offices of the Power Commission will be established in the Interior Department building in Washington.

As originally drafted, Section M of Regulation 1 read as follows:

M. "Construction of project works" means the actual construction of dams, water conduits, power houses, transmission lines or some permanent structure necessary to the operation of a complete project, and does not include surveys or the building of roads and trails, or the clearing of reservoir sites or other lands to be occupied, or the performance of any work preliminary to the actual construction of permanent project works.

The following change was suggested and probably will be adopted:

We believe "construction of project works" should include the building of roads and trails as it is frequently necessary to build a substantial and lengthy road to a power site before any actual work can be done thereat. The obligation of constructing a road is imposed upon a power development, and we believe the cost so incurred should be included in the cost of the project and that the work of building such a road should be considered as a part of the construction of the project works. When roads are destroyed by project works and the developer is required to substitute another in conformity with state laws or the terms of the charter, the cost of building the substituted roads should be included in the cost of the project.

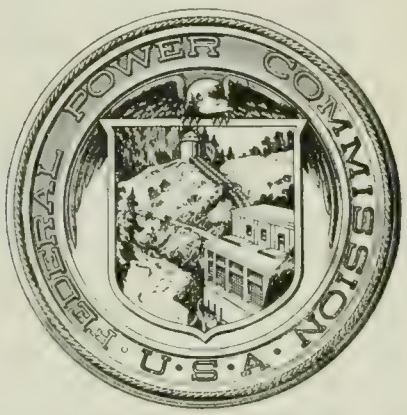
After long discussion, no agreement could be reached as to Section N of Regulation 1, Section N reads as follows:

N. "Power capacity" of a project means the continued product of (1) the factor 0.08; (2) the average effective head in feet, and (3) the stream flow in second-feet estimated to be economically available.

It was contended that in determining "power capacity" the minimum flow of streams should be the third factor.

Section 6 of Regulation 3, as drafted, requires a statement as to the proposed plan of financing the development for which a preliminary permit has been asked. It was suggested that this should be changed so as to read "Such data as the applicant desires to supply as to his ability to finance the project." No conclusion was reached in that connection.

Section 5 of Regulation 4 and Section 7 of the same regulation called for a large amount of detailed information on the application for major project licenses. It was decided that only general information will be required on the application. The commission is to call for such special information as may be required. The full detail then may be supplied when the project is



OFFICIAL SEAL OF THE FEDERAL POWER COMMISSION

complete. Practically the same conclusion was reached in regard to Section 9 of Regulation 4.

Section 12 of Regulation 4, as drafted, reads as follows:

12. A statement, in duplicate, of the action taken by the applicant in order to comply with the laws of the state or states within which the project is located with respect to bed or banks and that the applicant has fully complied with such laws.

The following substitute was suggested:

A statement in duplicate showing that the applicant has complied with the laws of the state or states within which the project is located with respect to bed and banks and with respect to the right to engage in the business of developing, transmitting and distributing power and in any other business necessary to effect the purposes of a license under this act.

Executive Secretary Merrill did not approve the language of the substitute, but he does agree with the principle involved.

Considerable discussion was had on Section 14 of Regulation 4. It reads as follows:

14. A detailed statement, in duplicate, of the financial arrangements that have been made for developing the project and of financial plans for future execution.

It was claimed that it would be difficult and in many cases impossible to secure the consent of bankers to a full compliance with the section prior to the issuance of a final license. The discussion went into the relation of state laws and the lack of standardization, as well as the inability of the commission with its present personnel to keep the records necessary.

Section B of Regulation 6 was drafted in the following language:

B. Priority established by preliminary permit may be lost if additional data required by the commission are not filed within the time prescribed, if there is failure to fulfill the requirements of the permit, if the permit is canceled, if there is failure to present satisfactory evidence of ability to carry out the plans proposed, if the proposed conditions of the license are not accepted within the time fixed by the commission, or if the project is not such as in the judgment of the commission will be best adapted to a comprehensive scheme of improvement and utilization for the purposes of navigation, water-power development and of other beneficial public uses: provided, however, that priority in the respect last named will be maintained if within a time fixed by the commission the permittee modifies its plans as required by the commission.

The following substitute for Section B of Regulation 6 was proposed:

Priority established by preliminary permit may be lost if there is failure to fulfill the requirements of the permit, or if the proposed conditions of the license as set forth in the preliminary permit are not accepted within the term of the permit.

After discussion it was apparent that the section will be left in original form.

Section F of Regulation 7 was drafted as follows:

F. Upon a satisfactory showing of reasons therefor the commission may authorize permittees to perform such construction work as may be necessary to maintain water rights under state law, or as may be desirable in preparation for the construction of project works; but neither the granting of such authority nor the performance of such work shall be deemed to have created any equities or to have established any rights beyond what would have been created or established had such authority not been given or such work not been performed.

The following substitute was submitted:

Upon a satisfactory showing of reasons therefor the commission may authorize permittees to perform such construction work as may be necessary to maintain water rights under state law, or as may be desirable in preparation for the construction of project works; but the granting of such authority shall not be deemed to have created any equities or to have established any rights beyond what would have been created or established had such authority not been given.

After discussion it was agreed that the original regulation should stand, with the omission of the words "nor performance of such work."

Increased Freight Rates Throw Burden on Utilities

THE 40 per cent increase in Eastern freight rates which becomes effective next week will add greatly to the coal costs of the utility companies. Typical examples are the Potomac Electric Power Company and the Washington Railway & Electric Company, which use 215,000 tons of coal annually, on which there will be an increased cost of 90 cents per ton, a total additional cost of $193,500. The New York Edison Company and the United Electric Company and allied companies in Manhattan, using 1,500,000 tons of coal per year, will have an increased expense of $1,302,000. The Public Service Electric Company of New Jersey, will pay 80 cents additional per ton on 1,200,000 tons, total added cost of $960,000. At 1920 contract prices

the freight increase will add approximately 14 per cent to coal prices.

During July the total figures of all bituminous operators reporting to the Geological Survey show outputs of only 55 per cent of full-time production. Of the loss 25 per cent was due to transportation disability and 4 per cent to labor shortage. Movement of coal to New England tidewater during the first week of August reached 256,000 tons, with exports 490,000 net tons. In June, which is now reported completely, the New England movement was 772,000 tons. Lake shipments for 1920 are 5,500,000 tons behind 1918 and 6,750,000 tons behind 1919. Up to date, since the opening of navigation, dumpings at Erie ports stand at 7,647,000 tons.

Interstate Commerce Commission Extends Open-Top-Car Order

AS HAD been anticipated, the Interstate Commerce Commission has extended for an additional thirty days the order giving coal mines the first call on open-top cars. The commission declined to amend its order providing that cars be assigned for the daily needs of public utilities so as to extend this privilege to the shipment of coal to be stored for winter needs.

Coal Supply of New York Utilities Shows Slight Improvement

COAL on hand in reserve by the public utilities of New York City on Aug. 17, as reported by the Public Service Commission, was: Brooklyn Rapid Transit Company, 6,689 tons, five days' supply; Interborough Rapid Transit Company, 11,207 tons, five days; Richmond Light & Railroad Company, 384 tons, three days; New York Steam Company, 3,228 tons, six days; New York Edison Company, including United Electric Light & Power Company, 89,284 tons, twenty-three days; Brooklyn Edison Company, 55,524 tons, fifty-five days; Kings County Lighting Company, 184 tons, eleven days; Consolidated Gas Company, 35,147 tons, thirty-two days; Brooklyn Union Gas Company, 600 tons, fifteen days; Brooklyn Borough Gas Company, 404 tons, fifty days.

This report is dated Aug. 17 and shows a total among all the utilities of the New York City district of 273,313 tons of coal on hand as of that date. This is an increase of 13,506 tons over the previous week.

Acting Commissioner Barrett, in discussing the coal situation with a representative of the ELECTRICAL WORLD, said: "While an improvement is shown, it is slight and is not by any means what could be desired. The public utility companies are fully 159,000 tons below the stocks they should have at this time of year. In order to pass through the winter with a safe margin the companies should have about 800,000 tons on Oct. 1."

He further pointed out that the total amount of coal on hand when lumped together is only about ten days' supply for all the utilities and that under the present regulations they were permitted to receive daily only sufficient coal for that day's operation, which does not allow any coal to be stored. Commissioner Barrett also stated that at the present no hard coal was being received in New York City and that very few private property owners had been able to put in their winter supply of coal for heating purposes. To provide hard coal for this purpose cars now used for soft coal shipment must be diverted to the anthracite fields."

A. I. E. E. Committee Appointments by President Berresford

AT THE first meeting of the board of directors of the American Institute of Electrical Engineers for the administrative year beginning Aug. 1. 1920, held in New York, on Thursday, Aug. 12, President Berresford appointed committees for the administrative year. The chairmen of the committees appointed are as follows:

Finance—Charles Robbins, assistant sales manager Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Meetings and Papers—W. I. Slichter, professor of electrical engineering Columbia University, New York.

Publication—N. A. Carle, chief engineer Public Service Electric Company, Newark, N. J.

Board of Examiners—Clayton H. Sharp, technical director Electrical Testing Laboratories, New York.

Sections—J. B. Fisken, chief engineer Washington Water Power Company, Spokane, Wash.

Student Branches—C. Francis Harding, professor of electrical engineering Purdue University, Lafayette, Ind.

Membership—E. H. Martindale, president and general manager Martindale Electric Company, Cleveland, Ohio.

Public Policy—H. W. Buck, consulting engineer Vielé, Blackwell & Buck, New York.

Law—Samuel Sheldon, professor of physics and electrical engineering Polytechnic Institute, Brooklyn, N. Y.

Headquarters—W. A. Del Mar, chief engineer Habirshaw Electric Cable Company, New York.

Safety Codes—Farley Osgood, vice-president Public Service Electric Company, Newark, N. J.

Code of Principles of Professional Conduct—George F. Sever, Jackson & Moreland, Boston, Mass.

United States National Committee of International Electrotechnical Commission—C. O. Mailloux, consulting engineer, New York.

Standards—D. C. Jackson, Massachusetts Institute of Technology, Boston.

Co-ordination of Institute Activities—L. T. Robinson, engineer General Electric Company, Schenectady, N. Y.

Economics of Electric Service—Philip Torchio, chief electrical engineer New York Edison Company, New York.

Educational—C. E. Magnusson, professor of electrical engineering University of Washington, Seattle, Wash.

Electrical Machinery—B. A. Behrend, consulting engineer, Boston, Mass.

Electrochemistry and Electrometallurgy—F. A. J. Fitzgerald, president Fitzgerald Laboratories, Inc., Niagara Falls, N. Y.

Electrophysics—F. W. Peek, Jr., consulting engineer General Electric Company, Pittsfield, Mass.

Industrial and Domestic Power—A. G. Pierce, Cutler-Hammer Manufacturing Company, Pittsburgh, Pa.

Instruments and Measurements—F. V. Magalhaes, superintendent testing department, New York Edison Company, New York.

Iron and Steel Industry—W. F. James, sales engineer Westinghouse Electric & Manufacturing Company, Philadelphia.

Lighting and Illumination—C. E. Clewell, University of Pennsylvania, Philadelphia.

Marine—Arthur Parker, electrical engineer New York Shipbuilding Company, Camden, N. J.

Mines—Graham Bright, engineer Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Power Stations—H. P. Liversidge, assistant chief engineer Philadelphia Electric Company, Philadelphia.

Telegraphy and Telephony—Donald McNicol, editor *Telegraph and Telephone Age*, New York.

Traction and Transportation—Charles S. Ruffner, vice-president North American Company, New York.

Transmission and Distribution—E. B. Meyer, assistant to chief engineer Public Service Electric Company, Newark, N. J.

Senate Committee Investigating Coal Situation Among Utilities

HEARINGS in the coal situation have been held in several sections of the country by the Senate Committee on reconstruction and production similar to the one reported in the ELECTRICAL WORLD for July 31, page 252, at which John W. Lieb, vice-president of the New York Edison Company, outlined the coal situation in New York City. Meetings were held at Baltimore, Aug. 18, and Philadelphia, Aug. 19. For Aug. 30 in the Federal Building at Boston another hearing is scheduled.

Nebraska Section, N. E. L. A., Prepares Comprehensive Program

FOR its annual convention, which will be held at the Fontenelle Hotel, Omaha, on Sept. 8 and 9, the Nebraska Section of the National Electric Light Association has prepared the following program:

WEDNESDAY, SEPT. 8

Morning.—Address of welcome by Mayor E. P. Smith; "Central-Station Merchandising," by T. E. Roach, Union Light & Power Company, discussion led by W. S. Byrne of the Nebraska Power Company and M. A. Curran of the Western Electric Company; "Legal Obligations of the Central Station," by J. A. C. Kennedy, Nebraska Power Company; "Promotion and Development of Rural Transmission Lines," by S. H. Brooks, Continental Gas & Electric Company, discussion led by A. J. Cole of the Platte Valley Power Company.

Afternoon.—Electric field day at the Omaha Field Club, with golf matches and horseshoe-pitching contests.

Evening.—Dinner at the Omaha Field Club, J. E. Davidson toastmaster. A discussion on "Public Relations in Nebraska" will be led by W. B. Roberts, president Union Power & Light Company; Horace M. Davis, Nebraska Committee on Public Utilities Information, and L. R. Wilson, general commercial superintendent Nebraska Telephone Company.

THURSDAY, SEPT. 9

Morning.—"The National Association," by M. H. Aylesworth, executive manager N. E. L. A.; address by Thorne Browne of the Nebraska Railroad Commission; "Illuminating Engineering and Lighting Development," by H. E. Mahan of the General Electric Company; reports of committees.

Afternoon.—Luncheon at the Fontenelle Hotel; executive committee meetings.

Members and guests are invited to inspect the power plant and new electric shop of the Nebraska Power Company on Thursday afternoon. A large attendance at the convention is expected from Iowa as well as Nebraska, and co-operation from jobbers and dealers is looked for. Telephone, railway and gas interests are joining with the electric fraternities to further the work of the Nebraska Committee on Public Utility Information.

Meeting of Utility Men of Northwest at Spokane

PLANS for the thirteenth annual convention of the Northwest Electric Light and Power Association at Spokane, Wash., Sept. 8 to 11, include a meeting of the new hydraulic power committee of the National Electric Light Association. The following Western engineers are members of this committee: Markham Cheever, Salt Lake City, Utah, chairman; J. B. Fisken and B. M. Merrill, Spokane, Wash.; H. H. Schoolfield, Portland, Ore.; G. C. Sears, Seattle, Wash.; H. A. Barre, Los Angeles, Cal.; J. P. Jollyman, San Francisco, Cal., and C. O. Poole, Riverside, Cal.

President J. B. Fisken of the association reports that invitations to attend the convention have been sent to Martin Insull, president of the N. E. L. A., and M. H. Aylesworth, executive manager. Details of the program as thus far arranged are as follows:

WEDNESDAY, SEPT. 8

Morning.—Routine reports and address of President J. B. Fisken.

Noon.—Address by N. E. L. A. official before Spokane Advertising Club.

Afternoon.—Report of the Accounting Section, J. S. Simpson chairman; review of N. E. L. A. range and water heater report, A. C. McMicken.

THURSDAY, SEPT. 9

Morning.—Report of Hydro-Electric and Technical Section, G. E. Quinan chairman.

Afternoon.—Discussion of above report; safety report.

Evening.—Address on a public utility subject.

FRIDAY, SEPT. 10

Morning.—Report of advisory committee on co-operation of electrical interests, R. W. Clark chairman.

Afternoon.—"Public Utilities Competition," George L. Myers, Public Relations Section; "Successful Public Utility Management of the Future," Franklin T. Griffith.

Evening—Annual banquet at Davenport Hotel

An extensive entertainment program has been arranged including a competition on Saturday, Sept. 11, at Hayden Lake for the Kilowatt Golf Club cup. Provisions are also being made for the guests to visit the Interstate Fair, which will be held in Spokane the same week.

Rocky Mountain Section, N. E. L. A., to Meet with Colorado Association

AT THE Hotel Colorado, Glenwood Springs, Col., Sept. 13 to 15, the Rocky Mountain Section of the N. E. L. A., which was formed last year, will hold its convention jointly with the Colorado Electric Light, Power & Railway Association. Matters of general interest will be taken up at joint sessions, but all business sessions of both organizations will be held separately. These arrangements were decided upon at an executive committee meeting of the Rocky Mountain Section in Denver, Col., Aug. 3. At that time the following chairmen of special sections were appointed:

Public Relations Section—Bulkeley Wells, president Western Colorado Power Company, Denver.

Technical Section—T. O. Kennedy, general superintendent Denver Gas & Electric Light Company.

Tacoma City Officials Refuse to Discontinue Sale of Ranges

AGAINST the complaint of local dealers in electrical appliances, the city officials of Tacoma, Wash., are continuing a policy of selling electric ranges direct to consumers. Commissioner Ira L. Davison of the light and power department has ruled that it is the right of the city to cut the high cost of living by providing ranges at a small increase over the wholsale price. It is said that the city buys ranges cheaper than any other purchaser on the Pacific Coast because of the volume of its business. Mr. Davison asserts that the city is 140 ranges behind in its orders.

New President of Pacific Gas & Electric Company Changes Personnel

ALTHOUGH the appointment of a new president of the Pacific Gas & Electric Company, San Francisco, Cal., has brought about no change of management or policy, several promotions have been made. One of the first acts of the new president was to appoint Frank A. Leach assistant general manager. Mr. Leach was formerly manager of the Alameda district, which is the largest of all the districts, embracing all of Alameda and Contra Costa Counties and parts of Solano County. Lee H. Newbert, formerly manager of the commercial department, has been appointed to fill the position of manager of the Alameda district. Mr. Newbert is well known through his work with the California Electrical Co-operative Campaign and is at present president of the Pacific Coast Section of the N. E. L. A. Earl Fisher has been appointed to the position of manager of the commercial department. Mr. Fisher is chairman of the Commercial Section of the Pacific Coast Section, N. E. L. A., and has been assistant manager of the commercial department for several years.

Ontario Hydro Commission Will Not Build Auxiliary Steam Plant

DECISION has been made by the Hydro-Electric Power Commission of Ontario not to proceed with the construction of the proposed auxiliary steam plant in the Niagara Falls district. Several reasons are given for this action. The final tenders received indicated that instead of a capital cost of about $4,000,000 for the initial 50,000-hp. unit the work would cost in excess of $5,500,000.

Besides the high cost of labor and material the commission set forth the following additional reasons for not proceeding: The guarantees of earliest deliveries by the various companies tendering would not permit of the plant being constructed and ready for operation earlier than December, 1921. Moreover, it was estimated that the high cost of operation and the price of coal, as well as the cost of installation, would add at least $10 per horsepower to the cost of power in the Niagara district.

Hugh L. Cooper & Company, who are preparing an extensive report on the Chippawa-Queenston development at Niagara Falls, have advised the commission that the two units of 55,000 hp. each will be ready for commercial operation on Oct. 1, 1921, provided that there is no further interference with construction.

Cape Cod Properties Consolidated

UNDER the name of the Cape & Vineyard Gas & Electric Company, the Buzzards Bay Electric Company and the Cape & Vineyard Lighting Company have been consolidated, with the approval of the Massachusetts Department of Public Utilities, in the interests of better and more economical service. The two properties are under the management of the Carpenter interests, with headquarters at Falmouth, Mass. The Vineyard company serves a portion of the island of Martha's Vineyard, and the Buzzards Bay company serves the territory between the Cape Cod Canal and Chatham. It is planned to interconnect the two by submarine cable, so that energy from the tidewater steam plant of the New Bedford Gas & Edison Light Company will be available on Martha's Vineyard.

Starting of Kerckhoff Station Breaks Three-Year Power Famine

THE new Kerckhoff project of the San Joaquin Light & Power Corporation of Fresno, Cal., was put into operation Sunday, Aug. 15, at Auberry, 40 miles from Fresno, before 2,500 invited guests, who made the trip over mountain roads to the project, coming from all parts of the state. This is believed to be the largest assemblage that ever attended a ceremony of this kind in the State of California. Four hundred and eighty-five automobiles were required to carry the party.

The big 14,200-kva. generators were started by two switches mounted on a platform under a large canopy spread beneath pine trees a mile from the power house. William K. Kerckhoff, president of the corporation, after whom the project is named, assisted by R. C. Starr, Jr., son of the construction engineer who built the project, closed the switches. A huge electric sign spelling the name "Kerckhoff" was mounted above the platform. As the generators gathered momentum the lamps in the sign changed from a faint red to bright white, while the crowd cheered and detonations of dynamite rent the air. An arc with a 6-in. gap flashed forth, while four aëroplanes equipped with radio telephone and telegraph instruments circled above, announcing to the San Joaquin Valley that the "power famine" of three years' duration had been broken.

A short program of speaking preceded the starting of the generators. General Manager A. G. Wishon, chairman of the day, outlined the history of the company and told of the efforts to finance the necessary development, inviting the public to become partners in the corporation in its future developments. Col. H. D. Loveland of the State Railroad Commission, in a short talk, called attention to the novel situation in which purchasers of securities of the power company find themselves. "You are our boss," said Commissioner Loveland. "If you become a partner with Mr. Wishon in the power company, you are our boss and we are under your jurisdiction. We realize that the rates of the public utilities have been whatever their commission saw fit to charge, and we have regulated them without fear or favor and according to conditions as we find them. I want to ask you how this commission could inflict a more serious evil on the State of California than to impose rate conditions that would not permit of a fair rate of return? Such a policy would halt development."

R. C. Starr, construction engineer, received an ovation as he mounted the platform to thank the organization for its help in completing the job sixty days in advance of schedule. Other speakers were: Chester Rowell, editor of the Fresno *Republican*, and A. C. Balch, vice-president of the corporation. Among the notable guests were Congressman John E. Raker, one of the sponsors for the recently enacted water-power bill. Mr. Raker expressed his admiration for the scale on which operations are conducted by the San Joaquin Light & Power Corporation at its Kerckhoff project. Congressman H. E. Barbour of Fresno accompanied Mr. Raker on his inspection of the work.

American Tractors in Formosa.—About twenty electric tractors of American make are now in service in the island of Formosa. These range in size up to about 75 hp. They are used on sugar plantations and are said to be giving such good satisfaction that many more are likely to be ordered.

Standardization in Great Britain.—Though only two years old, the British Engineering Standards Association reported excellent progress at a recent annual meeting. Forty-five standard specifications for electrical apparatus alone are in course of preparation under the auspices of the society, which covers all branches of engineering in its work.

Wisconsin Commission Picnics.—A picnic participated in by all the departments of the Railroad Commission of Wisconsin was held on Tuesday afternoon, Aug. 3. Races, tugs of war and a baseball game followed by supper and dancing were the features of the event. The contests were participated in by every one, including the members of the commission and women as well as men employees.

A Bright Town.—Bucyrus, Ohio, has less than 10,000 population, but its new lighting system, comprising 502 units, of which 114 are 600-cp. lamps mounted on single-unit "white way" standards, has placed it among the best lighted places of its size in the United States. The lamps burn all night and every night, on a 4,000-hour schedule, with the exception of one-half of those composing the "white way," which go out at midnight.

The New English Electricity Districts.—The division of England into "electricity districts" under the provisions of the new act is proceeding rapidly and the boundaries of a number of such districts have been announced. What is doubtless the most important division of all—the "London and Home Counties" division—takes in roughly the territory within a 25-mile radius of the metropolis, including a tremendous population and many manufacturing sections.

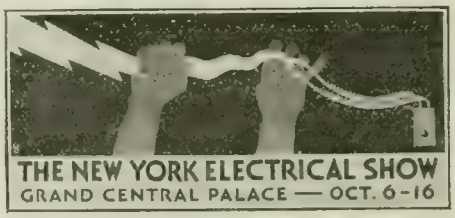
Political Workers Will Use Electric Signs in Campaign.—The Cox Electric League, a political organization composed of electrical workers, has determined upon a plan to boost its candidate by means of electric signs to be put up throughout the country. The signs will consist of a circle containing the letter X. First three-quarters of the circle, forming the letter C, will be illuminated; then the entire circle, forming the "O," and finally the "X," thus completing the name of the Presidential nominee.

Prone-Pressure Method of Resuscitation Proves Its Value.—Frank Grinnell, the substation operator of the Consumers' Power Company at Muskegon, Mich., was closing the 72-kv. air-break switches on a 5,000-kva. bank of transformers recently when lightning caused a flash over the insulators supporting the switch, the flash jumping to the steel framework and thence to the frame around the outdoor oil switch. The surface of the ground was damp from rain and Mr. Grinnell and Mr. Nelson, the substation foreman, were knocked down. Grinnell came into contact with the framework and was rendered unconscious. Fortunately the employees of the company are trained in the use of the prone-pressure method and Nelson at once put his knowledge into practice. After he had worked over Grinnell for ten or twelve minutes normal breathing was restored.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Grasping the Idea.—The display card here reproduced has been issued by the promoters of the New York Electrical



Show to advertise that annual event, which this year will take place in the Grand Central Palace, New York City, from Oct. 6 to Oct. 16.

Production of Copper Decreased in 1919.—The advance statement of the production of copper in the United States last year issued by the Geological Survey puts the smelter output at 1,310,972,580 lb, compared with 1,908,533,595 lb. in 1918 and 1,886,120,721 lb. in 1917. The total production of refined copper was 1,768,000,000 lb., a decrease of 665,000,000 lb. as compared with 1918. The four leading states in copper mining are Arizona with 536,000,000 lb., Michigan with 201,000,000 lb., Montana with 175,000,000 lb. and Utah with 146,000,0000 lb. The value of the total output was $243,751,000.

Increases in Electric Rates.—The Rockford (Ill.) Electric Company has received authority to increase its power rates 30 per cent temporarily pending a further hearing. Flat rates in North Baltimore, Ohio, have gone up 20 cents a month. An order has been issued by the Public Service Commission of West Virginia granting increased electrical rates to the Wheeling Public Service Company. The rates applied for were granted except that the minimum monthly charge for electrical service was made 75 cents instead of $1. The Montana Public Service Commission has refused the request of the Helena Light & Railway Company for a suspension of electric rates in that city.

Standardization of Supply Pressures in Switzerland.—As the result of meetings held this summer by the electrical bodies of Switzerland, a standard of low-pressure supply for that country has been virtually agreed upon, the potentials adopted being 125, 220 and 350 volts for alternating current and 110, 220 and 440 volts for direct current. It is recommended that old plants be extended and new ones constructed according to this decision.

An "Electric Eye."—Taking advantage of the fact that in the dark the electrical conductivity of selenium is low while it is increased by light, the degree of conductivity varying with the brightness of the light, Eugene Steiger, an inventor who recently arrived in the United States from Zurich, Switzerland, has perfected, according to claims said to have been demonstrated recently before engineers and other witnesses, a selenium-cell apparatus known as an "electric eye." By placing this contrivance in an electric circuit switches for street lamps, lighthouse signals or burglar alarms are turned on automatically, it is said, and when light again appears the switches are automatically turned off.

Electricity in the Arctic Regions.—The projected hydro-electric plants on the south coast of Iceland, about 60 miles from the capital, Reykjavik, will apparently be a degree or so further south than the oil-burning plant of the Alaskan Industrial Mining & Power Company at Nome or the water-power development of the Canadian Klondyke Power Company above Dawson, which are within 200 miles of the Arctic Circle; but if developed on anything like the scale announced the Iceland plants will far eclipse in size those just named and all other Far Northern installations. Even if the six Icelandic plants, with a possible utilization of 1,000,000 hp., that are talked about come to be built and find in the fixation of nitrogen for fertilizing purposes a reason for being, only a fraction of the vast potential water power of the ice-bound regions will be utilized.

Woes of the Meter Reader in India.—That the lot of Hindu meter readers in British India is not a happy one is apparent from the complaint made by one of them, printed in an English contemporary. Among the drawbacks and dangers of the calling he enumerates "insults from consumers," "being bitten by dogs," "falling from ladders" and "banging of doors in the face." Moreover, there are incessant delays. "Many a time," says the unfortunate native, "butlers would not condescend to reply at once till after some time they take pity and answer that either the lady inside is dressing or taking bath, or the inmates are asleep, and I had better call after some hours or on the next day. Some meters are placed in dirty lumber rooms, some in bathrooms and lavatories, some in bedrooms, others again in kitchens, where a beef is being cooked when a Hindu meter reader goes round."

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Value Not Determined by Character of Service.—Accrued depreciation, the Montana Public Service Commission recently observed, cannot be ignored in a valuation for rate-making purposes on the theory that a plant, although old, is as valuable as a new plant if it gives 100 per cent efficiency in operation, since the character of the service rendered does not determine value.

Where a Valuation Is Unnecessary.—The Pennsylvania Public Service Commission recently asserted, in passing upon an electric railway's application for increased fares, that it would not require a utility to incur the expense necessary to a valuation proceeding in cases where the evidence showed that an increase was necessary to pay the operating expenses without including any provision for a return on the investment.

Expenses of Outside Management Disallowed.—The Montana Public Service Commission has refused to allow as operating expenses of a utility operating gas, electric and street-railway departments a fee of 7½ per cent of the net earnings paid to a New York management, together with excessive traveling and other expenses of the directors, where the affairs of the three utilities were managed locally by a combined general manager and attorney, each department having a superintendent and there being a full office staff.

Allocating Property of Electric Light and Water Company.—In apportioning the property of the Gardiner Light & Water Company as between the water and electric departments the Montana Public Service Commission proceeded on the basis of the time user. It based the valuation of the combined electric and water utility on the "actual cost" theory where the existing plant would not be reproduced from an engineering standpoint at the present time under any circumstances and no claim was made for appreciation in plant value due to recent abnormal conditions, and where there was also satisfactory evidence as to the original cost.

Rural Extensions and Rate of Return.—In ordering that the amended rules of the Wisconsin Power, Light & Heat Company and other companies relating to rural extensions be placed on file, subject to investigation in case of complaint, the Wisconsin Railroad Commission observed that the necessity for a rate increase should be very urgent before the authorization of any rate higher than that specified in a contract between an electric utility and rural consumers in cases where all or a part of the construction costs of the extension required to serve such consumers had been advanced by them. To encourage the development of such service, however, it must be permitted to earn the same rate of return as the urban business of the company, while at the same time terms as to financing must be permitted which will make possible the immediate investment of considerable sums of money without taxing the resources of the utility for obtaining capital.

Energy Charge Favored When Shortage of Supply Exists.—In case of a shortage of the supply of electricity the California Railroad Commission holds that an energy form of rate should be adopted, especially in the case of agricultural consumers, in order that the cost of service may be equitably divided between those who continue to use the power freely and those who curtail their consumption.

Proper Ratio of Consumers to Population.—Granting increased rates to the Western Hydro-Electric Company, the Michigan Public Utilities Commission said that the rates fixed would yield a reasonable return provided the company so managed its property as to obtain its reasonable quota of consumers. This in the case of electric customers the commission put for the community in question at the ratio of one to every five in the population, whereas the present ratio was only one to nine The commission also criticised the management of the company because only two-thirds of its existing customers were metered and said that all customers should have meters and flat rates be abolished. A well-put *obiter dictum* of the decision referred to the "twilight zone" between rates so low as to be confiscatory and so high as to be oppressive, in which zone the judgment of the commission may operate without judicial interference.

Recouping Street-Railway Losses from Electric Department Earnings.—In justification of its decision not to determine the rates for the divisions of the Helena Light & Railway Company on a separate basis the Montana Public Service Commission said: "Confiscation or deprivation of property contrary to the constitutional right begins when the revenue derived from rates prescribed is less than legitimate and necessary operating expenditures; and a rate theoretically sufficient for each utility alone would have the precise effect of producing revenues below operating requirements, at least in so far as the street railway is concerned. . . . We are satisfied that patrons of the Helena Light & Railway Company would rather recoup street-railway losses out of electric earnings than abandon the railway system for greatly decreased light and power rates. It must be distinctly understood that we yield the principle of separation only because of the facts of this particular case and only for so long as necessary."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Powers of Michigan Railroad Commission.—In an action brought against the Michigan Railroad Commission by the city of Detroit the Michigan Supreme Court declared that the commission was not deprived of the power to fix the rates of a utility because it was operating within the limits of a city under a home-rule charter. It is proper, the court held in the same case, to fix the value of a utility's property on the basis of the present market values as to land and reproduction cost less depreciation as to structures. (177 N. W. 306.)

Contracts Not Voided by Change in Form of City Government.—In the suit of the city of Mobile against the Mobile Electric Company to restrain the city from holding an election to vote on a proposed ordinance affecting the company's franchise, and to obtain a decree that an agreement adopted in 1918 to suspend the operation of the original contract between the city and the company until the end of the war (the Alabama Public Service Commission to be asked to fix just and fair rates) is still valid, the Supreme Court of Alabama affirmed the order of the lower court granting a temporary injunction. The case was affected by the facts that a technical state of war still exists and that a commission form of government has taken the place of the former Mayor and Council in Mobile. Among the findings of the Supreme Court were, in effect, these: (1) Where the Public Service Commission changes a subsisting rate pursuant to an agreement between a municipality and a public service corporation the validity of its action must depend on the legality of the agreement; (2) a contract resolution not signed in the name of the city but merely by commissioners purporting to act for it is one which is not merely defective or irregular but is no contract; (3) where the resolution of city commissioners attempting to suspend a contract for furnishing light to city residents was a nullity an election to adopt an ordinance to reinstate the original contract would be useless and could be enjoined; (4) the provisions of the code affecting contracts do not apply only to cities operating under the aldermanic form of government since they affect also contracts in other instances and through officials other than mayors; (5) where there was no substantial or even attempted compliance with one of the most important and mandatory requirements of the code relating to city contracts the agreement was void. (84 S. 816.)

M. Luckiesh, heretofore physicist of the Nela Research Laboratory at Cleveland, has as a result of reorganization of the laboratory and expansion of its work been appointed director of applied science and will have charge of a separate laboratory. This laboratory of applied science and the new laboratory of pure science will hereafter constitute together the Nela Research Laboratory. Dr. Nichols will be director of the pure-science laboratory, and the work of both laboratories will be co-ordinated under the general direction of Dr. E. P. Hyde. Mr. Luckiesh's appointment is in recognition of the able work which he has rendered to the industry in the field of lighting. Himself a scientist, Mr. Luckiesh has done a great deal in linking together the science and the art of illumination



M. LUCKIESH

through original studies and investigations. He was born in Maquoketa, Ia., Sept. 14, 1883, and was graduated from the Iowa State College in 1905. He entered Purdue University in 1906 and was graduated with the degree of B.S. in E.E. After a year of teaching in the State University of Iowa he entered the Nela Research Laboratory in 1910. In 1911 he obtained an M.S. degree from the State University of Iowa and in 1912 an E.E. degree from Iowa State College. Mr. Luckiesh has devoted a great deal of attention to the study of colors. He has written many papers and the following authoritative textbooks on lighting and color: "Light and Shade," "Color and Its Applications," "The Language of Color and the Lighting Art," and "Artificial Light—Its Influence on Civilization."

Michio Izawa, assistant traffic manager for the Japanese government railroads, and Kukujiro Hirayama, railway engineer of the imperial lines of Tokio, are visiting America and studying the American railroad systems. They are particularly interested in electrification of steam railroads since Japan must import its supply of fuel and the mountainous sections permit the development of a large amount of hydro-electric power.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

A. G. Wishon, general manager of the San Joaquin Light & Power Corporation, Fresno, Cal., who formally started the company's Kerckhoff station of 42,600 kva. on Aug. 15, was one of the first investigators of water powers in the High Sierras. He was born at Coppeges Mill, Mo., Nov. 6, 1858, and went to California in 1889. In 1894 he became interested in an irrigation project that required the building of a 1,100-hp. power station for pumping water out of the Kaweah River. In working out this project he began to survey the power possibilities of the High Sierras and to lay plans for the development of what has since proved to be the great source of power for the entire San Joaquin Valley and the city of Los Angeles. Like other Western pioneers, he found the securing of capital one of the great drawbacks. With the assistance of John Hays Hammond, however, in 1898 he organized the Mount Whitney Power Company, and as manager of that company he completed the construction of its first plant in June, 1899, 31 miles from Visalia, 42 miles from Portersville and Tulare, the chief points of distribution. A second power station was later started, but Mr. Wishon resigned in September, 1902, when it was about half completed, to develop other power sites on the Tule River south of the Mount Whitney projects and became associated with W. G. Kerckhoff and A. C. Balch, capitalists of Los Angeles. In January, 1903, Messrs. Kerckhoff and Balch purchased the railway and water properties in Fresno, Cal., and the San Joaquin Power Company. Later the railway interests were sold to the Fresno Traction Company, and the San Joaquin Light & Power Corporation was organized with Mr. Wishon as general manager, the position he still retains. Associated with him in the management of the company is his son, A. Emory Wishon, whose development of the self-interest basis for financing public utilities, as presented in the May 1, 1920, issue of the ELECTRICAL WORLD, has created widespread interest in the East as well as the West. In addition to his activities as a public utility man, A. G. Wishon is identified with other interests as director of the California Raisin Company and proprietor of extensive vineyards and farming property in the San Joaquin Valley. Other details of Mr. Wishon's contributions to the development of the resources of this district, almost entirely dependent upon electric service, appears in this issue on page 368.

Dr. Ernest Fox Nichols, formerly president of Dartmouth College and more recently professor of physics at Yale, who early this year joined the staff of the National Lamp Works of the General Electric Company, Cleveland, has accepted an invitation to assume the immediate direction of the laboratory of pure science of the National Electric Lamp Association under the title of director of pure science. The laboratory of pure science and the laboratory of applied science, which together will constitute the Nela Research Laboratories, will be under the general direction of Dr. Edward P. Hyde, who organized the Nela Research Laboratory in 1908 and who now becomes its director of research. Dr. Nichols was born at Leavenworth, Kan., in 1869, was graduated in 1888 from



DR. E. F. NICHOLS

the Kansas Agricultural College, and after graduate study at Cornell University spent three years at the University of Berlin. He received the degree of doctor of science from Cornell in 1897, and was professor of physics at Colgate University for six years before taking the chair at Dartmouth in 1898. Dr. Nichols later became professor in experimental physics at Columbia University, and about ten years ago he was made president of Dartmouth. Early in 1916 he resigned to accept a professorship of physics at Yale University, which position he held until he joined the Nela Research Laboratory. He has made many notable researches, the best-known being the invention of a radiometer for stellar measurements.

Obituary

E. H. Mulligan, district manager of the Southern California Edison Company at Redlands, died July 12 after a long illness. Prior to his affiliation with the Edison company in 1908 he was connected with the earliest hydro-electric installations in California.

Trade and Market Conditions

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

Household Appliance Manufacturers Aim to Develop New Devices

MANUFACTURERS of motor-driven household devices see a big future ahead of them, both at home and abroad. The demand for such leaders as washing machines and vacuum cleaners seems to have reached its peak in this country, where the manufacturing capacity of existing factories will with one or two exceptions probably be sufficient to take care of all future domestic requirements. However, there is an insatiable foreign demand still untouched, and factory extensions now being made by household-device manufacturers are mainly to supply this demand.

Manufacturers are looking around for new devices with which to supply their domestic customers. Dish-washing machines, domestic refrigerating machines and electric ironing machines are among those being considered, but they all seem to require a large outlay of capital either to develop the machines or to stimulate demand.

This quest of manufacturers for new lines may lead to the development of entirely novel electrical labor-saving devices or to the further development of devices now on the market. However, for the manufacturers who simply continue to increase the output of their standard products, there seems to be a foreign market large enough to absorb whatever part of their output cannot be sold in this country.

Uneven Conditions in Industrial Reflector Market

INQUIRIES instituted among manufacturers of industrial reflectors in making a comprehensive survey of the field reveal uneven conditions in that line. Varying reports are received as to the volume of sales that are being made at present, the condition in which stocks of finished reflectors are to be found and the rapidity with which deliveries can be made. Producers generally seem to concur in an optimistic feeling regarding the future of the industry, however, because, according to them, industrial lighting today is tending more and more toward standardization and plants are at the same time realizing that proper lighting is an important factor in promoting efficient production.

The months of July and August are usually rather quiet for sales of reflectors, this being the period when stocks are reinforced in anticipation of the fall trade, which is somewhat heavier then. In spite of this, one of the large makers states that July was the biggest month in the history of his business and that the volume of orders received for the first five months of this year was three times as large as for the same period in 1919. Several other producers are also finding a good and fairly regular demand for their product, but this is not a universal condition as evidenced by other reports of "fair," "spasmodic," and in at least one case an answer of "poor," returned to the question regarding demand.

Stocks of finished reflectors on the whole appear to be in bad shape, with almost half of the manufacturers having absolutely no reserve stocks, and several others say their supply is poor or below normal, while in only one or two cases are favorable returns given, and then the statement is made with a qualification such as "good considering conditions." These conditions referred to are undoubtedly affecting production, and foremost among them seems to be the question of raw material. Occasionally one hears of some easing up of the shortage there, but for the most part companies are severely handicapped for lack of all or part of such material as fuel, metal, porcelain for sockets, etc. Transportation is also materially impeding the output of producers, the item of steel alone requiring many weeks to reach the factory.

In spite of these unfavorable conditions, at least as many manufacturers report a normal volume of production as those who say their output is below capacity, and in the latter case it is quite often added that the situation is improving. More than 50 per cent of the industry reports freedom from labor troubles, although in some instances where no strikes have been experienced, a shortage of skilled workmen is reported. Inasmuch as labor, raw material and transportation conditions naturally affect different manufacturers in varying degrees, the range of time in which deliveries can be made varies in almost every case. In one or two instances deliveries were quoted from stock up to two weeks, while the maximum length of time ran to three months and the majority of delivery figures would probably be encompassed within a range of about three to eight weeks.

Back orders are very numerous and some have even been held up as long as three or four months, although this is not usual. As a result cancellations have occasionally been made, though not to any great extent. Prices have held steady since general increases were made two to three months ago, and opinion is about evenly divided as to whether further advances will soon be necessary. Those who held the affirmative view base their belief on prevailing high prices of labor, metal, fuel, packing, etc. Collections in general are characterized as fairly prompt, though some complaints of slowness are registered and also of traces of tightening collections.

Record Exports of Switches in June

EXPORTS for all classes of electrical material with the exception of locomotives total $46,724,126 for the six months ended June 31, 1920, according to figures made public by the Bureau of Foreign and Domestic Commerce. This compares with a total of $48,608,056 for the first half of 1919 and with $27,857,184 for the corresponding period of 1918. Thus the first half of 1920 is running about 4 per cent less than 1919, but about 67 per cent more than 1918. Electrical exports for 1920 if continued through the year at the same rate as for the first half would result in a year's total of about $93,000,000, compared with an actual total of $89,000,000 last year.

An interesting comparison is afforded by the figures of various electrical goods exported during the past two and a half years. The total exports of motors, amounting to $6,113,900, for the first half of 1920 represent an increase of 5 per cent over the same period in 1919 and about 80 per cent over 1918. An excess of $438,000 in generators marks the first six months of 1920 in comparison with 1919, and $1,300,000 represents the increase over 1918. The present half year's figures on transformers, however, are about $349,000 below those for 1919, but are $654,000 above 1918.

Electrical heating and cooking appliances are also steadily increasing in favor abroad, as shown by the total of over $900,000 reached at the midyear mark in 1920, which

figure is approximately 13 and 230 per cent ahead of the same period in 1919 and 1918 respectively.

The June, 1920, total of exports for electrical goods is $9,011,949, which is the next to the highest monthly record, being exceeded only by the sum of $10,992,631 in June, 1919, which compared with $5,019,519 for the same month in 1918. The decrease of almost $2,000,000 between June of this year and last is largely accounted for by a drop of over four-fifths of a million on the item of insulated wire and cable and almost one-fifth of a million each on batteries, dynamos and metal lamps. Out of nineteen different items, the totals of the sixth month a year ago exceeded those of June, 1920, in fourteen. The largest excess among these twelve was about $827,000, or 139 per cent, on insulated wire and cable; but June of this year has to its credit the largest percentage increase over June, 1919, by exporting 4,375 per cent more arc lamps, though the record figure of $7,743 in itself is small. Another class of goods in which the exports of last June touch an unprecedented figure is switches, the total value of $608,330 excelling the best previous amount of $593,975, registered in June of 1919, by more than $14,000. Below is the comparative table for June, 1919 and 1920:

	June		Six Months Ended June	
	1919	1920	1919	1920
Batteries	$787,748	$578,146	$3,197,135	$3,334,810
Carbons	173 582	113,109	856,597	672,379
Dynamos and generators	750,546	571,340	2,560,411	2,997,764
Fans	130,817	191,434	995,838	717,698
Heating and cooking apparatus	192,551	164,344	814,002	921,575
Insulated wire and cable	1,420,699	593,370	5,590,056	3,683,653
Interior wiring supplies	280,631	270,709	1,257,182	1,514,820
Arc lamps	173	7,743	7,578	13,609
Carbon-filament lamps	5,176	4,518	113,171	58,463
Metal-filament lamps	530,085	364,864	2,824,812	2,054,812
Magnetos, spark plugs, etc.	219,826	290,723	1,680,382	1,919,442
Meters and measuring instruments	319,336	237,735	1,667,087	1,322,661
Motors	1,562,521	1,250,638	5,835,350	6,113,900
Rheostats and controllers	65,384	83,504	264,103	371,194
Switches and accessories	593,975	608,330	1,672,047	2,182,674
Telegraph apparatus	92,220	30,458	515,608	378,288
Telephones	377,395	275,212	1,892,059	1,914,641
Transformers	438,483	402,016	2,233,075	1,884,728
All others	3,041,383	2,973,756	14,631,563	14,667,015
Total	$10,992,631	$9,011,949	$48,608,056	$46,724,126

Supply of Rigid Conduit Offers No Immediate Relief

REPORTS received from jobbers in the metropolitan territory on the rigid-conduit situation within the past couple of weeks may, according to representative manufacturers, give an erroneous impression of the true general market condition of this material. A curious situation exists in that while the supply of conduit for New York and certain points to the south has materially improved, the general situation throughout the rest of the country apparently shows little betterment. This is only natural when the true significance of the improved supply in these instances is understood.

According to representative manufacturers of conduit, the transportation situation as it affects them is very little if any better. Added to this circumstance is the dwindling supply of pipe that has for some time past been available for the manufacture of conduit. Steel mills attribute the shortage to their inability to get cars for shipping their product to the makers of conduit. One of the latter has received no pipe for a month and a half, and another manufacturer has received no recent supplies except by boat. As a result of this lack of raw material caused by the car shortage, one of the large makers of conduit has ceased production during the past two weeks and another company has not turned out any conduit in over a week.

Prior to this, however, stocks of finished conduit had accumulated at the mills awaiting cars to carry it away, but a system of embargoes that was placed upon producers in the Middle West made it very difficult to move their product. At one time a permit was even necessary to ship the material. Recently, however, the situation has been relieved to the extent that shipments can be made to certain territory in the East and some points southward in a little better shape, although the car shortage continues and the rest of the country remains almost as restricted in its supply as before. Consequently, with the outlet to their market restricted, conduit manufacturers have shipped their product in large quantities to the metropolitan district, creating the misleading impression that exists among some jobbers to the effect that conduit is becoming very plentiful. This condition would seem to be but temporary, however, inasmuch as manufacturers say the unusual flow of conduit into the favored territory will cease as soon as freight conditions improve generally.

Regarding the general market for conduit over the country, no let-up in the insistent demand has as yet appeared, and in distant places like Cuba a condition of absolute famine prevails. New orders are accepted with no promise as to date of delivery and with price quoted in effect at time of shipment. Back orders have in some cases piled up sufficient to absorb production for nearly a year to come. The large labor turnover found among the many foreigners employed in this industry is a further source of inconvenience.

In spite of these factors, prices have generally remained firm, but some producers hold to the opinion that an advance may be necessary owing to the increased freight rates.

Metal Market Situation

LIGHT sales feature the copper market. Producers are holding for 19 cents through August, September and October, with very little interest being shown in deliveries beyond that date. The market seems under no more pressure to sell than to buy. Encouragement is gained from the improvement in freight conditions, which is allowing more shipments of metal on contract to be made.

In the outside market business is also extremely quiet, with prices nominal and scant inquiry being made for future positions. August shipments can be obtained for 18.50 cents, though this price may be shaded slightly as there is a little more pressure to sell for immediate shipment. The market at London has lately presented a dull tone, with standard spot slightly weaker in the last fortnight.

Increased prices on aluminum have gone into effect, amounting to slightly over 2 cents a pound on 98 to 99 per cent ingots. The zinc market presents a firmer tone, the price of spot taking a slight rise, and though demand at present is not very heavy, fears of a shortage are expressed because of car shortages and plants being closed by strikes. Not much buying strength is evidenced in tin, but the market apparently presents a very strong undertone.

There is not a great deal of lead in evidence in spite of the recent advance of ½ cent a pound. The market continues to hold firm.

Midsummer dullness is being intensified by unrest and transportation difficulties in the scrap-metal market, so that little activity is evidenced there. A slight decrease in the price of old zinc is noted.

NEW YORK METAL MARKET PRICES

	August 10	August 17
Copper	£ s d	£ s d
London, standard spot	93 10 0	93 5 0
	Cents per Pound	Cents per Pound
Prime Lake	18.75 to 18.85	18.75 to 18.85
Electrolytic	19 00	19 00
Casting	18 00	18 00
Wire base	22 50 23 00	22 50 23 00
Lead, trust price	8 50	9 00
Antimony	7 00	7 00
Nickel, ingot	43 00	43 00
Sheet zinc, f.o.b. smelter	12 50	12 50
Zinc, spot	8 15	8 35
Tin	48 25	48 00
Aluminum, 98 to 99 per cent	33 00	35.10

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	15 50 to 16 00	15 50 to 16 00
Brass, heavy	9 25 to 9 50	9 25 to 9 50
Brass, light	7 25 to 7 75	7 25 to 7 75
Lead, heavy	7 25 to 7 50	7 25 to 7 50
Zinc, old scrap	5 50 to 5 75	5 25 to 5 50

THE WEEK
IN TRADE

IN SPITE of midsummer trade dullness, which is everywhere slowing the market for electrical material, the volume of sales in almost every district is reported as considerably higher than the usual summer level of other years. The slump is noticeable only in the light of the exceptionally brisk business recorded earlier this year. The notable exceptions are in the Puget Sound and Intermountain sections, where extreme quietness features the industry. Even in the latter districts as elsewhere, however, optimism reigns as the result of the heavy trade which is expected to materialize with the coming of the fall months.

The credit situation seems to be characterized by the increasing tightness of money, and practically all districts are experiencing a slowing up of collections. The money stringency is expected to be alleviated in many parts of the country, however, with the harvesting of the good crops that are reported from all sections.

Southern territory is the only quarter where an appreciable amount of residential construction is under way, other districts seemingly being deterred by the prevailing scarcity and high prices of building material, although in the East a large volume of building for commercial purposes is under way.

Stocks are in general considerably improved, as lessened demand and slightly easier transportation makes itself felt, but a shortage of cars is causing great concern in the West and in the Northwest, where the car demands of the lumber and grain interests are considerable. Prices seem to be holding steady except for an increase of from 10 to 15 per cent on motors.

NEW YORK

Compared with the volume of business earlier this year, the electrical trade has been rather quiet the past week, but in comparison with the usual midsummer slackness of other seasons the amount of sales registered at present is very encouraging.

Local reports indicate a considerably easier transportation situation in both incoming and outgoing shipments, not that deliveries are being effected much more quickly than has been the rule, but orders placed perhaps months ago are now beginning to come through. As a result of better shipments and lessened demand, sizable stocks are accumulating in most lines, particularly in flexible armored conductor, lamps, rubber-covered and lead-covered wire and fuses. The rigid-conduit supply is also a little better in this territory.

Residence construction remains practically negligible, but thousands of homes are needed here and a large amount of work is on the boards. When the supply of building material eases up, as it seems reasonable to suppose it will, after the improved financial situation of the railroads has had time to make itself felt, a large amount of electrical material will be needed for the projects that are now planned.

Jobbers agree that collections are a bit tighter at present and must be pushed with more persistance, but the general situation with regard to payment of bills is characterized as fairly good

Lamp Cord.—Good stocks of both silk and cotton material are reported, with only a fair demand. The greatest call seems to be for cotton cord, and hence silk is more plentiful, if there is any choice between the two. Shipments are coming in better on orders placed months ago.

Safety Switches.—Although many jobbers do not touch this article in local territory, demand in many quarters appears to be picking up considerably.

Non-Metallic Flexible Conduit.—Reports vary considerably, as some jobbers have good stocks and experience no difficulty in meeting the small demand they are finding, while others say that demand is good and at least one distributer has no stock, is sold out for the remainder of the year and is behind on filling orders. Prices quoted range all the way from $33 to $38 for the $\frac{3}{2}$-in., and from $36 to $42 per 1,000 ft. for the ¼-in. size.

Flexible Armored Conductor.—Fairly good stocks have now accumulated under the influence of lessened demand and better shipments. Prices are showing signs of softening, with No. 14 quoted in the neighborhood of $105 per 1,000 ft.

Fuses.—Demand, though not extraordinary, is probably close to normal, with reports varying as to which type sells the best. Good supplies of both renewable and non-renewable makes are on hand.

Wall Panels.—Some jobbers are finding a shortage, said to be caused by a dearth of sheet steel, but others have accumulated a good stock by anticipating their orders. Demand is about normal.

Rubber-Covered Wire.—Plentiful stocks are taking care of the fairly good demand which exists. Shipments are regular, although the larger sizes are a bit slower. No. 14 is quoted at $11.50 per 1,000 ft. in lots under 5,000 ft., and at about $11 for larger quantities.

Lighting Fixtures.—No trouble in obtaining supplies seems to be experienced in this line and stocks are in good shape. Demand is not especially heavy, though increased sales are looked for in about a month.

Lead-Covered Wire.—A fair demand is felt, with good stocks the rule. Shipments are slow, however. Price quotations cover a wide range.

Lamps.—Good prospects for a heavy fall trade are reported and many jobbers are already fully stocked up in anticipation of this demand. Others, however, have not yet been able to build up their supplies, although orders are said to be on the way.

CHICAGO

The electrical trade is keeping busy and prices are firm or on the raise, although Chicago's building permits for the current week maintained their low rate of $700,000 and many industries showed price losses and decreases in volume of sales. Some manufacturers, finding new building too expensive, are re-equipping and overhauling existing plants and thus maintain the demand for certain lines of electrical goods. As a whole, stocks are gradually improving and back-order files are being correspondingly lightened, but porcelain, glass, line hardware and certain power apparatus are extremely hard to get.

Credit conditions remain practically stationary. With efficient organization, close scrutiny of orders and prompt follow-up, collections are about the same as they were a year ago under much less active collection work. The financing of new projects in the agricultural districts is becoming increasingly difficult as banks are still loaded up with paper covering last year's grain.

Motors.—Recently noted advances in certain motors and generators have been followed by similar moves on the part of other manufacturers until now practically all sizes and styles above 1 hp. are 15 per cent higher than prices prevailing in June and July. A standard 5-hp., 1,800-r.p.m. induction motor is now quoted at $129. Fractional sizes have also registered increases of from 7½ to 10 per cent.

Oil Switches.—Heavy demand keeps stocks ragged, only certain sizes being available for immediate shipment. Factories are requiring up to ninety days on all orders for standard types for protection of induction motors. The current quotation on the 2,500-volt, 200-amp. switch is $64.

Wires.—Uncertain receipts tend to keep stocks badly broken. No price changes have been registered for some time, No. 8 bare copper being priced at $24 per 100 lb. in 200-lb. lots and No. 12 weatherproof at 34 cents per pound in 500-lb. lots.

Poles and Cross-Arms.—Delivery on these items remains uncertain on account of poor car supply at loading points, but goods are coming through fast enough to prevent any serious inconvenience. Prices show decided firmness, which is notable in view of the abrupt declines of the last few weeks in all other lumber products.

Locust Pins.—Stock conditions locally are much improved, although time is required for the delivery of orders of any great size. The limited supply of raw material seems to justify the present price, which in lots of over 2,000 is $52.94 per 1,000.

Porcelain Sockets, Receptacles, Etc.—Lists which were withdrawn on this class of material a few weeks ago have been reissued and show substantial increases all along the line. Supply is wholly inadequate to fill the current demand, although this demand is below normal.

Household Appliances.—The unusually heavy bookings of last spring are being filled as rapidly as possible, with cancellations and rejections apparently in no greater proportion than in previous seasons. Considerable talk has been heard about wholesale cancellations, but diligent search fails to find many definite cases.

BOSTON

Trade is running somewhat below the recent volume of sales, although many jobbers are booking business far in excess of previous summer weekly totals. In some cases long deliveries are slowing down orders, but except in motors and porcelain fittings, stocks are improving considerably. Collections are slow and unsatisfactory, some of the good customers of even the larger jobbers being a little tardy in settlements. High prices of labor and materials are holding back greatly needed house construction and acute congestion is expected this fall. Agitation for state and city financing of home building is becoming evident. Industrial building is still going forward with vigor. Prices are firm, with advances of 10 to 15 per cent in leading makes of motors quoted this week. Energetic efforts are being made by New England motor manufacturers to increase their facilities. Labor conditions exhibit no new complications, with the exception of an inter-union disagreement in telephone circles which has not yet threatened service continuity.

Motors.—Price advances of 15 per cent on General Electric two-phase, three-phase and direct-current motors and 10 per cent on Westinghouse, Century, Wagner and Robbins & Myers motors are announced. Deliveries vary beyond all ordinary quotations. The market is literally shot to pieces on motors of less than 10-hp. rating.

Wire.—Long deliveries are slowing down orders, according to some agencies. In moderate amounts, requirements are being well handled, however. Rubber-covered wire is quoted at $13.13 per 1,000 ft. for No. 14 in 5,000-ft. lots. Bare copper wire base is 23 cents and requires four to five weeks for delivery, and weatherproof sells at 27 cents base, averaging eight to ten weeks delivery in quantity. Some jobbers can ship from stock.

Rigid Conduit.—The arrival of deferred shipments is rapidly increasing jobbing stocks. A leading distributer reports a well-assorted supply on hand now of both large and small pipe, with more coming into town. Fittings are also in reasonable supply.

Controlling Apparatus.—Advances of 10 to 15 per cent are announced in motor-control equipment prices, corresponding to motor-price increases.

Flexible Armored Conductor.—This material is plentiful, and a steady price of $110 per 1,000 ft. in 5,000-ft. lots is quoted. The demand is good.

Non-Metallic Flexible Conduit.—Substantial stocks are reported, with fair demand, running to lower volumes of orders. Prices are firm, the ⅜-in. size bringing $33.50 per 1,000 ft. in 5,000-ft. lots, and ½-in. loom $36.50.

Electric Drills.—Stock shipments are being made on local orders. The price of a representative ¼-in. electric drill, 110 volts to 220 volts, is $100 net.

Fans.—Retail fan sales have been much stimulated by a week of continued extreme humidity. Wholesale stocks do not appear to be exhausted, however.

"Nail-it" Knobs.—Good supplies are on hand, and in barrel lots, these bring $34.65 per 1,000. Stocks are not excessive, however.

Sockets.—Current requirements are being met comfortably. In case lots pulls are quoted at 50 cents net each, keys at 28 cents and keyless at 26 cents.

ATLANTA

Jobbers report a shrinkage in the number of orders received, though on the whole the volume of business in electrical lines continues to hold up well. Sentiment indicates that a gradual contraction will be experienced as urgent calls for material on back orders are filled. Business in general shows signs of slowing up. Retailers are making every effort to liquidate their excess holdings and are somewhat adverse to placing new orders for heavy fall stocks. While this is largely traceable to the tightening up in the money market, the resistance of the buying public to high prices is having the effect of causing more cautious buying. Building construction continues to be delayed by the difficulty in transportation, and this, together with the rumor that some of the larger industrial plants—the textile trade in particular—will curtail operations in the next few days, has caused the labor market to ease up considerably. Residential and commercial building construction in the smaller towns has shown unusual signs of activity, and construction under way, while slow on account of material shortage, will be sustained in these centers for some little time to come.

Meters.—There are no 5-amp. or 10-amp. two-wire or three-wire meters in the territory, while the demand is strong. The larger sizes can be had in very limited numbers only, and shipments on large polyphase instruments are quite unsatisfactory. High tension types are quoted at from eight to fourteen weeks.

Outlet Boxes.—The scarcity in this item continues, the stocks of semi obsolete boxes being exhausted. Jobbers state that they can make no definite promises of delivery as yet.

Switch Boxes.—There are practically no supplies of this article in the territory, with little prospects of the situation improving in the near future. Such small shipments as come in are quickly absorbed by back orders.

Cut-Outs.—The shortage of cut-outs is acute, owing apparently to the difficulty in obtaining porcelain. No shipments of moment have been received in this territory for some time.

Distributing Transformers.—One jobber reports the receipt of eighty-four transformers, while his back orders amount to approximately 850. This is causing considerable delay in the connecting up of industrial plants recently changed to electric drive. Shipments on stock sizes are from sixteen to twenty-five weeks.

Schedule Material.—Stocks are reported in better shape than they have been for several months past, ample supplies of rosettes, sockets, tubes, knobs and cleats being reported. Prices—Snap switches, lots of 50 to 250, 5-amp., 34 cents each; key sockets, lots of 100 to 500, 38 cents each; rosettes concealed, lots of 50 to 250, 20 cents each; "Nail-it" knobs, $4.99 per 100.

Motors.—Jobbers are far behind in their motor orders, high fuel cost having caused even greater demand than was realized in the early spring. The 15 per cent price advance of last week, which came as somewhat of a surprise, has failed to check the demand. Deliveries range from twenty to fifty weeks, shipments on single-phase motors being particularly long.

Poles.—Car shortage continues to interfere with pole deliveries from local distributing centers, though jobbers are quoting immediate shipments out of Chicago to this territory. Freight charges are slowing down shipments from the latter point, however.

SAN FRANCISCO

The height of the fruit season coupled with the freight-rate advance has sent every wheel rolling on California railroads and has jammed every terminal and yard. The value of California crops will be close to a record-breaking figure this year, for, with the exception of the Sierra foothills and where a shortage of water exists in various localities, the total is enormous. This is a very important thing in a state where practically all cities and towns in the interior are dependent for their prosperity on natural products.

Bells.—A marked increase in lawlessness has produced a campaign for the installation of daylight alarm systems in banks, etc., and considerable missionary work is being done with firms along these lines. This apparatus is not stocked on the coast, but is shipped from the East on sixty days' delivery. Other bells are being sold, particularly special voltage bells or ones that are wound to operate on bell-ringing transformers.

Telephones.—The situation here is very serious and has resulted in practically depleting coast stocks and greatly lengthening deliveries. No improvement is in sight.

Wireless Equipment.—The present demand is rapidly increasing and exceeds even the call before the days of wartime regulations. Formerly certain dealers in each district were known as wireless headquarters, but now it seems more and more as though such material is being regularly stocked by all dealers.

Medical Appliances.—Expectations of a wet winter and the usual winter demand for vibrators and the like have caused the placing of good stock orders. Violet-ray machines have received particular emphasis from the visits of factory agents and from a regular increase in demand.

Farm-Lighting Plants.—The State Fair in Sacramento in September has alloted a considerable space for the exhibition and demonstration of this line. It will be divided into two sections, one covering lighting and the other household devices.

Household Appliances.—Early in the year the great difficulty was to procure factory deliveries, but now shipments are rolling in and surplus stocks have actually accumulated. Business has dropped off considerably and dealers are looking for solicitors to comb the field more intensively.

SEATTLE—PORTLAND

Conditions along electrical lines in Seattle and the Puget Sound district, generally speaking, show little if any improvement over the last few weeks. Jobbers still report sales of consequence at a minimum, while retailers state that sales of appliances and fixtures are lighter each week. However, both jobbers and retailers confidently expect sales to pick up considerably, starting early in September, after the vacation season is over. The building slump in Seattle, especially, is occasioning considerable comment because authorities aver there is no lack of money with which to finance legitimate building undertakings, and further because Seattle is so badly underbuilt in practically all classes of buildings.

Lumber buyers seeking to dodge the freight-rate increases have purchased heavily during the past week. Orders accepted by West Coast lumbermen exceeded production by 5 per cent and shipments by 13 per cent. Cars for lumber loading continue scarce, only about thirty per cent of actual requirements being furnished. There is no evidence of the reported rush of cars to the West to move lumber which was announced recently.

Vacuum Cleaners.—With but one or two exceptions these are the best selling household device on the market, and recent shipments are enabling dealers to meet the demand, which is expected to show continued increases. The recent price advance has not affected sales to any noticeable extent, though many are being made on the installment plan.

Water Heaters.—Demand is picking up, especially in the 4-kw. and 5-kw. sizes. Jobbers have good stocks and are prepared to meet the demand, which should show further increases this fall.

Schedule Material.—Stocks continue to accumulate, with the volume of sales sluggish on account of the continued slump in building.

Sewing Machines.—Slackening of demand is generally noted throughout the Northwest, though the past week showed a slight improvement in Seattle. Stocks are in good condition and prices are tending upward, although no decided increase has gone into effect recently.

Ranges.—Prices are apparently slowing up sales materially, as householders figure the expenditure is too great in face of uncertain conditions. Stocks are good.

Dry Cells.—Stocks are in good shape, but demand is below expectations. Shipments are coming through in a comparatively satisfactory way, and prices show no recent change.

SALT LAKE CITY—DENVER

Demand for all kinds of electrical equipment affecting the mining industry continues good, while other phases of the market are sluggish and uncertain. Nearly one-sixth of all electrical equipment and supplies sold in the Intermountain region is purchased by owners and operators of mines. Hoists, wires, lamps and tramway supplies are used in great quantities the year round. The summer is coming to a close with a general market condition that is slow and disappointing. Distributers and dealers are devoting much of their time and energy to preparing for the fall trade, which promises a satisfactory improvement over the average for the three months just past.

Despite the present discouragement there is persistent optimism about the immediate future. The electrical industry is banking on good crops to alleviate the condition of business lethargy. Crop yields on irrigated lands will be well above the average for the past two or three years, though yields in many dry farm sections are falling below official estimates. All in all, the prospects are good. The only concern of the farmers is the outlook for a satisfactory market and adequate transportation to move the crops. Growers of perishable products are especially purturbed over uncertainties of transportation. Already improvement is noted in the market for electrical supplies. The peak of the period of conditions approaching business stagnation seems to be safely passed. Inquiries and orders from dealers indicate a rapid revival of business throughout the Intermountain West. Collections are still slow and money continues tight.

Electrical Washers.—Manufacturers seem to have more than caught up with back orders and are urging jobbers to stock. Lines that a while back were the most scarce are now available in any quantities. Prevailing high prices discourage extensive buying.

Fans.—The season is rapidly on the wane. Stocks are pretty well cleaned up. Dealers are pleased with the volume of the trade for the summer.

Rotary Sewing Machines.—For some unaccountable reason this business has not had a satisfactory growth in the Intermountain region. Jobbers are awake to the possibilities, however, and are planning intensive campaigns calculated to stimulate trade.

Wire.—The condition of scarcity is greatly improved. Eastern factories that have been closed down on account of labor troubles are now making deliveries. The production of wire in the West is a growing industry. Factories operating near mining centers will be able more and more to meet the Western demand.

Lamps.—Trade is beginning to pick up. Slightly longer summer evenings are accountable for the increase. It is believed that the outlook will grow steadily better with the approach of fall and winter.

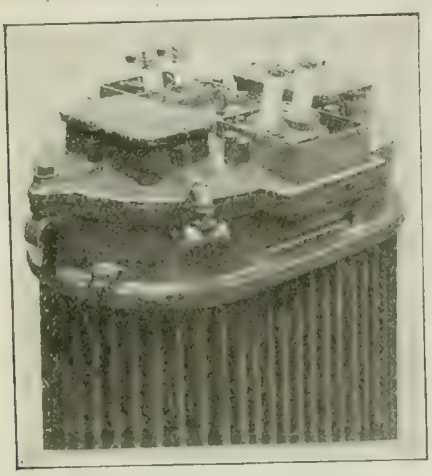
Heating Appliances.—Demand throughout the summer has been fair. Dealers are stocking now for winter and holiday trade.

New Apparatus & Appliances

A Record of Latest Developments
and Improvements in Manufacturers' Products
Used in the Electrical Field

Transformer Bushing

A new type of bushing for use with outdoor-type transformers of moderate voltage has been put out by the General Electric Company, Schenectady, N. Y. The lower portion of the bushing is similar to the company's standard high-voltage bushing; ample clearance is provided in the housing. The use of these transformers is only limited, as



TRANSFORMER HOUSES MAY BE ELIMINATED

regards voltage, the maker says, by the voltage limits of the underground cable used in connection with them.

Dome Bell and Buzzer

The Holtzer-Cabot Electric Company, Roxbury, Boston, Mass., has developed a hub-dome bell and a hub-dome buzzer. The entire mechanism, which is mounted on a heavy molded insulation base, is

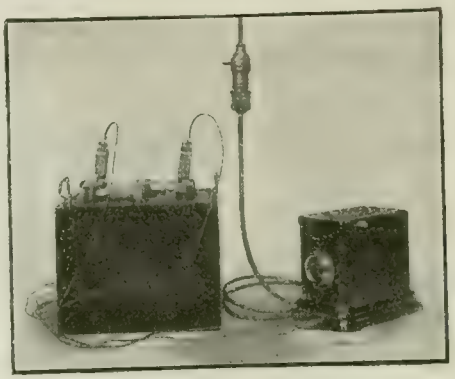


OPERATES ON EITHER ALTERNATING OR DIRECT CURRENT

underneath the gong. Greatest over-all width is 2⅝ in. It is claimed that vibration will not loosen the specially made self-locking contact screw. Either alternating or direct current may be used. The buzzer mechanism is similar to that of the bell.

Storage Battery Charger

A mechanical-type instrument for transforming 60-cycle alternating current from the lamp socket into direct

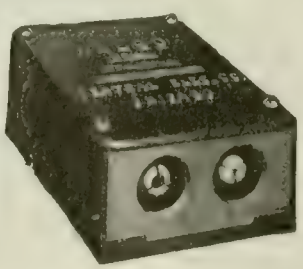


BATTERY NEED NOT BE REMOVED FROM CAR

current for storage-battery charging is being marketed by the King Electric Manufacturing Company, Inc., 20 North Niagara Street, Tonowanda, N. Y. The manufacturer says the apparatus is self-adjusting as regards time of charge and polarity, and that upkeep is extremely low.

Heavy Receptacle for Electric Welding

To meet the demand for a dependable receptacle and plug to be used in electric welding work, the Central

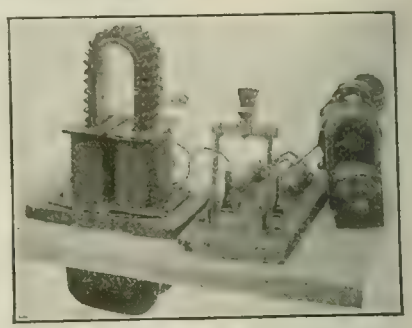


TWO PORCELAIN BLOCKS MOUNTED IN CAST-IRON CASE

Electric Company, 316 South Wells Street, Chicago, has developed the Ralco receptacles and plugs. The receptacle for use on two-wire direct-current circuits consists of two heavy porcelain blocks, in which are mounted heavy contacts forming a rectangular block which is approximately 5 in. x 4⅜ in. x 2¼ in. deep and is mounted in a substantial cast-iron case. It has a capacity of 225 amp. at 250 volts.

Set for Charging Permanent Magnets

The Esterline Company, Indianapolis, Ind., has placed on the market a new equipment for charging permanent magnets. This is designed to insure maximum charging of the magnets and to get them into place without losing a large portion of the initial charge. After the magnet has been charged, it

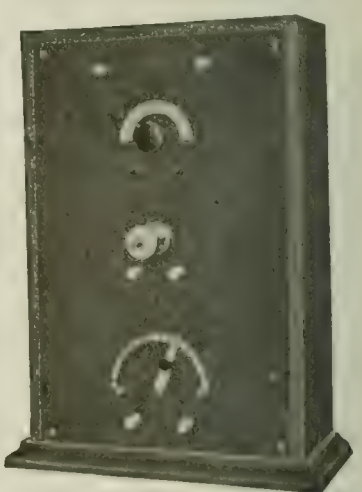


FLEXIBLE KEEPER HELPS TO RETAIN MAGNETISM

is lifted through the charging coils, the U-shaped keeper coming up with it, and a flexible keeper is then laid over the exterior of the magnet, remaining there until the magnet has been placed on the magneto frame. The coils are wound on bronze spools and can be furnished for any commercial direct-current voltage.

Radio Receiving Set

The junior receiving set, type HJR, manufactured by the Modern Radio Equipment Company, Elizabeth, N. J., is designed to meet the demand for a simple and efficient receiving set for beginners. It is portable, and only three adjustments are said to be needed.



RECEIVING SET FOR BEGINNERS

A dust-proof detector and variable condenser are mounted on the panel.

Note on Recent Appliances

Worm-Driven Hand Drill

The Arnold Electric Tool Company, New Haven, Conn., has developed a worm-driven portable hand drill, each section of which is a separate unit.

MANUFACTURERS' ACTIVITIES

Record of Changes Affecting Sales and Distribution
Together with Trade Personals and Notes on Foreign Trade,
Jobbers' News and New Trade Literature

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY has taken a five-year lease of the Springfield (Mass.) "Homestead" building, where it will establish a mail-order house for the distribution of small electrical equipment and supplies. The building is close by the local post office and extensive alterations are being made to adapt it to the new service. It is planned to occupy the establishment about Sept. 1.

THE LEWIS ELECTRIC COMPANY, Massillon, Ohio, will soon start work on the construction of a new plant 40 ft. x 120 ft., on Grant Street for the manufacture of the Lewis safety entrance switch. The company is capitalized at $150,000.

THE FRANKLIN MOORE COMPANY, Winsted, Conn., manufacturer of electric hoists, small electric cranes, etc., has appointed William C. Briggs vice-president in charge of manufacturing. Mr. Briggs was formerly sales engineer and New York manager for the Shepard Electric Crane & Hoist Company, Montour Falls, N. Y.

THE YORK MANUFACTURING COMPANY, York, Pa., manufacturer of refrigerating machinery, ice-making machines, etc., has taken over the plant of the York Brewing Company, which it will utilize for experimental and testing departments, etc.

THE F. E. NEWBERRY ELECTRIC COMPANY, recently organized, has taken over the plant and holdings of the Newberry-Bendheim Electric Company, Los Angeles, Cal.

A. E. ROBERTS, formerly vice-president and general manager of the Hedden Iron Construction Company, Newark, N. J., has been elected first vice-president of the Milliken Brothers Manufacturing Company, Woolworth Building, New York City, manufacturer of radio towers, transmission towers, fabricated all-steel buildings for electrical service, etc. He will be in charge of the New York office and direct all matters pertaining to sales.

THE GOODMAN MANUFACTURING COMPANY, Forty-eighth Place and Halsted Street, Chicago, Ill., manufacturer of electric mine locomotives and kindred equipment, has leased a four-story building at 216 Penn Avenue, Pittsburgh, Pa., containing about 18,000 sq.ft. of floor space, for the establishment of a branch repair and supply works.

CHARLES EISLER, incandescent-lamp equipment engineer, has entered the consulting engineering field and is now designing and developing special and automatic machines for the manufacture of standard, miniature and gas-filled lamps. The organization will also maintain a department for manufacturing wire product used in the incandescent lamps for which machinery is being developed and installed. A temporary office will be opened at 159 Clifton Avenue, Newark, N. J.

THE BLACK & DECKER MANUFACTURING COMPANY, Baltimore, Md., announces that it has sent a letter to all jobbers handling its line, stating that there will be no reduction in prices this year, and that, starting Jan. 1, 1921, the company will protect its jobbers against loss through price reductions for sixty days after the purchase of goods. The letter says, however, that if conditions make a reduction possible, it will be made promptly so as to give the ultimate purchaser the benefit, and the company will absorb any loss which would otherwise be caused the jobber who bought within sixty days before the change in price.

THE MANHATTAN ELECTRICAL SUPPLY COMPANY, 17 Park Row, New York City is offering for sale 37,000 shares of capital stock (without par value), the proceeds to be used to provide additional working capital, extension of existing facilities, general corporate needs and the retirement of all preferred stocks now outstanding.

THE ROCHESTER ELECTRIC PRODUCTS CORPORATION, Rochester, N. Y., recently organized, has taken over the manufacture of the Rochester electric motor, formerly made by the Rochester (N. Y.) Motor Corporation. The Rochester Motor Corporation will concentrate on its Duesenberg type automobile engine. At present the Rochester Electric Products Corporation will manufacture direct-current apparatus only of the power-motor type from ½ hp. to 15 hp., both constant and adjustable speed, horizontal and vertical drives, with plain bearings and ball bearings. D. W. Smith, with offices in the Singer Building, will represent the company in New York City and immediate surrounding territory, and Smith & Lewis, Real Estate Trust Building will cover the Philadelphia district. E. F. Davison is president, J. H. Kimmel is vice president and E. D. Smith, Jr., secretary.

HENRY HYMAN & COMPANY, INC., 476 Broadway, New York City, specialists in metal goods, announce that they have opened a branch office at 25 North Franklin Street, Chicago, in charge of Ernest Alschuler and Irving J. Jacobsen, who represent the United States Electric Manufacturing Corporation. They will take care of all business in the Western territory.

THE RAUSCH & LANG COMPANY has been granted a permit to build a 300-ft. x 320-ft., one-story, concrete-and-steel factory in the Willimansett section of Chicopee, Mass., for the manufacture of electric motor cars. The plant will cost about $275,000.

THE NATIONAL CARBON COMPANY, Cleveland, Ohio, has recently issued its No. 35 carbon-brush catalog, which supersedes catalog No. 34. Some grades of carbon brushes previously listed have been eliminated and others added. The number of types of shunts used has been reduced.

THE ALTORFER BROTHERS COMPANY, Peoria, Ill., manufacturer of electric washing machinery, has recently opened a branch office in the Bush Terminal Building, New York City, and also has established warehouse facilities in New York. This office will have charge of the sales in the territory east of the Ohio-Pennsylvania line and north of the Virginia-North Carolina line. The company states that the A B C ironing machine will be ready for the market in a short time. Walter L. Williams is manager of the New York office.

THE BRIGGS & STRATTON COMPANY, 110 Wisconsin Street, Milwaukee, Wis., recently organized, has started operations at its plant for the manufacture of the Briggs-Stratton Mellowes electric refrigerator. The officers are: S. F. Briggs, president; W. F. Manegold, treasurer; A. W. Mellowes, general manager, and B. M. Stoddard, sales manager.

THE EMERSON ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., announces that new prices to the trade applying to list of spare parts for Emerson oscillating, non-oscillating and ceiling fans and to lists of spare parts for "Northwind" fans will be found in discount sheet No. 8100, dated Aug. 5, 1920, and effective that date. Discounts on power-motor spare parts formerly appearing in motor price book have been withdrawn and new discounts are being quoted on motor parts.

Supply Jobbers' Notes

THE RIGBY ELECTRIC SUPPLY COMPANY, Rigby, Idaho, and the Rexburg (Idaho) Electric Supply Company have consolidated and have opened a new place of business in Idaho Falls, Idaho, under the name of the Farm & City Electric Company.

THE BROOKLYN ELECTRICAL SUPPLY COMPANY, 56 Myrtle Avenue, Brooklyn, N. Y., has taken on several new lines within the past year and put two additional men on the road. The company celebrated its twentieth anniversary in June.

THE NEW ENGLAND ELECTRICAL SUPPLY JOBBERS' CLUB was the guest of Edwin C. Lewis, of the Lewis Electric Supply Company, Boston, at an outing held on July 13 at "Cedarholm," the residence of Mr. Lewis at Ponkapog, Mass. Twenty-one jobbing houses were represented.

Foreign Trade Notes

MARKET FOR ELECTRICAL FITTINGS IN ITALY.—While the demand for electrical fittings in Italy continues large, conditions have changed of late, as various local companies have been organized for the manufacture of these goods as well as electrical heating and cooking apparatus. There is, however, a great scarcity of all kinds of good electric light fittings which will take a long time to supply.

THE UNDER-FEED STOKER COMPANY OF CANADA, LTD., has been organized to take over the plant and property of the Jones Underfeed Stoker Company, Ltd. The new company is not only



OUTING OF NEW ENGLAND ELECTRICAL SUPPLY JOBBERS' CLUB

new in name and personnel but also in engineering and manufacturing advantages. To the experience of the former Jones Underfeed Stoker Company are added the engineering resources of the Underfeed Stoker Company of America. The officers are: Lloyd Harris, president; S. A. Armstrong, vice-president and managing director; James L. Ross, secretary.

THE ENGLISH ELECTRIC COMPANY OF AUSTRALIA, LTD., which is the alliance and extension of the Standard Waygood Hercules, Ltd., Sydney, and G. Weymouth Proprietary, Ltd., Melbourne, both of which were engaged in the manufacture and sale of electrical and allied machinery, has recently started operations. The new company is capitalized at about $2,000,000 and will develop the manufacture in Australia of electric machinery, etc. New works near Sydney are now being built and equipped.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A commercial agent in England (No. 33,481) desires to secure the representation of firms for the sale in South Africa of farm-lighting plants, etc.

A merchant in Italy (No. 33,482) desires to secure an agency for the sale of electric supplies, etc.

A member of a firm in Uruguay (No. 33,185) is in the United States and desires to purchase electrical equipment, farm-lighting machinery, etc.

Fabricantes Asociados de Maquinaria, Lonja del Comercio 540, Apartado 1766, Havana, Cuba, would like to communicate with electrical manufacturers or jobbers with a view to purchasing all the enameled and galvanized conduit it can obtain up to ten cars. The company would also like to get in touch with some of the larger electrical supply jobbing houses in the United States. H. W. Brooks is manager.

Trade Publications

CONDUITS.—The Garland Manufacturing Company, West Pittsburgh, Pa., is circulating two small leaflets, one entitled "Galvaduct" (galvanized) "Loricated" (enameled), covering its rigid conduits, and the other entitled "Sterling Flexible," describing its flexible armored conductor.

VALVE-CLOSING DEVICE.—The Cutler-Hammer Manufacturing Company, Milwaukee and New York, has issued an illustrated leaflet entitled "Extension to L Street Station, Boston," in which a brief description is given of the Dean control.

HEATING AND VENTILATING FANS.—The Buffalo Forge Company, Buffalo, N. Y., has issued catalog No. 421 on "Conoidal" fans for heating and ventilating purposes.

WATT-HOUR METERS.—"Instructions for Sangamo D-5 Watt-hour Meters" is the title of Bulletin No. 54 published by the Sangamo Electric Company, Springfield, Ill.

RADIO APPARATUS.—The General Radio Company, Cambridge, Mass., has issued bulletins Nos. 101, 201, 202, 301, 401, 501, 701 and 901, describing its different types of radio laboratory apparatus.

AIR COMPRESSORS AND PUMPS.—The Crowell Manufacturing Company, 298 Taaffe Place, Brooklyn, N. Y., is circulating two leaflets covering its type "A" and type "B" positive pressure blowers or rotary air pumps and type "D" rotary air compressors or vacuum pumps.

WOOD-STAVE PIPE.—Catalog No. 42 entitled "Wyckoff Wood Pipe," published by the A. Wyckoff & Son Company, Elmira, N. Y., describes its machine-made wood-stave pipe for waterworks systems, power plants, etc., and also Wyckoff's cypress steam pipe casing for underground and exposed steam and hot-water pipe.

WATERWHEELS AND GOVERNORS.—The Holyoke Machine Company, Worcester, Mass., has issued catalog No. 13, covering its different types of Hercules turbine waterwheels, and also a small booklet entitled "The Improved Governor," in which it describes its new governor for waterwheels.

VOLTMETERS AND INDICATING METERS.—The Roller-Smith Company, 233 Broadway, New York City, has recently issued bulletin No. 150, covering its small portable type H A voltmeters, ammeters and indicating wattmeters for alternating current.

SPUR GEARS.—"Gears from 'Standard of Baltimore' turn the Wheels of Industry" is the title of a booklet issued by the Standard Electric & Elevator Company, Inc., Baltimore, Md., describing the gears developed by the company in connection with general power transmission and special motor-driven apparatus.

New Incorporations

THE CALUMET MOTOR COMPANY, Houghton, Mich., has been incorporated with a capital stock of $100,000 to manufacture fractional-horsepower motors. The officers are Ocha Potter of Houghton, president, and John G. Bannetts of Calumet, secretary and treasurer.

THE ISLAND CITY ELECTRIC COMPANY, Long Island City, N. Y., has been incorporated by P. J. Shelley, W. A. Treadwell and W. S. Brown, Bridgewater, N. Y. The company is capitalized at $30,000 and proposes to manufacture electric lamps and other electrical products.

THE STEATITE ELECTRIC PRODUCTS CORPORATION, New York, N. Y., has been chartered with an active capital stock of $215,000 to manufacture electric heating equipment and appliances. The incorporators are T. D. Finizio, S. T. Moore and J. N. Strang, Yorktown Heights, N. Y.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

MANCHESTER, N. H.—The Board of Education will soon award contract for the erection of a practical arts high school to cost about $450,000. Electric lighting will be installed. C. R. Whitcher, 814 Elm Street, is architect.

MANCHESTER, N. H.—Contract will soon be awarded by the Board of Education for the erection of a high school on Notre Dame Avenue to cost about $300,000. Electric lighting equipment will be installed. W. E. Provost, 581 Union Street, is architect.

ATHOL, MASS.—Bids will be received about Sept. 10 by F. A. Ball, chairman of a committee, for the erection of a memorial community hall to cost about $250,000. An electric lighting system will be installed. Brainerd, Leeds & Kellogg, 89 Franklin Street, Boston, are architects.

ATTLEBORO, MASS.—New bids will be received by the First National Bank until Aug. 24 for the erection of a four-story office building and bank. Electric lighting equipment will be installed.

GREENFIELD, MASS. The town officials will soon receive bids for the erection of a high school to cost about $100,000. Electric lighting equipment will be installed. Address Harry Richardson, 23 Pleasant Street.

LANCASTER, MASS.—At a recent meeting the extension of the street-lighting system on Shirley Road was discussed.

LITCHFIELD, CONN.—Plans are being prepared for rewiring the city for electric light and power at a cost of about $40,000. F. O. Holm is city clerk.

Middle Atlantic States

LOUISVILLE, N. Y.—Petition has been made to the State Public Service Company by the Louisville Power Corporation for permission to construct a local electric plant.

NEW YORK, N. Y.—The New York Edison Company, Irving Place and Fifteenth Street, has plans under way for the erection of a new fifth Street to cost about $500,000. William Whitehill, 12 Elm Street, is architect.

UTICA, N. Y.—The Utica Gas & Electric Company was not included in the Adirondack Power Company merger as was erroneously reported in these columns on July 17.

YONKERS, N. Y.—Contract has been awarded to Fitzpatrick & McArthur of Yonkers by the Yonkers Electric Light & Power Company for the erection of a transformer station to cost about $150,000.

HACKENSACK, N. J.—Contract has been awarded to the W. H. White Construction Company by the building committee of the Hackensack General Hospital for the erection of a hospital addition and power house to cost about $150,000.

ALLENTOWN, PA.—Specifications will be prepared by William R. Schnabel, civil engineer of the Water Department, for furnishing one 12,000,000-gal. centrifugal pump and one three-stage, 7,000,000-gal. pump, one 500-hp. electric motor improvements, etc.

PHILADELPHIA, PA.—Bids have been received by the Ferguson Carpet Company, Stenton and Rockland Streets, for the erection of a power house, 40 ft. x 76 ft. Stewart A. Jellet, Real Estate Trust Building, is engineer.

BALTIMORE, MD.—The Columbia Graphaphone Company, 16 South Howard Street contemplates the installation of a 7,000 kw. generator for the operation of 568 motors from 2 hp to 150 hp each at its plant now being erected at Oramgeville.

FREDERICK, MD.—The installation of one 125-kw. generator to be belted to existing unit at the municipal electric light plant is contemplated.

FREDERICKSBURG, VA.—The power house at the government proving grounds in King George County has been destroyed by fire, causing considerable loss.

WASHINGTON, D. C.—Bids will be received at the office of the Chief Signal Officer, U. S. Army, Washington, D. C., until Aug. 26, for furnishing, under PR 4246-27CP, five 1-kw., 115-volt telephone motor-generators.

North Central States

BATH, MICH.—The Bath Electric Light & Power Company, recently organized with a capital stock of $5,000, contemplates the erection of a power house.

DETROIT, MICH.—Contract will soon be awarded by the American Machine Products Company, Eighteenth and Howard Streets, for the erection of a factory to cost about $45,000. Electric light equipment and wiring for power motors will be installed.

DETROIT, MICH.—The Public Lighting Commission, 40-56 Atwater Street, has awarded contract to the Contracting & Material Company, 3219 South Michigan Avenue, Chicago, Ill., for furnishing material and labor for installing electric light equipment on certain streets at $325,446.75.

DETROIT, MICH.—The Knights of Columbus, Detroit Council No. 305, 930 Woodward Avenue, is considering preparation of plans for the erection of a club house to include electric light equipment at a cost of about $500,000.

SUNFIELD, MICH.—Tentative plans will be prepared preparatory to an issue in bonds for a municipal electric light plant and for equipment for lighting in village.

CLEVELAND, OHIO.—The Masonic Temple Association, care of Albert Wright of the Otis Elevator Company, 1373 East Sixth Street, contemplates the erection of a memorial building to cost about $4,000,000. Electric wiring and elevators will be installed.

CLEVELAND, OHIO.—Bids have been received by city officials for furnishing one 10,000-kw. steam turbo-generator, condensers, auxiliaries and switchboard from the Merchants' Light & Heat Company, 2 West Washington Street, Indianapolis, Ind., $284,350, Westinghouse Electric & Manufacturing Company, Union Bank Building, Pittsburgh, Pa., $285,350; Allis-Chalmers, Park Building, Pittsburgh, Pa., $300,000.

DUBLIN, IND.—The erection of an electric light plant to cost about $9,700 is contemplated. Plans include the installation of a transformer, tower and switching equipment to cost $1,600.

EVANSVILLE, IND.—The Southern Telephone Company is considering placing all its wires in the fire district underground at a cost of about $15,000.

FORT WAYNE, IND.—The Board of County Commissioners has plans under way for the erection of a county farm building and power house to cost about $600,000. Charles R. Weatherhogg, Hamilton Bank Building, is architect.

INDIANAPOLIS, IND.—Work will soon be started on the construction of a power and boiler house for the American Hominy Company to cost about $45,000. The installation of generators, boilers and other considerable equipment, to cost about $45,000, will be made.

PETERSBURG, IND.—Bids will be received by the Board of County Commission until Aug. 30 for the construction of a court house to cost about $400,000. Electric wiring will be installed. Elmer E. Dunlap, 909 State Life Building, Indianapolis, is architect.

WEST HAMMOND, IND.—Contract has been awarded to the Broline-Nolan Company, 8 South Dearborn Street, Chicago, Ill., by the La Salle Iron Works, 2305 South Halstead Street, Chicago, for the erection of a steel plant to cost about $650,000 including equipment. Electrically driven machinery will be installed.

CHICAGO, ILL.—The Chicago Junction Railway, 38 South Dearborn Street, has plans under way for an addition to its power house and compressor plant to cost about $80,000.

NEW ATHENS, ILL.—The Probst Products Company of New Athens has been granted a twenty-year franchise, permitting the erection of a pole line to Lenzburg for furnishing electric power there.

APPLETON, WIS.—Preliminary plans are under way by the Wisconsin Telephone Company, 418 Broadway, Milwaukee, for the erection of an exchange addition to cost about $50,000. Switchboards, etc., will be installed. A. C. Eschweiler, Goldsmith Building, Milwaukee, is architect.

BARRON, WIS.—Contract has been awarded by the city officials to Otto Berg, proprietor of the Taylor Flour Mill, for the installation of power-plant machinery to supply power and light in Barron.

MAYVILLE, WIS.—Petition of the Mayville Business Men's Association, care of secretary, for an ornamental street-lighting system in Mayville has been signed, and the matter will be taken under consideration by the City Council.

PESHTIGO, WIS.—Plans are under way for an addition, 26 ft. x 29 ft., to the power house of the Oconto Service Company, T. A. Pamperin, president. Mead & Seastone of Madison are engineers.

PLYMOUTH, WIS.—The Service Motor Company contemplates the erection of a public garage to cost about $100,000. Electric wiring and power equipment will be installed.

PORT WASHINGTON, WIS.—General contract has been awarded by the city officials to the Nordberg Manufacturing Company, Chicago and Oklahoma Streets, Milwaukee, Wis., for furnishing, erecting and connecting one condenser. J. Cooney is city clerk.

SHEYBOGAN, WIS.—The St. Nicholas Hospital, care of P. Reiss, 1225 North Seventh Street, has awarded general contract for the erection of a power house at the institution to cost about $50,000. Frank Geib, 1439 South Ninth Street, is engineer.

SPOONER, WIS.—Contract has been awarded to the St. Paul Electric Company, 145 East Fifth Street, St. Paul, Minn., by the Apple River Milling Company for the erection of a 30-mile, 22,000-volt transmission line, including transformers, at about $30,000.

WEST ALLIS, WIS.—A new lighting system for Greenfield Avenue is under consideration.

CANNON FALLS, MINN.—The Cannon Falls Milling Company, E. O. Holm, general manager, 822 Flour Exchange Building, Minneapolis, Minn., contemplates the erection of a dam about 150 ft. wide, at Cannon Falls, to furnish power for its own use.

GENOLA, MINN.—Contract has been awarded to Bergquist & Dunphy for the erection of a high-tension transmission line from Genola to Pierz. J. A. Hagen is city clerk.

HIBBING, MINN.—Petitions have been circulated for the installation of an electric lighting system on First Avenue, South. J. P. Murphy is city clerk.

ST. CLOUD, MINN.—The city officials contemplate the installation of electric lights on part of Germain Street. A. W. Buckman is city clerk.

MASON CITY, IOWA.—The Masonic Cathedral Association contemplates the erection of a temple to cost about $250,000. Electric wiring will be installed.

VINTON, IOWA.—An issue of $45,000 in bonds has been approved by the voters for additions to the municipal light and power plant and waterworks, including the installation of an engine and generator.

FARGO, N. D.—The Union Light, Heat & Power Company, M. L. Hibbard general manager contemplates having repairs made to its electric and gas plant at Fargo.

GRAND FORKS, N. D.—Bids will be received by the North Dakota Industrial Commission until Aug. 30 for installing piping and all auxiliary equipment, some of which has not yet been purchased, in the power plant at the new terminal elevator. C. L. Pillsbury, 805 Metropolitan Building, Minnneapolis, Minn., is engineer.

MINNEWAUKEN, N. D.—Bids will be received until Sept. 8 for the installation of an electric light plant. G. A. Gilbertson is city auditor.

NEW ROCKFORD, N. D.—The General Utilities Corporation has rejected all bids for furnishing and installing generators and engine at its power plant. The project has been abandoned.

OSNABROCK, N. D.—Contract has been awarded to the Electric Construction Company, Grand Rapids, Wis., for the installation of an electric light and power plant.

VALLEY CITY, N. D.—Contract has been awarded to McManis & Tarnoski, 184 Endicott Building, St. Paul, Minn., for the construction of a power plant at $60,000.

WATERTOWN, S. D.—Contract has been awarded to the Electric Construction Company, 174 East Sixth Street, St. Paul, Minn., for a lighting system and "white way" in the business district at $54,800. Contract for residence district has not been awarded.

NEWMAN GROVE, NEB.—The Nebraska Gas & Electric Company plans to re-equip its plant and erect transmission lines.

BONNER SPRINGS, KAN.—The Bonner Portland Cement Company contemplates the installation of transformers at its plant. P. R. Ladd is chief electrician.

MONTEZUMA, KAN.—It has been suggested by the Mayor and the City Council to call an election for the purpose of voting bonds for an electric light plant.

SALINA, KAN.—Plans are being prepared by Study & Farrar, architects, Arcade Building, St. Louis, Mo., for the erection of an administration building and an addition to the existing power plant at the Wesleyan University to cost about $400,000.

Southern States

NEW SMYRNA, FLA.—At an election to be held on Sept. 7 a bond issue will be voted on for the purpose of installing an electric lighting plant.

MEMPHIS, TENN.—The Item Biscuit Company of Omaha, Neb., contemplates the erection of an electric power plant for factory service at its new plant at Memphis. The total cost is estimated at about $500,000.

OXFORD, MISS.—At an election to be held on Aug. 27 the proposal to issue bonds for improvements, repairs, etc., to the municipal light plant and waterworks will be submitted to the voters.

TULSA, OKLA.—Bids will be received by the Thompson Brothers & Hughes until Sept. 1 for the construction of an office building to cost about $750,000. Electric lighting equipment will be installed. Herbert L. Bass, 801 Hume-Mansur, Indianapolis, Ind., is architect.

FORT SAM HOUSTON, TEX.—Contract has been awarded to Graham & Collins of San Antonio for the outside electric distribution system included in the plans for the construction of thirty-seven corrugated-iron warehouses on which work has been started. The cost of the project is estimated at about $2,000,000. Lieut.-Col. Fidello G. Chamberlain is officer in charge of construction.

Pacific and Mountain States

ASTORIA, ORE.—The navy department has authorized extensive improvements to the local radio station to cost about $30,000.

REEDSPORT, ORE.—An election has been held for the purpose of submitting to the voters an issue of bonds to the amount of $50,000 for the construction, operation and maintenance of an electric light and power plant. J. K. Cavers is city recorder.

LOS ANGELES, CAL.—Bids will be received by the Board of Education, William A. Sheldon secretary, until Aug. 25 for electric wiring the gymnasium building to be erected on the Franklin High School site.

SACRAMENTO, CAL.—Bids will be received at the office of M. J. Desmond, city clerk, until Sept. 30 for furnishing nine power transformers ranging from 25 kv.-a. to 500 kv.-a. with auxiliary equipments and appurtenances; ten or more centrifugal pumps, from 1,000 to 11,000 g.p.m.; ten or more squirrel-cage induction motors from 50 hp. to 900 hp. or more; also one 10-ton electric crane, conduits, switchboards, etc., for the pumping and filtration works.

BRIGHAM CITY, UTAH.—An election will be held on Aug. 31 for the purpose of submitting to the voters an issue of $200,000 in bonds for rebuilding the municipal electric light plant.

SALT LAKE CITY, UTAH.—Owners of land in the Bonneville Irrigation District have voted to bond their property in the sum of $600,000 for the construction of an irrigation pumping system, including a power house. Plans call for two 500-hp. and two 900-hp. motors to be installed in the pumping station. Electrical energy will be secured from the 44,000-volt line of the Utah Power & Light Company.

KIMBERLEY, IDAHO.—An irrigation district is being organized in the Kimberly, Hansen and Murtaugh sections of Twin Falls and Cassia County, to irrigate 45,000 acres of land in what is known as the Hansen-Butte project. It is proposed to erect a pumping station on the Snake River near Murtaugh and generate electricity to operate the pumps, and also to have electric power for the tract.

Canada

BRANDON, MAN.—The Canada Gas & Electric Corporation contemplates the extension of its distribution system in Brandon. George Patterson is manager.

MINNEDOSA, MAN.—A bylaw has been submitted for the construction of a power plant having a capacity of 150 kw.-hr., to cost about $21,660.

WINNIPEG, MAN.—The civic power plant at Point du Bois was damaged by fire to the extent of $25,000.

FREDERICTON, N. B.—The New Brunswick Hydro-Electric Commission contemplates early construction work on the development of three water powers.

ST. STEPHEN, N. B.—The Mann Axe & Tool Company contemplates the purchase of 220-volt, 60-cycle, three-phase, alternating current induction motors as follows: One 10-hp., 900 r.p.m.; seven 20-hp., 1,200 r.p.m.; one 15-hp., 1,200 r.p.m.; one 10-hp., 1,200 r.p.m.

GODERICH, ONT.—The National Shipbuilding Company, W. H. Hutchinson, manager, contemplates the installation of electrically operated machinery for the handling of flax.

LONDON, ONT.—The erection of a new city hall to cost about $1,250,000 is contemplated. Electric light and elevator equipment will be installed.

SASKATOON, SASK.—A bylaw has been passed permitting extensions to the electric light and power plant to cost about $15,800. Andrew Leslie is city clerk.

Miscellaneous

WAILUPE, T. H.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., [illegible] building at Wailupe (specification 4259).

(Issued Aug. 3, 1920)

1,345,075. Device for Testing Pole Windings; Jasper F. Cullin, Detroit, Mich. App. filed Dec. 29, 1919. Polarity tested by compasses.

1,346,138. Flashlight Device; Paul C. Smalley, Newark, N. J. App. filed March 29, 1919. Lens insulates reflector from casing.

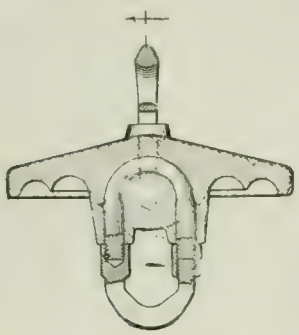
1,348,157. Apparatus for Amplifying Pulsating Electric Currents; Lee de Forest, New York, N. Y. App. filed July 22, 1915. Oscillating audions arranged in tandem or in multiple.

1,348,171. Switching-Over Device for Electrical Lighting Installations for Railway Trains and the Like; Hugo Grob, Zürich, Switzerland. App. filed Nov. 9, 1915. Operation depends on strength of generator exciting current.

1,348,198. Method of Building Inductor Elements for Dynamo-Electric Machines; Vincent G. Apple, Dayton, Ohio. App. filed May 20, 1918. Electrically welded.

1,348,206. Plate for Electrolytic Cells; Lewis W. Chubb, Edgewood Park, Pa. App. filed April 4, 1917. Large area plates.

1,348,207. Electrolytic Cell; Lewis W. Chubb, Edgewood Park, Pa. App. filed April 4, 1917. Formed of striplike elements.



1,348,248. Disk Suspension Insulator

1,348,201. Telephone-Exchange System; Edward E. Clement, Washington, D. C. App. filed July 15, 1907. Each trunk has a terminal selector switch for connecting subscriber's to idle trunk leads, to first selector, and each switch returns to zero after clearing.

1,348,213. Radio-Telephone System; Lee de Forest, New York, N. Y. App. filed Aug. 26, 1916. Using air jet.

1,348,236. System for Charging Storage Batteries; Thomas L. Mount, New York, N. Y. App. filed June 19, 1918. Adaptable to railway car service.

1,348,239. Electric Motor; Oscar H. Pieper and Alphonse F. Pieper, Rochester, N. Y. App. filed May 27, 1912. Totally inclosed.

1,348,248. Disk Suspension Insulator; Louis Steinberger, Brooklyn, N. Y. App. filed Jan. 24, 1917. Uniform arc-over value in dry and wet weather.

1,348,259. Insulating Knob; Louis Steinberger, Brooklyn, N. Y. App. filed Jan. 17, 1918. For telegraph keys.

1,348,263. Electrically Heated Shoe-Treeing Iron; Edwin N. Chandler, Braintree, Mass. App. filed Nov. 23, 1913. Simple construction.

1,348,348. Electric Regulation; John L. Creveling, Tucson, Ariz. App. filed March 14, 1916. Used with battery.

1,348,350. Incandescent Electric Lamp; Theron Davis, New York, N. Y. App. filed Nov. 14, 1917. Filament on mandrel.

1,348,359. Automatic Circuit-Breaker Switchboard; John P. Hayes and John E. Barnhart, Pittsburgh, Pa. App. filed Feb. 4, 1919. Three-pole breaker for mounting back of board.

1,348,394. Circuit-Continuing Device; Harry A. Douglas, Bronson, Mich. App. filed Aug. 15, 1918. Bayonet socket.

1,348,395. Circuit-Continuing Device; Harry A. Douglas, Bronson, Mich. App. filed Aug. 15, 1918. Bayonet socket.

1,348,434. Electrical Test Set; Eugene A. Johnson, Walla Walla, Wash. App. filed April 2, 1919. To cut meters in circuit.

Record of Electrical Patents

Notes on United States Patents

1,348,430. Teletypewriter or Printing Telegraph; Einar G. C. Lofgren, Minneapolis, Minn. App. filed April 21, 1916. Adaptable to standard typewriters.

1,348,434. Adapter for Electrode Holders; Oliver J. Marshick, Detroit, Mich. App. filed Oct. 31, 1919. To increase contact area.

1,348,456. Spark Indicator and Plug Tester; John S. Stevenson, Baltimore, Md. App. filed April 29, 1918. Auxiliary spark gaps.

1,348,467. Battery Plate; Arthur J. Adams, Milwaukee, Wis. App. filed Oct. 15, 1919. Grid arrangement.

1,348,469. Cylinder for Paper-Drying Machines; John E. Alexander, Port Edwards, Wis. App. filed Nov. 26, 1917. For replacing steam-heated cylinders.

1,348,477. Fan; Allen A. Canton, New York, N. Y. App. filed Aug. 20, 1919. Fan and heater.

1,348,506. Foot Warmer; Jose A. Mata, Berkeley, Cal. App. filed Nov. 25, 1919. Consists of guarded incandescent lamp.

1,348,530. Electrode Holder; Thomas Willard, San Bruno, Cal. App. filed July 25, 1919. Insulated holder, clamps by rotary motion.

1,348,534. Insulator Bracket; Charles H. Beine, Kenosha, Wis. App. filed June 29, 1918. Service wire clamp.

1,348,539. Electric Motor; Julius M. Breitenbach, New York, N. Y. App. filed March 23, 1917. Designed for differential of motor vehicles.

1,348,555. Engine Starter and Generator; Thomas R. Du Bois, Niagara Falls, N. Y. App. filed March 4, 1915. Double-unit starter and generator.

1,348,620. Protective Socket; Samuel L. Adelson, New York, N. Y. App. filed May 9, 1919. To prevent theft.

1,348,648. Electric Heating Element and Wiring Therefor; Sherman L. Kelly, Toledo, Ohio. App. filed Oct. 23, 1916. Reduces dissipation of heat from the under side.

1,348,717. Telegraph Instrument; Jose V. Guerra, Santiago de Cuba, Cuba. App. filed March 31, 1920. Adjustable.

1,348,752. Extensible Electrical Fixture; Roy E. Shaw, Spearfish, S. D. App. filed July 26, 1920. Reel device with spring for rewinding flexible extension cord.

1,348,780. Telephone System; Bryant D. Campbell, Oakland, Cal. App. filed April 3, 1917. Centrally controlled pay telephone system.

1,348,809. Rheostat; John G. Kjellgren, Cleveland, Ohio. App. filed Jan. 6, 1917. Track-welding rheostat made of many fine wires in parallel.

1,348,825. Method and Apparatus for Detecting Low-Frequency Impulses; Reginald A. Fessenden. App. filed May 21, 1917. For detecting submarines.

1,348,835. Switching Apparatus; Fritz Abdendorff, Wilmersdorf, Berlin, Germany. App. filed March 16, 1914. Automatic telephone switches.

(Issued Aug. 10, 1920)

1,348,907. Electric Power System; Ira T. Swartz, Indianapolis, Ind. App. filed June 23, 1917. Battery and generator set with relay devices for protecting battery against overcharge or undercharge.

1,348,909. Telephone Toll Circuits; John F. Toomey, New York, N. Y. App. filed Feb. 20, 1919. Cords for preventing inefficient operation by toll operators.

1,348,948. Electric Butt Welding and Molding Device for Metal Wheel Rims; Joseph W. Jackson, Anderson, Ind. App. filed July 11, 1919. Mold prevents burr at point of weld.

1,348,949. Adjustable Support for Electric Lamps; Johan P. Johansson, Fannalund, Sweden. App. filed April 19, 1919. Telescopic arm and weighted cord.

1,348,986. High-Tension Electric Machine; Charles Fayer, New York, N. Y. App. filed June 26, 1919. Improved insulation and accessibility of parts.

1,349,003. Commutator; Earle P. Lee, Rochester, N. Y. App. filed Aug. 20, 1918. Method of temporarily connecting leads to risers during winding.

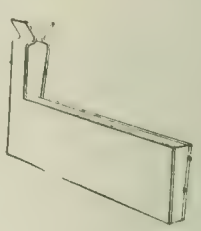
1,349,053. Non-Metallic Resistance Element and Process of Making Same; Alexander L. Feild, Lakewood, Ohio. App. filed June 16, 1919. Contains titanium carbide, zirconium oxide and boric anhydride.

1,349,100. Dynamo-Electric Machine; William T. Reynolds and Bruce A. Reynolds, Port Arthur, Tex. App. filed May 4, 1918. Solenoids rotate shaft by means of crank.

1,349,103. Radio-Signaling System; James H. Rogers, Hyattsville, Md. App. filed May 2, 1917. Horizontal antennæ with grounded plates at ends.

1,349,104. Radio-Signaling System; James H. Rogers, Hyattsville, Md. App. filed Jan. 17, 1918. Horizontal antennæ.

1,349,130. Heating Apparatus; William S. Hadaway, Jr., New Rochelle, N. Y. App. filed March 4, 1916. Japanning oven heated by electrically superheated steam.



1,349,003. Commutator

1,349,131. Heating Apparatus; William S. Hadaway, Jr., New Rochelle, N. Y. App. filed March 4, 1916. For electrically superheating steam.

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Electrical World

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The Electrical Home Idea

THE stimulation which has been given the use of labor-saving household appliances by the "electrical home" idea, now rapidly spreading in the West, means much more to the industry than the kilowatt-hours used or the sale of the millions of dollars' worth of equipment. It means that the dwellers in these homes will have a deeper appreciation of the fundamental necessity of electricity if properly directed and encouraged by the electrical industry. These people will be builders of public opinion most favorable to the better regulation and easier financing of electrical developments. The thing to do is to sell the electrical idea with the electrical home idea.

Cost and Competition for Money

PUBLIC utility financing in years gone by called for the best thinking of the executive and operator in management and operation. Today nothing short of ingenuity and persistence, based upon the results of the foresight originally displayed in building for the future, is keeping the business on a going basis. To the increases in costs of operation and construction have been added difficulties in getting money for needed expansion in the form of competition from Canadian securities and those of foreign governments with a rate of return better than 8 per cent, as well as from the securities of industries in which the risk is sufficiently small to destroy interest in public utility paper that returns less than 8 per cent. To commissions the utilities are looking for a remedy through the granting of such increases in rates for service as will enable them to compete for money on a fair basis. This relief, already postponed too long, should come with little delay on the presentation of the required evidence, for when the process of deflation has been completed and the wreckage cleared away the assured stability of public utility investments will be evident.

A Queer Municipal Point of View

VIGOROUS protests have arisen in the city of Sheffield, England, over the action of the municipal authorities in adopting a flat rate for electrical energy regardless of its use. The city government holds that the cost of generating every kilowatt-hour is the same at any given moment, that it is no concern of the city to what use it is to be put, and that all must pay alike except for uniform concessions on a sliding scale to large consumers. The manufacturers naturally cannot see either policy or justice in thus wiping out the distinction between motor service and lighting service, and they maintain that if the flat-rate charge is enforced the effect on the rapidly spreading electrification of mills and factories will be disastrous. It would seem at this distance as if the officials of the British city are little likely to increase the popularity of municipal ownership by flying in the face of expert knowledge and accumulated experience.

Cut Glare and Save Energy

GLARE will probably, like the poor, be always with us, but the wise user of electric illumination will never relax his efforts to reduce this disturbing and wasteful characteristic. Misdirected light is generally synonymous with excessive consumption of electrical energy. The demand for electric service is growing fast and in many cases cannot be supplied as rapidly as is desired. There is a direct relation between giving a community better and larger service and campaigning against careless and spendthrift uses of plant output. Even if bills are reduced in individual cases by the cutting down of glare and the correct distribution of luminous flux, little likelihood exists of permanent loss of revenue. New uses of electricity in old establishments diversify the load, tend to increase plant efficiency and spread patronage, all to the betterment of the investment.

Aëroplanes in Hydro-Electric Construction

SUBSTITUTION of the aëroplane for the automobile in inspection work by the construction engineer of the San Joaquin Light & Power Corporation marks the entry of this mode of transportation into hydro-electric construction in the West. Other uses may be expected to follow, for the plans of the Southern California Edison Company for its new plants in the High Sierras include the employment of bombing planes to transport construction materials. Where the projects are situated great distances from engineering headquarters, with the country rough and mountainous and the trails narrow and precipitous, the aëroplane enables a start to be made on construction work several months earlier than would be possible by building the necessary roads. Other obvious uses of the aëroplane include the spotting of men and material in inaccessible places, the patrolling of long transmission lines and the locating of special trouble arising from storms or floods.

Segregate Industrial Loads

UNLESS active steps are taken by many central-station companies to reclassify their connected industrial loads, serious errors are sure to creep into unit cost and revenue analyses of the power business. On numerous systems the motor load so far overbalances the heating output that at present no great harm is suffered in figuring yearly revenues per horsepower connected, average energy sales per horsepower installed, new-business expenses, installation outlays and other items of interest in the scientific management of central-station operations. In other cases, however, electric

furnaces, welding outfits, ovens, large cooking installations and diversified apparatus of growing importance are absorbing so much energy and yielding so much desirable income that a proper analysis of the results of such business demands a separation for statistical purposes of this class of load from motor service. State commissions should modify their annual return forms to provide for this separation of data, and operating companies on whose systems the industrial heating load is important can well afford to establish and to maintain the necessary equipment and the corresponding performance records.

The Complete Automaton

STATIONS substantially automatic have been described from time to time, and we now are pleased to greet what seems to be quite the nearest approach to a reasoning mechanism that has yet been devised. The mechanism in point, described in this issue by S. G. Leonard, is that of several automatic industrial substations for the big plant of the Packard Motor Company at Detroit. The plant had quite outgrown the economic range of its own direct-current system, so the situation was met by taking three-phase energy at 4,600 volts from the central station and setting up at strategic points along the direct-current bus system automatic motor-generated substations each of 1,500 kw. capacity. The sensational feature of the installation is not, however, in the unusual size of the automatic units but in the application of automatic working to synchronous motor drive, obviously of great importance in a case like this.

The substation starts, if the direct-current bus voltage is abnormally low for five seconds, by energizing the motor through an auto-transformer, bringing it up to synchronism and then transferring it to the running connection. Then the direct-current generator, having been brought close to the bus voltage, is thrown in and the voltage is adjusted to 250, where it is held up to 125 per cent of full load, above which point the voltage is automatically lowered until the load is at that limit. Below this point the control is shifted to voltage regulation for 250 volts unless the load drops below 15 per cent for a predetermined period, when the motor-generator automatically retires from service until again needed. Besides all this there are the usual relays against overload or reverse current on either side, plus protection against overheating of the machines or their bearings and overspeed.

One must read in detail the various items of this extraordinary system of automatism fully to appreciate it, but its most remarkable feature is the bringing of the big motor into synchronism and full action. This is accomplished by taking advantage in a highly ingenious fashion of the sudden drop of the alternating starting current as the motor falls into synchronism and the simultaneous building up of the exciting current derived from the direct-current machine. The co-operative character of these changes is fully shown in the diagram of connections. The situation calling for such an elaboration of automatic devices is a rather exceptional one, but it has been met by a most remarkable display of resourcefulness, and we shall be surprised if the final result is not an admirable one. Although minor difficulties may develop and require symptomatic treatment, the installation represents a long step ahead toward that full self-control that will go far to promote the interconnection of groups of auxiliary electric plants.

Arcing Grounds on High-Tension Lines

IN THE modern electrical engineering laboratory a number of arc oscillators have come into use for the purpose of generating a sustained series of electrical oscillations, usually of high frequency. The electrical oscillations so produced are ordinarily utilized either for heating or for electric communication. Although these arc oscillators differ in many ways among themselves, yet they all have the characteristic habit of producing an oscillatory discharge in a conducting path, thereby lowering the potential at the arc. The arc is then weakened. The potential thereat rises to a point where the discharge becomes reinforced, and so on in indefinite cyclic repetition. It sometimes happens by mischance that conditions at some weak point on a transmission line lead to an arc discharge which is able to establish recurrence automatically. Each such discharge may set up a series of powerful transient surges along the line. Under these circumstances a persistent generator of oscillations may be formed. If the discharge to ground is powerful, so that many amperes pass through the arc, the rupture of the discharge may set up enormous transient voltages. The most objectionable feature of the combination is that it tends to be persistent, so that the insulators and insulating system are subjected to prolonged overstress.

In an article on the subject this week by W. D. A. Peaslee a special form of artificial transmission line is described, together with the measurements made of an artificial arcing ground's characteristics. The quantitative relations involved are by no means easy. Many measurements of this kind, under various and regulated conditions, will be necessary before a satisfactory theory of the phenomenon is likely to be obtained. It is, however, comforting to see a beginning made in the quantitative investigation, and the method described should prove helpful to other researchers.

Electric Vehicles in City Service

IN THE Digest section of the ELECTRICAL WORLD recently reference was made to a study of the electric vehicle situation which deserves more than a passing thought. The problems concerned are substantially alike the world over, and here, as abroad, the really vital one is the provision of adequate charging facilities. The most vigorous drive to promote the use of electric vehicles is doomed to failure if there is constant trouble with prompt and proper charging. The special field most usefully covered is commercial and convenience traffic in urban and suburban territory. As to the first, the very general adoption of the eight-hour day makes horse-drawn trucks particularly uneconomical, and the rising cost of gasoline seriously affects the ordinary power truck even now, with worse conditions in prospect. There are, too, other adverse conditions in its use which cannot be neglected. Any one who takes notice of the actual operation of the ordinary delivery car observes that the engine is seldom stopped for a delivery of goods but is kept running while a boy scatters an armful of packages at several neighboring

houses. A short run and the performance is repeated, and so on for hours.

For the purposes of vehicles designed to run around over a moderate area, electric drive is uniquely simple and convenient. For either light or heavy service electric trucks can now be had at a reasonable price, and the batteries have been improved until, when properly cared for, their endurance is admirable. Right here comes the rub—insuring that necessary care. We see no other way than the provision of service stations in sufficient number and capacity to give the electric vehicle owner a fairly easy time of it. It is futile to answer that once there are a multitude of electric cars in use service stations will naturally spring up—for you cannot get the multitude without them.

Lack of convenient charging facilities is the main reason that the electric vehicle, with all its manifest advantages, lags behind its opportunities. The advent of cheaper, lighter and more efficient forms of electric vehicles is only a step in the right direction, for the real trouble lies in the small mileage of motive power carried, combined with lack of facilities for supply and lack of care. To insure care requires the active cooperation of manufacturer and central station. The field is so good for both and the progress made of late so real, even on a modest scale, that it is high time to push on. But no amount of boosting will do real and permanent good if the charging facilities remain lacking.

Industrial Power in California

CALIFORNIA is the banner state in the development of electric service. It furnished the cradle of modern power transmission and has assiduously nourished it into full growth. No other state shows so general a distribution of power supply or so large a proportion of its people availing themselves of it. One does not wonder, then, that in industrial work California shows the leadership that is indicated in the preliminary survey published in this week's issue. No data of this sort can be made absolutely complete, but they do in this instance give a correct indication of the situation as it is. Broadly, they show that more than five-sixths of the rated horsepower of the motors in the 300 large industrial works on which reports have been received is operated on purchased energy. Less than 5 per cent of the power comes from isolated plants and most of this in cases where the fuel is a byproduct. The causes of so remarkable a result are clear. In the first place, the state is pretty much a continuous network of transmission and distribution lines from which power can be obtained at a moderate price. The use of this power has been intelligently exploited, and recent conditions in industry have tended to make motor drive imperative.

Such conditions are really dominant, for the high cost and relative inefficiency of labor call for the utmost that can be done in efficient labor-saving devices. Experience has very plainly shown that motor drive is the foundation upon which such achievements are built. The list which we publish indicates the varied nature of the industries for which these conditions hold, and that, despite California's great supply of fuel oil, transmitted power holds the field. Our readers will do well to study these data from the Pacific Coast with particular reference to the situations elsewhere. Of course, the hydro-electric resources of the East are less extensive, and until recently fuel has been relatively cheap. That advantage is disappearing and it cannot come back. Everything indicates that fuel, and particularly the transportation factor in its price, will remain high. The obvious inference is that industry must more and more rely on hydro-electric power or power generated by fuel at the highest possible efficiency. The big central stations have risen to the occasion and are extending their lines, yet they are chiefly of urban utility, and it is to the extension of industry over the whole country that we must look for ultimate and permanent prosperity. Therefore, there cannot too quickly be the fullest possible extension of the supply of electric power, following the good example set by California. The nation's biggest problem today is the distribution of industry, not its concentration.

Establishing a Simple Basis for Rates

THE incursions which public demands for power have in recent time been making upon the maximum supply which central stations are able to deliver has made it necessary to scan more closely the plants and factories which operate at low power factors. Such customers' plants not only take a reduced amount of active power from the volts and amperes they absorb from the mains, but they also prevent other customers from receiving their due share of power when the central-station generators are working up to their volt-ampere capacities.

The consensus of opinion at the White Sulphur Springs convention of the American Institute of Electrical Engineers last June was that the power factor of any polyphase system, balanced or unbalanced, should be defined as the ratio of the total active to the total apparent power, and is obtained from the ratio of the total active and the total reactive components, as recorded by polyphase active wattmeter and polyphase reactive wattmeter respectively. It was held that the unbalance factor should be separately defined and taken into account in the contracts.

Last week we printed a paper by Ray H. Wolford, on a plan for establishing rates based on a different scheme of measurements. It is proposed to measure the total active energy consumed, by means of a polyphase watt-hour meter, to the usual degree of precision, in the usual way, and also to install a special instrument consisting of a three-phase, four-wire, three-current-coil polyphase watt-hour meter so modified, adjusted and connected as to record total voltampere-hours, or total apparent energy consumed, with a more limited degree of precision. By the use of an ordinary block-interval demand meter, controlled through the usual contact-making devices, it is proposed to secure a maximum-demand record in kilovolt-amperes, that is to say in apparent power.

The plan of operating a watt-hour meter in such a manner as to record apparent energy on its dial is ingenious, but necessarily limited in precision, except when the power factor is constant. It is claimed, however, that the power factor may vary over a considerable range without introducing a large error in the record, and that the degree of precision secured is commercially sufficient for ascertaining the maximum demand. This is an interesting subject for discussion among central-station managers.



W. Winans Freeman

A public utility executive whose ideas and ideals of electric service have been widely reflected in the policies and practices of the industry

FOR the past ten years W. W. Freeman has been an influential counselor on matters of public policy in the National Electric Light Association. For 1910 and from 1914 to 1919 he was chairman of its committee dealing with these matters. This recognition has been accorded to him largely on three counts: He came up through the ranks of a large central-station organization; he has studied from all angles the components of good service and the ways by which an understanding of good service will capture the good will of the public, and he conceived in the beginning the value of commission regulation and has untiringly fought for a fair consideration of the service functions of the utility and the needs of the public. Mr. Freeman's rise in public utility affairs has been due to clear thinking and honest, ambitious effort. He was born in Canada June 8, 1872, and received his education in that country, but came to the United States at the age of seventeen. He was first employed as a stenographer in the office of the Edison Electric Illuminating Company of Brooklyn, but was advanced rapidly to be secretary to the general manager, assistant secretary of the company, then to be secretary and treasurer, and finally to be the active head of that organization with the title of vice-president and general manager. In 1913 he resigned to become American representative of the English financial house of Sperling & Co., which had large investments in public utilities in the United States, Canada and Mexico. In 1914 he became associated with the Columbia Gas & Electric Company as vice-president, assuming executive direction of that company's properties in Ohio and Kentucky, with headquarters in Cincinnati. In that city he is president of the Union Gas & Electric Company, one of the above-mentioned properties.

Mr. Freeman has served as president of the National Electric Light Association and of the Association of Edison Illuminating Companies. Last year he was elected president of the Society for Electrical Development in recognition of this knowledge of conditions in the electrical industry and his ability to assist in working out the comprehensive program of promotional work which that society has been engaged in since the close of the war. His success in this undertaking is evidence both of his whole-hearted, unselfish devotion to the electrical industry and the thoroughness with which he does things.

First Automatic Industrial Substation

Motor-Generator Set of 1,500 Kw. Is Installed at Load Center and Automatically Takes Load When Voltage Drops — Automatic Features Will Reduce Operation Cost, Give Improved Service and Reduce Light Load Losses

By S. G. LEONARD
Switchboard Engineering Department Westinghouse Electric & Manufacturing Company

THE present trend in industrial plants to spread over considerable ground area has brought forth several problems which are not present in smaller plants. Of these problems the supply of electrical energy for the motors and control apparatus in the shop has met with some difficulties, especially when direct-current energy is used. When it is planned to utilize the energy at some distance from the power plant a large investment in copper for buses is necessitated and poor voltage regulation may result. An obvious remedy is to change to alternating-current supply and to convert this to direct-current energy at the load.

The Packard Motor Company of Detroit encountered this trouble in supplying a heavy load from direct-current generators. The peak load on this plant is 24,000 amp., and it is expected that it will increase to 30,000 amp., in the near future. The power station is near the center of the factory, and the distribution requires a heavy bus run in a tunnel the full length of the buildings. The voltage drop at the end of the bus is considerable, and the I^2R loss consequently is large. To improve the voltage regulation and to provide for the increasing demand it has been decided to purchase alternating-current energy from the central station and to install a number of substations along the plant bus, at points as near the large load centers as possible. This will permit the removal of some of the present copper. These substations are to be made full automatic, in order to obtain further economy, and there is now building the full automatic control equipment for two of these substations. Each is to control one motor-generator set with a 4,600-volt, three-phase, 60-cycle synchronous motor and a 1,500-kw., 250-volt, two-wire direct-current generator. The field of the synchronous motor is to be excited from the direct-current generator.

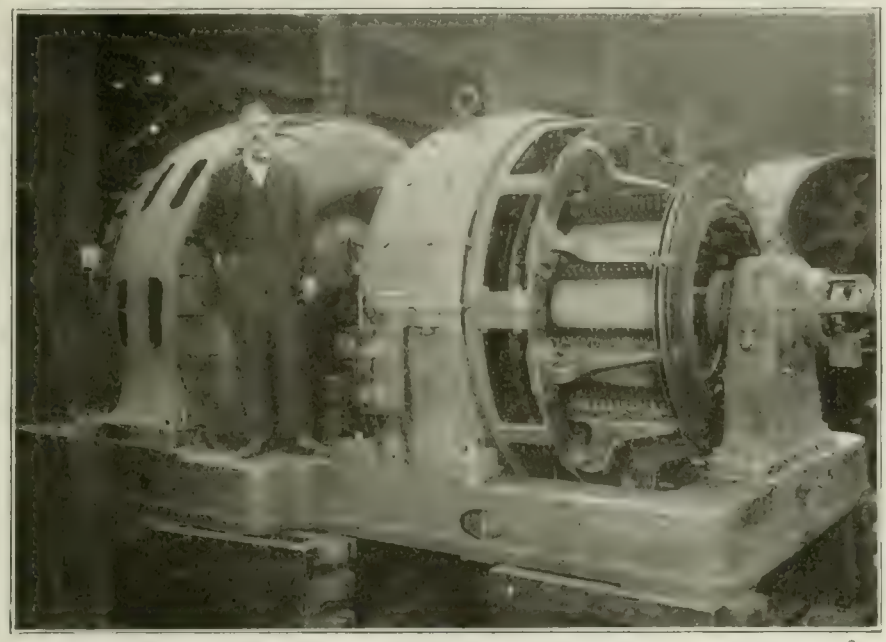


FIG. 1—1,500-KW. MOTOR-GENERATON SET FOR AUTOMATIC OPERATION IN PACKARD MOTOR PLANT

The control features of this station can be summarized as is indicated in the following paragraphs:

(a) The station starts if the direct-current bus voltage lowers and remains down for more than five seconds.

(b) The alternating-current motor is connected to the auto-transformer, brought up to speed and, when in synchronoism, transferred to the running position using a transition scheme of change-over.

(c) The direct-current generator voltage is automatically adjusted to within a small percentage of the bus voltage before the direct-current carbon breaker is closed.

(d) After the carbon breaker is closed the voltage is automatically adjusted to 250 volts and maintained at that point until the load on the generator has reached 125 per cent full load.

(e) If the concentration of load adjacent to the automatic station becomes so great that an overload is thrown on the machine, the voltage will be automatically lowered until 125 per cent full load is carried.

(f) Whenever the load falls so that there is less than 125 per cent full load on the machine, the control is restored to a voltage-regulating relay and the bus will be held at as near 250 volts as possible.

(g) If the machine carries less than 15 per cent of its rated load for a period of time accurately adjustable from three to twenty minutes, the station will be automatically taken out of service.

(h) Automatic protection is provided against alternating-current overload, alternating-current low voltage, alternating-current failure or phase reversal, direct-current reverse current, direct-current overload, overspeed, hot bearings and too high machine temperature.

(i) The operation of the entire equipment depends only on the sequence of operation of relays and contactors which function as a direct result of the electrical condition present at the time of operation.

By reference to Figs. 2 and 4 the sequence of operation may be traced as follows: When the voltage on

the shop bus falls below a predetermined value, for example 90 per cent of normal or below, the station is started. The contacts of the primary direct-current voltage relay (1) close and a circuit is established if the knife switch is closed, energizing the coil of alternating-current voltage time-delay relay (2). At the end of a definite time interval, which may be adjusted accurately up to a maximum time of five seconds, the contacts of this relay close. The time element prevents the station responding to momentary reductions in direct-current bus voltage, and in addition prevents the station from starting in case the alternating-current-voltage is abnormally low. The closed contacts of the alternating-current voltage relay (2) complete a circuit which closes a two-pole, 50-amp. master relay (3), thereby energizing the auxiliary control bus *A*-1. The relay completes its own holding circuit, making further functioning of the control apparatus independent of line voltage. Energizing of the auxiliary control bus *A*-1 energizes also control bus *A*-2 until after direct-current carbon breaker (12) closes. This is an 8,000-amp. carbon-type, electrically operated, non-automatic breaker connected between the positive side of generator and the positive shop or line bus. Its closing coil is operated from direct-current energy. Upon closing, the breaker latches in, and the voltage must be cut off from the closing coil. Shunt relays (4 and 6) similar to the two-pole master relay close and in turn close the alternating-current star point breaker (5) and the alternating-current starting breaker (7). These breakers are oil-immersed, three-pole, single-throw contactors which are closed by means of alternating-current magnets. The contacts are held closed by keeping voltage applied to the operating coil and are not mechanically latched. The first-mentioned breaker is used for connecting an end of each auto-transformer to a common point, thus forming a star point. The second breaker is used for connecting the synchronous motor leads to the starting taps of the auto-transformer. Both breakers have several mechanical interlocks. Thus this operation starts the motor-generator set.

As the set comes up to speed the starting current decreases until synchronism is reached, when it takes a sudden drop. The field of the synchronous motor, directly connected at all times to the armature of the direct-current generator for excitation, has an induced emf. generated in it which opposes the tendency of the generator to build up its voltage until the motor pulls into step, after which the generator builds up in the normal way, thus increasing the motor-field excitation to normal. Use is made of the combination of these two phenomena to indicate synchronism, as follows: A low-current induction-type indicating relay (9), the contacts of which open on over current, is connected to the secondary of a current transformer in the starting-tap circuit, and the coil of the field current relay (8) is connected in the motor-field circuit. While coming up to speed the large motor armature current keeps the contacts of the indicating relay (9) open, and the contacts of the field current relay (8) are open. When the motor pulls into step the contacts of these relays (8 and 9), which are in series, close, thus completing a circuit which operates an alternating-current shunt relay (10). This relay completes its own holding circuit and in addition short-circuits the coil of the alternating-current shunt relay (4), which opens, and opens the star-point breaker (5).

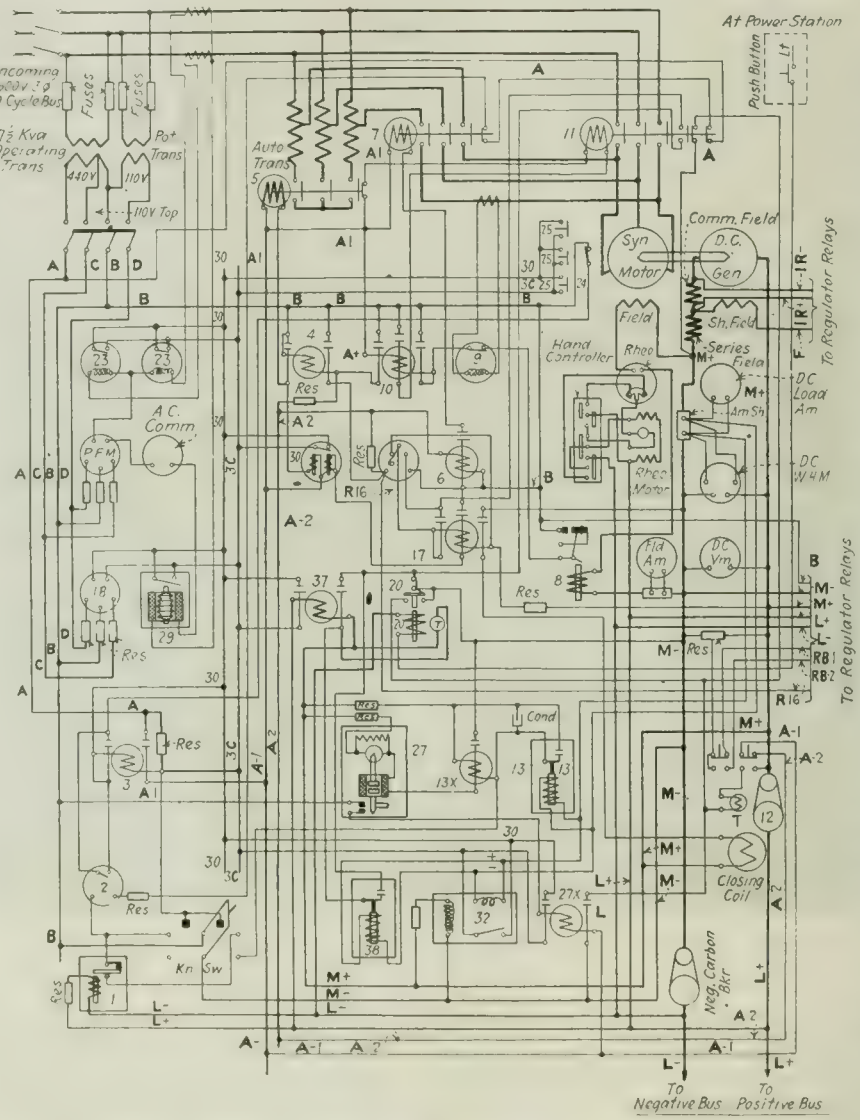


FIG. 2—DETAILED WIRING SCHEME FOR AUTOMATIC CONTROL OF SUBSTATION

This leaves the machine connected to the alternating-current line through the auto-transformers, which act as reactances and hold the synchronous motor in step. As the star point breaker (5) opens, an interlock on it completes a circuit which closes the running breaker (11).

While the set is coming up to speed the voltage-balancing relay (39), which is shown in the diagram Fig. 3, has its contacts (39-R) closed. This means that the secondary relay (14-R) operates and tends to raise

the generator voltage. While the alternating-current shunt relay (4) or secondary relay contact (14-R) is closed the coil of the time relay (16) is short-circuited and does not operate. As the generator voltage builds up after synchronous speed is reached, the voltage-balancing relay (39) operates to balance the generator voltage against the direct-current bus voltage. After these remain equal for two or three seconds the short circuit around the coil of the time relay is removed (16), and its contact on closing energizes the coil of the direct-current shunt relay (17), which closes and thus closes the positive generator breaker (12). This breaker in

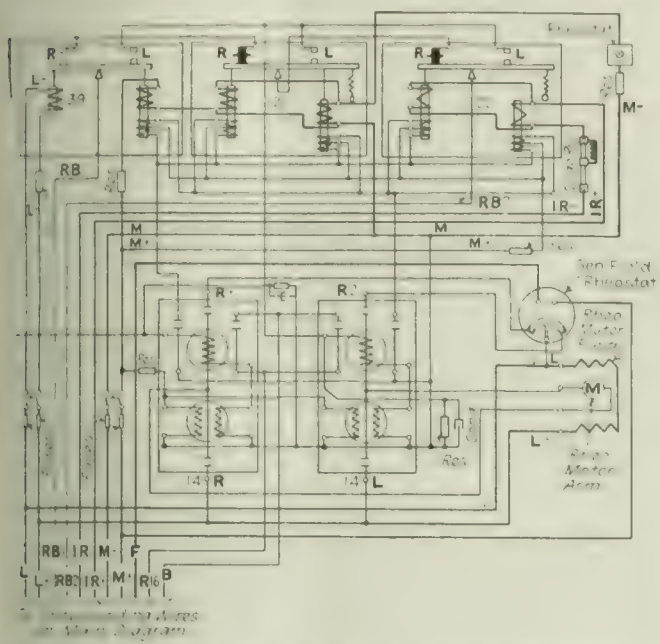


FIG. 3—SCHEMATIC DIAGRAM FOR VOLTAGE-REGULATING EQUIPMENT

closing deënergizes bus *A*-2, and thus opens the starting breaker (17) when the alternating-current shunt relay (6) opens. This time relay (16) returns to zero position after two or three seconds, and its back contact short-circuits the coil of the direct-current shunt relay. (17). This direct-current shunt relay opens and thus removes voltage from the closing coil of the positive machine breaker (12), so that it remains mechanically latched.

The closing of the positive machine breaker (12) takes the control of the field-rheostat (14-R and 14-L) contactors entirely away from the voltage-balancing relays (13-R and 13-L) by opening an auxiliary switch on the positive machine breaker (12). Control is now given to voltage regulating relay (21) and overload limit relay (22).

The contact beam of the overload limit relay (22) acts so that the contacts (22-R) are closed until the load on the direct-current generator reaches 125 per cent normal as indicated by the millivolt drop across the commutating-pole field winding to which the coils of this relay (22) are connected. With the contact (22-R) closed the position of the contacts of voltage-regulating relay (21) governs the control of the secondary relay (14-R and 14-L) and thus the generator voltage.

As the generator has just been connected to the direct-current bus the contact of the voltage-regulating relay (21-R) is closed and the voltage rises until the 125 per cent load point is reached or until the generator voltage is brought to 250 volts, at which point it will remain. If the load on the set increases the overload relay contact (22-L) closes, operates the secondary relay (14-L) and lowers the field excitation to reduce the generator voltage.

It is thus seen that before paralleling the generator on the bus the generator voltage is balanced against the bus voltage by means of the voltage-balancing relay (39), and the two voltages must remain equal for two or three seconds. After connecting the generator to the bus the control of load is taken up by the voltage-regulating relay (21) and the voltage is kept at 250 volts unless the load reaches 125 per cent normal, at which point the control is taken over by the overload limit relay (22) to reduce the generator voltage until satisfactory load is obtained.

ANTI-HUNTING FEATURE OF REGULATOR EQUIPMENT

The automatic regulator diagram shows extra coils at the bottom of each plunger. Suppose the voltage-regulating relay operates to raise the voltage of the generator, the contact of the voltage-regulating relay (21-R) closes and establishes a circuit to operate the secondary relay (14-R). An interlock on this relay energizes one-half of the extra anti-hunting coils. This causes the contact of these two relays (21-R and 14-R)

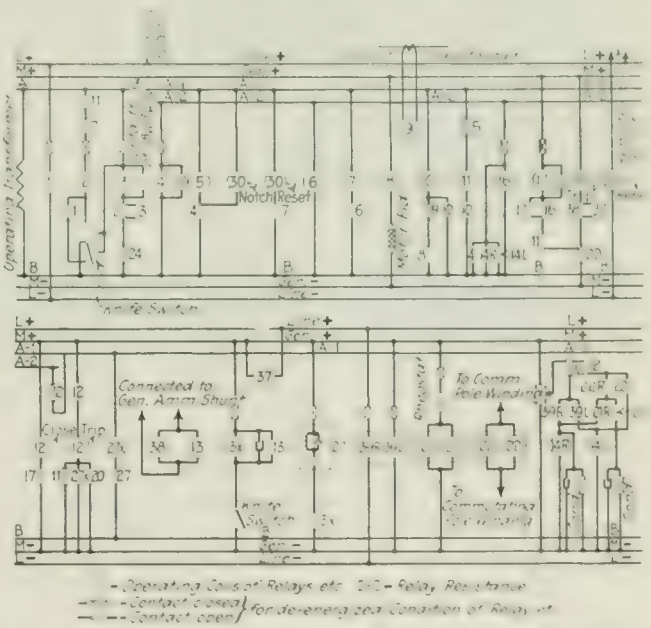


FIG 4—SIMPLIFIED DIAGRAM OF RELAY CONNECTIONS

Key to Apparatus:

1. Primary d.c. voltage relay.
2. Time-delay relay.
3. Master relay (d.c. shunt).
4. A.c. shunt relay.
5. Star-point breaker (contactor in oil).
6. A.c. shunt relay.
7. Starting breaker (contactor in oil).
8. Field-current relay.
9. Low-current indicating relay.
10. A.c. shunt relay.
11. Running breaker (contactor in oil).
12. Positive machine breaker (electrically operated).
13. Underload relay.
13x. D.c. shunt relay.
14R. Secondary relay (closed when raising field excitation).
14L. Secondary relay (closed when lowering field excitation).
16. Time relay (single-pole, double-throw).
17. D.c. shunt relay.
18. Low-voltage and reversed-phase relay.
20. Lock-out relay.
21. Voltage-regulating relay.
21R. Closed when raising voltage.
21L. Closed when lowering voltage.
22. Overload-limit relay.
22R. Closed on underload.
22L. Closed on overload.
23. A.c. overload relays.
24. Overspeed trip.
25. Bearing thremostat.
27. Underload-delay relay.
27x. A.c. shunt relay.
29. Thermal relay.
30. Lock-out relay.
32. D.c. reverse-current relay.
37. Overvoltage relay.
38. D.c. overload relay.
39. Voltage-balancing relay
39R. Closed when raising voltage.
39L. Closed when lowering voltage.

to open before the machine voltage actually reaches the voltage desired. This is done because the generator voltage change lags a little behind the change in field current.

Suppose the voltage-regulating relay (21-L) closes to lower the generator voltage. The secondary relay (14-L) operates and starts lowering the voltage. An interlock on this relay energizes the other halves of the anti-hunting coils and so causes the contact of the voltage-regulating relay to open and the rheostat motor to stop before the voltage actually reaches the desired point. The voltage then settles after a short time to a value corresponding to the field excitation. The anti-hunting coils operate in a similar manner on overload-limit relay (22) and voltage-balancing relay (39).

Method of Shutting Down

Shutting down of the motor-generator set is dependent upon the position of the underload relay (13). When the load on the generator falls to or below a predetermined value the contacts of this relay open and thereby allow the direct-current shunt relay (13-X) to close.

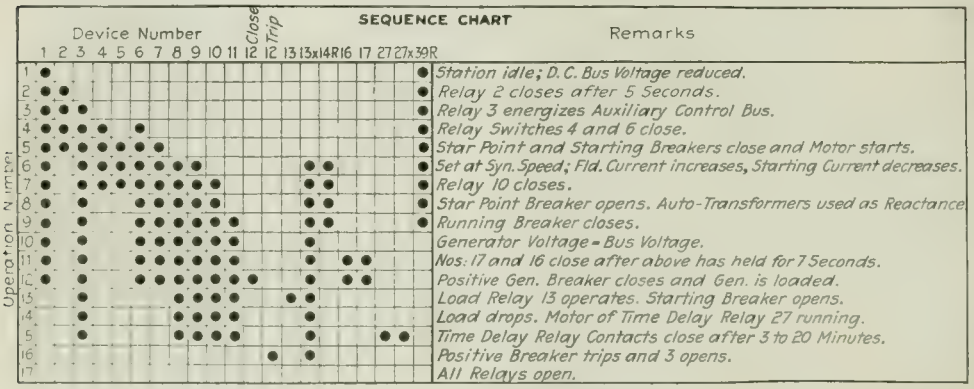


FIG. 5—SEQUENCE CHART FOR AUTOMATIC SUBSTATIONS

This completes a circuit which starts the motor of the underload delay relay (27). If the underload is maintained for the time for which the underload delay relay is set, its contacts close, operate the alternating-current shunt relay (27-X) and energize the shunt-trip coil of the positive machine breaker (12) to open the breaker. At the same time, another contact of the alternating-current shunt relay (27-X) short-circuits the coil of the master relay (3) so that it opens, de-energizes auxiliary bus *A*-1, and all the contactors and relays open.

Protective Features of Station

Reverse-phase starting and single-phase starting are prevented by the closing of the contacts, of the reverse phase and the low-voltage relays (18), which short-circuits the coil of the master relay (3).

Low Voltage.—If the alternating-current line voltage is too low for satisfactory operation, the time-delay relay (2) will not operate, the contacts of the low-voltage and reversed-phase relay (18) close, and the station is prevented from starting. Should low alternating-current voltage occur while the station is in operation, the contacts of the relay (18) close to open the master relay (3).

Direct-Current Overload.—As stated already, under the scheme of operation the overload-limit relay (22) reduces the generator voltage to keep a maximum load of 125 per cent normal on the generator. If the generator voltage is lowered as much as the rheostat permits and the load is still too large, the motor-generator set will carry the overload until the thermal relay (29) connected to a current transformer in motor lead operates to trip the master relay (3). In other words, the thermal relay (29) takes care of continued overload. The thermal relay (29) is calibrated so that its temperature-time curve is steeper than that of the motor; therefore it will operate before the motor windings reach a dangerous temperature. The thermal relay automatically resets after its element and the machine cools sufficiently. The direct-current overload relay (38) operating from the generator shunt is set to operate on approximately 250 per cent load and its contacts close to trip the lock-out relay (20). This energizes the shunt trip of the positive breaker (12) and opens it. Before the generator can be reconnected to the bus the lock-out relay (20) must be reset by hand or electrically by means of a push-button in the power plant.

In case of a severe direct-current overload, which would be caused by a short circuit and ground combined, the negative carbon circuit breaker would trip. This breaker is normally latched in a closed position and does not reclose automatically after being tripped.

Alternating-Current Overload.—Should trouble develop between the high-tension side of the power transformers and the generator, protection is obtained by the alternating-current overload relays (23), whose contact short-circuits the coil of the master relay (3), thereby shutting down the station.

Polarity.—In case the direct-current generator voltage builds up with reverse polarity, the overvoltage relay (37) connected between the generator positive and the bus positive opens the master relay (3), and this locks out the station, necessitating a visit of the inspector to reverse the polarity.

Reverse Current.—The equipment includes the usual direct-current, reverse-current relay (32), whose contact short-circuits the coil of the master relay (3).

Overspeed.—The usual speed-limit device (24) mounted on the motor-generator set furnishes protection from overspeed by opening the master relay (3).

Bearing Protection.—A bearing thermostat (25) is mounted in each bearing of the motor-generator set and operates to open the master relay (3) when any bearing reaches a temperature of 100 deg. C.

Lock-out Feature.—This feature is provided by the lock-out relay (30), which operates each time the star-point breaker (5) closes and is reset to zero position each time the direct-current relay (17) operates to close the positive breaker (12). If this breaker closes three times before the direct-current shunt relay (17) closes, the station is locked out until the lock-out relay (30) is reset by hand.

Continuous Running.—If the two-pole, double-throw knife switch is thrown to the left the station will start and run with all the automatic protective features.

Shutting Down by Hand.—The inspector can shut the station down by opening the knife switch so that one of its blades touches the special jaw which forms a circuit shunting the coil of the master relay (3).

Developing Power of the Potomac River

It Is Estimated That 61,000,000 Kw.-Hr. May Be Obtained Annually for the District of Columbia by Providing Adequate Storage—Water May Also Be Used for Domestic Purposes Through the Carrying Out of This Project

By JOHN C. HOYT
Hydraulic Engineer U. S. Geological Survey, Washington, D. C.



THE GREAT FALLS OF THE POTOMAC RIVER, WHERE IT IS PROPOSED TO DEVELOP HYDRO-ELECTRIC POWER FOR THE DISTRICT OF COLUMBIA

AMONG the provisions of the new water-power act is one carrying an appropriation to cover the expense of an investigation of the power possibilities in the Potomac River for the supply of electrical energy to the District of Columbia. By a study of records of stream flow in the Potomac drainage area covering about twenty-five years it has been shown that by proper storage an adequate flow may be obtained for a low-water period as severe as any on record, thus avoiding the necessity of a steam auxiliary plant.

The last paragraph of Section 7 of the act reads as follows:

"The commission is hereby authorized and directed to investigate and on or before the first day of January, 1921, report to Congress the cost and, in detail, the economic value of the power plant outlined in project numbered 3, House Document numbered 1,400, Sixty-second Congress, third session, in view of existing conditions, utilizing such study as may heretofore have been made by any department of the government; also in connection with such project to submit plans and estimates of cost necessary to secure an increased and adequate water supply for the District of Columbia. For this purpose the sum of $25,000, or so much thereof as may be necessary, is hereby appropriated.

The plan referred to provides for construction of the dam on the Potomac River below Great Falls, which will produce an effective head of about 112 ft. (34 m.). On account of the low minimum flow of the river the ultimate development at this point will depend largely on either a steam auxiliary or storage to supplement the low-water flow.

In 1908 M. O. Leighton and A. H. Horton, engineers of the United States Geological Survey, made office studies of the storage possibilities at certain sites in the headwaters of the Potomac watershed, using as a basis the records of stream flow covering a period of twenty-five years, topographic maps and other available data relative to the Potomac watershed. This study covered only a portion of the basin, and other sites, some of which have been investigated by other agencies, are known to exist. In this investigation, the results of which are published as U. S. Forest Service Circular 143, under the title of "The Relation of the Southern Appalachian Mountains to Inland Water Navigation," six

RESERVOIRS IN POTOMAC RIVER BASIN

Stream and Location	Catchment Area, Sq. Miles	Mean Annual Run-off per Square Mile, Cu.Ft. per Second	Flow Available Cu.Ft. per Second	Capacity of Reservoir, Million Cu.Ft.	Capacity of Reservoir in Catchment Area, Sq.Miles	Height of Dam, Feet	Area of Flow Line, Acres
North Fork, South Branch, Potomac River at Petersburg, W. Va.	460	1 12	520	18,550	460	134	7,600
North Fork, Shenandoah River, Rockingham County, Va	210	0 84	180	6,910	210	92	3,410
North River, Rockingham County, Va.	290	1.33	390	14,150	290	96	9,710
Middle River, Augusta County, Va.	180	1.33	240	6,190	140	100	4,250
South Fork, Shenandoah River, Rockingham County, Va	500	1 42	710	2,290	50	40	3,930
	200	1 42	280	10,420	200	95	7,150

reservoir sites were studied as indicated in the accompanying table.

For the twenty-one climatological years ended Sept. 30, 1917, the flow of the Potomac River at Point of Rocks was less than 2,000 second-ft. (56.6 cu.m. per second) on an average of forty-three days a year and less than 2,500 second-ft. (70.7 cu.m.) on an average of seventy-one days a year.

Assuming that in the Potomac basin reservoir capacity amounting to that of the six reservoir sites in the above table is feasible of development and that half of this capacity can be utilized annually, 29,200,000,000 cu.ft. (826,000,000 cu.m.), there would be sufficient water to produce 61,600,000 kw.-hr. of energy at the proposed power site, assuming a plant efficiency of 80 per cent and using a fall of 112 ft. (34 m.).

The six reservoir sites referred to have a total capacity of 58,500,000,000 cu.ft. (1,660,000,000 cu.m.), which is equivalent to a mean annual flow of 1,850 second-ft. (52.3 cu.m.).

Records of flow of the Potomac River at Point of Rocks, Md., from June 1, 1896, to Dec. 31, 1919, show the following:

Mean—9,810 second-ft. (268 cu.m.).
Maximum—March 2, 1902, 219,000 second-ft. (6,180 cu.m.).
Minimum—Sept. 10, 1914, 540 second-ft. (15.3 cu.m.).

The longest and lowest low-water period was from May 14, 1914, to Jan. 5, 1915, during which the following flow was recorded:

Mean—2,950 second-ft. (83.5 cu.m.).
Maximum—Dec. 9, 1914, 15,700 second-ft. (443 cu.m.).
Minimum—Sept. 10, 1914, 540 second-ft. (15.3 cu.m.).

Mass-curve studies for the period covered by this low-water flow indicate that the reservoirs referred to, if full, would have provided one and eight-tenths times the amount of water necessary to maintain a uniform flow of 4,000 second-ft. (113 cu.m.) during said low water period of 236 days; three and three-tenths times the amount necessary to maintain a flow of 3,000 second-ft. (85 cu.m.), and eight and four-tenths times the amount necessary to maintain a flow of 2,000 second-ft. (56.6 cu.m.) One reservoir alone, shown in the table, has sufficient capacity to maintain a flow of 2,000 second-ft.

These preliminary studies indicate that, if the reservoir sites can be economically developed, storage may be an important factor in the development of the Potomac River as a source for power and water supply for the District of Columbia.

In this connection it may be noted that before starting investigations the Miami Conservancy District did not consider that there was any possibility of finding storage reservoir sites in the Miami basin of sufficient size and feasible of construction to control the floods. Nevertheless, in order that their study might include all phases of the flood-control problem, storage was investigated, and as the result reservoirs were found to be the most economical and feasible solution of the flood problem, and six or seven reservoirs are now being constructed which are expected to protect the Miami River basin from all future floods.

The comparison of the topography and land value in the Potomac and Miami basins led to the belief that the possibilities for developing storage in the Potomac are as good as in the Miami, if not better. They at least warrant careful consideration in connection with a study of the utilization of this basin.

Preliminary Power Permits Under Consideration

Federal Power Commission Announces List of Applications Under New Act—Every Section of Country Represented Except New England

ON AUG. 15 the Federal Power Commission at Washington made public the first list of applications for preliminary permits or licenses made under the provisions of the new water-power act. In accordance with Section 5 of the act these preliminary permits are for the sole purpose of maintaining priority of application for license under the terms of the act for a period not exceeding three years, while examination and survey for preparing the necessary maps, specifications, estimates and financial arrangements are under way.

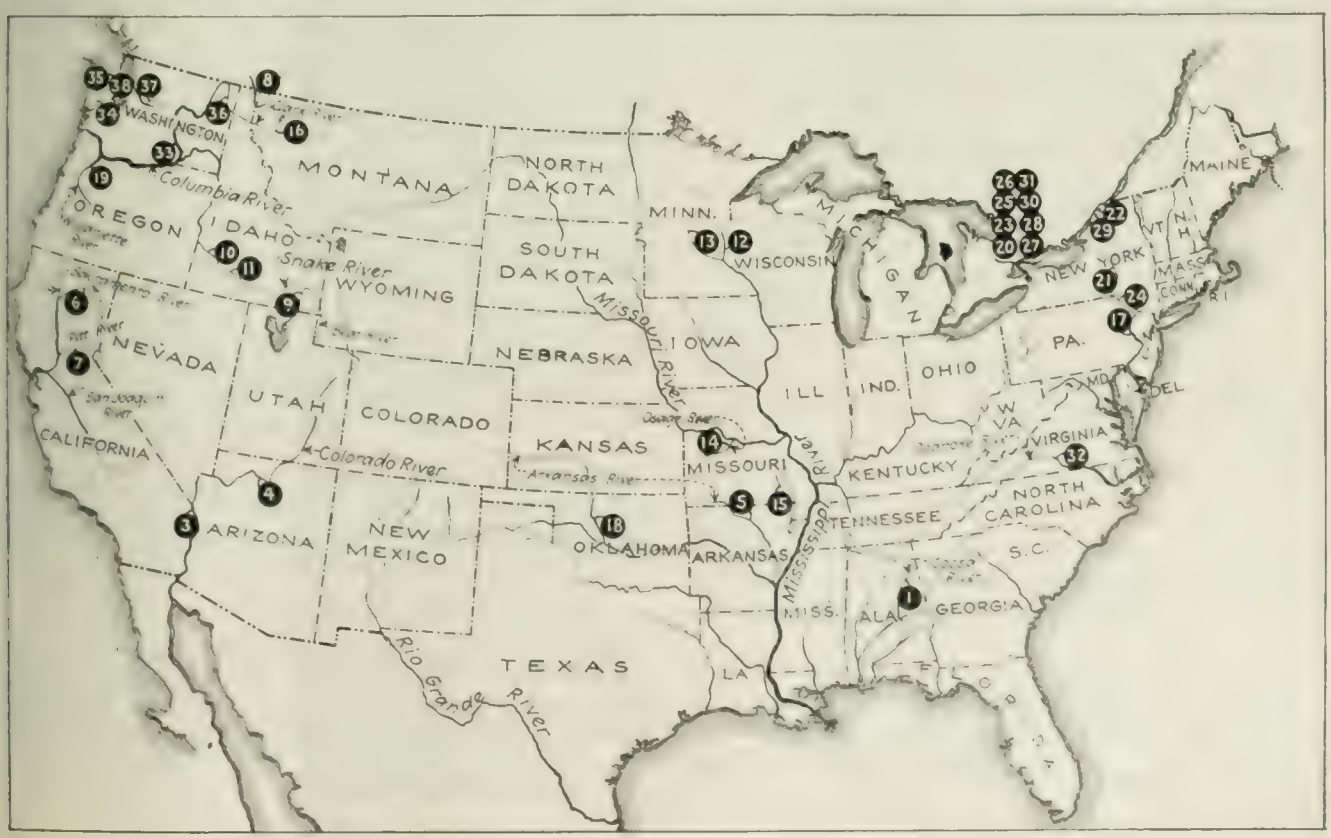
The list given below includes thirty-eight applications for power projects, distributed, as indicated on the accompanying map, in every section of the country except New England. Several comparatively unknown projects are included, while for a large number of the more important projects applications for preliminary permits have not as yet been made. The fact that no applications have been made for projects in New England is rather surprising. A large amount of attention is being paid to the fuller development of the Niagara River and the Falls, some eight applications having been filed for this project. Four other projects relate to sites in the State of New York. Considerable activity in future water-power development in Washington is indicated by the filing of six applications from that state. The commission has not made public the amount of power possible from the complete development of each project, or the investments involved.

The map on page 423 shows approximate location of power projects for which applications for preliminary permits are now on file with the Water-Power Commission at Washington.

APPLICATIONS FILED FOR PRELIMINARY WATER-POWER PERMITS

Map Reference No	State	Applicant	Address of Applicant	Location of Project
1	Alabama	Alabama Power Co	Birmingham, Ala	[illegible] River in Alabama below Government Dam No. 2
2	Alaska	Speel River Power Co	418 Lovcroft Bldg., San Francisco	[illegible] of Speel River in Tongass National Forest, Alaska
3	Arizona	Beckman & Linden Corp	(See this application listed under Cal.)	[illegible]
4	Arizona	C. A. Heberlein	Prescott, Arizona	Colorado Canyon, Coconino County, Ariz.
5	Arkansas	Dixie Power Company	33 Metropolitan Bldg., Chicago.	White River near Cotter, Baxter County, Ark.
6	California	Pitt River Power Co	San Francisco, Cal	Pitt River, California
7	California	R. W. Hawley	833 Market St., San Francisco.	Silver Creek and branches, Eldorado County, Cal.
8	California	Beckman & Linden Corp		Colorado River in Arizona and California
8	Idaho	G. W. Sperry	Bonners Ferry, Idaho	Moyie Falls on Moyie River, Idaho
9	Idaho	Utah Power & Light Co	Augusta, Me	South Forest, Lava, Narrows and Mink power sites on Bear River, Idaho
10	Idaho	Idaho Power Co	Boise, Idaho	Upper Salmon Falls on Snake River, Idaho.
11	Idaho	Idaho Power Co	Boise, Idaho	Twin Falls on Snake River, Idaho.
12	Minnesota	J. D. Markham	512 Globe Bldg., St. Paul, Minn.	Reserve-Markham Dam at [illegible] on St. Croix River, bet. Minn. and Wis.
13	Minnesota	St. Cloud Water Power Co.	St. Cloud, Minn.	Mississippi River in Stearns and Sherbune County, Minn.
14	Missouri	W. R. Baird	Lock box 1005, Lamar, Mo.	Osage River bet. Warsaw and Lincoln, and on Niangua River between Hahatonka and [illegible] at L. of O. Navigation Dist., Mo.
15	Missouri	Western Ice & Timber Co.	905 Syndicate Trust Bldg., St. Louis	Current River in Ripley, Carter and Channon Counties, Mo.
16	Montana	Rocky Mountain Power Co.	Butte, Mont.	Flathead River below outlet of Flathead Lake
17	New Jersey	Canada Syndicate, Ltd.	Duncan Young & Co., New York	Delaware River at or near Belvidere, N. J.
18	Oklahoma	C. F. Clement	Tulsa, Okla.	On Low Bend, Arkansas River, Okla.
19	Oregon	Crown Willamette Paper Co.	Pittock Block, Portland, Ore.	Falls of Willamette River, West Linn., Ore.
20	New York	City of Buffalo	Buffalo, N. Y.	Niagara River.
21	New York	Henry Ford & Son, Inc.	Dearborn, Mich.	Green Island, Government Dam on Hudson River, Troy, N. Y.
22	New York	Lonsville Power Corp.	Massena, N. Y.	St. Lawrence River, Croil Island to east end of Gooseneck Island, N. Y.
23	New York	Hydraulic Race Co.	Lockport, N. Y.	Niagara River
24	New York	Paul L. Brady	165 Broadway, New York	Delaware River, between Barryville, N. Y., and Shohola, Pa.
25	New York	Lower Niagara River Power & Water Supply Co.	Lewiston, N. Y.	Niagara River at Cleveland Ave., and Niagara Ave., City of Niagara Falls, N. Y.
26	New York	Niagara County Irrigation & Water Supply Co.	Lewiston, N. Y.	Niagara River, New York.
27	New York	Niagara Falls Power Co.	Niagara Falls, N. Y.	Niagara River, divert water above Falls, N. Y.
28	New York	Niagara, Lockport & Ontario Power Co.	Marine Trust Co. Bldg., Buffalo	Niagara River, divert water above Falls, N. Y.
29	New York	St. Lawrence Transmission Co.	Potsdam, N. Y.	Vicinity of Long Sault Rapids, St. Lawrence River, N. Y.
30	New York	Thomson & Porter	DeWitt Clinton Bldg., Buffalo.	Niagara River, N. Y.
31	New York	Niagara Gorge Power Co.	604 Ellicott Square, Buffalo.	Niagara River, direct water above Falls, N. Y.
32	Virginia	Roanoke River Development Co.	318 Mutual Bldg., Richmond, Va.	Roanoke River between Bugg's Island and town of Clarskville, Va.
33	Washington	Washington Irrigation & Development Co.	905 White Bldg., Seattle	Priest Rapids, Columbia River, Wash.
34	Washington	Alex. Polson	Montesano, Wash.	Headwaters of Wynoochee River, Olympic National Forest and northeastern part of Gray's Harbor, Wash.
35	Washington	Northwestern Pwr. & Mfg. Co.	Donworth, Todd & Higgins, Hoge Bldg., Seattle	Lake Crescent, Elwha River, Wash.
36	Washington	Hugh L. Cooper	101 Park Ave., New York	Clark Fork of Columbia River, Wash.
37	Washington	Sound Power Co.	25 Broad St., New York	Sultan River and Olney Creek, Snohomish County, Wash.
38	Washington	Straits Power Co.	25 Broad St., New York	Soldue River, Crescent Lake and Lyre River, Clallam County, Wash.

MAP SHOWING LOCATION OF THE ABOVE APPLICATIONS FOR PRELIMINARY POWER PERMITS. THE INTENSE INTEREST IN HYDRO-ELECTRIC DEVELOPMENTS IN THE STATES OF NEW YORK AND WASHINGTON IS CLEARLY INDICATED. SUBSEQUENT APPLICATIONS MAY POINT TO A WIDER DISTRIBUTION OF DEVELOPMENT UNDER THE NEW WATER POWER ACT



Arcing Grounds on High-Tension Lines

Experimental Investigation of the Voltage Stress on Insulators and Connected Apparatus on High-Tension Transmission Lines Due to the Normal-Frequency Voltage and the High-Frequency Surges Caused by Arcing Grounds

By W. D. A. PEASLEE
Electrical Engineer Jeffrey-Dewitt Insulator Company

THE occurrence of a ground on a transmission line gives rise to different forms of disturbance, depending for their relative magnitudes upon the particular conditions at the time of grounding and upon the electrical constants of the line. While these conditions are susceptible of mathematical analysis, it was considered of great importance to know to what extent such high-pressure stresses do occur in transmission lines and the connected apparatus. The investigation here described was undertaken to discover if possible to what extent the operating conditions could be reproduced and the mathematical analysis verified.

While a great deal of work remains to be done before the complete equations for the phenomena related to arcing grounds can be established, the general nature of the overvoltages is shown and the results of the tests indicate that arcing grounds do subject transmission-line insulators to voltage stresses far in excess of those met in normal service, and that these stresses are dependent on the operating voltage, the line constants and the position of the arcing ground on the line. With more data as to the variation of the stresses with frequency in a given case, it will be possible to determine with reasonable accuracy the stresses that the insulators of any line will have to stand by assuming arcing grounds at different points on the line and applying the power equations experimentally determined. These will be of the general exponential form, with the probable addition of another exponential term for frequency variation, as indicated by the tests.

Disturbances Caused by Grounds

When a ground is permanent and solid there is a transient change from stability in one condition to stability in another. The resulting transients have been well studied and their analysis is involved though not difficult. On systems operating with grounded neutral the electromagnetic disturbances caused by this short circuit may produce mechanical stresses of considerable magnitude.

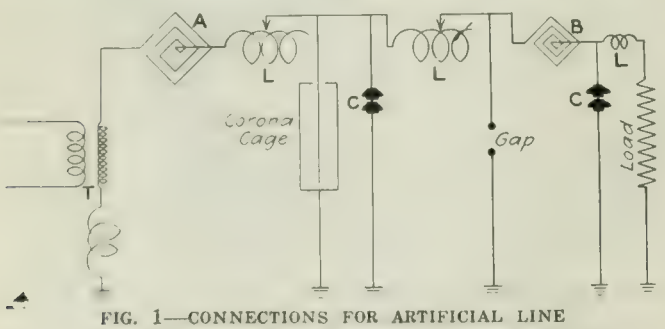


FIG. 1—CONNECTIONS FOR ARTIFICIAL LINE

A, B, protective helixes; *L*, loading inductances; *C*, insulator condensers; *T*, transformer.

When the ground is unstable in character a series of transient waves will be set up each time the ground is made and broken. As long as the current in the power arc is constant there will be no tendency toward oscillation in the line, but with a variation in this current the conditions will change. On the breaking of the arc the condenser, consisting of the capacitance of the line, will discharge across the gap, and the line will oscillate in sections on each side of the point of the ground, at a frequency depending on the length and constants of the sections involved.

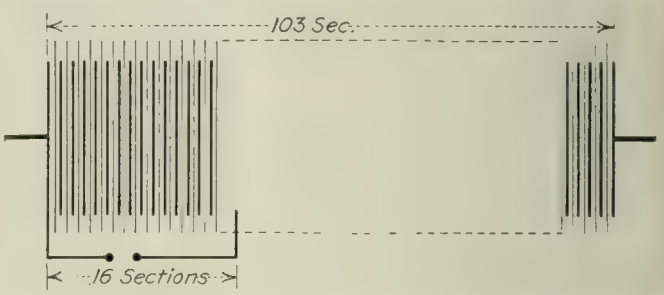


FIG. 2—MULTI-SECTION CONDENSER USED AS POTENTIOMETER

It has been shown by Ryan* that the effect of a superposition of high frequency upon low audio-frequency voltages was to give the combination a sparking distance equal to the sum of the sparking distances of the two separately, and this being true, it follows that the dielectric stresses imposed on a system by such a combination of high and low frequencies may be the sum of the separate stresses due to each alone.

Thus, while it is pretty well accepted that except for sustained high-frequency voltages, in which case the destruction is largely due to the terrific dielectric losses entailed, high-frequency voltages are not more destructive to insulators than low-frequency voltages, at the same time under certain combinations of inductances and capacitance very high potentials may be produced by their combination. In the case of a transmission line, the oscillations set up by an arcing ground are superposed on the low-frequency voltage of the line, the resultant stress being a combination of the stresses due to each.

Moreover, when a section of line is thus set in oscillation the high-frequency oscillations are communicated to the rest of the line and under certain conditions may produce therein terrific instantaneous voltages.

Discussion of the Mathematical Theory

When a circuit of inductance L and capacitance C is charged to a voltage E and then short-circuited in such a manner as to permit the condenser to discharge through the inductance, the discharge, as is well known,

*"Sustained Radio-Frequency High-Voltage Discharge," *Transactions Inst. Radio Engs.*, Sept. 16, 1915.

is oscillatory, involving a transfer of energy from the electrostatic to the electro-magnetic field in successive oscillations in such a manner that, neglecting the factor by which the stored energy is dissipated, the maximum electromagnetic energy must equal the maximum electrostatic energy, or

$LI_m^2/2 = CE_m^2/2.$

E_m = maximum transient voltages.

I_m = maximum transient current.

However, owing to the resistance of the circuit, the energy is dissipated and the succeeding maximum values of electrostatic and electromagnetic energy decrease according to an exponential law.

From these facts we get the well-known relation

$$\frac{E_m}{I_m} = \sqrt{\frac{L}{C}} = Z,$$

or what is called the surge impedance of the line. The physical significance of this factor may perhaps be better understood when we say that it is the impedance offered at any point to an advancing wave of the frequency given by these line constants. From this we get at once $E_m = I_m Z$, and so if I_m or E_m is known the other can be computed. Thus the voltage is equal to the current in the arc times the surge impedance of the line, and the current is a function of operating voltage and line constants or of the location of the ground.

Since the maximum electrostatic and electromagnetic energies must be equal, we see further that $Li^2/2 + Ce^2/2 = \text{constant} = K$, where i = instantaneous current, e = instantaneous voltage.

From these conditions it will be seen that the current is a maximum when the voltage is 0 and vice versa, so if the voltage is a sine function the current will be a cosine function, and we shall then have, neglecting the factor by which the energy is dissipated:

$$i = I_m \cos(\phi - \gamma)$$
$$e = E_m \sin(\phi - \gamma)$$

wherein $\phi = 2\pi$ ft. and γ is the phase angle at the moment the oscillations start, or $i_1 = I_m \cos \gamma$ is the value of the oscillating current at the moment of starting the oscillation. Likewise $e_1 = E_m \sin \gamma$ is the value of the oscillating voltage at the moment of starting the oscillation.

Given, then, the constants of the line and I_m or E_m, and knowing the instant at which the oscillations start, we can completely determine the resulting oscillating transient.

Thus in the case of an arcing ground on a transmission line E_m is the maximum voltage to ground and is known, and from it we can determine I_m, and if the phase angle of the starting point is known we can determine the oscillating transient completely.

Therefore, in the case of a transmission line with an arcing ground the total dielectric stress resulting will be the normal-frequency voltage stress plus the high-frequency oscillating transient stress applied in the form of series of highly damped trains obeying the above equations.

Again, if a line is short-circuited and the short-circuit current I_m is suddenly broken, the maximum voltage that can be induced is $I_m Z$. Thus in an arcing ground on a transmission line, especially when the neutral is grounded, but to a considerable extent even with isolated neutral, we find on the making of the ground a determinable oscillating current of maximum value I_m and on the breaking of the ground a determinable oscillating voltage of maximum $E_m = I_m Z$, where I_m is the maximum current to ground and is dependent on the position of the ground and on the line constants.

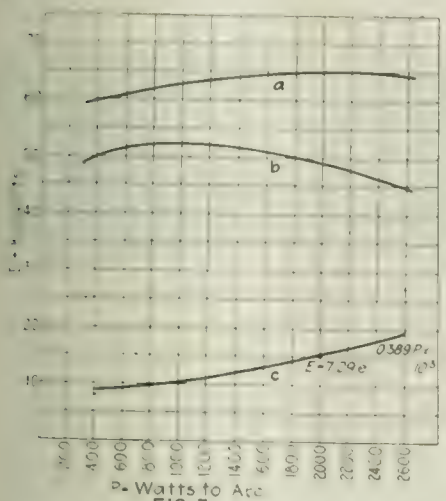


FIG. 3

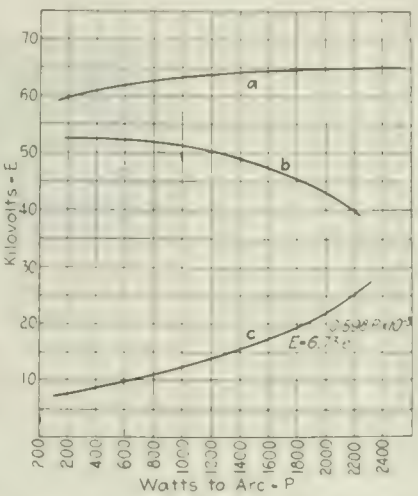


FIG. 4

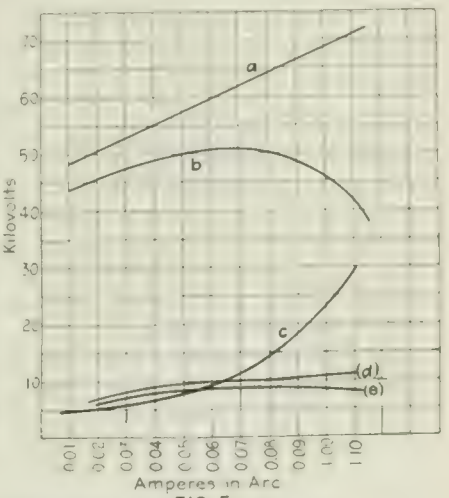


FIG. 5

FIGS. 3, 4 AND 5—EFFECT OF POWER (OR CURRENT) AT THE ARC UPON STRESS ON INSULATORS CAUSED BY ARCING GROUND

Oscillation frequency varies with location of the ground, as shown in Fig. 3, 740,000 cycles, and in Fig. 4, 960,000 cycles. Curve *a* shows total voltage stress; *b*, that due to 60-cycle voltage, and *c*, the high-frequency oscillation component. Curves (*d*) and (*e*), Fig. 5, give oscillation voltage on five outside end turns of inductances *a* and *b* (Fig. 1), for oscillation frequency of 740,000 cycles.

This oscillating current in combination with the constants of the line may cause high-voltage stresses in the line, especially at transition points, such as connected transformers or cables attached to it, which are added to the normal-frequency voltage stress, and the oscillating voltage caused by the rupture of the ground current also adds its stress to the normal-frequency voltage stress.

From these relations it is not a difficult matter to evolve the general equations of the line under arcing ground which appear in one form as:

$$I = D_1 e^{-\frac{\alpha t}{\gamma}} - D_1 e^{-\frac{\beta t}{L}}$$

$$E = \sqrt{\frac{L}{C}} e^{-\alpha t} \left[D_2 e^{\quad\quad} - D_1 e^{\quad\quad} \right]$$

These equations are simply a mathematical expression of the fact that in a transmission line subject to

arcing grounds there will be superposed on the easily calculated normal-frequency voltage and current waves transient waves of voltage and current of frequency dependent, in a given line, upon the location of the ground from transition points in the line, as the section between the ground and transition point will oscillate at a frequency determined by the constants of the section. Thus the section on either side of the ground will in general oscillate at different frequencies, and in certain rare cases the two sections will resonate. In any case disturbances from each section will be reflected in to the other, and it is readily seen that the situation becomes very complex in a short time (measured in micro-seconds). The following experiments were undertaken in an attempt, partially successful, to isolate the effects of such a condition.

Arrangement of Artificial Line

An experimental line was built up of massed constants as indicated in Fig. 1 (massed constants were used because of the expense of building one with even approximately distributed constants), and an artificial arcing ground was placed on the line as indicated.

The inductance of the line was lumped as shown and consisted of large air-core helixes, while the necessary capacitance was secured by connecting various insulators whose capacitances had been measured between the line and ground as indicated. A corona cage was employed as a condenser and surge indicator. The load, not used in the first experiments, consisted of several small glass tubes full of distilled water connected in zigzag by means of short pieces of rubber tubing. Sections of this could be cut in or out to regulate the current drawn. The transformer was a 125,000-volt, 10-kw. unit operated directly from a generator in the laboratory so connected as to give nearly a pure sine wave.

The initial experiments were carried out as follows: A certain voltage E was held on the line and the gap G closed until it arced over. The voltage across the arc was then reduced, owing to the inherent regulation of the line, extinguishing it. This permits the line voltage to rise again, reforming the arc, and this process is repeated, rather rapidly duplicating almost exactly the action of an actual line under arcing ground. This work was carried out in the dark, and with the spark shielded it was possible to see, by the increase of corona on the corona rod and on the insulator pins, that a quite appreciable increase in voltage on the insulators resulted on every making and breaking of the arc. The results, however, were so transient that they could not be recorded, so the gap was replaced by a rotary gap which made and broke the arc very rapidly and continuously, thus maintaining the desired effects.

The insulators used as condensers in this line are in the same relation to the normal frequency and transient voltages as the insulators of lines under operation commercially; therefore any extrà strain found on them traceable to this arcing ground would be a measure of the corresponding insulator duty on a line in operation. The first observations were by means of the extra corona formation on the pins and caps when the arc was in operation. The photographs show this effect, but it will be recognized at once that no quantitative measurement of it was possible in this way.

The evidence of a decided increase in voltage stress on the insulators was very plain. The corona streamers on the corona cage were lengthened several inches, and the corona around the insulator pins became very vicious when the arc was working. It now became necessary to make quantitative measurements of the voltage stress at the insulators. A sphere gap would short-circuit the line on arc-over and was of course not to be considered. A cathode-ray tube would have been ideal, but it was not available.

It therefore became necessary to develop a device to measure, by means of a spark gap, the dielectric stress on an insulator string when under the influence of combined 60-cycle and high-frequency pressure without the formation of a power arc in parallel with the insulator string or changing the constants of the oscillating circuit to an appreciable extent.

Multi-Section Condenser Use for Measuring Voltage

The conditions necessitated the use of a device which would give a definite and stable increment of the total stress up to a point of breakdown of the gap and which would not change appreciably the capacitance of the circuit when the gap broke down. The work of Professor Ryan in determining the distribution of the stress on the surface of an insulator, in which he employed a multi-section condenser to secure definite fractions of the total operating voltage, led to an investigation of this method for these particular conditions.

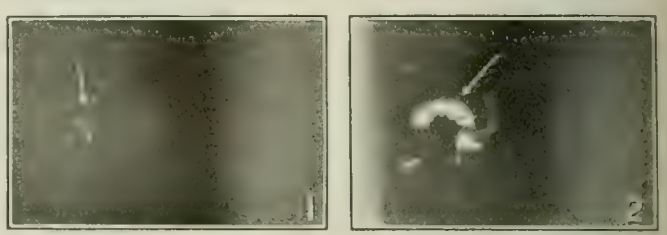


FIG. 6—HEAVY CORONA DUE TO OSCILLATORY VOLTAGE

Left, corona on insulator pin for 58,000 volts, 60 cycle, non-oscillating; right, with arcing ground, 46,000 volts, 60 cycles, oscillation frequency 730,000.

The oscillating section of the line under investigation had an average capacitance of 78.76×10^{-5} mf. and an inductance of 7.103×10^{-5} henries, which with lumped inductance and capacitance gave a natural frequency of 847,550 cycles per second.

A condenser was built up of 103 sections in series, as shown in Fig. 2, each section consisting of thin metal plates, 6 cm. $\times$ 5 cm., with a glass plate 0.1296 cm. thick between the plates, the whole clamped firmly together and immersed in oil. The capacitance of these sections in series was 0.119×10^{-5} mf., and the frequency with this condenser added to the line was 846,900 cycles per second. The spark was placed across sixteen end sections of this condenser, and on breakdown of the gap short-circuiting these sections the capacitance of the remaining eighty-seven sections in series was 0.1414×10^{-5} mf., giving a change in capacitance of 0.0224×10^{-5} mf. in a circuit containing 78.88×10^{-5} mf. Obviously, the change caused by the breakdown of the gap across these sections does not change the conditions of the circuit within the degrees of accuracy obtainable in such experimental work.

This equipment was then calibrated on 60 cycles by determining for various voltages the sphere gap breakdown across the sixteen sections. The results of many such determinations, reduced to standard conditions of barometer and temperature, indicate a very satisfac-

tory integrity. This calibration will not be correct for high-frequency voltages because, owing to the dielectric spark lag, the sphere gap at high frequency indicates a lower voltage than is actually impressed, especially when the oscillations are in the form of rather highly damped trains (the spheres used were small, 3.1 cm. in diameter). The error, however, will be an indication of a lesser stress than that actually put upon the apparatus.

The condenser was supported in oil on hard-wood blocks boiled in oil and the whole device was carefully guarded from stray electrostatic fields and leakage.

With the development of this device the scope of the work was greatly extended and further auxiliary devices became necessary. A means of measuring the combined high-frequency and 60-cycle current was provided by the rebuilding of an old hot-wire voltmeter into an ammeter.

Currents Measured with Hot-Wire Instrument

Data were now taken in order to determine in so far as possible the increase of voltage stress due to this arcing ground as a function of the power feeding into the arc or of the current in the arc. The power in the arc was approximated by subtracting from the input to the transformer on the low-tension side the known losses of the transformer and line. For the current relations current measurements were made with the hot-wire ammeter.

In Fig. 3 *a* is the total stress for the oscillatory case, *b* is the part of this due to the 60-cycle line voltage, and *c* is the duty due to the oscillations, in this case at a frequency of 740,000 cycles per second. The line is unloaded in this test. In Fig. 4 the same curves are shown for different locations of the ground on the same line, giving a frequency of 960,000 cycles per second line unloaded.

In Fig. 5 the same values are plotted against the current in the arc at a frequency of 740,000 cycles. Curves *d* and *e* are voltages across the five outside end turns of inductances *a* and *b*, showing that the sections on each side of the ground were oscillating. Curve *d* is for inductance *a*, nearest the transformer. The higher values of stress indicated on the inductance on the source side of the ground are probably due to the current drawn through inductance *a*, which affects the field distribution and so the distribution of stress. The ordinates are voltage stress across condenser potentiometer or duty on line insulators.

Determination of Equations for Voltage Stress on Insulators

The curves *c*, of Figs. 3 and 4, were plotted with logarithms of the voltage stress as ordinates and the exponential equations of the curves were determined, while the rectangular equations of the curves in Figs. 3, 4 and 5 were determined by the sigma-delta method of reduction. The results of these determinations are summarized below and warrant careful examination:

Fig.	Equations	Frequency
3	E = 7.20[illegible]P	
	$E = 9.31 + 1.62P^2$	740,000
4	E = 6.37[illegible]P	
	$E = 8.58 + 3.4P^2$	960,000
5	$E = 5 + 18{,}000I^3$	740,000

The apparent variation of these equations with the frequency of oscillation is very interesting, but until a vast amount of data is available deductions as to this feature of the work are unwarranted. The important point is the establishment of the variables in equations satisfying the data that will give information as to the manner in which the voltage stress is dependent on line conditions.

It will be noted that the initial points of the curves do not satisfy the data. The reason for this is that there is a certain amount of current or power, as the case may be, required to maintain the arc, and values approaching this minimum or below it will naturally be erratic and unreliable; so the equations can be seen to represent the conditions only for values of the variables well above the minimums required to maintain the arc.

Interpretation of Experimental Data

The voltage stress is seen to be a function of the power in the arc and specifically of the square of the power. Since the power is a function of voltage and current, it will be seen at once that the position of the arc on a given line is a vital factor in the severity of the voltage stress resulting from the arc. The line voltage for a given line is constant, and the current will depend on the amount of impedance in the line between the arc and the generator or the distance between the arc and the generator. The indications are then that the arcs forming close to the generating station are likely to be much more severe in their effects than those further away for two reasons—first, the power or current concerned is greater, and, second, the frequency of oscillation will be higher. From the equations derived from Figs. 3 and 4 it will be seen that for high frequencies the curve starts at a lower value but increases more rapidly than for low frequencies. The limits within which this holds are not known at present, but it is probable that it does not hold strictly for frequencies much above 2,000,000 cycles. All of these conclusions are amply supported by operating evidence.

The fact that the voltage stress is a function of the cube of the current indicates that the resistance of the arc is also a function of the current, a fact that has been reported by several investigators. If this were not so, the stress would be a function of the fourth power of the current. The evidence is therefore that the fact of the current-resistance characteristic of the arc being negative tends to increase the severity of the arc when once formed. This is another factor in the instability of conditions around the minimum values of power and current required to maintain the arc.

IT IS *inspiring to think that in the flake of snow and in the drop of rainfall man should have discovered little elves full of energy and ready to work for him. It is criminal to continue indefinitely using up our rapidly vanishing fuel reserves while the potential power in our great rivers rushes heedlessly and uselessly down to the sea. Only the armistice intervened to save the industries of the country from a realization of an acute power shortage. What would we say to the railroads if they persisted in speeding long trains of empty cars from the center of the country to the Gulf and the two oceans while freight and people stood beside the tracks awaiting transportation?*—E. K. HALL, *vice-president American Telephone & Telegraph Company.*

The Industrial Load in California

Adoption of Electric Drive in Primary Industries Very General —Central Station Figures for First Quarter of Year Indicate Large Increases in Industrial Load—Advantages of Motors

THERE is perhaps nothing else as potent in the resumption of normal financial conditions as increased production. In virtually all lines of industry reduction in hours of labor has accompanied to a greater or less degree increases in wages. Increased production must, therefore, be accomplished by the same workmen in a shorter time, a seeming impossibility in view of the reports coming from manufacturers of all classes that individual production per hour of employment has lowered since the end of the war. The elimination of unnecessary motions by the workman and the speeding up and constant operation of machinery will help, and the electric motor has a very essential place in this respect.

The recent large growth in the utilization of electrical energy in California industries is clearly accentuated by the central-station returns received from that state by the ELECTRICAL WORLD during the first quarter of this year. Car shortage, unsettled labor conditions and seasonal variation in illumination requirements were factors tending to lower the output of central stations materially, but despite these three adverse conditions the average daily output has gradually increased from 8,832,000 kw.-hr. in January to 9,030,000 kw.-hr. in April.

In an endeavor to ascertain the extent and distribution of this industrial load in California, the ELECTRICAL WORLD sent detail questionnaires to 1,310 industrial concerns. The names of these firms were obtained through the various local chambers of commerce of the state, and the list is believed to represent the total number of primary industrial establishments employing more than fifty operatives each. Fig. 1 shows the distribution of these industrial plants by sections of the state. Answers have been received from 299 companies which were so distributed among various industries as to give a very definite idea of the industrial power situation in California. Some very optimistic conclusions relative to the advantages of electrical energy in industry as a whole are to be drawn from this survey.

GROUPS OF MANUFACTURERS

The Census of Manufactures for 1914 divides all manufacturers into fourteen general groups as follows: Food and kindred products; textiles; iron, steel and their products; lumber and its manufactures; leather and its finished products; paper and printing; liquor and beverages; chemicals and allied products; stone, clay and glass; metal and metal products other than iron and steel; tobacco manufactures; vehicles for land transportation; railroad repair shops, and miscellaneous industries. The principal manufacturing industries in California using electricity as a source of power, as indicated by the survey, are iron and steel, including foundries and machine shops; shipbuilding; cement plants; food, including canning and preserving plants; mining; paper mills and paper products; chemicals, and lumber and lumber products. The accompanying table gives detailed data on the utilization of electric power in these industries as well as in other industries of less importance. Probably the most interesting data in this table show the comparatively small amount of energy generated by private plants. The generation of energy by the private plants of lumber and mining companies is to be expected on account of their isolation and the difficulty in taking care of the waste, but the fact that with the further exception of the food and iron and steel industries, no report of other private generating plants was received is a clear indication of the efficient manner in which the central station is meeting the load requirements of California's industries. There is probably no other section of the country which can show such a mastery of the industrial situation by the central stations.

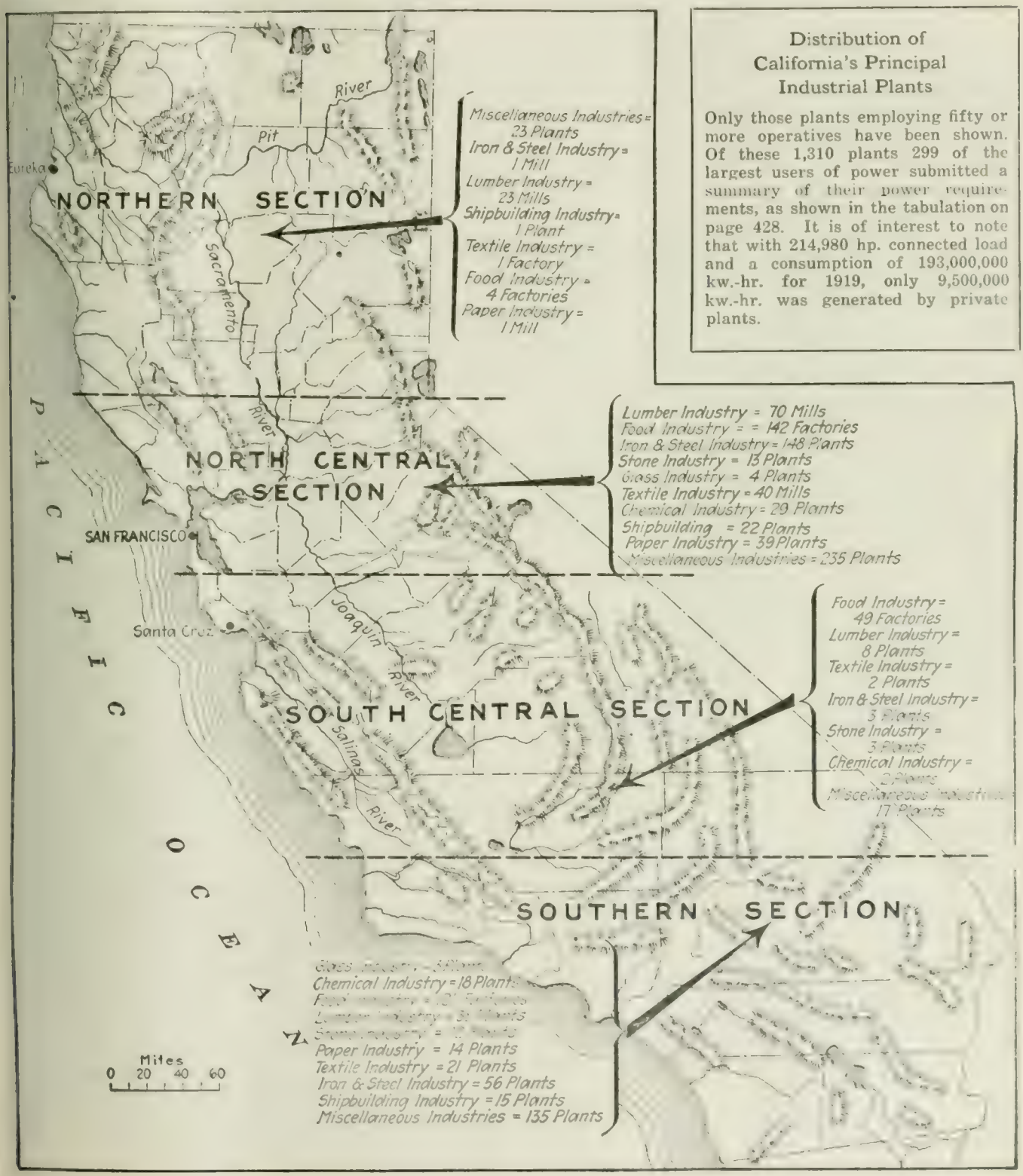
The food-preparation industry is the most important in California in value of products. This industry

SUMMARY OF INDUSTRIAL SURVEY OF CALIFORNIA AS OF JULY 1, 1920

Industry	Number of Companies Reporting	Water Wheels: Number	Water Wheels: Rating, Hp	Internal Combustion: Number	Internal Combustion: Rating, Hp	Steam Engines: Number	Steam Engines: Rating, Hp	Steam Turbines: Number	Steam Turbines: Rating, Hp	Electric Generators D. C.: Number	Electric Generators D. C.: Rating, Hp	Electric Generators A. C.: Number	Electric Generators A. C.: Rating, Hp	Energy: Generated, Kw.-Hr.	Energy: Purchased, Kw.-Hr.	Motors Installed: Number	Motors Installed: Rating, Hp	No. of Drives: Under 5 Hp	No. of Drives: Belt	No. of Drives: Chain	No. of Drives: Direct or Geared
Iron and steel	60	..	....	2	70	2	205	1	600	2	175	5	570	591,467	59,205,327	5,262	81,616	569	1,873	59	3,267
Motor trucks and accessories	11	.	.	..	...										524,840	130	1,502.5	43	88	1	20
Textiles	23					1	55			3	21.5				207,627	275	2,204½	70	151	27	83
Paper	9	1	300			1	637			1	65				6,230,760	100	1 672½	25	58		10
Leather	8			..	...										137,805	34	250	7	22	2	
Food	96			4	1,200	58	5,382	9	2,320	32	1,610	14	3,498	4,38.,080	16,867,864	2,207	32,968	784	1,946	137	599
Stone, clay and glass	10	..		1	20	4	220								38,570,116	257	16,713	29	155	2	55
Mining	4	1	1,300							1	275	1	1,000	897,520	11,742,690	121	7,707	14	23	3	8
Shipbuilding	13														41,116,484	1,941	46,099.5	360	516	14	1,285
Electrical equipment	3														633,290	288	860	197	92		52
Lumber	39					37	11,020	13	5,988	11	*435.5	17	5,070	3,619,720	3,472,394	1,051	17,535.5	195	637	5	129
Chemicals	16			2	40	3	390			3	112.5				4,314,732	392	6,624.5	81	269	14	62
Miscellaneous	7														516,877	283	1,226.5	191	144	7	97
Totals	299	2	1,600	9	1,330	108	17,909	23	8,908	53	2,694.5	37	10,138	9,494,787	183,540,606	12,341	214,979½	2,565	5,974	271	5,667

* This is the total of only four of the direct current generators.

includes the canning of fruits and vegetables, fish, oysters, clams, etc.; packing of dried fruits, the manufacture of pickles, jellies, preserves, sauces, etc.; wholesale slaughtering and meat packing and manufacture of sausage; flour-mill and grist-mill products; butter, cheese and condensed milk, and sugar manufacture. There are 316 plants of this general class in the state employing more than fifty operatives each, of which 45 per cent are in the north central part of the state. The reports received indicate that about 21 per cent of the electrical energy used in food-preparation factories is generated in private plants and that the amount of energy used in an average factory of this type is about 221,400 kw.-hr. per year. In the ninety-six factories reporting, 2,207 motors were installed with a total rating of 32,968 hp. Of the total number of motors 35 per cent are under 5 hp. The largest motor installed is rated at 500 hp., but the rating of the larger motors in a majority of the plants ranged from 25 hp. to 30 hp. The small motors range between ½ hp. and 1 hp. The usual voltage is 440 and 220, but two plants reported using voltage as high as 2,000. About 73 per cent of the machines are belt-driven, and 22 per cent are direct-connected or geared, the remainder being chain-driven.



The uses of electrical energy in factories of this industry are many on account of the varied processes necessary in the manufacture of food products. Motors are used to operate pumps, cream separators, churns, bottle and can washers, refrigeration machinery, conveyors, elevators, beet slicers, preserving machinery, presses, grinders, sealing machines, blowers and compressors. The heating of water and milk and the operation of cookers, sterilizers and dryers is accomplished in many cases by electrical energy.

Foundry and Machine Shops

The iron and steel industry, which in California is confined to foundry and machine shop activities, ranks fourth among the manufacturing industries of the state. There are about 208 plants of this class employing more than fifty operatives each, of which about 71.2 per cent are in the north central section of the state. This industry gives employment to about 7 per cent of the total labor of the state. In amount of electrical energy used, however, it ranks first among California's industries, and the returns received indicate that about 31 per cent of the industrial load in that state is utilized by foundries and machine shops. There are 5,262 motors employed by the sixty companies reporting, with a total installed rating of 81,616 hp. The largest motor installed has a rating of 800 hp., the average rating of the larger motors being, however, between 15 hp. and 20 hp. The usual voltage is 220, although in a few cases voltage of 440 is reported. More than 63 per cent of the machines are directly connected with the motors, and 36 per cent are belt-driven.

The uses of the motor in the iron and steel industry are not so varied as in the food-preparation industry. Among the primary uses are the operation of cranes, air compressors, sand mills, planers, grinders, boring mills, straightening presses, fans, blowers, saws, drill presses, rolling mills, hoists, conveyors, sand-blast exhausters, etc.

All Large Shipyards Electrified

The shipbuilding industry could not be considered as a primary industry of California prior to the war. At the present time, however, it takes rank among the first. Practically all up-to-date shipbuilding yards are equipped throughout with the latest electrical devices. The thirteen shipbuilding plants reporting consume 41,116,484 kw.-hr. of electrical energy per year. The survey indicates that no other class of industry in California consumes so much electrical energy per plant with the exception of cement mills. During the war rush period the central stations were severely taxed to supply the demand for energy from shipyards. This has, of course, materially decreased, although it still remains a large factor in the industrial load of the state. About 1,941 motors are installed by the reporting companies, with a total rating of 46,100 hp. The class of work being done in shipyards requires a high percentage of large motors. The largest motor reported is rated at 500 hp., and the average rating of the larger-sized motors is between 280 hp. and 290 hp. About 71 per cent of the machines are directly connected to the motors, 28 per cent are belt-driven, while only fourteen chain drives were reported.

Electric motors in shipyards are used to operate the following machinery: Compressors, punches, shears, ship and overhead cranes, bending rolls, scarfers, angle benders, lathers, drill presses, pumps, boring bars, joiners, cut-off saws, shapers, pipe tools, winches, exhaust fans, bolt cutters, conveyors, marine railways, etc.

The adoption of electric drive in stone, clay and glass plants has been very general. One large cement mill reported an annual consumption of 20,866,970 kw.-hr. This plant uses more than 158 motors with a total installed rating of 7,478 hp. About 87 per cent of the machines in this plant are belt-driven, and 12 per cent are direct-connected. Electric motors are used to operate crushers, rollers, kilns, elevators, conveyors, sack-filling machines, shovels, compressors, pumps, cranes, screens, drills, etc,

Lumber Industry

Lumbering and lumber manufactures constitute one of California's primary industries. The manufacturing end of the lumber industry is almost all electrically driven at the present time. The logging operations which could be worked electrically to great advantage are handicapped in California, or in fact in any lumber country, by the scarcity of power transmission lines.

Motors of 2,200 volts could be used in logging operations, but the high potential of 60,000 volts to 100,000 volts used in transmission lines would make necessary the installation of a portable substation and lines to follow the camps, as they move very often. Electric motor drives in woodworking plants have the advantage of decreasing the fire hazard, which is a big item in the lumber industry. Motors allow individual control and variable speed for machines such as hoists, veneer peelers and conveyors.

One of the most interesting of the late developments in the use of the electric motor in the lumber industry is to be found in electrically operated set works on carriages in sawmills. Two possible developments in the near future are the use of electric heat for dry kilns and magnetic steps on saw tables or clipper tables. The thirty-nine lumber companies reporting consume a total of 7,092,114 kw.-hr. per year, of which about 51 per cent was generated in private plants. About 1,051 motors were used, with a total rating of about 17,536 hp. The most widely used motor in the operation of woodworking machinery is the constant-speed squirrel-cage induction motor, and the usual voltage is 440 or 220. The few isolated lumber plants which installed 2200-volt motors are getting away from the high voltage rapidly.

The reasons for this change to low voltage are obvious—fire and safety hazard, high cost of installation and the greater damage to equipment in case of an electrical breakdown. The companies reported about 82 per cent of the machines as belt-driven, 17 per cent directly connected and only five chain-driven machines.

Some of the machines operated by electric motors in the lumber industry are saws, lathes, shapers, borers, elevators, jointers, blowers, drill presses, pipe cutters, punch presses, pumps, sorting lumber tables, cranes, etc. The storage-battery locomotive for trucking is widely used in the lumber industry.

The adoption of electric drive in other California industries has not been as general as in those cited above. It is possible, however, that a fuller response to the questionnaires would show that several other industries were adopting electrial drive quite generally.

The survey indicates a large and fertile field for future central station operations and furnishes evidence of the completeness with which the central stations are now covering the field.

Readers' Views and Comments

Rebuilding the Devastated Sections in France

To the Editor of the ELECTRICAL WORLD:

SIR: Why have not American contractors participated in the rebuilding of the devastated regions of France? There were predictions at the time of the armistice of great opportunities for them. Few of these opportunities have been realized. There are a number of reasons:

(1) The French want to rebuild according to French ideas, having regard also for the traditions of the ruined cities. These ideas are incompatible with the mass production proposed by some American contractors.

(2) The French have a pride in their ability to carry on construction. They resent the suggestion that they need help. There is, so far as I can learn, only one construction company here that represents American capital, and it is in reality a French company manned by French engineers and contractors. There are only three Americans in a responsible force of probably fifty.

(3) Construction can be taken in hand only so fast as the damages can be determined. This is an enormous task and necessarily can proceed only as rapidly as the relatively limited number of commissions of qualified men, familiar with local conditions, can work. With the fluctuations in wages and material prices, too, these damage credits are subject to frequent change. Under the law, an owner who rebuilds within 50 km. (31 miles) of the original site is paid the reproduction value as of the present date. Necessarily the estimate must be revised if wages and material costs change. A 20 per cent credit is granted as soon as the damages are determined, and other advances are made as the work proceeds. If an owner chooses not to rebuild, or to rebuild at a distant point, he receives damages based on values in 1914.

(4) The French government wisely decided to concentrate on work in the order of its economic importance: First, the reclamation of the land and the erection of temporary dwellings, then the restoration of the building-material industry, followed by the reconstruction of factories and the construction of permanent dwellings. The last feature has hardly yet been taken in hand. Therefore plans for rebuilding whole towns in permanent construction were not in order early in 1919 and are scarcely in order today.

(5) Building materials are scarce and must be distributed so that in all districts and towns progress may be at about the same rate.

There are other reasons, but these are the really important ones.

It is worth noting that the financing of work was not referred to until the question was raised by the visitor. In other words, the various factors above mentioned have always disposed of the American contractor before the question of finance was reached. The traditional position that all flows to the man with money did not hold here. Of course, France would still like to have American credits, but only to allow her to pay for raw material when the exchange has returned to normal or materially improved.

There is still much work to be done. In fact, only a beginning has been made, but the work is not likely to be done by American contractors. If they have capital to be employed, they may use it in France if they want to lose their identity and organize as a French company with French officials. Even then they will not get work, or succeed in what they get, unless they are willing to respect French customs and acquire some of that French tact to which we are largely strangers.

E. J. MEHREN.

Paris, France.

[E. J. Mehren, editor of the *Engineering News-Record*, one of the eleven McGraw-Hill publications, has just returned from Europe and reporting on engineering progress and opportunities there. This letter, containing some of his observations on conditions in the devastated sections of France, with special reference to the question of American participation in reconstruction, will interest readers of the ELECTRICAL WORLD.—EDITOR.]

Westinghouse Will Not Establish Mail-Order House

To the Editor of the ELECTRICAL WORLD:

SIR: I wish to call your attention to the fact that the note published in the ELECTRICAL WORLD of Aug. 21, p. 409, stating that the Westinghouse Electric & Manufacturing Company will establish a mail-order house for the distribution of small electrical equipment and supplies at Springfield, Mass., is incorrect as stated, since it implies that we propose to sell electrical household apparatus, etc., by mail, and this we have no intention of doing.

What we do propose to do here is as follows: We have quite a large business in supplying parts for the electrical starting, lighting and ignition equipment for automobiles, which we sell to our regular authorized dealers. As much of this business is by correspondence and practically all shipments are made by parcel post, we are arranging at Springfield, which will be the headquarters of our automobile equipment department, to organize this line of work in better shape than heretofore. This, as you can see, is not a mail-order business in the strict sense of the word, nor does it apply to any household line.

W. H. EASTON,
Publicity Department, Westinghouse Electric & Manufacturing Company, New York City.

Forestallers and Water Power

To the Editor of the ELECTRICAL WORLD:

SIR: First among the things to be avoided by the friends of water-power development are the wiles of "fake" promoters. One of the greatest nuisances in our complex modern civilization—as, indeed, he has been since time began—is the forestaller, he who, scenting a coming want, whether it be for theater tickets, fuel, foodstuffs, residences, building lots or public service franchises, gets in just ahead of the real purchaser or investor and extorts a totally unearned profit as his price for ceasing to obstruct the law of supply and demand. I am not, of course, referring to the legitimate middleman, but to the speculator whose sole idea is to buy cheap today and sell dear tomorrow and live in idleness on the double tribute he extorts. By all means let water-power sites be kept out of his clutches.

FRANK W. CHASE.

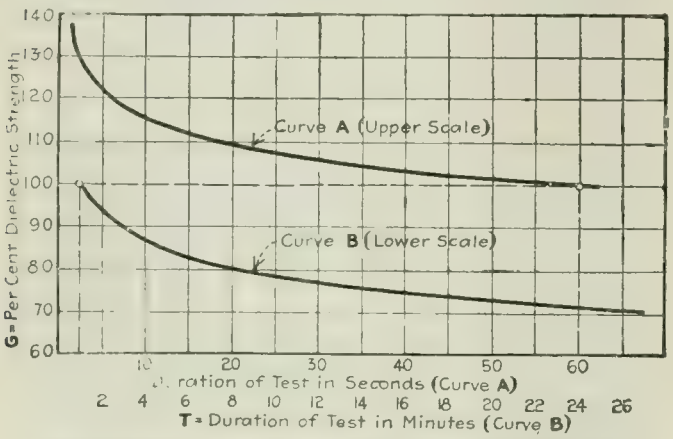
Brooklyn, N. Y.

Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Reduction of Dielectric Strength by Testing

SOME operating engineers specify longer high-voltage tests than the standard period of one minute, perhaps without realizing the relative effect on the dielectric strength of the insulation being tested. For the benefit of such engineers data are given by the accompanying curve, which gives average values from tests of ordinary solid insulating materials. The tests were made at 60 cycles in oil at 75 deg. C. The curves may be expressed by the formula $G = 100 - 21 \log_{10} T$, where G is the present dielectric strength on the basis that insulation tested one minute has 100 per cent strength at the end of the test, and T is the duration of the test in minutes.



PROLONGED TESTS REDUCE DIELECTRIC STRENGTH OF INSULATING MATERIAL

Station Conduit Records Help in Making Alterations

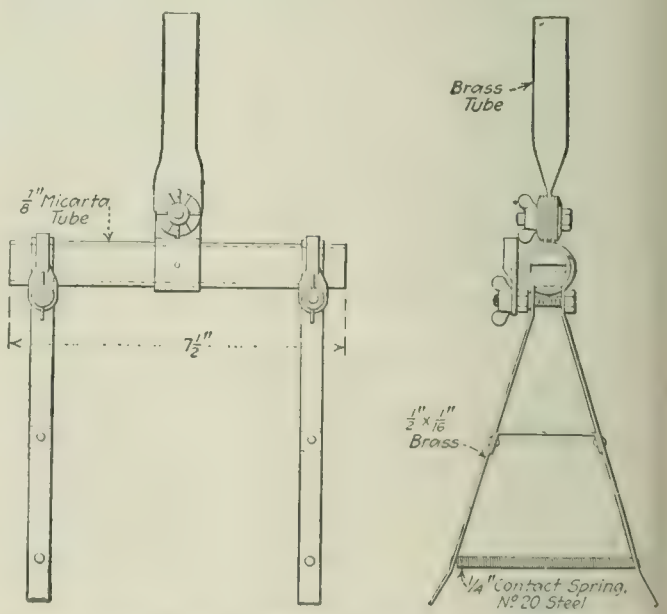
TO SAVE time and expense when making alterations in station wiring complete records of conduits and conductors prove very useful. In such records made by the Pennsylvania Water & Power Company a number is given to each pull box in the station and an arbitrary number to each conduit emerging in the pull box. A developed view of the pull box with each one of its conduits, showing exactly its location and number, is framed and mounted on a wall close to the pull box. A duplicate record is kept in the office. It is a practice in some stations to tag or mark cables in pull boxes, but it has been this company's experience that there is no satisfactory system of doing this. One trouble is that the tags are liable to be wrongly replaced when alterations are made. For this reason the cables are identified by means of the location of the conduits from which they emerge. A list is made up of every circuit in the station, on which are recorded the purchasing data for the cable and a record of the number of each pull box and each conduit that it goes through from its origin to its destination.

Such records should be made while the station is being built, and they should be changed if necessary with each alteration. The justification of going to the expense of completely recording conduits and circuits in a station already constructed depends upon how badly confused or crowded the conduit system is and on the frequency of alterations. Such an expense is seldom warranted.

ALEX. BAUHAN.
Pennsylvania Water & Power Company,
Baltimore, Md.

A Megger Fork That Facilitates Testing Line Insulators

FOR meggering suspension-type insulators in place the fork shown here, devised by the Southern California Edison Company, is very satisfactory. As such a fork often receives rough handling in the field, even being dropped from the top of towers, it must be practically unbreakable. This form consists of a $\frac{3}{8}$-in. (2.2-cm.) tube of $\frac{1}{16}$-in. (1.5-mm.) micarta and is about $7\frac{1}{2}$ in. (19 cm.) long. Near the ends of this tube are fastened forks of $\frac{1}{2}$-in. x $\frac{1}{16}$-in. (13-mm. x 1.6-mm.) brass clamped on the micarta tube and spaced apart by a flat brass separator. Between the ends of each fork is attached a contact spring $\frac{1}{4}$ in. (6 mm.) in diameter and 4 in. (10 cm.) long. When in use one of these springs rests on the cap of the insulator while the other rests on the



ADJUSTABLE JOINT AND SPRING CONTACTS OF THIS MEGGER FORK MAKE IT EASY TO TEST INSULATORS ON THE LINE

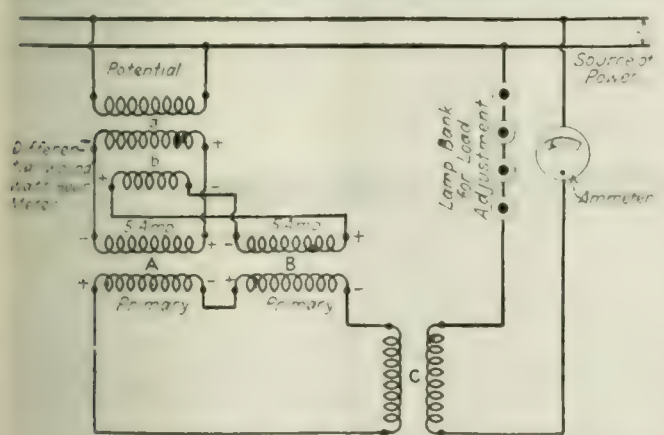
stud. At the center of the tube, by means of an adjustable joint, is attached a brass tube into which a ferrule on the end of a bamboo rod may be inserted. This rod is made up in 5-ft. (1.5-m.) sections for easy carrying. By use of the adjustable joint, which is attached by a wing nut, the fork may be turned to any desired angle for testing. Application to the insulators is very easy as the springs do not require that the fork be held steadily in one place. The lead wires are inserted in two lugs attached to the forks. In order to avoid creepage over the cloth insulation on the lead wires, which are of extra heavy lamp cord, the cloth is skinned back about 2 in. (5 cm.) from the end of the wire, leaving the rubber insulation exposed.

W. R. BATTEY,
Chief Electrical Designer.
Southern California Edison Company,
Los Angeles, Cal.

Differentially Wound Watt-Hour Meter for Testing Current Transformers

FOR quickly adjusting the turns on current transformers a differentially wound watt-hour meter has been used successfully by a Western central station for several years. This differential winding consists of two current coils wound on the same core. These are connected to the transformer to be tested and to the standard transformer, while the same current is passed through the primary side of both transformers. If the disk rotates in either direction, the transformer ratios are not the same; but if the disk remains still, the ratios are identical.

The watt-hour meter employed for this test is a rebuilt single-phase integrating meter of standard make. In order to obtain maximum sensitiveness the moving element was mounted on the best jeweled bearings obtainable. The 5-amp. current winding was removed and replaced by a double winding of the same number of turns for each winding. For this double winding two conductors of the same size, but insulated from each



CONNECTION TO DIFFERENTIALLY WOUND WATT-HOUR METER FOR TESTING CURRENT TRANSFORMERS

A—Standard current transformer. *B*—Current transformer under test. *C*—Stepdown transformer supplying current to primary sides of *A* and *B*. *a* and *b* are parallel coils wound on same core in watt-hour meter

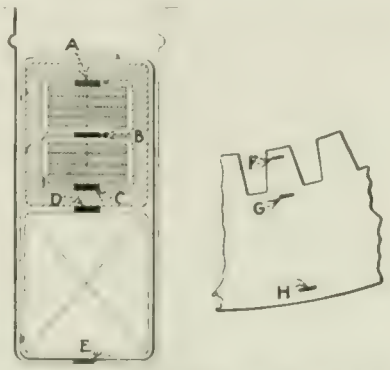
other, were wound side by side and transposed on every layer. The wires were bound tight together and were separated only when well outside of the magnetic path. The original 110-volt potential winding was retained, but the starting coil was removed. In order to test out the instrument the potential winding was excited and the two coils of the differential winding were connected in opposition while current from zero to 5 amp. was circulated through them. Under these conditions the disk remained stationary, showing that the coils were evenly balanced.

The principal use of this meter is in adjusting the number of turns on the current transformers. When the transformer has the correct number of turns adding one turn causes the meter to revolve in one direction and removing one turn reverses the meter. Very quick work is done.

E. C. WESCOTT.
Sacramento, Cal.

Distribution of Heat in Windings and Core of Generators

BY MEASUREMENTS with embedded temperature detectors the temperatures in the different parts of generators have been found to be as indicated in the accompanying illustration. It is seen from this diagram that the hottest point in the conductor is in the upper coil, or the coil nearest the open end of the slot, while



POINTS WHERE TEMPERATURE READINGS WERE TAKEN

the hottest temperature in the iron was, at normal voltage of the machine, at the base of the tooth, and, at 11 per cent voltage, at the extremity of the tooth.

This difference in temperature between the two coils is principally due to the difference in eddy-current loss arising from the cyclic change of leakage flux. The eddy loss in the top coil is lower if the throw of the coils in a particular slot is such as to increase the phase angle between the current in the two coils.

These tests indicated that the thermal drop through the insulation in large, long-core, high-voltage, 60-cycle machines is of the order of 50 deg. C. Moreover, all heat must flow transversely through the insulation. The thermal drop in the insulation in such machines cannot be appreciably lowered by changing the design of the ventilation.

These data were taken from a paper read by F. D. Newbury and C. J. Fechheimer before the recent meeting of the American Institute of Electrical Engineers.

LOCATION OF THERMOCOUPLES IN 12,000-KVA. ALTERNATOR TESTS, AND RELATIVE READINGS AT TWO VOLTAGES

Coil Position*	6,600 Volts, 900 Amp.			No. of Detector	7,200 Volts, 960 Amp.		
	Max.	Min.	Av.		Max.	Min.	Av.
A	78 3	71 3	74 1	6	91 3	84 3	86 8
B	77 0	70 3	73 0	6	89 0	74 7	84 0
C	72 5	66 3	69 5	6	84 0	78 6	81 4
D1	64 0	52 9	56 9	12	69 0	57 0	65 3
D2	58 7	43 5	51 5	5	63 5	56 5	60 7
—	54 0	42 8	47 9	6	66 5	54 2	60 1
E	48 0	44 3	4 . 3	3	60 5	53 4	56 6
G	4 . 0	40 4	45 0	3	58 3	47 1	5 . 5
H	45 1	40 5	43 0	3	53 8	50 5	5 . 2

*D1—single-slot coil; D2—double-slot coil

Industrial Applications

The Economical Utilization of Electrical Energy in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

Effective Light in Offices

THE light falling on the desks in offices is dependent upon the color of the walls and ceilings, therefore it is very essential that these be light in color—white or slightly cream-colored—to insure maximum efficiency of reflection. The accompanying table gives the approximate percentage of light from the lamps which may be expected to reach the desks under different conditions in rooms of average size, *i.e.*, about 20 ft. x 20 ft. (6 m. x 6 m.) using various types of lighting fixtures.

PERCENTAGE OF LIGHT REACHING DESKS

Types of Lighting	Light Ceiling		Medium Ceiling	
	Light Walls	Medium Walls	Light Walls	Medium Walls
Prismatic glass direct	60	53	52	48
Opalescent glass direct	50	45	44	42
Totally indirect	32	30	23	20
Semi-direct	38	34	28	24

The data are taken from information supplied by A. L. Powell, lighting service department of the Edison Lamp Works, General Electric Company.

Short Arc Is Necessary for Successful Welding

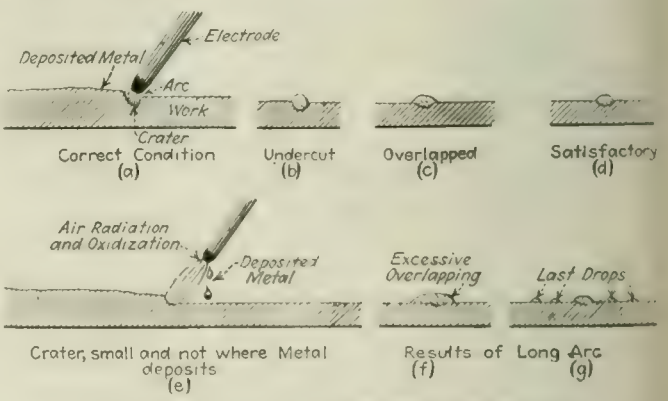
A SHORT arc held at the advancing edge of the puddle is the secret of successful electric arc welding. The natural tendency is to draw a long arc, but in this case too much of the heat is lost by air radiation, there is too great an area for oxidation of the metal in passing from the electrode to the work, and there is too great an area provided for the air to get in and form oxide and nitride, both of which are very undesirable impurities in the weld. There is a further chance with a long arc that the electrode material will not be deposited in the parent metal made fluid by the arc, but will be spattered outside or overlapping, in which case no weld results.

The electrode material must pass into the crater or fluid bowl made by the arc, and the electrode must be held in such a position that the metal can pass nowhere but into this fluid bowl. The fluid bowl appears only at the point the arc strikes, and the arc must be kept striking just ahead of the deposited metal, partially in the parent metal. If the arc is allowed to draw back on the bead, simply a bridge of metal welded from the weld to the point where the arc next strikes the parent metal will result. With flux-coated wire with the bare side advancing (the correct position) the flux coating will follow along, combining the molten puddle and preventing the arc backing up on the weld, provided that a close arc is held.

To get the correct rate of heat for any given condition of electrodes or work the following test should be applied: Run a bead and note whether the edges are undercut as at *B*, overlapped as at *C* or perfect as at *D*.

If they are slightly undercut, it can be told by looking at the bead, but the perfect weld and the overlapped weld can be told only by chipping off the bead. Different electrodes melt at different rates of heat, and different kinds of parent metals show small and larger fluid bowls or craters, depending on their make-up, so that even with the correct length of arc this test should be applied for each new condition. The undercut in general results from a bowl larger than the electrode deposited to fill it, and the overlap bead may result from too small a bowl or from a long arc. With an arc over $\frac{1}{2}$ in. (1.2 cm.) long, and with certain current densities, the bowl may disappear entirely, showing results as at *F*, *G* and *E*, which also show how the results indicated may be had.

With the completely coated electrode the arc exists inside of a viscous tube deposited at the same rate as the electrode, the idea being to keep the oxygen and nitrogen of the air from combining with the steel when molten and when it has its greatest chemical affinity. With this electrode a slag is left around and on top of the weld which must be chipped off from a clean start if the arc should happen to go out or in restarting to continue the bead. With the flux-coated electrode, bare side advancing, there is no danger of slag inclusion. As the slag can be brushed off in restarting, there is no need for chipping the arc clean. The best way of cleaning the weld is by the same action which brings the slag and dross to the surface of the weld with



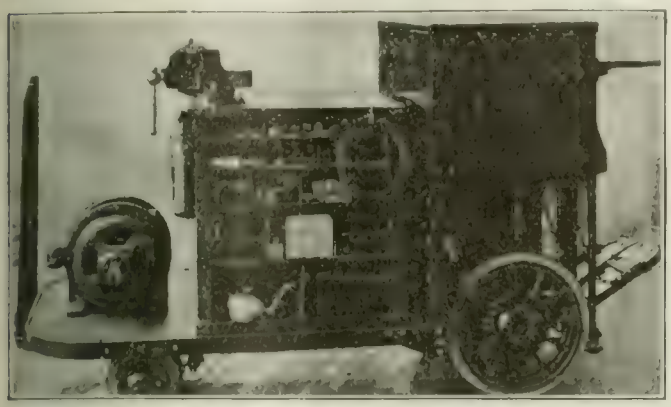
CORRECT METHODS AND INCORRECT METHODS OF ARC WELDING

this electrode. With bare wire there is naturally no danger of slag inclusion, but a continuous amount of the oxide and nitride of the iron is included as the time for bringing them to the surface is too short to allow them to disentangle.

C. J. HOLSLAG.
Electric Arc Cutting & Welding Company,
Newark, N. J.

Motor-Repair Trouble Wagon

TO REDUCE the periods of shutdown a portable repair wagon for maintenance of the motors and other electrical apparatus has been developed in a Detroit factory having 700 motors in operation and designed for an ultimate installation of 1,000 motors. In case any motor trouble develops or is indicated the foreman of the department calls the wagon by pushing the button on any pillar, thus operating an annunciator in the repair shop. The wagon, which is a modified industrial truck



A MOTOR-REPAIR SHOP ON WHEELS

This repair wagon is equipped with virtually everything necessary to correct the troubles usually found in motors, controllers, lamps, wiring and conduit. A trouble call brings the repair wagon to most parts of the plant in a minute or less.

painted red to compel attention and secure right of way, is equipped with a bench, a vise and everything that experience has shown to be necessary to making quick repairs to motors. With two or three exceptions the motors used in the plant are only up to about 15 hp. in size, and if a motor has to be removed there is a platform on the truck on which the motor or compensator or both can be carried back to the repair department and a new motor brought to the job.

The extent of the plant is roughly 600 ft. x 360 ft. (180 m. x 110 m.), but the truck can get to the farthest point one minute and a half after it has been called. There are always men in the repair department, so if the truck is out when a call comes some one goes on foot.

Detroit, Mich. Central Gear Company.

Double-Acting Solenoid Which Has Strong Pull

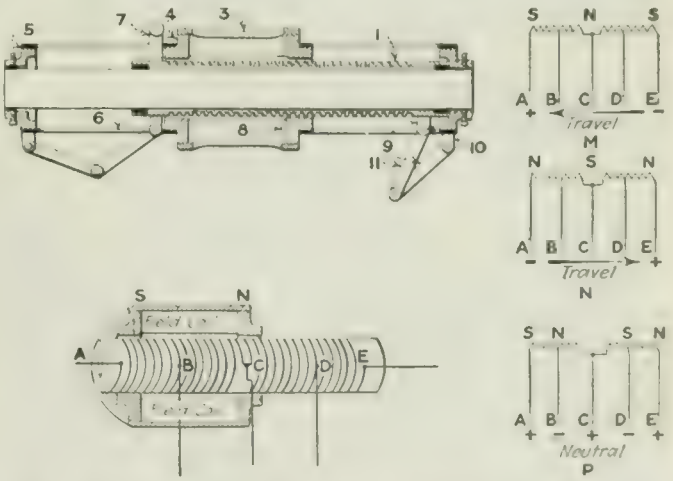
A SOLENOID which is double-acting and at the same time will attain a neutral position has been developed to operate a duplex friction clutch on a head frame of the United Zinc Smelting Corporation, Moundsville, W. Va.

This device pulls equally well in either direction with a nearly uniform pull throughout its travel, and a very long travel may easily be obtained. Moreover, in moving to its neutral it develops a pull equal to the forward or reverse pull and does not appreciably overtravel the neutral position. The solenoid consists principally of a field coil inside of which moves a hollow plunger around which is a specially divided winding. This plunger has grooves upon its surface in which the coils are wound. From the center to the right end the winding is left-handed, and from the center to the left end the winding is right-handed. The length of the winding in the grooves is twice the length of the field coil. The operation of the solenoid is as follows: The field coil is entirely surrounded by an iron inclosing cylinder and the end pieces of the cylinder are also of iron.

Therefore, when this coil is excited a magnetic flux is set up through the cylinder end pieces, and the sliding armature. The hollow armature slides upon a guide of iron which increases the flux. Referring to the perspective sketch shown here, when the current is sent from *A* through to *E*, the armature will tend to move to the left until the right-hand end of the armature is underneath the end of the field coil. The reason for this is that the current in the left end of the armature runs in one direction while that in the right end runs in the other direction owing to the reversal of the winding at the point *C*. This causes a north pole at the left end of the armature and a south pole at the right end.

These poles tend to get under opposite poles of the field coil and hence move the armature in a left-hand direction. To reverse the direction the current is reversed in the armature. In order to make the armature assume its neutral position current is massed as indicated in *P*. This makes a north pole at *B* and a south pole at *C*, which move the center of the armature directly to the center of the field coil. Connection with the different parts of the coil is made by means of flexible wire fastened to the links (11) as shown in the accompanying drawing.

It will be noted that the principle of the action of the machine, for which patents have been asked, corresponds to that of a direct-current motor. For this reason the travel is slow compared with the solid plunger solenoid. This is due to the counter-emf., generated by the moving plunger, which reduces the current and the pull as the speed increases. By making the housing long enough the plunger will overtravel and a counter-force produced by the reverse winding coming under the field coil will stop the plunger before it strikes the end fram-



THIS SOLENOID OPERATES IN EITHER DIRECTION OR ASSUMES A NEUTRAL POSITION

ing. On a test of a solenoid of this type with a 3-in. (7.5-cm.) plunger, $\frac{3}{4}$ in. (2.25 mm.) thick and 15 in. (37.5 cm.) long with a consumption of 500 watts to 600 watts, a pull of 40 lb. (18 kg.) developed with a 6-in. (15-cm.) stroke. J. W. MURRAY.

United Zinc Smelting Corporation,
Moundville, W. Va.

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

Electrical Home Idea Promotes Electric Service in California

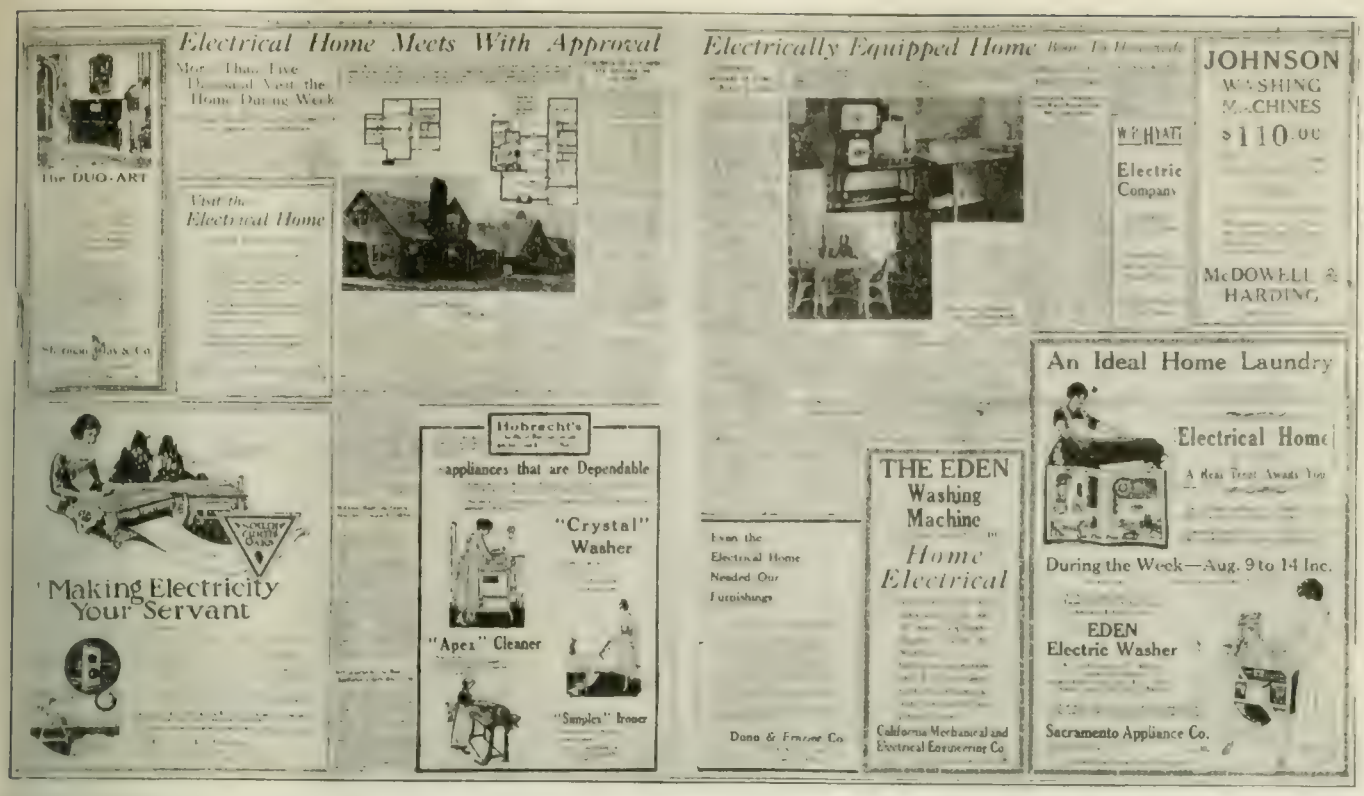
AS A MEANS of educating the public to a greater use of electric service model electrical homes are rapidly proving their value throughout California. These homes are being demonstrated and advertised by the California Electrical Co-operative Campaign in collaboration with leading real estate firms which have taken hold of the idea with enthusiasm.

The California Electrical Co-operative Campaign staged the first of these homes in San Francisco, with the combined assistance of the Mason-McDuffie Company real estate dealers, and electrical interests of the community. The Pacific Gas & Electric Company shared in planning and carrying out the exhibit and demonstrations, providing energy free of charge. An attractive house under course of construction in the St. Francis Wood district of San Francisco was chosen for the demonstration. The house was readily adaptable to the "convenience-outlet" idea, and the amount of wiring was trebled. Convenience outlets were increased from the five or six originally planned to thirty-six. Incidentally these were found insufficient, and in the later homes the number is being increased. Scenes in the various rooms of the electrical home are shown in the accompanying cuts. Approximately 18,000 people visited the house during the two weeks it was open to the public.

So successful was this experiment from the stand-



VIEWS OF SAN FRANCISCO'S ELECTRICAL HOME. MEN OF THE ELECTRICAL INDUSTRY CONDUCTED VISITORS THROUGH THE HOUSE AND EXPLAINED THE VALUE OF CONVENIENCE OUTLETS. EIGHTEEN THOUSAND PEOPLE VISITED THE HOME AND IT WAS OFTEN NECESSARY FOR THEM TO WAIT IN LINE TO GAIN ADMITTANCE, AS SHOWN IN THE UPPER LEFT



TWO PAGES OF SUNDAY NEWSPAPER SUPPLEMENT DEVOTED TO THE ELECTRICAL HOME IN SACRAMENTO

point of the electrical industry and the real estate firm alike that similar arrangements have been made for other California cities. The California Electrical Co-operative Campaign has already opened electric homes in Sacramento and Oakland and others are under way in Los Angeles, San Diego, Fresno, Bakersfield, Long Beach, Stockton and Berkeley. It is planned to establish, all told, eleven of the homes in the larger cities of California and to complete the campaign by Dec. 1 in order to secure the maximum effect on the Christmas shopping.

Advertising Methods

The home was advertised in the newspapers, in the street cars and by billboards, as well as direct by mail advertising. This latter consisted of invitations sent to clubs and to individuals to attend the demonstration. The cost of this advertising was borne jointly by the real estate firm and by the electrical industry of San Francisco. In response to the publicity thus given the installation, the house was continually crowded. Clubs attended in a body on many occasions, classes were taken over to see the home from the University summer school and hundreds of individuals made their way out to satisfy their own interest. Conductors on street cars leading to this district needed only to be asked for directions to the "Electrical Home" to answer with exactly the information wanted.

It is estimated that more than 200,000 persons will visit electrical homes in California before the first of the year, and about $14,000 will be spent in advertising them. Two-thirds of the expense will be carried by the real estate firms. This is distinct from the advertising which appears over the names of electrical dealers and power companies and the generous follow-up by the real estate people after the campaign is over.

An advertising feature of the program at Sacramento was a four-page supplement devoted to electrical advertising and reading matter in one of the Sunday papers. Two pages of this supplement are reproduced here. In these pages were the advertisements of thirteen electric contractors and dealers, one real estate firm, one house-furnishing store and one electric player-piano company.

The program of these campaigns has been arranged so that the advertising appears in newspapers with a large circulation outside of their respective cities, and thus by the time all the electrical homes have been advertised the state will have been covered twice.

More Electrical Homes to Be Built

More important than the large numbers of visitors at the San Francisco and Sacramento homes is the announcement by one real estate company that all its residences are to be built as electrical homes in the future. It is also reported that 150 homes now under construction in Oakland will be wired for electric ranges, and in Chico two houses are being built the wiring for each of which will cost more than $1,000.

While the electrical home idea is not new, the first electric house having been equipped by William J. Hammer in Newark, N. J., in 1884, and while "houses electric" have been successfully conducted from time to time by central stations in the East and South, particularly in Chattanooga, Tenn., and Brooklyn and Elmira, N. Y., the California Electrical Co-operative Campaign has succeeded in linking the idea with the needs of the times. Through its co-operative policy the interests of the electrical industry and real estate companies have been joined in a mutually profitable undertaking. From the standpoint of the central station this movement is providing, at a comparatively small cost, a much-needed campaign for the education of the public in the possibilities and proper use of household electrical devices.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Temperatures in Large Alternating-Current Generators.—W. J. FOSTER.—The writer calls attention to certain advantages that would result from reversing the common practice of ventilating the large generators in hydro-electric units. That is, it is proposed to take the air in directly from the room, piping it away to some point in the building remote from the machines or out of doors. This is a simpler scheme and results in a more comfortable temperature in the room in hot weather.—*General Electric Review*, July, 1920.

Lamps and Lighting

Lighting of Schools.—A. L. POWELL.—The problem of lighting school buildings is discussed and appropriate schemes of lighting for blackboards and other problems peculiar to school buildings are passed in review.—*Bulletin L. D. 109, Edison Lamp Works*, May, 1920.

Motor-Car Headlights and Rear Lights in Relation to Traffic Requirements.—J. W. T. WALSH.—A discussion of means to prevent the dazzling effect of automobile headlights and the use of headlights that are too powerful. Favorable reference is made to the American practice, particularly to regulations in the codes of New York and Connecticut.—*Illuminating Engineer*, April, 1920.

110-Volt Versus 220-Volt Circuits from the Standpoint of Lighting Service.—F. J. GRAY and E. B. FOX.—Although there would be some saving in copper by the use of 220 volts instead of 110 volts for lighting service, it is shown that the lamps manufactured for 220 volts are more expensive and less satisfactory, causing a much higher renewal cost than those for 110 volts. The excessive annual cost entailed by the use of high-voltage lamps more than offsets the saving in copper investment.—*Bulletin L. D. 105, Edison Lamp Works*, April, 1920.

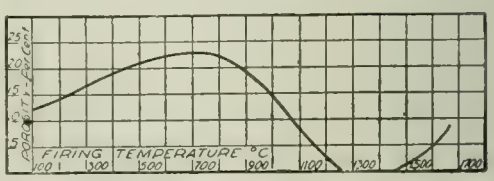
Generation, Transmission and Distribution

Electric Power for Mining.—F. S. VIELE.—Details are given of a 12,000-hp. hydro-electric plant and a steam plant of 10,000 hp. capacity for the supply of a mining load in Arizona. It is said that practically every mining operation in the vicinity is operated electrically by customers taking from 50 hp. to 5,000 hp. The system is that of the Arizona Power Company.—*Journal of Electricity*, July 15, 1920.

The Design of Distributing Networks.—C. A. GILLIN.—The writer deals with the fundamentals of distribution network design, considering the possible use of higher voltages than those commonly employed whether the system shall be underground or overhead and the standardization of substations.—London *Electrician*, July 2, 1920.

Stoker Furnace for Coal or Oil.—The design and installation of an oil-burning system in one of the plants of the Erie Forge & Steel Company is such that it takes only about twelve hours to make a change from one fuel to the other, depending upon whether the fuel supply is coal or oil.—*Power Plant Engineering*, Aug. 1, 1920.

Factors Controlling the Design and Selection of Suspension Insulators.—W. D. A. PEASLEE.—A discussion of the factors entering into the design and operating behavior of suspension insulators and the problems to be solved in designing a suspension insulator to overcome the objectionable features shown by experience to affect seriously the operation of the insulators in service. Factors to be taken into consideration in the selection of suspension insulators for a given condition are set forth and a brief discussion of the general trend of future improvements is presented. An interesting curve is given showing the relation between the firing



INFLUENCE OF FIRING TEMPERATURE OF PORCELAIN

temperature and porosity for one porcelain body, indicating that non-porous porcelain may be obtained when the firing temperature is between about 1,250 deg. and 1,450 deg. C.—*Journal A. I. E. E.*, June, 1920.

Traction

The Italian State Railway Electrification System.—A. BARBAGELATA.—An anaysis of the discussion of June, 1919, on the question of the system of electrification on the Italian State Railways. The author summarizes the economic superiority of the high-tension continuous-current system and calls for immediate application of this system to a group of important lines in central Italy pending the completion of the three-phase electrification of the Ligurian-Lombardy-Piedmontese railways.—*Technical Review*, July 20, 1920. (Abstracted from *L'Elettrotecnica*, Feb. 5 and 15, 1920.)

Regulation and Inductive Effects in Single-Phase Railway Circuits.—A. W. COPLEY.—Methods of calculating regulation are followed by an interesting study of inductive effects on communication circuits. In planning for an electrification which is paralleled by telephone and telegraph circuits, the writer states, it is essential that induction be taken into account from the start. The introduction of special devices into either the telegraph or the railway circuits is annoying and sometimes quite expensive. By carefully laying out the

transformer stations and determining the probable induced voltages beforehand, however, very little extra expense should be involved and a system can be obtained which is free from most of the extra devices. If the stations are so laid out that the short-circuit conditions on the railroad do not cause dangerous voltages in the telephone lines, normal operating conditions will as a general rule take care of themselves. If after all reasonable steps have been taken in the railroad circuit, the induced voltage is still above the working limits and yet does not cause a physical hazard, the use of some such device in the resonant shunt in the telegraph lines will probably take care of whatever voltage remains. If there is a short distance where the exposure is very severe, and the spacing of transformer stations to take care of this condition would be so close as to cause considerable expense, such a short stretch could be protected by some of the special devices considered above without affecting the rest of the system. In an appendix the writer shows how impedances of the trolley circuits may be calculated and also describes various arrangements of resonant shunts for use in special instances.—*Electric Journal*, August, 1920.

Installations, Systems and Appliances

A Fuel-Oil Installation.—H. A. WILCOX.—It is said that one of three boiler rooms of an old plant was equipped for oil burning to increase the steaming capacity without additional boilers. At the same time a costly method of coal handling was eliminated.—*Power Plant Engineering*, May 15, 1920.

Automatic Control of Arc Furnace Electrodes.—J. A. SEEDE.—The writer deals with that class of furnaces of the arc type in which control of the power input is obtained by moving the electrode up or down or in or out, as the case may be. How this automatic control is carried out is described for six different arrangements of electrodes. Advantages of automatic control over hand control are given by the author as follows: (1) Power input; (2) furnace maintenance; (3) electrode consumption; (4) labor charges; (5) quality of product; (6) upkeep of transformers.—*Journal, A.I.E.E.*, June, 1920.

The Largest Rolling Mill in the World.—This is a 42-in. (1.7-m.) plate mill of the reversing type, which can deal with slabs up to 7 ft. by 4.5 ft. by 1.5 ft. (2.1 m. by 1.37 m. by 0.46 m.), weighing 10 tons. Plates are turned out at the rate of 60 tons per hour for two hours and 30 tons for the remaining period of the shift. The motor is a double-unit machine with the units connected in series, the midpoint being at earth potential. The continuous rating of the motor is 6,750 hp. at 40 r.p.m., 1,600 volts, and a peak load capacity of 20,500 hp. at the same voltage and speed. The speed can be further increased up to 70 r.p.m. by weakening the motor field. Oscillographic tests show that this motor is capable of being reversed from 40 r.p.m. in one direction to 40 r.p.m. in the opposite direction in less than three seconds. The control for this motor is given in considerable detail.—London *Electrician*, May 7 and 14, 1920.

Methods That Will Make Electrical Parts of Mine Locomotives Run Efficiently.—A discussion of the possibilities of failure in motors, resistors, storage batteries and trolley arms of mine locomotives and the proper steps to be taken to prevent them and repair such defects as they appear.—*Coal Age*, July 29, 1920.

The Electric Lighting of Railroad Signals.—L. C. PORTER and F. S. STALLKNECHT.—It is pointed out that the electric lighting of railroad signals is both cheaper and more reliable than older methods using oil lamps. Although in some instances the installation of electrical equipment is more costly than that for the oil lamp, this first cost is soon wiped out by economy of operation over the period of a year or so.—*Transactions I. E. S.*, June 10, 1920.

Electrophysics and Magnetism

Measurement of Hysteresis Values from High Magnetizing Forces.—W. L. CHENEY.—After reviewing former attempts to measure hysteresis values with apparatus of a modified "isthmus" type and discussing possible causes for errors in observation, an improved method for measuring hysteresis values by means of this apparatus is described. The results agree, within the experimental error, with those obtained on standard types of apparatus. Observations, carried as high as $H = 2{,}500$ gausses, are shown graphically.—*Scientific Paper No. 383, Bureau of Standards*, June 19, 1920.

Spectro-photoelectric Sensitivity of Thalophide.—W. W. COBLENTZ.—Experimental data are given on the spectro-photoelectric sensitivity of Case's preparation of thallium-oxysulphide, called thalophide when exposed to thermal radiation of wave lengths extending from 0.58μ to 3μ. This substance has a wide, unsymmetrical, complex band of photoelectric sensitivity which terminates abruptly at 1.2μ. The effect of temperature was also investigated. It was found that, in common with nearly all photoelectric substances thus far examined, the sensitivity increases most rapidly on the short wave length.—*Scientific Paper No. 380, U. S. Bureau of Standards*, June 17, 1920.

Telegraphy, Telephony and Signals

The Alexanderson Continuous-Wave System.—This is a description of the high-power radio apparatus for radio-telegraph and radio-telephone transmission at New Brunswick, N. J. The New Brunswick station, which is typical of a 200-kw. Alexanderson installation, consists of three important developments: (1) An alternator, which generates currents directly at the frequencies required for the radio circuits with which it is associated. The frequency of these currents is solely dependent upon the number of field poles on the machine and upon the speed at which the rotating member is driven. This is in distinct contrast to certain other systems in which the radio-frequency currents are obtained indirectly by means of "reflector" circuits or frequency-raising transformers electrically associated with the alternator. (2) A magnetic amplifier, which provides a non-arcing control of the alternator output for radio-telegraphy and is equally applicable to radio-telephony. (3) A multiple tuned antenna, a development which has markedly reduced the wasteful resistance of the flat-top antenna and has therefore increased the transmitter over-all efficiency manyfold.—*Wireless Age*, July and August, 1920.

Miscellaneous

The Electrically Welded Ship Fullagar.—The Fullagar is an entirely welded ship. The success on this ship has shown that welding is effective for all purposes in such work. It is not claimed that it is necessarily the cheapest method. The ship is one of 25,000 cu.ft. (700 cu.m.) displacement.—London *Engineering*, July 2, 1920.

News in Brief

Summary of Market Conditions and of Recent and Approaching Happenings of Importance to the Industry

PESSIMISM in the South, induced by a rainy spell, and complaints of ruinous freight rates by the lumber interests of the Northwest, are offset to some degree by hopeful reports from the Intermountain states and improved transportation conditions East and South. Sales are still light and collections are reported as slow and difficult except on the Pacific Coast, where they are fairly prompt.

A RECENT drop in the price of cotton has not affected the prices of electrical goods containing this material, though cotton insulating tape and webbing have declined.

EVIDENCE of a growing market for American electrical household appliances abroad continues to accumulate, official returns showing more than 100 per cent increase in exports of these articles for 1919 as compared with 1918.

A MARKED scarcity of insulating paper is reported on account chiefly of the difficulty in obtaining necessary raw materials, but manufacturers are hopeful of an early improvement.

DELIVERIES of bare copper wire are impeded by fuel and car shortage, and stocks have been interfered with by the great demand for the insulated product, which has led to the conversion of much bare wire that would ordinarily have found its way to the dealers.

ORGANIZATION of the engineering staff of the super-power zone survey between Boston and Washington has been announced by the chairman, W. S. Murray. Wide publicity for the project is favored by its engineering staff.

PATENT licenses covering wireless telegraphy and telephony are to be exchanged by the American Telephone & Telegraph Company and the General Electric Company.

RAILROADS have been prohibited by the Interstate Commerce Commission from refusing coal cars to utilities because the latter have surplus coal on hand. The coal supply of New York City utilities continues to show a slight improvement.

RETURNS issued by the Geological Survey for the month of May show a total electrical output by central stations, electric railways and certain other plants of more than 3,500,000,000 kw.-hr., of which about 1,500,000,000 kw.-hr. was generated by water. These plants consumed nearly 16,000,000 tons of coal in the first five months of the year.

WORK has been begun by the San Joaquin Light & Power Company on its first 17,500-hp. unit in its new steam plant in the Kern County oil fields. The unit will burn 7,000,000 cu.ft. of gas a day and will be in operation next summer; estimated cost, $1,750,000. Four other units are planned.

WORCESTER, Mass., will have an electrical show in Mechanics' Hall, the largest auditorium in the city, Sept. 20-25.

A STATEMENT of principles covering rental charge, amortization of reserves, depreciation of reserves and allocation of earnings is being worked out by the Federal Power Commission.

RIGID economy in power consumption in view of the present acute shortage has been ordered by Power Administrator Butler of California.

FOR COMPLETION of its Caribou project by the addition of 20,000 kw. the Great Western Power Company has issued $3,500,000 in 8 per cent ten-year bonds.

A RADIO station with a radius of 12,000 miles, built by the United States Navy, has been put into operation at Bordeaux, France.

DIFFERENCE of opinion on the commercial value of the proposed Great Falls development on the Potomac was brought out before the Federal Power Commission.

THE "ELECTRICAL home" idea in California now includes seven houses completely equipped with convenience outlets. The seventh home will be in Long Beach and will be opened to the public Oct. 15.

A PROPOSAL that electrical contractors shall be required to have licenses from the city as well as from the state is included in the revised electrical code of Seattle, now under discussion.

ALREADY the largest membership reached by any American engineering body has been obtained by the Federated American Engineering Societies.

EIGHT important meetings of electrical associations are scheduled for the month of September.

AN ISSUE of $1,000,000 of 8 per cent ten-year bonds has been made by the Pacific Power & Light Company at 98.25, to yield 8¼ per cent.

THE JULY statement of the Southern California Edison Company shows an increase of 51 per cent in gross income over the corresponding month last year.

REFRACTORIES will be the topic discussed at the meeting of the Electric Furnace Association at Columbus, Ohio, on Oct. 6.

GAS-FILLED incandescent lamps are to replace gasoline lamps in St. Louis parks and are to be installed on isolated streets.

HYDRO-ELECTRIC engineers in New England report increasing interest among manufacturing establishments and bankers in plans for building new installations of moderate size and improving existing plants.

FURTHER expansion of the Lynn works of the General Electric Company depends in large measure upon the production record of the employees, according to a press statement by Manager R. H. Rice announcing the removal of the greater part of the small-motors department to the Bridgeport (Conn.) plant.

RECOGNITION has been granted to the Michigan central stations by the appointment of a representative of the Consumers' Power Company on the Coal Committee named by the Governor of the state.

OPPOSITION on the part of a citizens' organization to fixing an 8 per cent rate of return for the Potomac Electric Power Company was expressed at a hearing before the Public Utilities Commission of the District of Columbia.

APPLICATION has been made by the Connecticut River Company to the Federal Power Commission for permission to build a 40,000-hp. hydro-electric development, including dam and locks, on the Connecticut River at Windsor Locks, Conn.

A RESOLUTION favoring action by the Ohio Electric Light Association and its member companies to expedite the work of the Ohio Public Utilities Commission has been passed by the executive committee of the body first named.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

American T. & T. and General Electric to Exchange Wireless Patents

PATENT licenses covering wireless telegraphy and wireless telephony are to be exchanged by the American Telephone & Telegraph Company and the General Electric Company under the terms of a contract which was announced this week. Negotiations which led up to this contract were begun after each company had received letters from the Bureau of Steam Engineering of the United States Navy in which the bureau gave the opinion that the interests of all would be served best by some agreement between the holders of permanent patents.

H. B. Thayer, president of the American Telephone & Telegraph Company, in announcing the agreement, stated that under the exchange of patent licenses provided for in the contract the General Electric Company and the Radio Corporation of America, in which the General Electric Company has become interested, would be able to further the development of wireless communication and the American Telephone Company would be able to supplant its wire extensions.

"The world-wide wireless system of the Radio Corporation and the universal service of the Bell System," said Mr. Thayer, "are thus brought into a harmonious relation that will facilitate the use by the public of the present wireless-telegraph facilities of the Radio Corporation and, as the art advances, will enable the American Telephone & Telegraph Company to extend its telephone service to ships at sea and to foreign countries."

In order better to carry out the purpose of the agreement the American Telephone & Telegraph Company has purchased a minority interest in the Radio Corporation of America. W. S. Gifford, vice-president of the American Telephone & Telegraph Company, has been made a director in the Radio Corporation of America.

Railroads Shall Not Refuse Coal Cars to Utilities with a Surplus

AN INTERPRETATION of paragraph 4 of Service Order No. 9 has been given by Commissioner Clyde B. Aitchison of the Interstate Commerce Commission in a letter written by him to the public utilities of Maine, which states that such coal as may be accumulated by public utilities under the regular car supply "should not be used by the railroads as a means of reducing the number of cars that the public utilities may otherwise be able to secure for current needs under Order No. 9."

The occasion for this interpretation was the refusal of certain railroads to give priority assignment of coal cars to public utilities having on hand a supply of coal which the railroad agents considered to be in excess of their current needs. In these refusals the railroads had previously been upheld by the commission. It was shown that if such a ruling held good, any company having more than a day-to-day supply of coal would be unable to obtain cars under Order No. 9. The commission, after considering the matter from this viewpoint, issued the foregoing interpretation. Public utilities, therefore, may insist upon assignment of cars for coal sufficient to take care of their current needs and at the same time lay up a surplus supply of coal if they are able to secure it from any other source.

The coal situation among the utilities of the New England States is intense, and many of them will be hard put to it to supply their needs through the coming fall and winter.

Orders to investigate repeated resales of coal have been issued by the Attorney-General to every district attorney in the United States.

Coal Supply of New York Utilities Continues to Show Slight Improvement

ON AUG. 24 the total coal on hand and in reserve by the public utilities of New York City, as reported by the Public Service Commission, was 309,910 tons. This is an increase of 36,597 tons over the previous week. The public utilities are, however, still nearly 200,000 tons below the stocks they should have in reserve at this time of year. In normal times to pass through the winter with a safe margin the companies should have on hand about 500,000 tons by Sept. 1 and 800,000 tons by Oct. 1.

Great Falls Development Discussed Before Federal Power Commission

GREAT difference of opinion exists as to the commercial feasibility of the development of Great Falls, on the Potomac. This was clearly shown at a hearing on this project which took place before the Federal Power Commission on Aug. 24. Representatives of the Potomac Electric Power Company, the large steam plant of which furnishes most of the power for the District of Columbia and vicinity, opposed the project, S. R. Bowen, vice-president of the company, telling of adverse reports his company has received from engineers. He admitted that, while it had acquired power rights at the Falls sixteen years ago, his company has no present plan for the utilization of the water power.

Col. Charles W. Kutz, the Engineer Commissioner of the District of Columbia, testified that the development of the Great Falls project would be justified even if it were necessary to maintain existing charges. This contention was based on the advantages which would come from the diversion to other uses of the coal now required to operate the steam plant.

Federal Power Commission Holds Special Hearings

IN VIEW of the great importance which private interests are attaching to the exact language of the water-power act regulations the Federal Power Commission has held special hearings this week. Attention was concentrated on a statement of principles. Once an agreement is reached on the principles involved, it is believed that the final language can be worked out more leisurely. The principal points to be covered by the statement of principles are rental charge, amortization of reserves, depreciation of reserves and allocation of earnings. The scheme of development, construction and maintenance of project works has practically been completed by a committee consisting of Herman Stabler, R. R. Randall and O. G. Thurlow.

The Comptroller of the Treasury has ruled that the specific appropriation of $25,000 carried in the act may be expended for field service. In a former ruling the Comptroller held that no portion of the $100,000 appropriation could be used for the hiring of personnel.

R. R. Randall has been appointed an assistant engineer on the staff of the commission. Mr. Randall has been in immediate charge of water-power matters for the Forest Service. F. W. Griffith, formerly chief clerk of the Bureau of National Parks, has been appointed chief clerk for the commission.

Michigan Section, N. E. L. A., Discusses Utility Problems and Rural Service

THE public needs to attain a correct understanding of the meaning of commission regulation and to be convinced that it is a partner in public utility affairs and is hit directly when utilities are not fairly treated. This was the substance of the address of W. M. Smith, chairman of the Michigan Public Utilities Commission, before the convention of the Michigan Section of the National Electric Light Association, which opened at the Ottawa Beach Hotel, Ottawa Beach, Mich., on Tuesday of this week. The public's feeling that its interests and those of the utilities are not mutual must be done away with, Mr. Smith declared.

President Martin Insull and M. H. Aylesworth, executive manager of the N. E. L. A., told the convention of the significance of the new organization of that association and its ability to aid in the upbuilding of the industry.

In an address on "Home Rule Versus State Control," delivered at the Wednesday session, W. J. Hagenah of Chicago emphasized the impossibility of a municipality building up a specialized organization competent to deal with utility regulation problems. No one municipality has a large enough number of problems to keep such an organization employed, and in addition it would be too near the source of controversy to be impartial.

That electric power service is to be a vital factor in the work of the farmer was asserted by Prof. A. R. Sawyer of the Michigan Agricultural College in a paper on "Standardization of Electric Farm Line Equipment," in which the situation was discussed from the standpoint of the farms as well as the central stations.

The program during the Tuesday and Wednesday sessions included papers on electric meter maintenance, boiler-room efficiency, and the electric dishwasher, and also an account of the work of the Illinois Committee on Public Utility Information. The session extended over Thursday, on which day the subjects of machine billing and ledger posting and the value of statistics were discussed. J. B. Wooten of New York delivered an address on publicity at the banquet Wednesday evening. Lawn parties Tuesday and Wednesday afternoon were provided for the entertainment of those present, special entertainment for the ladies also being arranged.

Indiana Electric Light Association Announces Program

THE program for the convention of the Indiana Electric Light Association, to be held on Wednesday and Thursday, Sept. 15 and 16, has been announced as follows:

WEDNESDAY, SEPT. 15

President's address; committee reports; address, "Future of Electric Light and Power Companies," by Martin Insull, president N. E. L. A.; address by E. I. Lewis, chairman of the Indiana Public Service Commission; address, "Future of Public Utilities," by Charles C. Perry, president Indianapolis Light & Heat Company.

THURSDAY, SEPT. 16 (COMMERCIAL SECTION DAY)

Address, "Voluntary Versus Involuntary Co-operation," by William L. Goodwin, General Electric Company; address, "Central Stations and Contractors," by Samuel Adams Chase, Westinghouse Electric & Manufacturing Company; paper, "Industrial Application of Electric Power-Factor Correction and Its Effect," by T. F. English, general manager Indiana General Service Company; paper, "Reduced Operating Expenses Versus Increased Fixed Charges," by George A. Neal, Northern Indiana Gas & Electric Company; round-table discussion; election of officers.

Electrical Meetings in September

EIGHT important electrical associations will hold conventions in the month of September this year—four in the East, two in the Middle West, one in Colorado and one on the Pacific Coast. The dates and meeting places are as follows:

Sept. 8 to 11—Bedford Springs, Pa.; Pennsylvania Electric Association.

Sept. 8 to 11—Spokane, Wash.; Northwest Geographic Division, N. E. L. A.

Sept. 8 to 9—Omaha, Neb.; Nebraska Section, N. E. L. A.

Sept. 13 to 15—Glenwood Springs, Col.; Colorado Electric Light, Power and Railway Association and Rocky Mountain Geographic Division, N. E. L. A.

Sept. 13 to 16—New London, Conn.; Association of Edison Illuminating Companies.

Sept. 14 to 16—Kineo, Me.; New England Geographic Division, N. E. L. A.

Sept. 15 to 17—French Lick, Ind.; Indiana Electric Light Association.

Sept. 20 to 24—New York City; Association of Iron and Steel Electrical Engineers.

Programs of the Northwest, Nebraska and Colorado meetings were printed in the ELECTRICAL WORLD for Aug. 21, page 398; for the Edison company, Illuminating Engineering Society and New England meetings on Aug. 14, pages 349 and 350, and for the Iron and Steel association on Aug. 7, page 300.

In addition to the above meetings, the Telephone Pioneers of America will meet in Montreal on Sept. 10 and 11 and the American Electrochemical Society will convene in Cleveland on Sept. 30, continuing its meeting through Oct. 1 and Oct. 2.

Federated American Engineering Societies Largest Engineering Body

IN A bulletin just issued by the joint conference committee of the four founder societies, it is pointed out that there is a tendency when discussing the Federated American Engineering Societies to refer to it as a "proposed" organization. Attention is called to the fact that the Federated American Engineering Societies is in actual existence with a membership already that makes it the largest engineering organization in this country. This membership includes the American Society of Mechanical Engineers, Detroit Engineering Society, Technical Club of Dallas and American Institute of Electrical Engineers. Official action on the part of many other organizations is all that is necessary to complete their standing as regularly enrolled members.

Manufacturers Should Build "Customer-Partnership" with Utilities

AS THE business of electrical manufacturers is largely dependent upon the welfare of central stations and other public utilities, the manufacturers can materially assist through their national advertising in building good will for the utilities. Recognizing the value of this idea to the entire industry, J. M. Wakeman, general manager of the Society for Electrical Development, is advocating that electrical manufacturers devote their space for some time to this extremely important object. In discussing the matter with a representative of the ELECTRICAL WORLD Mr. Wakeman pointed out that this is a self-interest idea and could result only in profit to the manufacturers. He said:

"The manufacturers are having difficulty in filling orders which they have on their books, and those who have contracted for space in the popular magazines should use that space in behalf of the central stations and should so word their advertisements to appeal for the moral and financial support of the communities served by the central stations. Taking up the broad question of soliciting the support of the community, the main object is to build up a bulwark against Bolshevistic ideas, particularly along the lines of municipal ownership of public utilities, substituting the idea of 'customer-partnership' as opposed to that of municipal ownership.

"Our idea is that the manufacturers can well afford to devote their space to building up good will for the utilities in the minds of the people by pointing out how the self-interest of the community lies in the prosperity of the public utility."

Tennessee Contractors and Dealers Meet Next Week

NASHVILLE will be the meeting place of the Tennessee Association of Electrical Contractors and Dealers Saturday next, Sept. 4, when two sessions will be held at the Tulane Hotel. Governor Roberts will speak on public utilities commission topics and the following addresses will be made and discussed: "First Aid to Public Utilities," by J. P. Lawrence, Nashville; "Selling Appliances on Term Payments," by W. H. Synans, Nashville; "Comparison of Profits in Electrical and Hardware Trades," by H. G. Street, Memphis; "Proper Handling of Fixture Sales," by P. W. Curtis, Chattanooga; "Tennessee License Law," by W. R. Herstein, Memphis; "Conducting a Retail Store," by J. A. Fowler, Memphis; "Electrical Advertising," by E. S. Dunham, Memphis; "Window Display," by J. A. Corcoran, Schenectady, N. Y.; "The Mazda Lamp," by O. G. Heinke, Nashville, and "Fall and Winter Business Outlook," by C. R. Wright, Knoxville.

The Nashville Electric League will give a dinner to the delegates in the evening, when an address on "Harmonizing the Industry" will be made by a speaker not yet announced.

Refractories to Be Discussed by Electric Furnace Association

THE subject of "Refractories" has been selected for the session of the Electric Furnace Association which will be held at the Ohio State University, Columbus, on Wednesday afternoon, Oct. 6. The meeting will provide an opportunity for a discussion of their problems by the users and makers of refractories. Papers will be presented by steel men and by the manufacturers of bricks and lining materials, and considerable time will be allowed for questions and informal discussions by the delegates present.

Western Construction Engineer Substitutes Aeroplane for Automobile



REX C. STARR, the young construction engineer who broke all records in carrying through the Kerckhoff project of the San Joaquin Light & Power Corporation, has begun to use a 185-hp. biplane to decrease the time taken in covering by automobile the hundreds of miles of valley and rough mountain roads separating the various jobs under his supervision. This photograph shows him arriving at Auberry on the morning of Aug. 15 for the starting of the power house. Mr. Starr left Fresno at 8:30 a. m. and was in Auberry, 20 miles distant, in twenty-five minutes. His machine is piloted by Shirley Bush, a former army flier. The San Joaquin Light & Power Corporation has prepared a landing field at its headquarters camp at Auberry and also one at Crane Valley, 10 miles further in the mountains. Other fields will be prepared on the Kings River project and near the company's Kern River plant. Mr. Starr is probably the first hydro-electric construction engineer to make use of the aeroplane. He has already been flying between Fresno and San Francisco.

A. S. M. E. to Discuss Valuation

AT THE annual meeting of the American Society of Mechanical Engineers, which will be held in the Engineering Societies Building, New York City, from Dec. 7 through Dec 10, special sessions will be held on the subjects of appraisal and valuation and the application of engineering to woodworking. A committee will be appointed to review the society's work in the past covering valuation and appraisal of industrial and public utility plants and recommend subjects for discussion at the coming meetings.

California Co-operative Campaign Plans Lighting Exhibits

TWO committees of the California Electrical Co-operative Campaign, one in Los Angeles and the other in San Francisco, are completing plans to place in operation in those cities, in October, exhibits for the purpose of stimulating better industrial lighting. These plans follow the success of the industrial lighting exhibit made at the National Electric Light Association convention at Pasadena this year, where much interest was aroused in this scheme.

Specifications for Rural-Line Construction in Wisconsin

THE Railroad Commission of Wisconsin is preparing specifications covering rural-line construction. The growth of rural service in Wisconsin has been so rapid that the need of rules that will insure substantial construction and at the same time keep the original investment to the lowest possible figure is keenly felt. The rules under which rural extensions are made in the state provide for the financing of the lines by the customers. The commission is interested in seeing that future troubles due to inadequate construction or unnecessary construction costs are avoided. It is expected that the inductive interference problem will receive consideration as it is particularly important in rural work where ground-return telephone lines are common.

Electric Lighting Replaces Gasoline Park Lamps in St. Louis

THE city of St. Louis is installing about 3,400 80-cp. and 100-cp. gas-filled incandescent street lamps to replace the gasoline street lights which have been used in the city parks and to illuminate some isolated streets which are not now illuminated. Approximately 3,000 of the lamps will be connected to 6.6-amp. series circuits and the remainder will be 110-volt multiple units. The lamp posts are being made from crushed Missouri granite, and the circuits will require the installation of about 178 miles of underground cable.

Mobridge (S. D.) Hydro Project to Be Considered Next Spring

SUBMISSION of the Mobridge hydro-electric project, recently reported on by Mead & Seastone, to the voters of South Dakota will probably be made at the regular election next spring. This project involves building a dam in the Missouri River and foreshadows a possible ultimate output of 85,000,000 kw.-hr. (see Electrical World, June 12, page 1390). There has been some sentiment favoring submission this fall, but more conservative counsels have prevailed and the submission has been deferred until next spring to give full opportunity for discussion both in official circles and among the people of the state. It is said that the consulting engineers have, because of the unusual nature of the project and its importance in the development of the state, expressed a desire for a check of their report by an independent investigator.

Central Stations Recognized in the Michigan Fuel Committee

THE public utilities of Michigan have been recognized in the formation of the Michigan Coal Committee by the appointment of B. E. Morrow, manager production and transmission department of the Consumers' Power Company, Jackson, as a member. Gov. Albert E. Sleeper has appointed the following committee: Chairman, W. K. Prudden, president Prudden Wheel Company, Lansing, former fuel administrator; E. J. Dubois, fuel commissioner of Detroit Board of Commerce; Charles B. Kelsey, utility engineer, Grand Rapids; C. H. Benedict, Calumet & Hecla Copper Company, Lake Linden, and B. E. Morrow, Consumers' Power Company. The committee are now engaged in securing a definite report of fuel stocks in the state and will include in the report full information as to contracts and orders for fuel as well as amounts of coal being shipped at this time on orders and contract. The committee will take steps to assist Michigan fuel users to prevent interruption to their operations.

Anticipated Power Shortage in California Now Being Felt

"CENTRAL and northern California are now entering upon the acute period of the electric power shortage, owing principally to the lack of rains in the past winter and the present heat, which has dried up the rivers to the lowest stages known. It will be necessary for a 15 per cent cut to be made upon cement mills, gold dredgers and street railways at once. The supply of electric energy for power, except for domestic use, for growing crops and for handling perishable foods, must be reduced 20 per cent." This was the information sent out by H. G. Butler, power administrator of the California Railroad Commission, in a telegram to all the power companies in California calling for a meeting at his office at once. He further stated that "other industries will be restricted similarly as fast as the necessary steps can be taken. Street, sign and display lighting must be cut to the minimum consistent with safety."

"The steam plants of the California companies are operating at their maximum capacity," Mr. Butler continued, "and the smaller plants of consumers, wherever available for use, have been put into operation to reduce the demand upon the larger companies. Notwithstanding this, the demand for electric power at the present time largely exceeds the supply, and it is becoming necessary to place further restrictions upon the users of electricity where it can be done without excessive loss or damage, in order that there may be sufficient power to avoid loss of crops and to provide for the absolute needs of the other industries."

New Edison Medal Committee of A. I. E. E.

AT THE recent meeting of the board of directors of the American Institute of Electrical Engineers, the board, in accordance with the bylaws of the Edison medal committee, confirmed the appointment by President Berresford of Comfort A. Adams, chairman engineering division, National Research Committee, New York, as chairman of the committee, and of H. M. Byllesby, president H. M. Byllesby & Company, Chicago, D. E. Drake, sales engineer Westinghouse Electric & Manufacturing Company, New York, and W. L. R. Emmet, consulting engineer General Electric Company, Schenectady, N. Y., as members of the committee for terms of five years each. The board also elected three of its own membership as members of the Edison medal committee for terms of two years, namely, W. I. Slichter, Columbia University, New York; L. E. Imlay, operating engineer Niagara Falls Power Company, New York, and F. D. Newbury, division engineer Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

New Financing by Pacific Power & Light Company

THE Pacific Power & Light Company, with main offices at Portland, Ore., has issued $1,000,000 of 8 per cent ten-year bonds to mature in 1930. They are secured by a mortgage on the company's property and business, subject to its present mortgage, and also by deposit of a like amount of the company's bonds issued under the present mortgage.

The bonds were purchased by N. W. Langley & Company of New York and are being handled locally by Blythe, Witter & Company, the Ladd & Tilton Bank, Freeman, Smith & Camp, Lumberman's Trust Company and E. L. Devereaux & Company. The price is $98.25, to yield the investor 8½ per cent. Half a million dollars of the money is to be used to take care of the company's present floating indebtedness for improvements, and the other half million dollars is to pay for the new steam electric generating station at Astoria. It is understood that this money cost the company in the neighborhood of 10 per cent.

The company is awaiting decision by the Public Service Commission of Washington on its application for an increase in its electric rates in that state. If this be granted, it will materially help in the marketing of the bonds and the raising of additional money in the future for needed extensions and improvements.

Powerful Radio Station Put in Service in France

WHAT is described as the most powerful radio station in the world, with a sending radius of 12,000 miles (19,000 km.), was put in service at Bordeaux, France, last Saturday. This great sending radius is obtained by the use of very high-power arc transmission equipment and eight antenna towers 820 ft. (250 m.) high. Tests show that the audibility of signals from this station is about five times as great as from the Nauen station in Germany.

The first message sent out from Bordeaux, called the Lafayette station, was readily received at Washington and Bar Harbor, Me. It was said to be the first radio message sent around the world, because it should be possible to get messages 12,000 miles each way from the Lafayette station. This station was started during the war and built by the United States Navy, but it is to be turned over to the French government as soon as the tests now being conducted are completed.

Functions of International Bureau May Be Increased

CONSIDERATION is to be given to the matter of increasing the functions of the International Bureau of Weights and Measures when that body meets at Paris in September. It has been suggested that the bureau shall have the custody of numerous other standards than those of weights and measures, and it has also been recommended that the bureau arrange to investigate and promulgate constants of materials or physical values which at the present time are based solely upon private investigation. This would lead to international agreement through some sort of convention entered into by scientists in different countries as to the values to be used in engineering and scientific work similar to the agreement and general practice with respect to the value for gravity (G).

The suggested change has been considered with a large degree of favor by members of the American Physical Society, the National Academy of Science and the National Research Council. Dr. S. W. Stratton, director of the Bureau of Standards, will be the principal representative of the United States at the Paris meeting.

Wide Publicity Advocated by Engineering Staff of Super-Power Survey

THE desirability of wide publicity in forwarding the plans of the super-power survey was recognized at a recent meeting of the engineering staff connected with the project. James H. McGraw, whom W. S. Murray, chairman of the Super-Power Committee, asked to take charge of this part of the committee's work, suggested that the Editorial Conference of the Technical Press, on which between twenty-five and thirty papers are represented, would form the best medium through which to work. Mr. McGraw also pledged the services of the McGraw-Hill Company, with its eleven engineering journals.

The area to be included in the survey was discussed, and it was decided to include the water powers of the St. Lawrence and those in New England as far east as the Kennebec River in Maine. The southern boundary is to be the Potomac River and the western boundary will be the eastern slope of the Appalachian Mountains.

Chairman Murray expressed himself as favoring the appointment of a second member of the National Electric Light Association on the advisory board and said that he had asked the N. E. L. A. to make this appointment.

Reports from the division engineers were asked for, and L. E. Imlay of the power and transmission division of the survey, Henry W. Butler of the industries division and Cary T. Hutchinson of the railways division told of what they had so far accomplished, a suggestive discussion following.

The next meeting will be held on Monday, Aug. 30.

Safety Code Rules to Which Exception Is Taken by the N. E. L. A.

IN THE forthcoming edition of the National Electrical Safety Code the Bureau of Standards has expressed its willingness to designate those rules to which exception has been taken by the National Electric Light Association and other interests that have carefully studied the rules and are qualified to judge of their reasonableness. The objections raised and the reasons of the bureau for not changing the rules to avoid these objections will also be included.

Recent correspondence between the Bureau of Standards and the National Electric Light Association on the code will be of interest to readers of the ELECTRICAL WORLD. Through the courtesy of the *N. E. L. A. Bulletin* this correspondence is reproduced in full:

DEPARTMENT OF COMMERCE, BUREAU OF STANDARDS,
WASHINGTON, July 7, 1920.

National Electric Light Association, New York City:

GENTLEMEN:

1. Supplementary lists of changes to the 1916 edition of the National Electrical Safety Code were circulated in May and, as a result of the comments received, the bureau has endeavored by further modification to meet the objections which were raised and finally to frame the rules so as to be reasonable and proper to the vast majority of our conferees. We believe this has been successfully accomplished with respect to Section 9 and Parts 1 and 3. We have not, however, been able to meet all of the suggestions made with respect to Part 2, regarding which there seemed to be some irreconcilable difference of opinion.

2. One of the principal points which have delayed the new edition and regarding which there has not been general agreement is the loading specification for transverse loading. This has been simplified in form and modified numerically, but the apparent increase in requirements for grades B and C is largely balanced by modifications made for selected poles and for averaging poles. The aim has been to improve the form of the specification rather than to call for stronger or safer construction, and we believe the revised rules represent good modern practice better than the 1916 code.

3. We inclose herewith a final list of changes which will modify the lithograph copies and supplementary lists of changes already in your hands. We trust these additional changes will make the text of the new edition of the safety code satisfactory to you. In case there are important items remaining which you think have not been satisfactorily disposed of, we should be glad to have a statement from you mentioning such items and suggesting in what respects and for what reasons they are unsatisfactory and what action you would recommend to make them satisfactory. May we have a prompt reply? Respectfully,

S. W. STRATTON,
Director.

NATIONAL ELECTRIC LIGHT ASSOCIATION,
NEW YORK, July 19, 1920.

Dr. S. W. Stratton, Director Bureau of Standards, Washington:

MY DEAR SIR: We have just received your letter of July 7, together with supplementary list of changes to the 1916 edition of the National Electrical Safety Code, and believe that these changes are all in the direction of increasing the workability and reasonableness of the rules.

In response to your inquiry as to the general satisfactoriness of the National Electrical Safety Code rules as now revised for their third edition, we are glad to confirm our previous statements that, broadly and so far as information brought together permits accurate judgment, we believe that the great majority of the rules will not cause widespread hardship and will meet the real need for a workable national safety standard for electrical construction. We wish to commend the very sincere effort of the bureau to insure that no undue hardship shall be caused any interest affected and realize that this has involved considerable adjustment in the various trial requirements set up in previous editions of the code.

In some respects, comparatively few in number, it is our conviction that such information as is available warrants nationally less severe requirements than now proposed for the 1920 code. Probably the most important case of this kind is the proposed requirements for stronger construction of supply lines above 2,900 volts to ground than below that voltage limit. The 1916 code required this stronger construction only for supply lines above 5,000 volts between wires. We believe that the test data available support this proposed change to the extent that voltage to ground is made the criterion in the proposed rule rather than voltage between wires as formerly. We are, however, equally of the belief that the data show clearly that there is no warrant, even assuming the continuance of the present common type of telephone protector, for placing the dividing point below 5,000 volts to ground. On the basis of the data available it would appear that any change to be made in voltage limit for the 1920 edition should be upward. Certainly, before any change downward is made in the voltage limit the question of employing better telephone protectors should, we believe, be impartially investigated as an evidently cheaper means for maintaining safety than the requiring of serious increases in pole and conductor costs for the pole lines of light and power companies where voltages to ground exceed some unnecessarily low limit. Possibly there is still time to adjust this voltage limitation in the several rules so as to "make the penalty fit the crime."

In some other respects, also few in number, we are of the conviction that available data are still clearly insufficient on which to base actual mandatory requirements, though no doubt sufficient to justify the setting up or continuance of bogie requirements, such as those of 1916, avowedly for trial use. Probably the best examples of such rules are the transverse pole-line strength rules, No. 2, and the rules for oil-filled apparatus, No. 1. The intent in the latter rules, as proposed for 1920, is clearly to offer a suggested practice, and we believe this is the correct intent, pending further information which it may take some time to procure through the committees at work. The former rules as we read them in the proposed 1920 edition have no similar modifying statements to continue them on the same trial basis as applied to their counterparts in the 1916 edition. Information which we believe is essential before these (or any other transverse strength) rules become mandatory in effect should include ascertainment of the existence of pole-line failure where poles are various percentages under the proposed strength requirements; further study into the accuracy with which the proposed classification of degree of hazard and requirements in various situations measures their actual relative hazards; also further studies into the changes in the pole supply situation during the last nine or ten years, since the pole purchase classifications were prepared by the National Electric Light Association. This pole supply situation has been affected by local deforestation, transportation difficulties and increased expense in various communities and actual shortage of some kinds and sizes of timber formerly readily available. There would also be considered in this study as to what extent it is practical to make better distribution of poles along pole lines, according to the growth of loads, than has been the case hitherto. Tests would also be conducted to show to what degree increasing total weight for number of conductors carried affects the increase of load and the supporting of any one pole by the nearby poles in a tangent line.

Such studies, in our conviction, have by no means been carried far enough, and we feel that the changes developed by the bureau as a result of its interpretation of the partial data so far obtained on some existing lines should, if substituted for the former rules recognized as for trial use, be clearly designated as for trial application only. They would then represent a trial practice whose suitability as a standard could then be more maturely tested in the light of this

further study, and modified as found advisable in the public interest, before being expressed in mandatory form. This would apparently not only protect the industry against undue severity of requirement but would protect the bureau against the possibility of proposing as mandatory requirements which have not yet been subjected to the test of experience as fully as have other parts of the code and which may impose inequitable burdens on the industry.

We wish to congratulate the bureau on its success thus far in the difficult task of bringing all interests together to co-operate in the development of a national code, and we desire to continue most actively in the work. We hope that through our newly formed engineering department we may be able to make our co-operation more effective and more fully representative of all parts of the country and all phases of experience than has been found possible in the past.

We understand that a mention of our co-operation and objection to a few outstanding features of the code will be made by the bureau in its introduction to the third edition, and we should be very glad to have the opportunity of noting the manner in which our statement is summarized and discussed by the bureau.

We should also be glad to know to what degree the code is now satisfactory to the other interests concerned and in what respects and for what reasons any items continue to be unsatisfactory to them. Very truly yours,

W. J. CANADA,
Engineer.

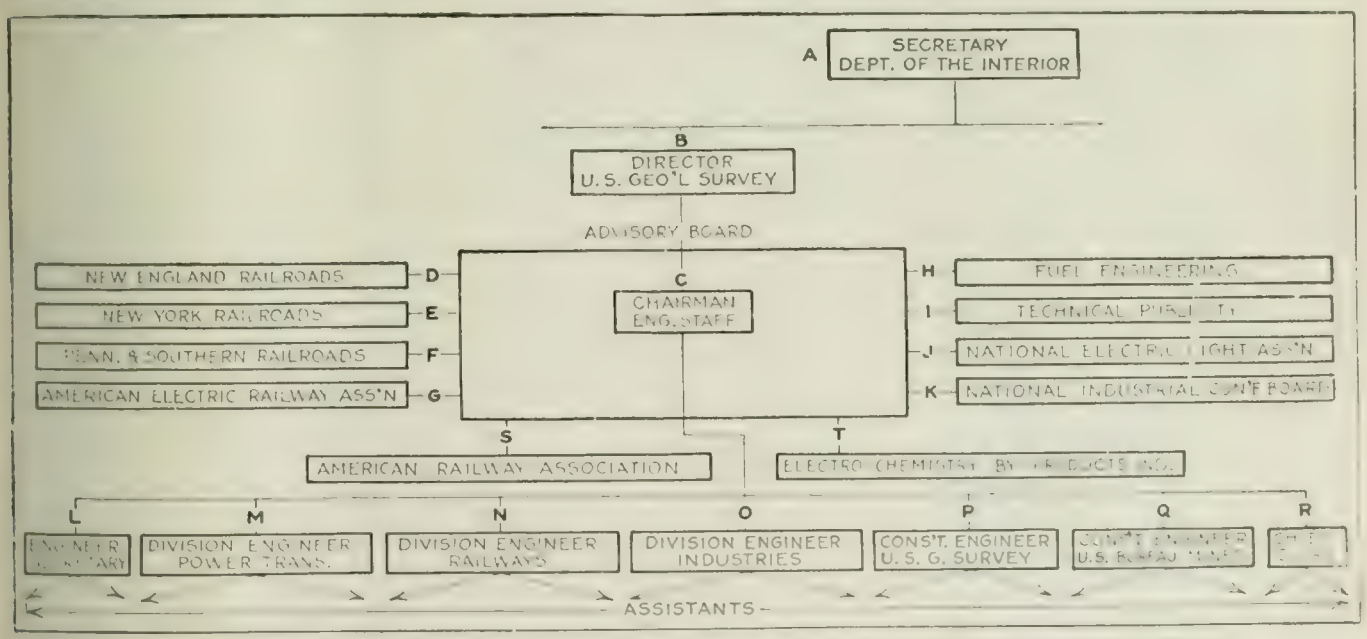
Plans are being formed for frequent conferences, comprehensive studies, surveys and tests during the coming year by which the National Electric Light Association can aid the Bureau of Standards to such a knowledge of the determining factors as will permit a thoroughly adequate treatment of the subjects covered by rules which impose a burden on the electric power industry and on users of electric service. This, it is expected, will result in the formulation of rules whose reasonableness can be demonstrated.

Organization of Super-Power Zone Engineering Staff

ORGANIZATION of the engineering staff which is to make an investigation and report under the auspices of the United States Geological Survey in the matter of the super-power survey between Boston and Washington has just been announced by W. S. Murray, chairman. The personnel and form of organization of the engineering staff are shown in the accompanyirg diagram. It will be seen that the organization is composed of an advisory board representing the various railroads, engineering, technical publicity, the National Electric Light Association, the American Electric Railway Association, the American Railway Association, the National Industrial Conference Board and other relatec interests. In addition, seven assistants make up the enginering staff, whose duty will be the collaboration of field data and its preparation for the report.

The services of the chief hydraulic engineer of the United States Geological Survey and of the chief mechanical engineer of the Bureau of Mines will also be contributed in part to the engineering staff of the super-power survey.

The work is to be divided into three departments—one of railway investigation, one of power and transmission investigation and one of industrial investigation. Meetings of the advisory board will be called not less than every two months, when the chairman of the engineering staff will review the progress of the work and the procedure during the next two months will be outlined. It is expected that all fundamental data, maps and diagrams will be collected by May 1, 1921. This will allow two months for the final preparation of the report text for presentation June 30, 1921, when the Congressional appropriation terminates.



ORGANIZATION CHART AND PERSONNEL OF ADVISORY BOARD AND ENGINEERING STAFF FOR SUPER-POWER SURVEY BETWEEN BOSTON AND WASHINGTON

A. John Barton Payne, Secretary Department Interior
B. George Otis Smith, Director U. S. Geological Survey
C. W. S. Murray, consulting engineer, New York, chairman engineering staff
D. E. G. Buckland, vice-president, N. Y., N. H. & H. R.R.
E. A. T. Hardin, vice-president, N. Y. C. & H. R. R.R.
F. Appointment not made.
G. John H. Pardee, president A. E. R. A.
H. L. P. Breckenridge, head department mechanical engineering, Yale, chairman advisory board
I. James H. McGraw, president McGraw-Hill Co. [illegible]
J. Appointment not made.
K. Magnus W. Alexander, [illegible] director National Industrial Conference Board
L. Henry Flood, Jr., consulting engineer, Pittsburgh, Pa.
M. L. E. Imlay, consulting engineer, Niagara Falls, N. Y.
N. [illegible]
O. [illegible]
P. [illegible]
Q. [illegible]
R. J. J. Maguire, chief [illegible], U. S. [illegible]
S. R. H. Aishton, president American Railway Association.
T. Appointment not made.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Direct Radio Service to Poland—The latest foreign nation to be brought into direct communication with the United States by means of radio service is Poland, the Radio Corporation of America having announced that service with that country has been established.

Y. M. C. A. Radio Course.—The department of education of the Young Men's Christian Association of New York City, East Side Branch, is organizing a course in the theory and operation of vacuum tubes. A booklet with full information can be obtained from A. R. Nilson, the secretary.

Sandusky's New Rates.—The schedule of electric rates recently approved by the City Commission of Sandusky, Ohio, for the Sandusky Gas & Electric Company eliminated the 4-cent step in residence lighting, all energy in excess of 60 kw.-hr. being now 5 cents instead of 4 cents. An increase of 10 per cent was granted for commercial and sign and window lighting, and the same increase with a coal-clause provision for motor service. The minimum charge was raised from 50 cents to 75 cents a month.

A Proposed Merger.—Application has been made to the Public Service Commission of Pennsylvania for the merging of a number of electric and gas companies chartered for eastern Pennsylvania counties into the Philadelphia Suburban Gas & Electric System. The companies that it is proposed to consolidate include the Charlestown Township Electric, the Schuylkill Township Electric, the Thornbury Light, the North Coventry Electric, the West Pikeland Electric, the Dilworthtown Electric and twelve others.

Dutch Electrification Commission Arrives in America.—A commission made up of railway experts has been sent by the government of the Netherlands to this country to study American methods of electrification. The party is headed by L. M. Barnet Lyon, member of the Board of Control of the Netherlands Railways. J. J. W. Van Loenen Martinet is the secretary. The first government line in Holland to be equipped will be that between Amsterdam and Rotterdam, a distance of about 55 miles. Other electrifications will follow. A super-power system is also proposed. The equipment will be largely multiple-unit, though locomotive operation will also be required. The commission will make a thorough study of American electrifications.

Public Utilities Law for Texas.—In an effort to obtain the enactment of a state public utilities law that will meet the indorsement of the various interests concerned, Governor W. P. Hobby has appointed a committee, representing the cities, the utilities, the legal fraternity, the Legislature and other bodies, to draft a bill which will be submitted at the next regular session of the Legislature in January, 1921. The League of Texas Municipalities, which is composed of the mayors and other officials of the different cities and towns of the state, is back of the movement.

Big Hydro-Electric Plant for British Columbia.—When the Bridge River power plant at Lillooet, B. C., on which work has begun, shall have been completed, the province will boast a hydro-electric development rated at 400,000 hp. The project involves an expenditure of $30,000,000. A fall of 1,000 ft. is to be taken advantage of, and a tunnel a mile and a half long is to be built through Mission Mountain to convey the water from Bridge River to Seaton Lake. Much of the power is to be distributed to Vancouver and Victoria, whose manufacturing prestige, it is expected, will thereby be greatly enhanced.

Building Operations in 1919.—Despite the discouraging reports concerning building operations, complete returns made to the United States Geological Survey from the building departments of 141 of the larger cities of the country show a large increase in 1919 compared with 1918. The building operations in these cities in 1919 cost $1,302,998,607, as against $430,014,365 in 1918, an increase of 202 per cent. Much of this advance is due to the increase in the cost of labor and materials, but this does not cover all of it, for the number of permits for buildings increased from 210,538 to 362,811, or 72 per cent.

Further Pacific Coast Rate Changes.—The Northwest Traction & Power Company of Everett, Wash., has filed a new rate schedule for residence service of 7.5 cents a kilowatt-hour for the first 45 kw.-hr. and 3 cents a kilowatt-hour for amounts in excess. The old rates were 8.8 cents and 6 cents, with a flat power rate of 3 cents. The California commission has granted the Pacific Gas & Electric Company and the Great Western Power Company permission to reduce their cooking rate from 4½ cents a kilowatt-hour to 3½ cents in all districts served by both companies. An increase of 15 per cent in power rates has been granted to the Coast Valleys Gas & Electric Company by the California commission, the lighting rates remaining unchanged. This increase is in the nature of a surcharge and will remain in effect for nine months, the length of time that the Pacific Gas & Electric Company, from which the Coast Valleys Company purchases its power, may enforce a similar increase.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

National Association of Electrical Inspectors.—The annual meeting of this association will take place in Philadelphia on Tuesday and Wednesday, Oct. 12 and 13. An executive meeting will be held in the auditorium of the Underwriters' Association of the Middle Department on Oct. 12.

Western Massachusetts Engineering Society.—C. C. Chesney, general manager of the Pittsfield works of the General Electric Company, was elected president of the Western Massachusetts Engineering Society recently. Other officers are: First vice-president, George E. Williams; second vice-president, E. E. Lockridge; secretary and treasurer, Winfield E. Holmes.

Chicago Section, American Welding Society.—The Chicago Section of the American Welding Society was organized in the rooms of the Western Society of Engineers on the evening of Aug. 3. Between eighty and eighty-five were present. Local by-laws were adopted and the following officers were elected: Chairman, M. B. Osburn, assistant superintendent Pullman Car Works, Pullman, Ill.; vice-chairman, O. T. Nelson, president General Boilers Company, Waukegan, Ill.; secretary-treasurer, L. B. Mackenzie, publisher of the *Welding Engineer*. Meetings will be held on the second Tuesday of each month.

Vancouver to Have Co-operative Association.—An Electrical Co-operative Association to unite all branches of the electrical industry in Vancouver, B. C., was started recently at a meeting called by George Kidd, general manager of the British Columbia Electric Railway Company. To complete the organization temporary officers were elected as follows: President, George Kidd; vice-presidents, W. G. Murrin, assistant general manager of the British Columbia Electric Railway Company; R. F. Hayward, general manager of the Western Power Company of Canada, and William McNeil. The advisory council consists of E. E. Walker, sales manager British Columbia Electric Railway Company, chairman; James Lightbody, publicity manager British Columbia Electric Railway Company; J. R. Read, local manager Canadian Westinghouse Company; H. Pim, local manager Canadian General Electric Company; J. F. Little, local manager Northern Electric Company, and W. C. Mainwaring, district sales manager Northern Electric Company. The jobbing houses were represented by F. P. Cope and E. B. Horseman and the contractor-dealers by E. Brettrell, S. E. Jarvis and W. W. Fraser.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Penalty in Lieu of Discount.—A penalty of 5 per cent on electric service bills not paid on or before the fifteenth day of the month following rendition of service has been approved by the Missouri Public Service Commission in lieu of a discount for prompt payment.

Restricted Street-Lighting Service at Former Rates Approved.—In granting increased rates to the St. James Ice, Electric Light & Power Company the Missouri Public Service Commission permitted the company to limit its electric service from sundown until midnight, the charges per lamp per month for street lighting to remain as before, basing its permission on the fact that the company was operating at a loss.

Fixing the Rate Base.—The California Railroad Commission will not include as a whole in the rate base upon which consumers of the owning company are required to provide a return the investment of an electric utility in a steam generating plant which is operated virtually for the sole purpose of generating energy for another utility. Nor will it consider as a part of the present rate base investments in a plant a large part of which is under construction at the time of valuation and on which interest is capitalized during the construction period.

Duty of Utility to City Served.—In ordering the Pacific Gas & Electric Company to extend its water service to outlying plants in Stockton the Railroad Commission of California laid down the general proposition that the company had "dedicated its service" to that city and held it to be "reasonable that it should provide service for the growth of the city." In view of a lack of available customers, however, the commission allowed a surcharge, to be added to monthly bills until the gross annual revenue from the extension shall reach at least 20 per cent of the capital invested in the extension.

Permitted Surcharge Not Applicable to Minimum Rate.—The Missouri Public Service Commission in authorizing the Union Electric Light & Power Company of St. Louis to add to its bills a surcharge of 5 mills per kilowatt-hour did not, it announced at the hearing of a customer's complaint, mean that this sum could be added to the accounts subject to the minimum charge, and the company was in error in so interpreting the order. The commission, therefore, while without authority to assess damages or inflict punishment for the wrongful charge, approved the restitution by the company of the excess amount charged in mistake.

New and Old Irrigation Customers.—In passing upon the application of the Idaho Power Company for greatly increased irrigation pumping rates (see ELECTRICAL WORLD, June 19, page 1444), the Idaho Public Utilities Commission declared that a higher rate for new irrigation customers than for old customers is justified when new investment is required to care for the new customers, when the peak of the load is in the summer during the irrigation season and when the old customers commenced extensive reclamation projects at a time when the peak load was in winter and consequently had comparatively low rates accorded to them.

Demand and "Hours' Use" Factors.—In its hearing upon the application of the Douglas County Light & Water Company for the authority necessary to increase rates for electric and water service the Oregon Public Service Commission criticised the company's existing form of electric rates for both lighting and power because it took into consideration only the quantity of energy consumed. The commission worked out a form for a schedule taking into consideration also the amount of the demand on the utility plant and the number of hours' use. The commission further registered its disapproval of flat rates and combined light and power rates as leading to discrimination.

Extension of Service Lines Beyond Corporate Limits.—Rendition of electric service to some consumers outside the corporate limits of the municipality served by a utility obligates the utility, according to a decision of the Missouri Public Service Commission, to render service to others similarly situated when the necessary extensions are justifiable. In pursuance of this principle the commission held that the expectant revenue justifies the extension of service by an electric utility 600 ft. or 700 ft. for the supply of six private consumers and two street lamps, upon condition that a consumer situated 200 ft. from other consumers and outside the corporate limits advance one-half of the direct cost incurred for his extension.

Elements Involved in Fixing Rates.—Asserting that it has the power to increase rates regardless of those fixed by a municipal franchise and that it can regulate the service of a public utility regardless of the provisions of its franchise when such franchise has been surrendered for an indeterminate period, the Arkansas Corporation Commission established for the Arkansas Light & Power Company in the city of Newport a schedule of electric rates drawn to yield a return of approximately 8 per cent. The value of the service, the commission said, was not the sole factor to be considered. Any just rate must necessarily be controlled largely by three distinct factors, namely, the value of the property, the cost of operation and the quality of the product sold, and to these three the number of consumers might with propriety be added.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Powers of Colorado Commission.—In the course of a recent decision in an action brought against the Public Utilities Commission of Colorado by a steam railroad the Colorado Supreme Court made a general statement affecting all utilities to the following effect: It was the intent of the Legislature to empower the Supreme Court to set aside or modify the orders of the commission if they were based on propositions of fact in support of which there is no evidence, but not to review findings of fact upon which the evidence is conflicting, that being a function of the Commission. (188 Pac. 747.)[1]

Confiscation Needs Convincing Proof.—In the case of a gas company against the Public Service Commission for the First District of New York, where it was sought to have the maximum-rate statute declared unconstitutional, the Supreme Court of the State has declared that before a rate will be deemed unconstitutional confiscation must be established by evidence which is convincing beyond a fair doubt. Where the product of the company is purchased from another corporation under the same management the most convincing proof of the fairness of the agreement must be produced before the rates fixed will be declared unconstitutional by the court. (181 N. Y. S. 623.)

Public Utility Procedure Not Changed by Creation of Kansas Court of Industrial Relations.—The Supreme Court of Kansas has thus construed the law as regards appeal against decisions of the Court of Industrial Relations established in that state: The law creating this body gives it authority over two classes of subjects—regulation of public utilities and regulation of industrial relations. On its public utilities side the court is simply the successor of the Public Utilities Commission and orders made in the field of public utilities regulation are to be reviewed as before. Section 12 of the act provides a method for the review of orders made in the field of industrial relations only, and it is the public policy of the state, established by the Legislature, that any controversy which falls within the jurisdiction of the Court of Industrial Relations on its public utilities side shall be adjusted there, subject to such review by the courts as the public utilities act prescribes. (190 Pac. 747.)

[1] Technical numbers refer to the volume and page of the National Reporter System.

Men of the Industry

Changes in Personnel and Position— Biographical Notes

D. J. Bittel, sales superintendent of the Consumers' Power Company at Battle Creek, Mich., has resigned. George Longwell succeeds Mr. Bittel.

S. W. Webb, formerly local manager of the Consumers' Power Company at Albion, Mich., has been appointed district manager at Cadillac, Mich.

Major Lewis W. Call has been selected as chief counsel for the Federal Power Commission. Major Call has been transferred from the office of the Judge Advocate General of the army.

Col. Bion J. Arnold, well-known consulting engineer of Chicago, has been retained by the Hydro-Electric Power Commission of Ontario to make a report on the cost, earnings and operating expenses of the proposed hydro-electric radial street-railway systems.

Robert F. Whitehead on Aug. 9 was appointed Commissioner of Patents by President Wilson, to succeed James P. Newton, who has resigned. At the same time Melvin H. Coulston was appointed First Assistant Commissioner of Patents. Both Mr. Whitehead and



R. F. WHITEHEAD

Mr. Coulston have been members of the Patent Office staff for more than eighteen years. The former entered the service Feb. 1, 1902, the latter thirteen days later. Mr. Whitehead is a native of Virginia and maintains his legal residence at Lovingston in that state. He was educated at the University of Virginia. He is a lawyer and has worked up through the various grades of examiner. Mr. Coulston is from New York and a graduate of Cornell University. He is serving his second term as president of the Patent Office Society.

Charles O. Lenz, a well-known consulting engineer of New York City, with offices at 120 Broadway, has been appointed one of the consulting engineers for the Foundation Company of that city.

W. B. Head, vice-president of the Dallas Power & Light Company and assistant to the president of the Texas Power & Light Company, has been appointed a member of a committee named by the Governor of Texas to draft a public utilities commission law.

A. D. Church, formerly manager in the San Luis district of the Midland Counties Light & Power Company, California, has been transferred to the Santa Maria district, relieving Mr. Ten Eyck, who has returned to college.

N. Sigimura, electrical engineer of Tokyo, Japan, and S. Kobori, mechanical engineer of the same city, are touring the United States and studying the latest electrical developments. They report that Japan is planning to develop large amounts of hydro-electric power to take care of the manufacturing which has increased so rapidly.

Dr. S. W. Stratton, director of the National Bureau of Standards, has sailed for Europe to attend the meetings of the International Bureau of Weights and Measures in September. He will be the principal American representative to discuss proposed changes in function and scope of the bureau, to include custody of other standards than weights and measures and the promulgation of constants of materials or physical values.

Paul Moore, who has been appointed secretary of the division of research extension of the National Research Council, will leave his present work as director of the information bureau of the War Trade Board to take up his new duties about Oct. 1. In the promotion of research, especially that of special interest to the industries, Mr. Moore will be associated with H. E. Howe, who is chairman of the division of the Research Council.

W. E. Blodgett, formerly secretary and treasurer and in charge of accounting of the Utah Light & Traction Company, has just been appointed comptroller of the Winnipeg Electric Railway Company, Winnipeg, Manitoba, Canada. Mr. Blodgett, who is a native of Wisconsin, gained his first accounting experience there and in Minnesota. He was accountant for the Twin City Rapid Transit Company, serving Minneapolis and St. Paul, prior to 1907, at which time he became associated with the Utah Light & Railway Company. He successively filled the positions of paymaster, statistician, chief clerk, assistant secretary and chief clerk to the general manager. After the consolidation in 1914 of the Salt Lake Light & Traction Company and the Utah Light & Railway Company to form the present organization, Mr. Blodgett became chief clerk to the general manager and to the secretary and treasurer. In 1916 he was elected secretary and treasurer of the company.

G. J. Walton has resigned as local manager of the California-Oregon Power Company at Klamath Falls, Ore., to engage in private business. Mr. Walton has been connected with the company named since 1906.

Lieut. Col. B. O. Clupek of the Czechoslovak army is traveling through the United States in the interests of the new state of Czechoslovakia. His principal interest is in hydro-electric development, and he is now visiting California and the Northwest.

E. H. Martindale, who took office on Aug. 1 as vice-president of the American Institute of Electrical Engineers, is president of the Martindale Electric Company of Cleveland. Mr. Martindale was graduated from the Case School of Applied Science in 1908. After experience with the Illinois Steel Company and the Commonwealth Edison Company he joined the staff of the National Carbon Company of Cleveland in 1910 and was placed in charge of the company's brush-testing laboratory. In 1912 he was made sales



E. H. MARTINDALE

engineer for the company on carbon brushes. Mr. Martindale has conducted original studies on the use of carbon brushes and presented his results in various publications and in a paper before the A. I. E. E. During the war he served as captain of engineers in service overseas. Last year he served as a member of the board of directors of the Institute.

Obituary

Howard L. Olds, vice-president Twin State Gas & Electric Company, Boston, Mass., died recently at York Village, Me. Mr. Olds was born at West Chesterfield, N. H., about fifty-one years ago. For some time he was identified with public utilities in Indiana, Illinois, Ohio and Detroit, Mich., and in 1916 took charge of the Eastern properties of the Middle West Utilities Corporation. He was a member of the executive committee of the New England Section, N. E. L. A.

Trade and Market Conditions

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

Insulating Paper Is Scarce, but Outlook Hopeful

MAKERS of electrical products which require insulating paper in their manufacture are confronted with a marked scarcity of this paper, chiefly on account of the difficulty in securing raw material, though it seems that the situation will soon improve. The demand for insulating paper is especially heavy at present because of the large orders being placed for power and telephone cables and condensers. Power-cable manufacturers report that their orders have about doubled, but they are paying prices varying from 23 to 30 cents a pound for paper which cost them 19 to 22 cents last January.

Old manila rope and rags, the two bases from which the best paper is made, are very hard to obtain. The principal source of supply of scrap rope is the shipping industry, and as there has been a falling off in transportation by water due to strikes and other causes, a shortage has resulted. Another factor which is active in diminishing the junking of rope is the high price of new rope, which is due to the great cost of raw hemp and the excessive demand from new ships being built. Rags are also scarce because the importation from foreign countries, which was formerly the chief source of supply, has been cut off. Quite lately, however, shipments from abroad have been resumed to some extent. As a substitute for these raw materials, wood pulp has been experimented with but has not yet been accepted by insulation manufacturers as a basis for the best papers. Moreover, wood pulp itself is difficult to obtain.

The very thin "glassine" all-linen paper, imported before the war chiefly for use in condensers, has been practically cut off from importation. American manufacturers have recently developed a paper said to be as good as the imported material, however, although it contains a large proportion of cotton. Another reason for the scarcity of insulting paper has been that the best grade of whiting, which is used in its manufacture, formerly came from England and the supply from that source has been cut off until a month or so ago.

Manufacturers express a hopeful view of the situation, however, because they seem to expect that the foregoing causes of shortage will soon disappear. Furthermore, European countries, including Norway, Sweden, Finland and Italy, are beginning to produce paper again for the first time in several years.

Low Cotton Has Not Affected Prices of Electrical Goods

DESPITE recent drops in the prices of cotton electrical products containing this material have not yet generally declined in price. About the only drop of importance has been a considerable reduction about Aug. 15 in the price of some lines of cotton insulating tape and webbing. In general the reasons for the firmness are the excellent demand, the large number of unfilled back orders, the high labor cost and the fact that the price of cotton is a small part of the cost of finished products. Another reason is that the spinning mills still have some 40-cent cotton with which they are filling orders placed some time ago.

In the matter of cotton insulating tape, which is more directly dependent on the price of cotton than other electrical products, there was in some cases a notable drop in price about the middle of August. The demand for this material is just ahead of the supply, though deliveries are not longer than one month. The thinner grades are harder to get as the fine yarns are scarce. Cotton-sleeving deliveries are made in two to six months. There is a very heavy demand for this material, which cannot be met by the mills because of a scarcity of sleeving machinery. Friction tape is more plentiful than it has been for some time and immediate deliveries can usually be made. No changes in price are reported.

Prices of lamp cord have not changed. Until recently manufacturers have been busy catching up with back orders, but at present deliveries are good in the face of a fair demand. The fine yarns used on magnet wire are difficult to obtain; consequently there is some scarcity of this material and prices are firm.

Stocks of non-metallic flexible conduit are in good shape and the demand is fair. Prices are holding firm.

Cloth manufacturers are hoping for still lower cotton, crop prospects are good and there is talk of heavy cancellations by tire manufacturers who use an enormous amount of cotton fabrics, but in spite of these factors manufacturers of electrical material whose basis is cotton state that present prices will hold firm for several months.

Lighting Glassware Raw Materials Show Little Shortage

ALTHOUGH reports circulated from the Middle West tend to show that there is a bad shortage of raw materials necessary to the marketing of lighting fixture glassware, representatives of some of the largest glassware manufacturers have stated to the ELECTRICAL WORLD that they are finding no particular shortage in these materials. They are prepared to commence shipment of large orders of commercial glassware of a rather plain design in from three to six weeks and in some cases make complete shipment in that time. Where there is considerable labor required to the finish of the glassware, these shipments may run up to six months. From this it appears that a lack of skilled labor rather than of raw materials is the deterrent factor.

The demand for commercial glassware has been heavy, and manufacturers say they see no let-up in the near future. The demand for residence glassware, on the other hand, has fallen off a bit; but it is expected that it will be resumed in good volume with better transportation facilities for the movement of building materials and a consequent easier price with the increased supply.

As for the raw-material question, it is true that the supply of European materials which some glassware makers depended upon has fallen off. But at the same time it appears that the domestic materials, which took the place of the foreign during the war, are being produced in better quantities and of an increasingly better quality, and many manufacturers are using them in whole or in greater part. It is doubtful that they will go back to foreign materials

again. There has been quite a heavy breakage, however, in glass pots made from domestic clay. This entails considerable loss not only of the pots but also of the liquid glass which is spilled.

Several factors are responsible for higher prices of the glassware. Labor turnover, particularly among the unskilled, has resulted in larger volume of rejections and breakage, breakage of pots and loss of liquid glass has added their toll, cost of overhead on lowered production is higher per unit, and the demand of labor for higher wages has just made itself felt. At the conference in Atlantic City in July the workers asked for increases ranging from 25 to 50 per cent all around. It was finally settled at different stages running from 5 to 14 per cent for those connected with electrical glassware. The average raise was about 10 per cent. Some of this is effective at once, while some will become effective Sept. 10. It is probable, however, that increases in the price of finished glassware will amount to more than the 10 per cent advance to labor.

Mills are not running up to capacity because of labor shortage, the average amount of production being about 80 per cent of installed capacity. This, with the heavy demand, is causing manufacturers to shorten the period of their regular summer inventory and repair shutdowns. It does not seem that there is any need for ordering lighting glassware too far into the future with shipments quoted around four to six weks on ordinary commercial glass, but with up to six months quoted on very fancy glass a certain amount of advance ordering must of course be considered. All things considered, the market seems to be in pretty good condition.

Promising Market for Electrical Devices Abroad

COINCIDENT with the news that manufacturers of electric household appliances must soon develop new devices in order to stimulate domestic demand which in some quarters is said to have reached its peak for those machines now on the market in this country, comes more and more evidence of the increasing demand abroad in this line. The figures of the Bureau of Foreign and Domestic Commerce show that the value of exports of heating and cooking appliances for the first six months of 1920 amounts to $921,575, as compared with $814,002 for the same period in 1919, or an increase of 13 per cent. The total exports for this class of material for the entire year 1919 amounted to $1,579,757, or more than double the figures of $686,339 recorded in 1918.

Switzerland seems to rank as one of the most fertile of foreign markets for appliances, for with the increasing supply of electrical energy furnished by the development of that country's vast water-power the use of electrically driven devices there is steadily increasing. In the past the use of such machines in Switzerland has been limited, washing machines, for instance, having been used only in public laundries. The country does not engage heavily in the manufacture of this class of goods, most of the material having been imported from Germany in the past. Appliances introduced in the country have to reckon with both direct current and one-to-three-phase alternating current of 100 volts to 500 volts and higher. In some sections of Switzerland the sale and installation of electric motors is a monopoly, but managers of power plants are anxious to assist in introducing electric appliances for household use in order to increase the consumption of energy, and they seem to think that now is the proper time for such appliances to be introduced.

The hydro-electric wealth of Italy is also being developed at a rapid rate following her reconstruction from war conditions, and manufacturers of electrical goods should find a very promising field there for their products. The energy for industrial and commercial use, while absorbed as quickly as it is produced, is extremely cheap and should be abundant within a few years.

In England a large selling organization has been in the market for labor-saving devices as a means of meeting the servant problem in that country. While the houses in England are not generously supplied with electricity, it is felt that the greater use of electricity there is assured and that a large field will then be opened up for electrical devices. The annual report of the Leeds (England) Corporation Electricity Department seems to bear this out in showing an increase in the use of electricity for domestic and heating purposes from $30,000 to $60,000 in 1919. The number of consumers also increased from 1,686 to 2,140. Many applications had to be refused owing to the fully loaded lines in certain districts.

One of the big difficulties in the path of the widespread use of American makes of appliances abroad has been differences in voltage and differences in the connections used, especially the latter. Steps toward remedying the objections against varying types of attachments have already been undertaken in this country, however, in a movement to standardize plugs and receptacles.

Foreign trade experts warn manufacturers not to cultivate customers abroad unless they take pains to accord to them the same, if not greater, courteous consideration that is extended to customers at home.

Metal Market Situation

THE copper market continues dull and lifeless, few sales being made either for nearby or future delivery. Consumers' demands for the third quarter have mostly been covered, and requirements beyond that period are not being anticipated because buyers are awaiting price developments. Producers are holding firmly at 19 cents and refuse to shade that price under inducement of attractive orders. In spite of the present weak demand, their position appears strong because consumers have allowed stocks of copper to become reduced to the danger point while hoping for lower prices to develop, and a heavier buying movement seems likely to materialize. The need of foreign countries for copper is great too, and it is only an unfavorable exchange rate which prevents large orders from that quarter. The general feeling is that the higher freight rates will be the occasion for an advance in price.

The outside market is also exceedingly quiet, and although prices are nominally shaded from ¼ cent to ½ cent, sellers do not seem very anxious to take orders at that price. Small interest is being taken in standard copper at London, but the market holds steady, spot advancing £1 during the past week.

Straits tin has taken a drop of 2¼ cents in the last fortnight, and the market presents a weak and inactive tone. Demand for lead is light, and considerable apprehension is expressed over foreign competition, as lead from abroad can at present be delivered duty-paid in this country at a price of about ½ cent per pound less than the market price here. A slight advance in spot zinc reflects the firm market that exists because of fears of a coming scarcity owing to strikes and the closing down of smelters. Only small quantities are being offered for sale and demand is rather active for prompt shipment.

NEW YORK METAL MARKET PRICES

	August 17	August 24
Copper	£ s d	£ s d
London, standard spot	93 5 0	94 5 0
	Cents per Pound	Cents per Pound
Prime Lake	18 75 to 18 85	18 75
Electrolytic	19 00	19 00
Casting	18 00	18 00
Wire bars	22 50 23 00	22.50 23.00
Lead, trust price	9 00	9 00
Antimony	7 00	7 00
Nickel, ingot	43 00	43 00
Sheet zinc, f o b. smelter	12 50	12 50
Zinc, spot	8 35	8 50
Tin	48 00	45 75
Aluminum, 98 to 99 per cent	35 10	35 10

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	15 50 to 16 00	15 50 to 16 00
Brass, heavy	9 25 to 9 50	9 25 to 9 50
Brass, light	7 25 to 7 75	7 25 to 7 75
Lead, heavy	7 25 to 7 50	7 50 to 7 75
Zinc, old scrap	5 25 to 5 50	5 25 to 5 50

THE WEEK
IN TRADE

CONSIDERABLE pessimism is evident in Southern territory over a prolonged rainy spell which has injured crops and reduced sales. In the Northwest complaint is also heard on the part of the important lumber industry there, which faces ruin if its appeals for modification of the freight rate advances are not granted. In the Intermountain section the general tone is, by contrast, very optimistic. Increased sales are coming from the many strikers who have returned to work, crop prospects are bright, and the lowest point of business inactivity seems to have passed.

Shipments are improving except on the Pacific Coast, where the car requirements for lumber, grain and fruit are precluding the accumulation of satisfactory stocks. In Eastern and Southern territory, however, the transportation situation is decidedly better, and fair stocks are building up in many lines. The chief items whose scarcity is felt throughout the country are porcelain, rigid conduit and hollow ware.

The usual fall increase in demand for seasonal goods has not yet made itself felt, and sales continue to be reported light in all districts. The Far West characterizes collections as fairly prompt, but this is the only exception to a consensus of opinion from all sections, which is finding money tighter and collections becoming slower and more difficult to accomplish.

NEW YORK

Little change is evident in the week-to-week trade. Business is in rather a quiescent state, seeming to await the expected heavier buying movement of the fall season which is looked for in certain lines, but these anticipations have not begun to materialize. Jobbers generally report a slow volume of trade but do not consider sales alarming by any means. In fact, in the light of the usual summer demand, this season's business is reported as normal at least.

Jobbers vary in their view of the credit situation, but on the whole it appears to be less favorable and collections are slowing up materially. This is felt to be the natural result of lighter sales, tighter money and retrenchments.

Transportation is continuing to improve, and with better shipments the rule, good stocks are accumulating in many lines, especially in flexible armored conductor, insulating tape, schedule material and switches. Stocks of porcelain and heating appliances still leave much to be desired, however. The rigid conduit situation varies, but on the whole is better in this territory. A shortage of heating appliances is expected to materialize before the holiday trade is over. Practically no building activity along residence lines is under way, but in some quarters the lower price of building material is expected to stimulate this activity. Prices continue firm.

Schedule Material.—Stocks are reported plentiful and shipments are occasioning no trouble. Demand is fairly good.

Knife Switches.—Regular receipts have caused good stocks to accumulate. Demand at present is fairly heavy.

Conduit Fittings.—Demand is good, but some jobbers say it has fallen off a bit. Stocks in many cases are in good shape, but in some instances supplies are short on many items. Shipments are slow.

Rigid Conduit.—Varying conditions feature this market. Local supplies have eased up to some extent, and occasionally large stocks are found. But many jobbers still have no stock or are short on certain sizes. Shipments are irregular and a good demand is found, though it is slightly less heavy as better receipts become available.

Tape.—Good stocks of both rubber and friction tape are reported. Demand is only fair and is not as heavy as it was. Shipments are fairly regular. Friction tape ranges from about 55 to 60 cents per pound, and rubber is quoted the same price by some jobbers and slightly less by others.

Flexible Armored Conductor.—Demand is decidedly off and prices are being cut to some extent. Receipts are coming in regularly and good stocks have accumulated with most jobbers.

Porcelain.—Demand has slightly fallen off, but shipments are very irregular and the scarcity continues. Very small and incomplete stocks are on hand, tubes being especially scarce.

Flashlights.—Demand has been fairly good, but sales campaigns have apparently not brought the results that were expected. No trouble in securing supplies has been experienced, and jobbers are well stocked up.

Heating Appliances.—Present shipments are slow and receipts only arrive on orders which are months old, so that the scarcity has almost stifled demand. Stocks are very low with flatirons in the best shape. A big shortage for the holiday trade is expected.

Vacuum Cleaners.—The market has fallen off until very few cleaners are sold at present, but a more active demand is looked for soon. Jobbers are well stocked up and have had no difficulty in obtaining supplies.

CHICAGO

Improvement in transportation facilities is building up jobbers' stocks, though they are still very spotty. Collections are slower than they have been, and a number of cancellations have been received from contractors and industrial customers during the week. Many buyers are asking their jobbers for more time in which to meet their obligations.

There is a very general shortage of meters and transformers, and utilities that failed to place orders for their requirements during the first few months of this year are now unable to get anything like the number of meters and transformers they need. Central stations are also experiencing great difficulty in getting power-house maintenance supplies, such as firebrick, steel rope for cranes, repair parts, etc.

Prospective buyers of household devices are holding off for lower prices, and electrical retail stores are experiencing a regular pre-war summer slump in business.

Washing Machines.—The Federal Electric Company is placing a swinging-wringer type of washing machine on the market which will sell for $10 more than the stationary-wringer type. The list price of the new machine is $165 in galvanized iron and $190 in copper.

Porcelain.—Difficulty in obtaining porcelain is affecting the supply and delivery of practically everything which requires this material in any form.

Farm-Lighting Plants.—Most dealers are buying all the machines they can get, for although business is slow at the present time it is expected to be very good in the fall.

Poles.—Fairly good stocks are now on hand, and orders are coming in rapidly from buyers who wish to get in their supply before the increased freight rates go into effect.

Meters.—There are practically no stocks of house-type meters in dealer's hands, and most of the central stations either have all they need to carry them through the year or none at all. One utility company is trying to get 10,000 meters before the end of this year.

Transformers.—The conditions in the transformer market are very similar to those which apply to meters. The central stations which ordered a year in advance have all they need, but those companies that have been buying from hand to mouth have practically no stocks and cannot obtain any.

Non-Metallic Flexible Conduit.—Shipments have been received in fairly large quantities, and ⅜-in. conduit sells for $32 per 1,000 ft. in lots of 10,000 ft. or more. There is a fair demand but the majority of sales are on back orders.

Wire.—There is a good stock of most sizes of copper wire in Chicago, but it is divided among many jobbers. The greatest demand is for weatherproof. No. 6 weatherproof is quoted at 32 cents per pound in 1,000-lb. lots.

Line Hardware.—There is a brisk demand because buyers have learned that a price increase of about 10 per cent is expected soon. Stocks are spotty.

Household Devices.—Retailers generally have fairly complete stocks and their needs are well filled. More aggressive selling methods are necessary to keep stocks moving, however.

BOSTON

Quieter buying is evident in most of the leading lines of electrical material. New England manufacturers are generally utilizing this period to fill back orders and to accumulate stocks despite continued railroad embargoes and delays. Porcelain, small motors and rigid conduit, however, are scarce. Prices show little tendency to break, and deliveries are not much shortened over the quotations of early summer. Considerable hesitation in buying is apparent, and many concerns are ordering only upon a hand-to-mouth basis.

Industrial activity is well maintained, although some of the larger textile mills which were shut down a few weeks ago have not yet resumed. Unsatisfactory collections are reported, especially among the larger buyers. Some jobbers are selling on a forty-five-day payment basis to many small customers, while some of the best accounts are asking 90 to 120 days. Hesitation and uncertainty seem to be the cause of these spasmodic conditions. Central-station rate increases are being announced here and there, and the public is apparently accepting them in good faith. The coal situation is much improved among the larger utilities. Building and engineering contracts for the week ended Aug. 19 in New England total $5,490,000, compared with $6,513,000 for the same week last year.

Motors.—Deliveries of forty to forty-two weeks are being quoted on alternating-current motors of 1 hp. to 10 hp. rating and sixteen weeks on direct-current units. Occasional "pick-ups" are being made for prompt delivery, but there is no counting on the supply when definite sizes, types and speeds are desired. Prices are firm after the recent advances.

Lamps.—Fall buying has set in and some anxiety is expressed as to the ability of existing stocks to meet the demand. Manufacturers are pushing production, but occasional shortages are reported, notably in 100-watt gas-filled units. Steady prices rule.

Wire.—Immediate needs are being well met, but ten weeks' delivery is being quoted by a representative jobber on weatherproof in quantity, the base price being 29 cents. Some sizes of bare copper wire are being quoted on six to eight weeks' delivery, with price at 24 cents base. Rubber-covered wire is plentiful, No. 14 selling at $11 per 1,000 ft. in 5,000-ft. lots.

Fuses.—Rumors of a shortage appear somewhat exaggerated. Enclosed fuses up to 600 volts are selling at 35 per cent off list in standard packages. Plug fuses are a little handicapped by the shortage of porcelain, but the market is far from bare. The 15-amp. size sells at 5 cents each, in lots of 500 and over.

Non-Metallic Flexible Conduit.—Steady conditions are reported, with no price changes and good supply available for current requirements. Demand is slow. The ¼-in. size sells for $36.50 and the ⅜-in. size for $33.50 per 1,000 ft. in 1,000-ft. lots.

Magnet Wire.—This is extremely scarce, and quotations have been withdrawn by some manufacturing and jobbing interests. Smaller sizes of copper wire are scarce, owing principally to recent strikes in the mills.

Flexible Armored Conductor.—Demand is easier for the time being, and prices are steady. Single-strip, No. 14, sells for $110 per 1,000 ft. in 5,000-ft. lots.

Rigid Conduit.—Stocks are very spotty, some distributers reporting little pipe on hand, while others have fair supplies resulting from the arrival of long-delayed shipments. There is certainly no surplus stock in the Boston market. Prices are quoted from Card 45, but are subject to delivery conditions.

Heating Appliances.—Good stocks of flatirons are on hand, and the scarcity of toasters has been pretty well remedied. Representative irons are selling to dealers at 25 per cent discount in lots of one to five, and at 30 per cent off in lots of six. The same discounts apply to toasters. Hollow ware is scarce, manufacturing facilities having been concentrated largely upon irons and toasters.

ATLANTA

Rainy weather has served to check building activities and has done considerable damage throughout the section. Some pessimism regarding the cotton crop is generally expressed, as the heavy rains and cool weather have caused it to loose its excellent condition of two weeks ago. These poor weather conditions are reflected in a general slackening up in the receipt of orders, this being particularly true in the rural districts. Food crops are reported in good shape, and a resumption of sunshine will probably dissipate the pessimistic outlook.

While the car shortage continues about as reported last week, jobbers are slowly accumulating limited stocks of some materials, though not in sufficient quantities to be satisfactory. The fall trade has not yet begun to be in evidence, few orders for season specialties being reported.

Residential and small commercial construction continues, although permits in Atlanta for the first half of August presented quite a heavy drop as compared with the two previous months.

Money continues tight, and collections show no change. Bank clearings are slightly under the same period last year, but are well sustained.

Wire.—Fairly satisfactory stocks of rubber-covered are on hand in assorted sizes, but weatherproof continues scarce. A brisk demand, with quotations of 29 cents for rubber-covered and 31 cents for weatherproof, is reported.

Rigid Conduit.—The black-pipe situation continues to improve, but there are no stocks of galvanized pipe in the territory. Jobbers do not express any opinion when this condition will show improvement. Prices, lots less than 2,500 lb., black, ¾-in., $12.49; 1-in., $18.46; 2-in., $40.18.

Lock Nuts and Bushings.—The shortage of these fittings continues acute, with no easing up in demand. Local stocks are exhausted and shipments very poor. No price changes, however, are reported.

Porcelain.—Shipments of porcelain recently received were quickly absorbed, and a scarcity of this material is again reported. There are no ⅛-in. x 3-in. or 4-in. tubes in the territory, while knobs, cleats and other classes of porcelain are available in only limited quantities.

Heaters.—These are not yet moving, and there is quite a conflict of opinion as to the outlook for fall trade. Indications are, however, that heaters will not be so popular this fall as last, and no heavy orders are being placed

Christmas-Tree Outfits.—Jobbers report that retailers are placing orders satisfactorily, and they predict a record business. Stocks are in good shape, with retail prices practically the same as last year.

Steel Reflectors.—Industrial-plant demands keep this line very active, the fall buying having still further stimulated the movement. Stocks are good, but shipments from factory on new orders are somewhat slow.

Interphones.—Most of the apartments now under construction are small and are not installing this equipment. Therefore sales are rather slow. Stocks are in fair shape.

Lead Cable.—Brisk demands for both lead and varnished cambric cable are reported, industrial plants placing heavy orders. Shipments are ranging from three to six months.

SAN FRANCISCO

There is an appreciable lull in all business, although electrical prices are steady and there is little indication of any drop there. Building operations are slower, and contractors are working two or three men where they usually employ a dozen. The appliance business, too, is stagnant, and buying generally is at a low ebb, the tendency being to run along on present stocks as far as possible. Pacific Coast stocks on this account are accumulating. Shipments from the East are slower because of heavy fruit movements and the large volume of shipping that has been induced by the impending freight rate advance. Collections are fairly prompt, averaging about fifty days.

Schedule Material.—Factory extensions are producing better shipments, yet back orders usually cause these to melt on their arrival. Because of shortages in Coast stocks of safety switches, whose use is required by state laws, a large amount of knife switches especially in the 60-amp. size are being sold.

Insulating Material.—Demand has picked up and tapes, mica material and fiber are showing a good movement. There seems to be a lull in the sale to motor-repairing firms, but wireless companies and export concerns are heavy buyers. Prices are steady and Coast stocks are good.

Washing Machines.—Good export sales and the establishment of Far-Eastern agencies are reported the past week. The appliance business is in an uncertain state because experienced salesmen are badly needed.

Ranges.—Deliveries from the factory are very poor and require the greater part of a year. Inasmuch as orders continue in a regular although small volume, it is necessary to do considerable substituting in order to cope with the shortage of salable sizes. Business will be solicited this winter from summer resorts so that installations may be made next season.

Heating Appliances.—Stocks are better. Further price advances are looked for, but there is no doubt that all the stock that can be secured will be sold during the Christmas season.

SEATTLE—PORTLAND

Trade along electrical lines in Seattle and the Puget Sound district shows no particular change over the past few weeks. Jobbers sales are light, and retailers' business is fair but tending downward. Stocks, generally speaking, are in excellent shape with the exception of ranges, hollow-ware devices, electrical heaters and conduit.

Building remains quiet and indications are that previous predictions that fall would witness a resumption of residence construction in this section were too optimistic as construction of any consequence will be postponed until next spring. Lumbermen of the Pacific Northwest see ruin facing them if the freight rate advances are not later modified to restore competitive conditions now existing between the different producing centers. The lumbermen will probably appeal to the Interstate Commerce Commission and, if necessary, carry their case to the federal courts.

Portland manufacturers report that the week's business was about normal for this time of year. Incoming shipments are poor and back orders keep stocks depleted. Money is tightening up and collections are naturally slow. The price of all alternating-current motors advanced 15 per cent the past week. Jobbers report that business is firm but not improving materially. Financially, this season is about 15 per cent ahead of 1919, but in quantity of sales it is probably about the same as last year. Stocks on the whole are not improving, for as fast as new goods arrive they are shipped out again in order to care for back orders. Collections are getting slower and credit continues to tighten. Small dealers who started in business immediately following the armistice or during the war are beginning to show serious signs of being unable to weather the storm. Wherever such indications are shown credit is promptly withdrawn. The enormous unloading of government electrical material in this section has undoubtedly worked to the detriment of the trade. Depleted stocks and delayed deliveries from the heat are also factors in bringing about this condition, but on the whole the general business outlook seems to be improved over a few weeks ago.

Heating Appliances.—Demand is showing a noticeable increase with the approach of fall and practically every jobber is reporting short stocks. Shipments are irregular and delayed. Electric irons sell the best, closely followed by toasters, stoves and heaters.

Farm-Lighting Plants.—During the month of September various makes will be shown at several state and county fairs. Stocks are in excellent shape and deliveries are coming through satisfactorily. This year is expected to establish new sales records.

Household Appliances.—Shipments of washing machines, vacuum cleaners and sewing machines are coming through in good shape, and demand is strong although not so heavy as earlier this summer.

Lamps.—Stocks are beginning to move, especially residence types, but there are plentiful supplies to care for the demand.

Rigid Conduit.—Stocks are short in sizes ranging from ½ in. to 3 in. The scarcity has been acute, but the situation is somewhat easier because demand is lighter.

SALT LAKE CITY—DENVER

Indications point to better days ahead in the electrical trade. A slight improvement is noted in collections. Crops are beginning to move and dealers are able to collect more satisfactorily on outstanding accounts and to make remittances in turn to their jobbers. Dealers whose sales have been hampered somewhat by non-employment among those from whom they draw their trade are more hopeful now since the settlement of labor troubles. Hundreds of union men who have gone back to work are beginning to make their influence felt as a buying factor.

Jobbers and distributers are urging dealers to tighten up on collections and to be less prodigal in the extension of credits. Complaint has been made that many electrical dealers who have been concerned about their lack of sales are taking long chances in the matter of extending credit to doubtful customers. This tendency is very demoralizing to business. Jobbers and dealers have not relaxed their sales efforts through the dull summer period. The more sluggish business has been the harder they have worked.

A spirit of optimism prevails in the Intermountain region despite present adverse conditions. Far-sighted jobbers see big business ahead and are making their preparations accordingly. A feeling that the peak of inactivity has been safely passed is persistingly spreading in the West. The electrical trade is banking on the harvesting of crops, which is now well under way, and the prospect of a good yield is unusually bright. Shipments are good and dealers are now able to accumulate stock in mose lines.

Christmas Tree Outfits.—Jobbers are making their initial appeal to dealers to stock these goods along with appliances for the holiday trade.

Motors.—Dealers report difficulty in getting an adequate supply to meet present demands. Motors are now used extensively for pumping water for orchards and farms. Thus irrigation has created a special seasonal demand.

Washing Machines.—Some makes are still somewhat scarce. In other cases factories have caught up with orders and are urging jobbers to permit them to unload. Wringers as a separate unit are not plentiful. More of them could be sold if they were available.

Electric Irons.—This device is just having its initial introduction through extensive advertising campaigns. It is meeting with general favor and the prospects for business look good. The supply is not adequate.

Lamps.—There is a scarcity just at a time when the call for this merchandise is picking up.

Schedule Material.—Supplies are reported very short. Factories have not yet caught up with back orders. As a consequence construction work is seriously hampered.

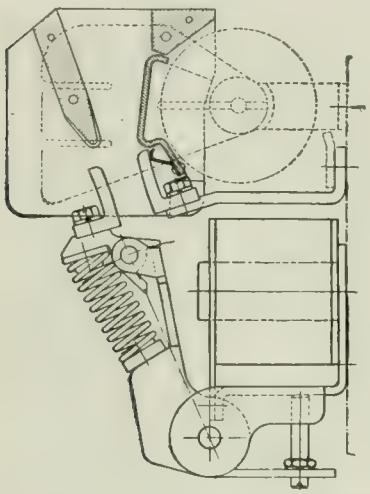
Rubber-Covered Wire.—There is a decided shortage here, though bare wire is reported plentiful.

NEW APPARATUS & APPLIANCES

A Record of Latest Developments
and Improvements in Manufacturers' Products
Used in the Electrical Field

Arc Splitter

An arc splitter to lengthen the life of contactor tips has recently been developed by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. It consists of a refractory

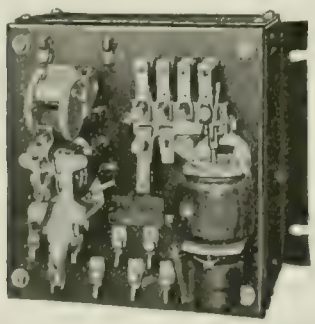


MAGNETIC BLOW-OUT CONTACTOR WITH ARC SPLITTER

element which is so placed in the arc box of the magnetic blow-out as to project into the path of the arc, thereby forcing the arc to pass around it and thus increasing its resistance, causing it to rupture more rapidly. The arc splitter is immediately above the contactor tips.

Elevator Controllers of Simplified Design

The entire line of elevator controllers manufactured by the Cutler-Hammer Manufacturing Company of Milwaukee has been replaced by a new



ONE OF NEW LINE OF ELEVATOR CONTROLLERS

line of fewer types and simpler construction. Among the new features are standardized carbon-to-copper power contacts, said to be non-freezing and quiet, and time-limit acceleration by a simple dashpot relay to provide smooth acceleration regardless of load. The time interval allowed the motor to come up to speed is determined by the setting of a dashpot relay which is externally adjustable. The relay serves to rotate a rocker arm carrying a series of fingers, which cut out resistance step by step or cause the accelerating magnet switches to close one by one.

Three-Phase Receptacle Has Spring Door

A receptacle for three-phase circuits having an extension with a spring-door cover has been developed by the Central Electric Company, 320 South Wells Street, Chicago. The extension is so constructed that it can be mounted on the receptacle in four positions so that the door can be opened to either side, to top or bottom, as desired. The dimensions when the receptacle is closed are: 7 in. high, 4¼ in. wide, 4¾ in. deep. This "Ralco" No. 610 EC receptacle is identical in construction to the old



SPRING DOOR MAY BE SET TO OPEN IN ANY DIRECTION

No. 10, except that it has the extension. The plugs are standard No. 10 "Ralco" plugs and are bored to take three-conductor No. 8 reinforced portable cord or smaller.

Notes on Recent Appliances

Vacuum-Tube Socket for Wireless Sets

The Precision Equipment Company, 2437 Gilbert Avenue, Cincinnati, Ohio, has designed a vacuum-tube socket equipped with grid "leak" for use in wireless sets.

Electric Clothes Washer

The Odin Company, 325 West Ohio Street, Chicago, has brought out a revolving cylinder clothes washer.

Self-Cleaning Lighting Fixture

An industrial lighting fixture which cleans itself every time the light is swiched on or off has been placed on the market by the Associated Engineers Company of 180 North Dearborn Street, Chicago, under the name of the "Clean-Pull" unit. The fixture consists of a reflector, a pull switch, a cord and a cleaning device consisting of two wiping blades. Every time the cord is pulled to operate the switch it simultaneously brings the two wiping blades into action. Each blade makes a complete revolution, one against the reflecting surface of the reflector and the other against the lamp bulb. In this way the dirt is swept off both lamp and reflector. The fixture is made to take 300-watt to 500-watt

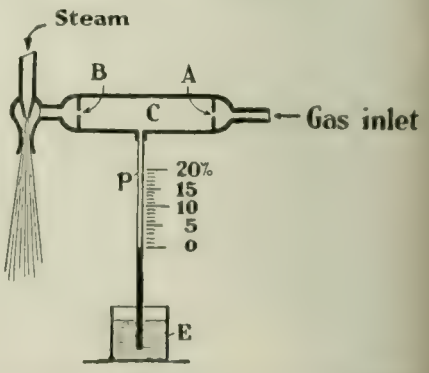


REFLECTOR CLEANED EVERY TIME SWITCH IS PULLED

lamps and is sent out completely wired and assembled so that any maintenance man may erect the unit on existing outlets.

Single and Multiple CO_2 Indicator

The Uehling Instrument Company, 71 Broadway, New York City, is offering a new design in single and multiple forms of CO_2 equipment, the latter serving any number of steam boilers simultaneously up to a total of six. Among the manufacturer's claims are speedy action, resulting from a new



SCHEME OF OPERATION OF CO_2 INDICATOR

form of aspirator, absence of chemical solutions, simplicity and a plan for providing an auxiliary boiler-front CO_2 indicator.

MANUFACTURERS' ACTIVITIES

Record of Changes Affecting Sales and Distribution Together with Trade Personals and Notes on Foreign Trade, Jobbers' News and New Trade Literature

STEVENS, WALLIS & BRAZIER, INC., Deseret Bank Building, Salt Lake City, factory representatives of electrical manufacturers and advertising directors for jobbers, are handling the advertising of the Automatic Electric Washer Company in eleven Western states. This firm was responsible for the effective advertising whereby 1,711 automatic washing machines were sold during the month of March in the Intermountain territory by the Utah Power & Light Company. This is the record for retail sales on washing machines in this territory. Mr. Brazier, the manager of the selling department, was formerly sales manager for a number of years for one of the largest electrical jobbing houses in the West. Mr. Stevens, the president of the company, was for years connected with the electrical industry in both the merchandising and the power-production fields.

THE HOLTZER CABOT ELECTRIC COMPANY, Roxbury, Mass., is planning to erect an addition to its plant, 26 ft. x 78 ft.

J. A. JANNEY, central district specialist on household appliances for the Western Electric Company, will become field sales manager for the National Sweeper Division of the Torrington Company, Torrington, Conn., on Sept. 1.

COL. EDWARD B. ELLICOTT, recently mustered out of the army after two and one-half years' service in the chemical warfare division, is associated with A. M. Castle & Company, Chicago, as chief engineer. Previous to entering the service he was for eight years city electrician of Chicago and for eleven years chief electrical engineer of the Sanitary District of Chicago.

RALPH B. COLEMAN, well known among Middle Western central-station men, has become associated with the Consolidated Wire and Machinery Corporation, 519-529 West Van Buren Street, Chicago.

THE CHASE-SHAWMUT COMPANY, Newburyport, Mass., has taken over the Chase-Shawmut Department of the Condit Electrical Manufacturing Company, with Sears B. Condit, Jr., president and treasurer, and Frank D. Masterson, vice-president and general manager. Mr. Masterson has been associated with the Shawmut fuse business for twenty-one years.

THE GRANDEN ELECTRIC COMPANY has been organized to take over the property and business of the Burgess-Granden Company, Omaha, Neb., Mr. Burgess of the latter company having retired from business. The company will continue to manufacture artistic lighting fixtures and to deal in electrical appliances and supplies. Charles A. Granden, formerly secretary and treasurer of the Burgess-Granden Electric Company, is president of the new company.

THE WESTERN REFLECTOR COMPANY has removed its plant from 1053 West Lake Street, to 1221 West Madison Street, Chicago, where it has much larger quarters.

LANDERS, FRARY & CLARK, INC., New Britain, Conn., has leased the large portion of the plant now held by the Tuskeloid Company at Sussex Avenue and Dey Street, Newark, N. J., which it will equip at once for the manufacture of metal kitchen products.

THE GREENFIELD TAP & DIE CORPORATION, Greenfield, Mass., has completed plans for enlarging its forge shop at Turners Falls, consisting of two new buildings, on which work will be started at once. The proposed new five-story plant of the company at Greenfield is held up for the time being.

THE SENECA WIRE & IRON COMPANY, Fostoria, Ohio, has filed plans for an addition, 167 ft. x 208 ft., to cost with equipment about $100,000.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, East Pittsburgh, Pa., has awarded contract for the erection of a one-story addition to its plant at Essington, 120 ft. x 200 ft., to be used as a foundry.

THE BLACK & DECKER MANUFACTURING COMPANY, Towson Heights, Baltimore, Md., has increased its capital stock from $350,000 to $2,000,000.

THE GLACIER MACHINE MANUFACTURING COMPANY, Chicago, manufacturer of ice-making machines, has leased a plant at Ravenswood, Schreiber, Devon and Hermitage Avenues.

THE ADVANCE ELECTRIC COMPANY, 6315 Maple Avenue, St. Louis, manufacturer of electrical devices, has filed plans for the erection of a one-story extension, 50 ft. x 100 ft., to cost about 15,000.

THE HIGH POINT MACHINE WORKS, High Point, N. C., dealer in used equipment, announces that Lee Overman has taken charge of its electrical department, his appointment having taken effect Aug. 15. The department has been enlarged and a force of experts added.

THE EXPORT MANAGERS' CLUB of Bridgeport, Conn., was organized on July 1. It consists of the export managers of twenty-one of the large manufacturers in Bridgeport, and for the present the number of active members is limited to twenty-five. As many associate members will be admitted as it is found possible to accommodate at the meetings. Robert M. Eames, export manager of the Bryant Electric Company, is president; John J. Conway, export manager of the Acme Shear Company, is vice-president, and Harold W. French, export manager of the Bridgeport Hardware Manufacturing Corporation, is secretary and treasurer.

THE HIRCHY COMPANY, manufacturer of clothes-washing machines, formerly located in the Security Building, Minneapolis, Minn., is now established at 257-263 South First Avenue, East, Duluth, Minn.

THE NATIONAL LAMP WORKS, Cleveland, Ohio, is holding its eighth consecutive summer sales conference for its field executives and jobber representatives at its camp adjoining the Nela Park works of the company. Each week from June until September the conference is in session, and gives lectures, demonstrations and factory trips. Various kinds of games and recreational features are also incorporated in the programs.

THE UEHLING INSTRUMENT COMPANY, 71 Broadway, New York City, manufacturer of fuel economy equipment, announces that it is now represented in New England States by the Smith Engineering & Supply Company, 89 State Street, Boston, Mass., manufacturers' agents and engineers, specializing in power-plant equipment. S. W. Smith, president of the latter company, was until recently associated with the Uehling Instrument Company, with headquarters in the New York office.

THE M. B. AUSTIN COMPANY, 700 West Jackson Boulevard, Chicago, manufacturer of electrical supplies, has acquired a site at 108-116 South Desplaines Street, 91 ft. x 118 ft., on which it proposes to erect a two-story plant, to cost about $100,000.

RICKARD & SLOAN, INC., New York City, announce the removal of their offices from the Evening Post Building to 25 Spruce Street, effective Aug. 1, where they will have much larger quarters.

THE CRANE COMPANY, 836 South Michigan Avenue, Chicago, recently celebrated the sixty-fifth anniversary of the founding of the company by R. T. Crane in 1855. Today the company has three main groups of buildings devoted to manufacturing in Chicago, Ill., Bridgeport, Conn., and Montreal, Canada, having a total working space of 13,856,042 sq.ft., and its employees number 15,304. From the factories its products go into fifty-nine branches and warehouses of the company. In this catalog are listed 20,000 different articles covering "Everything for Any Pipe Line Anywhere." It is interesting to note the long-continued co-operation of the 518 directing and executive heads of the Crane organization, their service averaging twenty and a half years. The Crane coworkers hold $7,000,000 of the Crane Company preferred stock, and stockholders may be found in every part of the organization.

THE MEADOWS MANUFACTURING COMPANY, formerly of Pontiac, Ill., is now established in its new factory at Bloomington, Ill. The company manufactures power washing machines, grain elevators, etc.

THE WAITE & BARTLET MANUFACTURING COMPANY, manufacturer of electrotherapeutic apparatus, has moved its plant from New York City to 53 Jackson Avenue, Long Island City, N. Y., where general offices, factory and salesrooms will be located. Dental X-ray rooms have been opened at 103 Park Avenue, New York City.

MASPETH FACTORY OF THE SPRAGUE ELECTRIC WORKS.—The new factory of the Sprague Electric Works for the manufacture of cable, conduit and supplies is at Grand Street and Garrison Avenue, Maspeth, L. I. It is a two-story building comprising approximately 100,000 sq.ft. In addition to the main building there is a two-story structure containing about 12,000 sq.ft. which will be used for the New York district sales warehouse. Work is to be started at once on three new structures to supplement the present buildings on the



CAMP NELA SALES CONFERENCE

property, including a warehouse containing about 19,000 sq.ft., a garage about 120 ft. x 25 ft., and a small warehouse 100 ft. x 15 ft. for the storage of rigid conduit. It is expected to have these buildings ready for occupancy within sixty days.

J. J. COSTELLO, formerly sales engineer with James C. Barr, Boston, has established offices at 201 Devonshire Street, that city, where he will represent the Lewis & Roth Corporation, Philadelphia, manufacturer of high-tension devices and power-plant specialties and also will handle the New England sales for the Cutter Company, Philadelphia, manufacturer of the I-T-E line of circuit breakers and other equipment.

SPECIAL COURSE FOR TECHNICAL MEN.—Arrangements have been completed by the educational authorities of the Western Electric Company, 195 Broadway, New York City, and the faculty of Columbia University to enable the employees of the former to carry on post-graduate courses coincident with their regular duties. This system has been limited to the members of the engineering department, where more than 3,000 technical students are eligible to take advantage of the offer. Approved graduates of colleges and scientific schools may pursue graduate work for masters' degrees and fulfill the requirements in two calendar years.

Supply Jobbers' Notes

THE MILNER-FLOWER COMPANY, Buffalo, N. Y., has moved from its old location and is now occupying the entire building at 9 Union Terrace, which has been remodeled to accommodate its electrical appliance jobbing business.

Foreign Trade Notes

ELECTRICAL TRADES DIRECTORY.—"The *Electrician* Directory and Hand Book of the Electrical Engineering and Allied Trades" (the blue book) for 1920, has been issued by Benn Brothers, Ltd.; *Electrician* offices, 8 Bouverie Street, E. C. 4, London, England.

GREAT DEMAND FOR ELECTRICAL SERVICE IN PARIS.—At the present time a large number of electrical installations are being made in Paris. This, it is understood, is being done by the tenants at their own expense, they having waited in vain for prices to fall and now fearing a further increase in cost. The present charge for the installation is estimated at about 3,000 francs for three rooms, about four times pre-war costs.

GREAT INCREASE IN USE OF ELECTRICITY FOR DOMESTIC AND INDUSTRIAL PURPOSES IN NORWAY.—From 1910 to 1918 the consumption of electricity for industrial purposes in Norway increased from 145,000 hp. to 770,000 hp., increasing at the rate of 80,000 hp. per annum, or 430 per cent in all. Domestic requirements increased during the same period from 68,000 hp. to 210,000 hp., an increase of 210 per cent.

LARGE INCREASE IN CONSUMPTION OF ELECTRICITY IN ARGENTINA.—The annual report of the Société d'Electricité de Rosario, the headquarters of which are in Brussels, showed an increase in total receipts over those in 1918, while, as contrasted with 1915, the advance is no less than 50 per cent. The supply of electricity to private houses is now 80 per cent greater than in 1915. The report refers to the rapid way in which domestic electrical appliances, notably electric flatirons, are being adopted, these being now used even in the most modest household. The consumption of energy for power purposes increased 33 per cent in the last year. Altogether the company is now furnishing service to 21,630 consumers, as against 1,284 in 1915.

WATER POWER in GREEK MACEDONIA.—By a law recently passed the Greek government is authorized to expropriate, with safeguards for the protection of private interests, water power of a number of rivers and waterfalls in Macedonia, which it is estimated would develop a total of about 66,000 hp. Recent investigations have resulted in the discovery that new sources of water power, capable of developing from 20,000 hp. to 30,000 hp., might be created by the junction of several rivers. Practically all of the larger falls in Macedonia are on the railway lines between Monastir and Saloniki. At present less than one-tenth of the total available power is being utilized.

Trade Publications

POWER WASHERS. — The Meadows Manufacturing Company, Pontiac, Ill., is distributing a sixteen-page booklet describing its different types of "Meadows" power washing machines.

BATTERIES. — The O-K Giant Battery Corporation, Gary, Ind., is distributing a seventy-two page booklet entitled "Face to Face with Facts," in which it describes its various types of dry rechargeable batteries.

GAGES.—The Schaeffer & Budenberg Manufacturing Company, Brooklyn, N. Y., has issued catalog sections No. 1, 50 and 75, covering its pressure, vacuum and draft gages and gage testers; also a preliminary bulletin describing its hand and stationary tachometers.

POWER-PLANT DEVICES. — The Yarnell-Waring Company, Chestnut Hill, Philadelphia, Pa., has issued folder No. G 1301, covering the Yarway devices for modern power plants, and booklet No. B 410, describing different types of the Yarway blow-off valves.

INSTRUMENTS.—"A Few Simple Methods of D. C. Testing in Routine Practice" is the subject of bulletin No. 13, recently published by the Pyroelectric Instrument Company, 636 East State Street, Trenton, N. J.

FUSES. — E. W. Snow & Company, Rochester, N. Y., are circulating catalog No. 15, covering their different types of inclosed electric fuses.

HYDRO-ELECTRIC PLANTS.—"Hydro-Electric Developments" is the title of an illustrated booklet published by Charles T. Main, engineer, 201 Devonshire Street, Boston, describing a number of hydro-electric developments. Several photographic reproductions of different plants are also shown.

ICE-MAKING APPARATUS.—The Frick Company, Waynesboro, Pa., is distributing three numbers of "Ice and Frost," series A, covering its ice-manufacturing machinery as follows: No. 3, describing its inclosed compressors; No. 4, small refrigerating plants, and No. 5, vertical and horizontal refrigerating machines.

PIPE AND TANKS.—The Redwood Manufacturers' Company, Hobart Building, San Francisco, Cal., has issued catalog 9, describing its Remco redwood pipe, and price list 14, covering its Remco redwood tanks.

LIGHTING SYSTEMS.—The National X-Ray Reflector Company, 235 West Jackson Boulevard, Chicago, is distributing a folder entitled "Eye Comfort," inclosing leaflets describing its apparatus for industrial-lighting, store-lighting and flood-lighting systems.

MERCURY-ARC RECTIFIERS. — The General Electric Company, Schenectady, N. Y., is distributing a small booklet covering its multiple mercury-arc rectifiers.

MELTING POTS.—The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has issued a two-page leaflet, entitled "Metal Melting Pots," describing the C-H melting pots, both portable and bench types.

DEVICES FOR CONDUIT CONNECTIONS.—"Spraguelets" is the title of a small booklet issued by the Sprague Electric Works of the General Electric Company, New York City, covering its Spraguelet devices for conduit connections. The company is also distributing a booklet entitled "The Universal Key," "a cross-reference for matching any standard wiring device to any desired box and cover."

RIVETED STEEL PIPE.—The Western Pipe & Steel Company, of California, San Francisco, Cal., is distributing bulletin A-19, describing its riveted steel pipe and accessories.

PANELBOARDS, SWITCHES ETC.—Bulletins Nos. 1, 3, 4, 6, 7, 8 and 13, issued by the Metropolitan Electric Manufacturing Company, Boulevard and Fourteenth Street, Long Island City, N. Y., describe and illustrate respectively its standard panelboards, steel boxes and trims, safety panelboards, rotary snap-switch panels, standard knife switches, inclosed fuses, "Yankee" renewable fuses, plug fuses and flush switches, etc.

WATERWHEEL-DRIVEN GENERATORS.—Bulletin No. 40,601, entitled "Vertical Shaft Waterwheel-Driven Generators," published by the General Electric Company, Schenectady, N. Y., describes and illustrates its standard vertical waterwheel-driven generators from 30 kva. to 625 kva.

BATTERY-CHARGING SETS. — The General Electric Company, Schenectady, N. Y., has recently issued bulletin No. Y-1364, covering its multiple-battery-charging motor-generator sets, and bulletin No. Y-1369, describing its motor-generator sets for series-multiple charging; also bulletin No. 64,200, describing and illustrating its new gathering locomotive, trolley type.

GASOLINE MOTORS FOR STATIONARY WORK.—The Sterling Engine Company, Buffalo, N. Y., has issued a twenty-four page booklet with illustrations covering the Sterling gasoline motors for stationary work for driving centrifugal pumps and electric generators.

WATERWHEELS.—Bulletin No. 40 issued by the Fitz Water Wheel Company, Hanover, Pa., describes and illustrates its "I-X-L" steel overshot waterwheels and accessories.

FEED-WATER HEATERS. — Warren, Webster & Company, Camden, N. J., have issued bulletins No. 100-1 and 102, covering the "Webster" feed-water heaters, rectangular cast-iron types.

New Incorporations

THE FULTON COUNTY GAS & ELECTRIC COMPANY, Gloversville, N. Y., has been incorporated with a capital stock of $1,732,600. The company is a consolidation of the Fulton County Gas & Electric Company and the Mohawk Electric Company and will operate in the counties of Fulton, Herkimer, Montgomery, Otsego, Schenectady and Schoharie. Among the directors are Lucius H. Liiteaur, New York City; Walter Clark, Philadelphia, and James C. Delong, Syracuse, N. Y.

THE RARITAN VALLEY HYDRO-ELECTRIC COMPANY, Three Bridges, N. J., has been incorporated with a capital stock of $100,000 by I. F. Halton, Brooklyn, N. Y.; C. W. Alspaugh, Bernardsville, and J. S. Ammermann, Neshanic, N. J.

THE ROSSIE (N. Y.) ELECTRIC & MANUFACTURING CORPORATION has been incorporated with a capital stock of $50,000, by Dr. T. A. E. Young, John W. Wilson, Georg · N. Wilson of Rossie; Alvin Nebon and John Williamson, South Hammond. The company proposes to develop water power and plants for generating and transmitting electricity.

THE LOWE-ELLIOTT CORPORATION, Freeport, N. Y., has been chartered with a capital stock of $50,000 to manufacture electric storage batteries and kindred products. The incorporators are H. M. Lowe, W. J. Martin and M. A. Elliott.

THE ANTHRACITE ELECTRIC & WELDING COMPANY, Pottsville, Pa., has been incorporated with a capital stock of $20,000 to manufacture electric welding equipment. Martin L. Dunn is treasurer.

THE SOONER BATTERY & ELECTRIC COMPANY, Okmulgee Okla., has been incorporated by B. C. Campbell, Lee W. Cotter and O. J. Hannigan. The company is capitalized at $10,000 and proposes to manufacture electric batteries and other electrical apparatus.

THE FLAT ROCK LIGHT & POWER COMPANY, Anderson, S. C., has been incorporated with a capital stock of $5,000 by W. L. Hayes, J. Wesley Brown and L. C. Keys.

THE OAK RIDGE (N. C.) LIGHT & POWER COMPANY has been organized to distribute electricity to be furnished by the Southern Power Company. D. L. Donnell is president and D. L. Nance secretary and treasurer.

THE LEWISBURG (KY.) ELECTRIC LIGHTING COMPANY has been incorporated by O. A. Bland, E. W. Duncan and James Westry. The company is capitalized at $10,000 and proposes to operate an electric light and power system in Lewisburg.

THE CASE ELECTRIC COMPANY, Fairmont, W. Va., has been incorporated by E. L. Lively, W. H. Spedden, T. M. Courtney and F. K. Everett, all of Fairmont. The company is capitalized at $10,000 and proposes to do a general electrical engineering and contracting business.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

NASHUA, N. H.—Plans are under way by the Nashua Manufacturing Company for extensions and improvements to its power house.

CHARLESTOWN, MASS.—The Palmer & Parker Company, 103 Medford Street, contemplates the construction of a power house at its factory to cost about $15,000.

TAUNTON, MASS. — The Municipal Lighting Commission has awarded contract to the Westinghouse Electric Company, 6905 Susquehanna Street, Pittsburgh, Pa., for additions and extensive improvements to the municipal electric light plant on West Water Street to cost about $400,000.

WAKEFIELD, MASS.—The Heyward Brothers & Wakefield Company are not contemplating the erection of a power house as was erroneously stated in these columns Aug. 7.

PAWTUCKET, R. I.—The American Electrical Works of Phillipsdale has plans under way for the erection of a transformer station, 15 ft. x 40 ft., at its plant.

PAWTUCKET, R. I.—Contract has been awarded to Joseph F. Cole, Niagara Street, Providence, by the What Cheer Chemical Company for the erection of a power house at its plant to cost about $15,000.

BRIDGEPORT, CONN.—Bids are being received by Fletcher & Thompson, Inc., engineers, 1089 Broad Street, for an addition to the power house of the Bridgeport Brass Company, East Main Street, to cost about $14,000.

HARTFORD, CONN.—Bids will be received by the Board of Education until Sept. 7 for the erection of a high school to cost about $750,000. Electric lighting equipment will be installed. Whiton & McMahon, 36 Pearl Street, are architects.

MONTVILLE, CONN.—Contract has been awarded to the Austin Company, 217 Broadway, New York, N. Y., by Robert Gair & Company, 50 Washington Street, Brooklyn, N. Y., for the erection of a paper factory and power house to cost about $600,000, at Montville. William Higginson, 18 East Forty-first Street, New York, N. Y., is architect.

NEW BRITAIN, CONN.—The Board of Education will soon award contract for the construction of a school to cost about $350,000. An electric lighting system will be installed. D. K. Perry, 27 West Main Street, is architect.

NEW HAVEN, CONN.—A petition has been circulated among the merchants of Dixwell Avenue for the installation of an ornamental street lighting system on that thoroughfare from Broadway to Shelton Avenue.

WINDSOR LOCKS, CONN.—The Connecticut River Company, care of C. H. Tenney & Company, 201 Devonshire Street, Boston, Mass., contemplates the erection of a dam 30 ft. high and 2,000 ft. long, on the Connecticut River for power purposes.

Middle Atlantic States

BROOKLYN, N. Y.—Bids will be received by the superintendent of school buildings of the Board of Education, Room 2800, Municipal Building, Manhattan, until Sept. 1, for installing electric light equipment in public schools 10, 23, 35, 45, 55 and 77, Brooklyn.

HORNELL, N. Y.—Application has been made to the Public Service Commission by the Hornell Electric Company for permission to erect a power plant at Hornellsville, with local distribution system for light and power service.

MIDDLETOWN, N. Y.—A charter has been granted to the Oakland Power Company to generate electricity for light, heat and power purposes in Orange and Sullivan Counties.

OSSINING, N. Y.—Bids will be received by Charles F. Rattigan, superintendent of State Prisons, Capitol, Albany, until Sept. 15, for the construction of a building for additional accommodations, electrical work, addition to the power house, etc., at Sing Sing Prison, Ossining.

CROSSWICKS, N. J.—Charles W. Bricks plans to erect a power and lighting plant at Crosswicks for the purpose of supplying electrical energy to residents of that place and to North Crosswicks. Application has been made to the Board of Freeholders for permission to erect overhead wires and underground equipment in North Crosswicks.

ELIZABETH, N. J.—The Board of Education has plans under way for the construction of a new power house in connection with an addition to the local high school on South Street. Total cost is estimated at about $350,000.

NEWARK, N. J.—The Board of Trade, 800 Broad Street, will soon receive bids for the erection of an office building to cost about $1,000,000. Electric light equipment will be installed. Guilbert & Betelle, 2 Lombardi Street, are architects.

THREE BRIDGES, N. J.—The Raritan Valley Hydraulic Electric Company contemplates the erection of an electric power plant near Three Bridges. C. W. Alpaugh of Bernardsville is head of the company.

WEEHAWKEN, N. J.—The Board of Education has received a bid on electrical work for the new Public School No. 1, West New York, from Walter Coleman, Jersey City, at $13,633.

DILLSBURG, PA.—Notice has been filed by the Dillsburg Light, Heat & Power Company of an increase of $40,000 in capital stock for proposed expansion.

EASTON, PA. — Contract has been awarded to Wark & Company, 1239 South Broad Street, Philadelphia, by the Young Men's Christian Association, 9 Centre Square, Easton, for the erection of a Y. M. C. A. building to cost about $400,000. Electric lighting equipment will be installed.

HARRISBURG, PA.—A special meeting of stockholders of the Harrisburg Light & Power Company will be held on Sept. 24 for the approval of an increase in capital stock of $1,720,000, part of which will be used for extensions and improvements to its electric plant and system.

NEW CASTLE, PA.—The Lehigh Portland Cement Company, 718 Hamilton Street, Allentown, has plans under way for the construction of several buildings at New Castle to cost about $200,000, including a waste heat installation power house, 44 ft. x 140 ft.

PHILADELPHIA, PA.—The Philadelphia Roll & Machine Company, Twenty-fifth Street and Washington Avenue, contemplates the erection of a power plant at Fifty-second Street and Grays Avenue.

SHINNSTON, W. VA.—The Ridge Silk Company of Clarksburg contemplates the erection, by day labor, of buildings at Shinnston to cost about $30,000, including an electric power plant to cost $6,000. J. H. Nuzum is president.

HAMPTON ROADS, VA.—Contract has been awarded to John R. Proctor, 74 Cortlandt Street, New York, N. Y., by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the installation of an underground electric distribution system on Block Z, at $34,880.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Sept. 3 for furnishing arc radio transmission equipment for the navy yard at Philadelphia, Pa. (Specification 6,148.)

North Central States

CARSON CITY, MICH.—Plans are under way for the erection of a power plant in Carson City to cost about $150,000. The Fargo Engineering Company, Jackson, are engineers. Work will be done by day labor.

DETROIT, MICH.—Bids will be received by the Public Lighting Commission, Atwater Street, for furnishing the following materials, freight prepaid, to Detroit: 3,000 ft. No. 6 B. & S. G. solid copper wire, 8-32-in. varnished-cambric insulation, covered by asbestos braid; 30,000 ft. No. 6 B. & S. copper wire, stranded 4-32 in. 30 per cent Para rubber insulation, double-braid, 3,000 ft. No. 6 B. & S. G. stranded copper wire 8-32-in. 30 per cent Para rubber insulation, double braid; 4,000 ft. No. 10 B. & S. G. strand copper wire, 2-32-in. 30 per cent Para insulation, double braid, hard-drawn copper wire, triple-braid weatherproof insulation as follows: 5,000 lb. No. 2, 2,000 lb. No. 4, [illegible] lb. No. 6 B. S. & G. solid conductor, 1,500 lb. No. 4 B. & S. G. stranded conductor, 500 lb. No. 10 B. & S. solid conductor; soft-drawn copper wire, double-braid waterproof insulation as follows: 3,000 lb. No. 6 B. & S. G. stranded conductor, 5,000 lb. No. 12 B. & S. G. solid conductor. G. J. Finn is commissioner of purchases and supplies.

MARION, MICH.—The Winterfield Light & Power Company, recently organized at Marion, contemplates the erection of a power plant near Everett for furnishing light and power to several towns.

SAGINAW, MICH.—The American Safety Navigation Company, care of managing secretary, Board of Commerce, has plans under way for the construction of a factory and an office building, the initial units of plant to cost about $10,000,000. Electric light and power equipment will be installed.

COLUMBUS, OHIO.—Contract has been awarded to E. J. Spencer, Huntington Bank Building, by the Columbus Railway, Power & Light Company, 102 North Third Street, for the erection of a substation to cost about $25,000.

GREENVILLE, OHIO.—Plans are under way for the erection of a power plant, 35 ft. x 40 ft., for the Franklin Traction Company, George Hill president and manager, Eighth and Broadway Streets.

RUDOLPH, OHIO.—The Rudolph Light & Power Company, recently incorporated with a capital stock of $10,000, contemplates the erection and operation of an electric light plant.

TOLEDO, OHIO.—H. J. Ricker, 343 Spitzer Building, contemplates the purchase of five 50-hp., 220-volt, 60-cycle, three-phase motors and on electrically driven centrifugal pump not under 3-in. to 4-in. intake, complete with starting compensator.

HENDERSON, KY.—The city officials contemplate the purchase of electric light poles to cost about $2,000.

PRINCETON, ILL.—The installation of an additional unit in the municipal electric light plant, to develop 400 hp., is contemplated at a cost of about $17,000.

SPRINGFIELD, ILL.—The construction of a lighting system on Fourth Street is under consideration.

TAYLORVILLE, ILL.—Bids will be received about Oct. 1 for the proposed addition to the municipal pumping station which will convert it into a combination light plant and pumping station. Plans include the installation of two 300-kw. generating units and one of 200-kw., two 300-kw. boilers, switchboards, etc. Improvements will also be made to the street-lighting system. W. S. Merkle, Laclede Gas Light Building, St. Louis, Mo., is consulting engineer.

BRUCE, WIS.—Extension of the power and light line of the Big Falls Power Company from Bruce to Apollonia is contemplated.

MANCHESTER, IOWA.—Survey of the municipal pumping station is being made by W. E. Skinner, engineer, 15 South Fifth Street, Minneapolis, Minn., with a view of electrifying the equipment. It is probable that a survey of the municipal power plant may be made later.

BUTLER, MO.—Bonds to the amount of $65,000 have been voted for the erection of an electric power plant. J. F. Smith is city clerk.

KANSAS CITY, MO.—Extension of the ornamental street-lighting system on Thirty-first Street from the Paseo to Prospect Avenue is under consideration.

ST. JOSEPH, MO.—Bids will be received about the middle of September by the Western Tablet Company, Eleventh and Mitchell Streets, for the erection of a power house to cost about $35,000. R. & E. R. Meier, 203 Lincoln Building, are architects.

ELLENDALE, N. D.—The Ellendale Electric Company contemplates the erection of an electric transmission line from Ellendale to Guelph and Ludden, to cost about $25,000. G. E. Dodge is manager.

Southern States

PAYNE CITY, GA. [illegible] extensions to the electric lighting system are contemplated by the City Council.

MIAMI, FLA.—The Bay View [illegible] Corporation will erect an electric light and power plant.

CLARKSVILLE, TENN.—The Kentucky Public Service Company contemplates the purchase of electric equipment, turbines, etc., in connection with the local electric light plant now being rebuilt.

KNOXVILLE, TENN.—The Knoxville Railway & Light Company contemplates extensive improvements to its power plant and transmission systems.

FLORENCE, ALA.—Contract has been awarded to the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., at $779,400 for four generators and accessories to be used in connection with the Wilson Dam.

PINE BLUFF, ARK.—The Jefferson Cotton Oil Mill Company contemplates the installation of thirteen additional motors to complete electrification of its mill.

SHREVEPORT, LA.—At an election to be held on Sept. 14 a proposal to issue $25,000 in bonds for the construction of a fire-alarm system will be submitted to the voters.

McALESTER, OKLA.—The Abbott Pike Lodge has plans under way for the construction of a Masonic Temple to cost about $500,000. Thompson & Harding, 504 Southern Trust Building, Little Rock, Ark., are architects.

AMARILLO, TEX.—At an election to be held soon a proposal to issue $426,000 in bonds for municipal improvements, including $30,000 for a fire alarm station, will be submitted to the voters.

CLEBURNE, TEX.—The local waterworks contemplates the installation of a 150-hp. electric motor and a compressor with daily capacity of 1,250,000 gal. W. S. Hockaday is superintendent.

DALLAS, TEX.—The Texas Hosiery Mills, 1407-09 South Ervay Street, will establish a hosiery factory and contemplates the installation of electrically-driven knitting machinery.

WICHITA FALLS, TEX.—Bids will be received by the Chamber of Commerce until Sept. 1 for the installation of a lighting system on ten streets in the city. Plans include laying 30,245 ft. cable, constructing 324 concrete bases and erecting standards.

Pacific and Mountain States

TACOMA, WASH.—The Consumers' Central Heating Company contemplates the erection of a power and heating plant to cost about $200,000 and the installation of electrical machinery to generate 1,600 hp.

MARE ISLAND, CAL.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., and at the Public Works Office, Navy Yard, Mare Island, Cal., until Sept. 11 (Specification 4127), for a lighting protection system in connection with the ordnance buildings to be erected at Mare Island. A deposit of $10 is required for plans and specifications, which may be obtained at the above address and from the Commandant, Navy Yard, Mare Island.

OGDEN, UTAH.—Bids will be received at the office of the contracting quartermaster, 317 Colonel Hudson Building, for the construction of sixty buildings, electrical work, etc., near Ogden. Plans and specifications and further information may be obtained on application to the above address.

EMIGRANT, MONT.—According to a decision of the game and fish commission at Helena, improvements are to be made to the Emigrant fish hatchery, including the erection of an electric light plant, garage, etc.

LOVELAND, COL.—Petition has been made to the State Public Utilities Commission for permission to continue the construction of a municipal power and light plant.

Canada

ST. JOHN, N. B.—The New York Cotton Mills contemplates electrification of its plant.

FORD CITY, ONT.—The Fisher Body Company of Canada contemplates the erection of a factory for the manufacture of auto bodies. Electric light and power equipment will be installed. Albert Kahn, Walker Road, Walkerville, is architect.

PORT ARTHUR, ONT.—The Kaministiquia Pulp & Paper Company contemplates the installation of a hydro-electric plant at its new pulp mill. The cost is estimated at about $1,000,000.

(Issued Aug. 10, 1920)

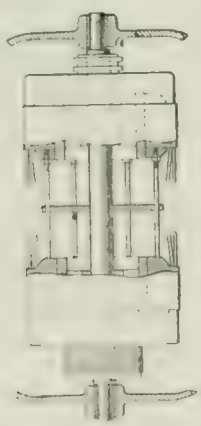
1,349,358. SHAFT BRACING; David Barclay, Conneautville, and Adolphus M. Dudley, Oakmont, Pa. App. filed Sept. 10, 1915. Truss between motor and generator of combined sets.

1,349,365. SYSTEM OF DISTRIBUTION FOR RAILWAY FEEDER CIRCUITS; Almon W. Copley, Wilkinsburg, Pa. App. filed March 8, 1917. Reverse-energy relay.

1,349,371. ELECTRICAL SYSTEM; Siegmund H. Eckmann, Manchester, England. App. filed July 14, 1915. Combination of direct-current generators for load control.

1,349,373. MEASURED-SERVICE TELEPHONE SYSTEM; John Erickson, Chicago, Ill. App. filed Dec. 15, 1916. Pay station for automatic phones.

1,349,375. SYSTEM OF CONTROL; Arthur J. Hall, Wilkinsburg, Pa. App. filed July 5, 1917. For polyphase machines operated through phase converters.



1,349,376. CONTROL SYSTEM; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed Jan. 5, 1916. To prevent slippage of induction-motor-driven vehicles.

1,349,377. DYNAMO-ELECTRIC MACHINE; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed March 7, 1916. Arrangement of windings.

1,349,379. CONTROL SYSTEM FOR ELECTRIC FURNACES; Edgar A. Hester, Edgewood Park, Pa. App. filed Oct. 30, 1918. Changes transformer taps.

1,349,381. AUTOMATIC TELEPHONE SYSTEM; Emil Lycoln, Chicago, Ill. App. filed March 25, 1918. For releasing connector switches.

1,349,385. ELECTRICAL PROTECTIVE DEVICE; Herbert Pearce, Manchester, England. App. filed May 2, 1918. For parallel feeders.

Record of Electrical Patents

Notes on United States Patents

1,349,501. MAGNETIC SEPARATOR; Myron Dings, Milwaukee, Wis. App. filed Aug. 2, 1918. Circular cross-conveyor with plurality of unloading points.

1,349,531. AUTOMATIC FIRE ALARM; George E. Rattermann, Chicago, Ill. App. filed Nov. 5, 1917. Phonographic record attachment calls alarm over telephone lines.

1,349,539. PORTABLE ELECTRIC RIVET HEATER; Louie T. Weidrick, Baltimore, Md. App. filed April 6, 1920. Arc furnace.

1,349,548. RAILROAD ELECTRIC LANTERN; Harold C. Breckenbridge, Musselshell, Mont. App. filed Aug. 16, 1919. Displays differently colored lamps.

1,349,549. ELECTROPLATING APPARATUS; William Dietzel, Merrick, N. Y. App. filed Feb. 18, 1919. Rotary.

(Issued Aug. 17, 1920)

14,929 (reissue). DRY BATTERY; Ferdinand P. Baumann, Kusnacht, Switzerland. App. filed May 28, 1918. Electrodes in the form of plates.

1,349,583. FRAME FOR LAMP RESISTANCES; Harry D. Rohman, New York, N. Y. App. filed March 20, 1917. Installed in connection with standard panelboards for lighting and heating systems.

1,349,581. REVERSING BRUSH GEAR FOR DYNAMO-ELECTRIC MACHINES; Harry D. Rohman, New York, N. Y. App. filed Oct. 9, 1917. Maintains constant polarity in the external circuit regardless of the direction of rotation.

1,349,597. ELECTROLYTIC CELL; Herbert I. Allen and Kent R. Fox, Portland Me. App. filed April 2, 1919. Cathode in shape of a rectangular box.

1,349,655. ELECTRICAL TESTING DEVICE; Richard C. Bierbower, San Antonio, Tex. App. filed June 11, 1918. Improved mechanical interrupter.

1,349,656. ELECTRICAL TESTING DEVICE; Richard C. Bierbower, San Antonio, Tex. App. filed Oct. 2, 1919. Spark coil for high-tension testing.

1,349,678. ELECTRIC SEWING-MACHINE CABINET; Emil A. Kopf, Newark, N. J. App. filed Sept. 14, 1917. When folded appears as table.

1,349,692. MAGNETO FRAME; Pierre J. R. Postel-Vinay, Paris, France. App. filed Oct. 13, 1919. Improved lid over brushes.

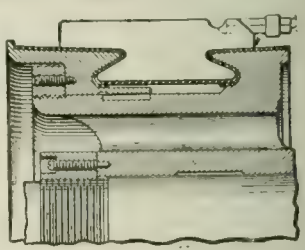
1,349,729. MODULATING AND TRANSMITTING SYSTEM; Edward L. Nelson, East Orange, N. J. App. filed March 8, 1918. Coupling oscillating audions or similar electric discharge devices in a new manner.

1,349,792. CONDENSER; Ralph W. Stearns, Schenectady, N. Y. App. filed Oct. 24, 1916. For absorbing high-frequency disturbances on distribution systems.

1,349,831. TESTING APPARATUS; Walter W. Gramer, Marinette, Wis. App. filed March 8, 1919. For testing spark plugs.

1,349,854. COMMUTATOR FOR DYNAMO-ELECTRIC MACHINES; Edward D. Priest, Schenectady, N. Y. App. filed Dec. 17, 1917. Reduces vibration of leads and provides means whereby machine will be operative even though one lead breaks.

1,349,866. ENGINE-STARTING APPARATUS; Lionel M. Wolffsohn, Union, N. J. App. filed March 8, 1917. Clutch device for automobile starter.



1,349,854. Commutator for Dynamo-Electric Machines

1,349,870. ELECTRICAL STARTING APPARATUS; Joseph Bijur, New York, N. Y. App. filed Nov. 21, 1914. Starter disengages when engine starts.

1,349,892. METHOD OF AND MEANS FOR OBTAINING CONSTANT DIRECT CURRENTS OR POTENTIALS; Irving Langmuir, Schenectady, N. Y. App. filed Dec. 22, 1915. Kenetron rectifier producing current of high degree of constancy.

1,349,901. ALARM DEVICE; Wilmer W. Miller, Ardmore, Pa. App. filed Aug. 4, 1916. Burglar alarm sent over telephone circuits.

1,349,907. APPARATUS FOR RECTIFYING ELECTRIC CURRENTS; Arthur F. Noshit, Wilkinsburg, Pa. App. filed Aug. 20, 1914. Employs spark gap in combination with condensers.

1,349,957. BATTERY-TERMINAL FASTENING; Alda F. Hawkins, Fort Worth, Tex. App. filed April 5, 1920. Clamped terminal for storage cells.

1,349,961. SIGNALING SYSTEM; Richard M. Hopkins, New York, N. Y. App. filed Oct. 20, 1916. Fire-alarm system which avoids continued operation of alarm due to trouble in transmitter.

Electrical World

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The Coal Situation

"TAG, you're it!" fits the coal situation admirably. "Coal shortage is imaginative and leads to hysteria," say the jobbers. While the producers blame the wagon mines and the railroads, the railroads in turn disclaim any blame for lack of coal production. Out of it all stands clearly the fact that many sections of the country are short of coal and this is proved by its high cost. Were markets amply provided no such prices as now obtain would be asked for fuel. True, the general situation is not as bad as it was, but it is far from comforting, and electric light and power companies will keep up their fight for supplies for present consumption and for storage. Promises cannot be burned under boilers or be converted into electricity, and the utilities are obligated to furnish service to their respective communities and mean to carry out their end of the bargain. Coal they must have for that purpose and they will not be content with anything else.

Self-Interest in Financing Utilities

THINKING of an inspiring kind found voice at a recent convention of California bankers when one of their number advanced as a reason for direct investment by banks in public utility securities and for recommending their purchase to patrons the self-interest that bankers have in thus promoting the development of the state. "What of it," exclaimed the speaker, "if you can buy some other security that will pay you a little higher return or yield you a little more profit? The difference in yield is nothing compared with the tremendous direct benefit you will get from the development of the state." The spread of this idea will place the stability of public utility investments on the same fundamental basis on which it is generally conceded that electric service everywhere rests.

Regulation in Michigan

THE latest evidence that the problems of the public utilities are gradually becoming understood in high places comes from Michigan. The public service commission law in that state has been operative only a little more than a year and yet Chairman Smith of the Michigan Public Utilities Commission has managed in that short time to comprehend the situation rather fully. From the facts in his possession he concludes, like Commissioner Edgerton of California, that over and above the ordinary rate of return necessary to keep a utility in an operative condition there must be some reward for efficiency, as well as a surplus to safeguard it against the day of adversity. What comfort such a public utterance must bring to the utilities of Michigan, and yet unless the justice of Chairman Smith's position is understood by all it will avail nothing. Hence the necessity of telling the people the truth about their public utilities so that they may judge aright of the need of close co-operation and harmonious action between the utilities and the commission so that both may merit public esteem. Service, after all, is what counts, and it wins more friends than all the honeyed words of the demagogue or the propagandist.

Popularizing Interconnection

WIDESPREAD publicity of the advantages of a "super-power" trunk line along the north Atlantic seaboard has created a lively interest in the subject among engineers everywhere, and especially among those who previously appreciated the benefits of interconnection even on a modest scale. It would be a mistake, however, to assume that the general public knows much about interconnection at this stage of its development. For this reason, there is an opportunity for intensive educational work during this fall and winter by public utility men. It is interesting to note that such a plan is proposed at Haverhill, Mass., where the local Chamber of Commerce expects to call upon technically qualified speakers to address that body upon the meaning and benefits of the super-power and lesser interconnection schemes. The co-operation of local central station men and of the industry generally with these organizations of alert and progressive business representatives offers a means of making clearer one of the great economic movements of the day and setting forth more effectively than could otherwise be done the aims and ideals of modern electric service.

Technical Education

IN A few weeks our technical schools will throw open their doors to thousands of returning students. Youth, ever impulsive and enthusiastic, seeks knowledge and under proper guidance can surmount many difficulties. But there are handicaps which no student should be called on to endure in a country like ours. By that is not meant shortage of equipment, valuable as apparatus is. The lack of competent instructors is far more serious than any dearth of equipment, and on that score many of our smaller institutions of learning have suffered grievously. Society in general and industry in particular is a loser whenever a technical graduate is not adequately and properly instructed. Therefore, the industry which seeks or uses graduates in engineering has an interest in their general proficiency and should see to it that funds are available for the best instructors obtainable. Indeed, much of the money spent by manufacturers in shop schools of instruction could be employed to better advantage in our institutions of learning, which are designed for that purpose and no other. Teaching is an art by itself, like manufacturing, only it lacks commercialism, and the community which rates its tradesmen above its instructors is hopelessly lacking in discernment.

Protecting Parallel Transmission Lines

TWENTY years ago a relay was almost invariably an electromagnetic device used in telegraphy for increasing the strength of signaling current in a local or secondary circuit. In recent years, however, the term has come into application in telephonic, radio, chemical, lighting and power circuits, so that it is of much broader meaning than formerly. Protective relays are now extensively employed in power stations and substations to isolate disturbances.

An interesting type of protective relay is described in this number by E. R. Stauffacher, who refers to an application where two three-phase transmission lines run in parallel from station to station. Current transformers in the phases of these lines operate differential relays in such a manner that if the system is normal the current divides in definite proportions between the two lines, but if a short circuit occurs on one line the balance will be destroyed. The relays then actuate in such a manner as to disconnect the faulty wire or wires at each end.

As power-transmission systems grow and interchange energy the task of the protection engineer becomes more complex and difficult. We may expect to see an increasing number of protective devices come into standardized service.

A Much Mooted Question

IN recent issues we have reverted to the much-mooted question of oil as a central-station fuel. As between oil and coal the situation is, in fact, one of balance, since the prices of both fluctuate in their upward drift. The price of coal at the shaft is rising moderately, that at the bunker immoderately. A recent analysis of the situation indicated that in one way or another the middlemen were getting a large and increasing proportion of the difference. Transportation, too, is a serious item and may be yet worse in the future. How far it is linked with the working of the sales mechanism remains to be seen. As to oil the situation is different. It comes via pipe lines or tankers from sources which are under somewhat unified management, and its price shifts according to no laws that can be predicted. When the price for B.t.u., is down it becomes a most useful fuel, owing to its collateral advantages, which are set forth this week in our article on the subject. The decrease of smoke, the reduction of boiler-room labor, the freedom from ash-removal tell heavily in any comparison on a practical basis, as also does the advantage of ease in pushing the fires in case of need.

As to the actual boiler efficiency attained, there is wide difference of opinion, since the results obtained with coal fired in modern stoker-equipped plants leave littla to be improved upon. Leaving thermal economy in abeyance, the oil has the best of it in some important particulars. Not the least of these is the easy storage of fuel oil in concrete or steel tanks in large quantity near the station. Such a fuel reserve is of high importance in these troublous times. The relative ease of operating oil-fired boilers is attractive, but whether the unions would permit the operation of ten boilers by one fireman may be open to grievous doubt. There are rather attractive features in a combination of coal and oil firing under favorable conditions, as a refuge in time of trouble, some of which have been published from time to time in the ELECTRICAL WORLD.

When it comes down to the final analysis of the situation, the vital factor is one that belongs to the totally unknown; that is, the future course of the relative prices of coal and oil. If rumors of foreign deals are true, there is no very cheerful outlook for modest prices for fuel oil, especially if a swing toward oil firing in many plants should occur. The only operator who is really safe is he who has a contract for oil long enough and at a price low enough to permit him cheerfully to scrap the whole oil-burning outfit at the end of the term. Otherwise he may or may not find the experience really profitable.

Modern Tendencies in Cable Construction

A VERY suggestive summary of modern tendencies in cable construction was recently noted in our Digest section. Much of the experimental work on the subject has been done abroad, where from the greater proportion of urban requirements the use of cables is relatively greater than here. As the author of the paper in question fully appreciates, when transmission distances lengthen and higher and higher pressures are reached, aërial lines are increasingly important, and their use abroad is very materially extending. It is curious to note the attempts at compromise by conductors carried in troughs on solid insulators and packed in compound. A few such were made here in the very early days of power distribution, but were soon given up, as seems to be the case abroad, in favor of cables. Electrostatic capacity and dielectric hysteresis are and will continue to be dominant in high-voltage transmission by alternating currents.

The general principles of cable design and construction have been well established for more than twenty years, and the most considerable change in practice has been the rapid increase in the use of impregnated paper insulation, especially for the higher voltages. Vulcanized bitumen, which seems to have come into considerable use in England, is much less well known elsewhere and is hardly in the running at anything but moderate pressures. Jute is little used save for an exterior serving, and rubber, excellent in some circumstances, is rerely used now at the higher pressures, even as the phrase would be used in English practice.

As regards the arrangement of conductors, there has been but little change for a long period, owing to the fact that the earlier workers knew their job well. Conductors of segmental section have some obvious advantages but have not yet obtained a strong grip on the art. The chief modifications in late years have been in the direction of incorporating in the structure one or more pilot cables for protective purposes or splitting the main conductors into pairs, commonly concentric, to serve a similar function. Such cables are of considerable service in distribution work and have been adopted in some American stations with excellent results.

The insulation applied to the conducting system has not changed radically in recent years, save as it has gradually been thickened to resist higher voltage. The most significant advance has been in the grading of the insulation to lessen the electrostatic gradient. We cannot agree that this is only of theoretical importance. Those who are dealing only with modest distribution pressures may not feel the need of it, but if the time

comes when cables are to be used for important transmission work, the electrostatic gradient will become a vital factor in the problem of economic design. Even now the same matter must be taken into account in the installation of the insulator strings of a high-voltage overhead line.

Professor John Perry, F.R.S.

IN THE death of Prof. John Perry on Aug. 4 the technical and scientific world has suffered a serious loss. Though he had reached the allotted threescore years and ten, he had not lost interest or activity in his scientific work, and the energies of his last years during the war were devoted to his country's service, particularly in the development of the gyrostatic compass.

Educated in Belfast, finally at Queen's College, he early showed distinguished ability and presently was appointed assistant to Sir William Thomson. At five-and-twenty he was one of the little group of scientific men called to Japan to build up technical education there. It was a fortunate chance that thus brought him into contact with his long-time friend and colleague Professor Ayrton, with whom his name is instinctively associated by every electrical engineer. Together they plunged into a series of distinguished investigations on electrical subjects, which were communicated mostly to the Royal Society and brought the authors well-deserved fame. Sir William Thomson's comment was that the pole of scientific research had shifted to Japan.

Returning with Prof. Ayrton in 1879, the active career of the friends in the development of electrical engineering was continued, and together they laid the foundations of the Finsbury Technical College, one of the most notable engineering colleges in Great Britain. He stayed at Finsbury until 1896 and then became professor of mathematics and mechanics in the Royal College of Science at South Kensington, in which his later and important educational work was developed. Prof. Perry's mathematics were those of the engineer rather than the mathematical investigator. He was possessed of extraordinary intuition, the true spirit of the engineer, and he brought to his teaching a rare enthusiasm for dealing with concrete matters in an intensely practical way. He brought a new light to the mathematics of technology and his book on the subject was a masterly one which made a strong impression on technical education in many countries. It was in his ability as a teacher of sound principles that his greatest contributions to engineering rest, and more and more in his later years his energies were devoted to a work of instruction which has meant much to the development of British applied science.

Personally he was a man of most lovable and interesting character. Those who had the pleasure of his acquaintance well remember the alertness of his mind, the breadth of its sweep, his keen sense of humor, and unvarying friendliness to the young engineer who came in touch with him. He was most active in the meetings of the British Association for the Advancement of Science, of which for a good many years past he had been the general treasurer. In close touch with all scientific advances up to the very end of his life, his career was a most distinguished one, and his example of unswerving fidelity in search of the truth should be a lasting stimulus to the engineering profession.

Data on War-Time Central-Station Activities

A COMPREHENSIVE review of the status of the central-station industry during one of the most intensive periods of the war has just been published by the United States Census Bureau as a part of that Bureau's 1917 Census of Electrical Industries. The next regular five-year survey which is scheduled to be taken in 1922 will form, in conjunction with the census just published, an authoritative picture of central-station activities during periods of war rush, and peace-time production. The present report, a review of some of the most interesting portions of which will be found in the following pages, covers central-station operations from several angles not heretofore included in any survey of the Census Bureau. Among these is the distribution of the output for lighting, power, other public-service corporations, plant consumption and line losses; output generated and purchased; income from light and power customers; and data on fuel consumption.

One of the most striking phases of the analysis of the tabulations is the excess of municipal over commercial stations in some eight states, and the fact that the average rate secured by municipal plants was much higher than that charged by the private utilities. The increase of 756 municipal plants as against 565 new commercial electric stations is not so remarkable when the fact is considered that these are mostly small plants serving but one locality, while one commercial plant may serve a territory embracing many separate municipalities. It is to be regretted that the Census Bureau did not include a survey of isolated or private plant electrical operations and motor installations.

Measuring Reflection of Walls in Situ

IN THE predetermination of the number, power and distribution of light sources for the proper illumination of offices and other building interiors much depends upon the reflection factors of the walls and hangings. Whereas a single lamp may give a good general illumination in a room supplied with red walls of good reflecting properties, a dozen such lamps may have to be installed in order to obtain the same illumination in the same room when the walls are dark and have poor reflecting properties. It is ordinarily necessary for samples of the wall covering to be taken to the photometric laboratory in order to determine the reflection factor of the material. In this issue, however, Dr. A. H. Taylor describes a form of portable reflectometer which can be taken into the room to be investigated.

The instrument as described is a modification of the integrating sphere. By an ingenious removal of a small spherical sector from the sphere, thereby leaving a round hole in its wall, the wall of the room is optically substituted for the wall of the sphere at this point.

One of the interesting by-products of the article is the evidence adduced to show that the reflection factor of a certain slab of magnesium carbonate is as much as 99 per cent. This is a surprisingly high value, but it is given as obtained in three ways. This reflection efficiency beats the electrical efficiency of large transformers, which we believe is a little under 99 per cent. We had supposed that transformers were unsurpassed in this respect.



John B. Fisken

Dean of engineers in the Northwest and a leader in A. I. E. E. and N. E. L. A. activities in that section, who as president of the Northwest Electric Light and Power Association will preside at its annual convention next week

LAST month John B. Fisken completed thirty-three years of service in engineering-construction, maintenance and operation of the central station properties that now make up the system of the Washington Water Power Company at Spokane. During this time he has been a leader in all phases of engineering and is regarded in the great Northwest as the dean of engineers. In the activities of the American Institute of Electrical Engineers he has always taken a prominent part. Particularly has his influence been felt in building up the Pacific Coast section, of which he was chairman last year. He was also largely responsible for the organization of the Spokane section, of which he was chairman in 1913 and 1914. In 1916 he was elected manager of the Institute, in 1919 vice-president and recently was appointed chairman of its sections committee for 1920-1921. Likewise, in the Northwest Electric Light and Power Association Mr. Fisken has been an earnest worker as a member of its hydro-electric and technical committee. This year he has served as its president and next week will preside at the annual meeting in Spokane.

Mr. Fisken was born at Helensburgh, near Glasgow, Scotland, Nov. 2, 1861, and received his technical education in Glasgow and London. He came to this country in October, 1886, and took up electrical work in Seattle, Wash. In January of 1887 he went to Victoria, B. C., with the Victoria Electric Illuminating Company, then to Vancouver, and in August, 1887, to Spokane, Wash., where he has since remained. He was first associated there with the Spokane Falls Electric Light & Power Company, then with its successor, the Edison Electric Illuminating Company of Spokane, and the Spokane Street Railway Company, and finally with the Washington Water Power Company, which absorbed the latter companies. A system is now operated which includes four hydro-electric plants, with a combined rating of 78,050 kw., that serve 684 miles of high-tension transmission lines and 700 miles of low-voltage circuits. For that company Mr. Fisken is now consulting engineer. His responsibilities have included those of superintendent of light and power until 1918, then chief engineer, succeeding Carl F. Uhden, until his recent appointment.

Current-Balance Relay Protection

Necessity for the Development of a New System of Relay Protection Where Duplicate Parallel Lines Are Operated Is Met by Current-Balance Relay — Has Proven Effective in Case of Line Trouble

By E. R. STAUFFACHER
Protection Engineer Southern California Edison Company

THE Southern California Edison Company has recently placed in operation a system of relay protection which has structural operating features not found in common practice in the protection of parallel lines. In brief this system consists of a balance between the currents in similar phases of the two parallel lines—the lines being in parallel at more than one point—and as the currents in the lines under normal conditions are equal, while under abnormal conditions they are widely different, there is a basis upon which the relays will operate satisfactorily.

To understand the need for this kind of apparatus reference must be made to the system wiring diagram (Fig. 1). From Kern River No. 1 plant to and through Castaic, Fernando, Macneil, Los Angeles No. 3, Newmark, Puente, Chino and to Colton substations extends a double 60,000-volt transmission line. This line is 175 miles (280 km.) long and is of No. 4/0 copper. The Kern River plant is of 20,000-kw. capacity and feeds into the line noted. In addition the following plants connect with this line: Borel, at Castaic, with 10,000 kw.; a connection to the 47,000-kw. Long Beach steam plant at Macneil; a connection at Newmark through Eagle Rock substation to the 64,000-kw. Big Creek plants; a connection at Newmark to Long Beach steam plant by means of two 60,000-volt No. 4/0 copper lines only about 20 miles (32 km.) long, and connection at Colton to several small plants totaling 15,000 kw., and also to the system of the Southern Sierras Power Company, through a 5,000-kw. frequency changer. This line is practically the backbone of the system, and when a complete severance of both lines of this transmission bus takes place the system is badly split and a long interruption is likely to occur before the load can be so adjusted as to permit synchronizing.

Before the installation of balance relays, the practice had been to operate the two 60-kv. lines in parallel at Los Angeles No. 3, Newmark and Colton. At other points the lines were not paralleled and connection was made to one line only. At Kern River two of the 5,000-kw. generators would be connected to one line and two to the other side. At Castaic the outgoing power would be on one line and the incoming power from Borel on the other.

The stations at Macneil and at San Fernando were connected at either one or the other of the lines. Under these conditions each of the substations was operating from only one source of energy. If a short occurred on the line at any point betwen Kern River No. 1 and Los Angeles No. 3, which is a distance of approximately

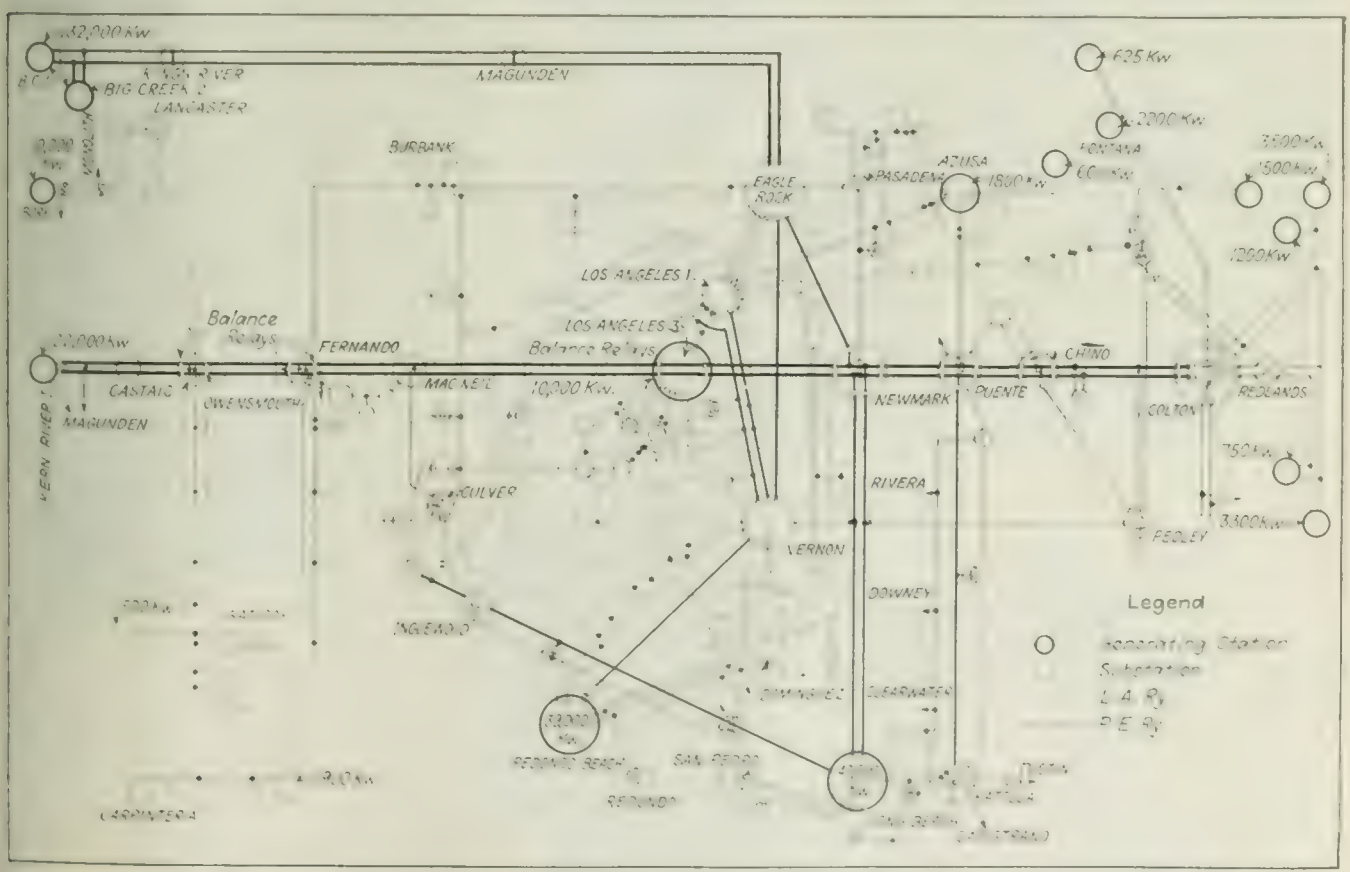


FIG. 1—SYSTEM DIAGRAM OF SOUTHERN CALIFORNIA EDISON COMPANY, SHOWING BACKBONE PARALLEL LINES

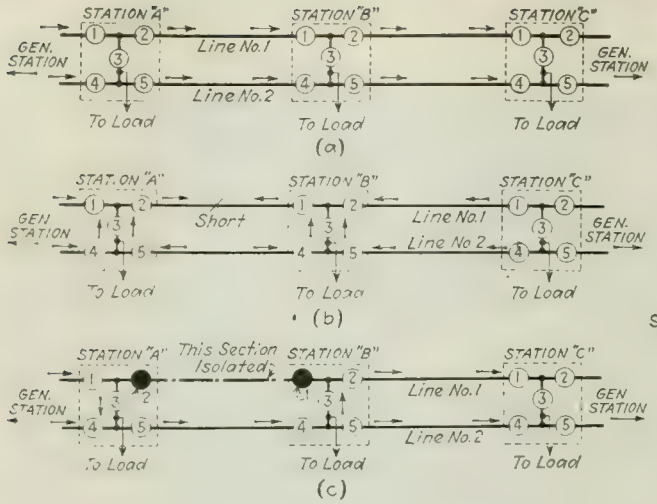


FIG. 2—BALANCE RELAY OPERATION

(a) Lines normal, (b) lines at time of trouble, (c) lines immediately after trouble is cleared. It is seen that only a section of one line is out of service.

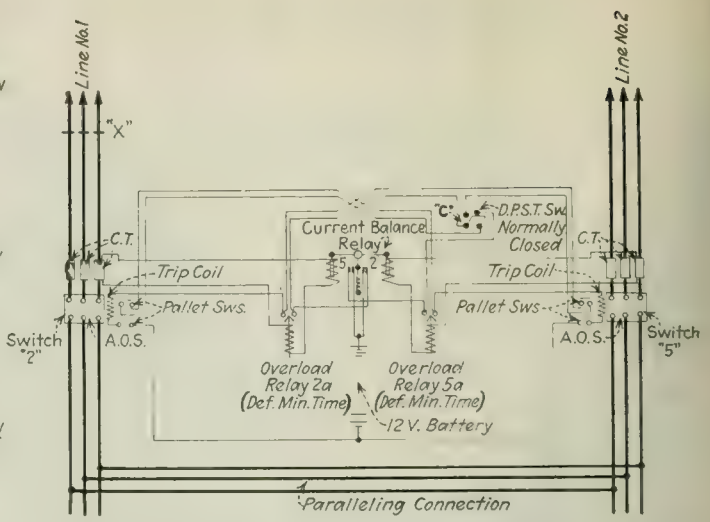


FIG. 3—SCHEME OF PARALLEL LINES PROTECTION IN ONE PHASE

It is only necessary to open switch *C* when one of the line switches has opened, and the operator is preparing to close this switch again to test the line.

117 miles (188 km.), these substations suffered an interruption.

When the balance relay scheme was put into operation it necessitated the operation of the Kern River transmission line in parallel with each of the stations mentioned. The equipment of the balance relays has been designed and installed so that only the defective section of the line will drop out upon the occurrence of short circuits. This gives the station a source of power from each of the four line sections entering the station. The relay operates upon the theory that in a grounded star system there will be more current in a phase which is grounded than in the same phase of the other line which is ungrounded. Provision has also been made so that in the event of one line in a section dropping out owing to a ground or short circuit, or if it is out for repairs, the remaining section is automatically put on definite-minimum, inverse-time limit relays and thus is protected in case of a short circuit in other parts of the system.

By reference to Fig. 2 the method of operation of the relays is illustrated. When the transmission line is in a normal condition, the circuits are closed by switches 1 and 2, and 4 and 5 and paralleled by switch 3 in each case. If a short occurs on line 1 between stations *A* and *B*, more current will flow through switch 2 in station *A* than in switch 5 in the same station.

A similar condition exists in station *B*, where more current flows through switch 1 than through switch 4. This condition of unbalance is utilized to operate the relays which will trip out switch 2 in station *A* and switch 1 in station *B*, thereby isolating the defective section of the line and preventing an interruption, as the total current can flow on the remaining line between stations *A* and *B*.

The balance relays consist of two similar solenoids mounted with their plungers suspended from the ends of a lever, similar to a walking-beam, as shown in Fig. 5. They were designed by the engineering department and built in the shop of the Southern California Edison Company. The solenoids are energized from bushing-type current transformers in the line oil switches. Referring again to Fig. 2, the current in phase *A* of line 1 is balanced against the current in phase *A* of line 2. This relationship is carried out with all three phases. When more current flows in phase *A* of line 1 than in phase *A* of line 2 the solenoid of line 1 will exert a stronger pull on its plunger than will the other solenoid on its plunger and so cause a deflection of the balanced arm, closing the relay contacts, which, in turn, will trip out the proper line switch. Fig. 3 gives the detailed wiring in one phase. The tripping current is furnished by a 12-volt Edison storage battery.

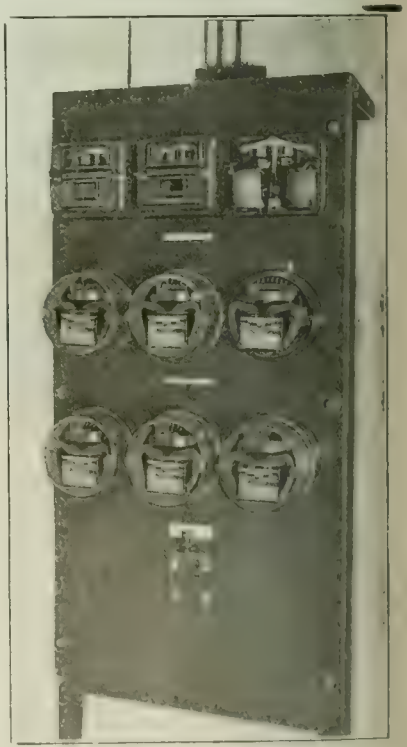


FIG. 5—TYPICAL RELAY PANEL

Current-balance relays above, inverse-time-limit relays below

These current balance relays have been in operation for about three months on a section of the Kern River line, the installation being made at Castaic, San Fernando and Los Angeles No. 3 substations. During these

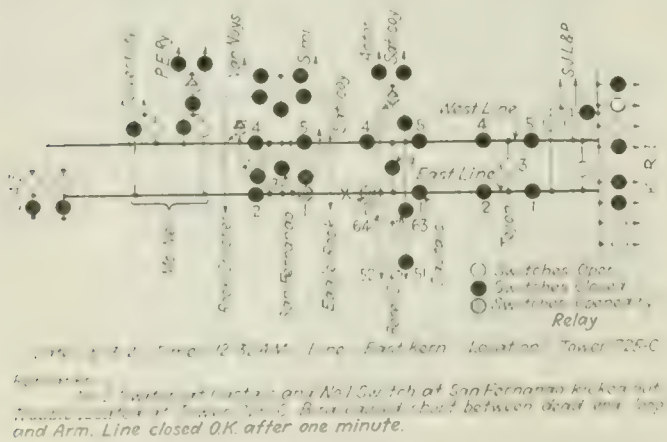


FIG. 4—TROUBLE RECORD, SHOWING ACTION OF SWITCHES

few months of operation they have successfully cleared several shorts without interruption to the energy supplied by the transmission line.

These relays were installed to protect the transmission line against grounds or shorts on the line, but were not designed to protect against any trouble which might develop inside of the substation. There have been a few cases of faulty operation of the relay, with the result of the severance of the transmission line because of the fact that the relays did not protect against trouble in the station. In one case, for example, there appeared to be simultaneous shorts on the transmission line and between two bushing terminals of one of the 60-kv. oil circuit breakers in the Castaic substation. With a view of studying the operation of the relays, the drawing shown in Fig. 4 was made and is now used to record the actions of the various switches when a short circuit develops.

This balance relay scheme of protection of parallel transmission lines seems to offer great promise, and when a line is equipped throughout with relays it should do a great deal toward the lessening of the expense of maintenance and of patrolling important transmission lines.

A New Portable Reflectometer

The Device May Be Used To Measure the Diffuse Reflection Factor of Walls in Place by Means of a Portable Photometer and an Integrating Photometric Sphere — Test Data Confirm Accuracy of the Method

By A. H. TAYLOR
Associate Physicist, Bureau of Standards

IN THE lighting of offices, factories, etc., the reflection of light from the walls and ceilings plays a very important part. If the illuminating engineer wants to make an intelligent forecast of the illumination which will be obtained with any lighting system which he may recommend, it is very desirable for him to know the reflection factor of the walls and ceiling. Some engineers can make good estimates of these factors merely by an inspection, but very few have had a sufficient amount of experience to enable them to do this successfully. Hence it is apparent that an instrument which would remove the element of guesswork from such factors would fill a very real need.

Previously there has not been available an instrument which would accurately measure the reflection factors of surfaces without removing them to the laboratory, but such an instrument has now been designed. It is based on the use of the integrating photometric sphere which has proved so useful in the laboratory for integrating light flux.

The theory of the reflectometer described herein was worked out by the author in 1916, and shortly thereafter the experimental instrument used in these tests was built, but pressure of other work has prevented a thorough test of it until within the last few months. The instrument consists of a small sphere, about 5 in. in diameter, arranged as shown in Fig. 1. It may be used with only diffused light on the test surface, or with a mixture of diffused and direct light. These two conditions are shown respectively in Figs. 1a and 1b. The photometer, which may be a portable photometer such as the Macbeth or small model Sharp-Millar, is attached to the small spherical reflectometer, and the observer views the opposite wall of the hollow sphere through the hole *C*. The portion of the sphere *c'* is cut off by a plane, leaving the opening *c''*. The surface to be tested is placed over this opening, and the light from a small low-voltage lamp is directed into the sphere wall or onto the test surface, depending on whether the lamp is at *A* or *B*. The attachments are so constructed that their positions are interchangeable. In the experimental instrument the area of the portion cut off was 10 per cent of the total sphere area.



MEASURING REFLECTION FACTOR OF A WALL IN SITU

THEORY OF REFLECTOMETER

The interior illumination of a hollow sphere with diffusely reflecting walls may be considered as composed of two parts—(a) the light received directly from the light source, and (b) the illumination made up of light diffusely reflected from the sphere walls. The part (b) is the same in value at all points in an empty sphere, in accordance with the

theory of the integrating sphere. Assume the hollow sphere arranged as shown in Fig. 1a. Let the area of the complete sphere be unity. When the arrangement of the sphere is that shown in Fig. 1a, the diffuse reflection factor of the test surface, Mx, may be determined from the equation

$$M_x = a(K_x - 1)[c''m + a(1 - m)] \div [ac'(1 - m) + mc''(c' + K_x a)],$$

Where c' = ratio of sphere area cut off to total sphere area,

c'' = ratio of hole to total sphere area,

$a = 1 - c'$ = fraction of total sphere area which remains,

b_o = average brightness of sphere wall, due to reflected light only, when hole is uncovered.

b_x = average brightness when hole is covered with a flat test surface having a reflection factor m_x.

b = brightness when test surface has same reflection factor as sphere surface, m.

$K = \frac{b}{b_o}$ and $K_x = \frac{b_x}{b_o}$

m_x = diffuse reflection factor of sphere surface, and

$$K \quad (a + c'm_x)[mc'' + a(1 - m)] \div [mc''(1 - m_x' + a(1 - mQ].$$

The reflection factor of the sphere surface is determined from

$$m^2[c' - a + Kac''] + ma[c' + (c'' - a)(1 - K)] + a^2(1 - K) = O, \qquad (2)$$

The above equations have been derived for the case where the direct light from the lamp is incident on the sphere wall. While it is possible to use the reflectometer with that arrangement, it is much more sensitive to changes of reflection factor of the test surface, and therefore more accurate, if it is arranged so that the direct light is incident on the test surface. The most convenient method is to use the former arrangement and determine the value of m from equation (2); then arrange the instrument so that the light is incident directly on the test surface, as shown in Fig. 1b. By using for a reference standard a surface painted with the sphere paint or something less perishable, it is then possible to evaluate in absolute measure the reflection factor of any test surface. The value, m'', for any test surface may be determined as follows:

Let c', c'', a, m and m_x have the same meaning as before.

Let b' = brightness of sphere surface when the hole is covered with a test surface of factor m_x.

m' = reflection factor of the reference standard

R = (value of b^0 when hole is covered with surface m'') ÷ (value of b' when hole is covered with surface m').

$$m''[a(1 - m) + c''m(1 - m)] : m'[a(1 - m) + c''m(1 - m'')]$$

Solving for m'', $m'' = Rm'[a + m(c'' - a)] \div [a(1 - m) + c''m(1 - m' + Rm')]$ (3)

In the special case where $m' = m$, we have $m'' = m - Rm[a(1 - m) + mc''] : [(1 - m)(a + c''m) + Rm^2c'']$.

In order to verify the theory of this instrument a graded series of test objects was made up. Neutral gray objects were obtained by mixing black drawing ink and lampblack with a white cement ("Keene's fine"). They were surfaced with coarse sandpaper, resulting in fairly good diffusers.

The test objects were first tested for reflection factors by the point-by-point method. The objects were illuminated normally by a 60-watt vacuum tungsten lamp, and the surface brightness was measured at intervals of 10°. The amount of flux reflected was then calculated by applying the proper factors, and since the incident flux was known, the ratio of the reflected to the incident flux gave the reflection factors of the test surfaces.

A number of the cement standards and a block of magnesium carbonate were measured by both methods

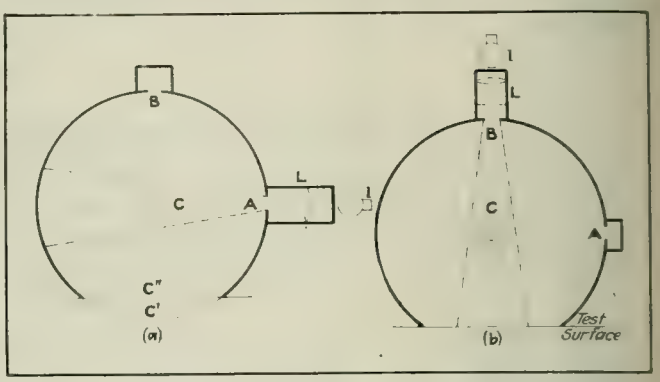


FIG. 1—TWO ARRANGEMENTS OF SPHERE REFLECTOMETER

L—Lighting tube with concentrated filament lamp *l*. B and C—Observation windows. Portable photometer may be used to observe brightness of windows. The functions of openings A, B and C are interchangeable.

of using the reflectometer and by the point-by-point method just described. By the use of equation (2), using a flat test surface painted with the same paint as that used in the reflectometer, the reflection factor of the sphere surface was found to be 88.3 per cent. This value was then substituted in the equations and the reflection factors of the various test objects were computed. The results of the measurements in the three different ways are shown in the table.

It will be noted that the agreement between columns 1 and 2 is almost perfect, and that for factors above

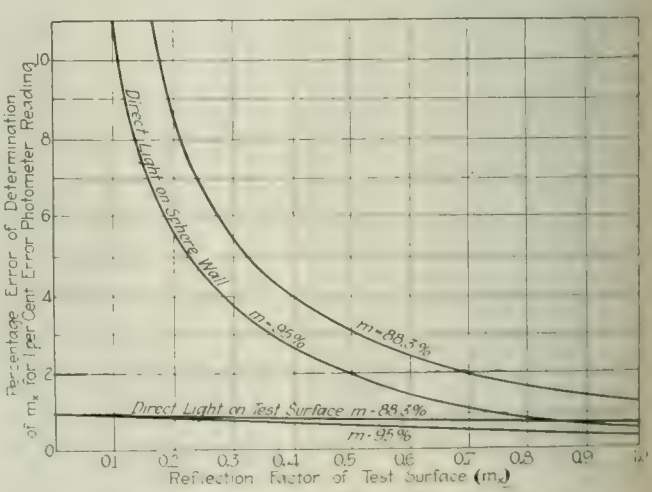


FIG. 2—CURVE SHOWING SENSITIVENESS OF METHOD FIG. 1A

80 per cent column 3 is also satisfactory. The differences between this and the other columns may be in part real, as the reflection factor for light incident diffusely may be higher than for light which is mostly incident normally. It is probable that the differences are partly experimental, as the method represented by column 3 is not very sensitive. This is clearly shown by the curves in Fig. 2. The very high value for mag-

REFLECTION FACTORS (IN PER CENT) BY THREE METHODS OF MEASUREMENT

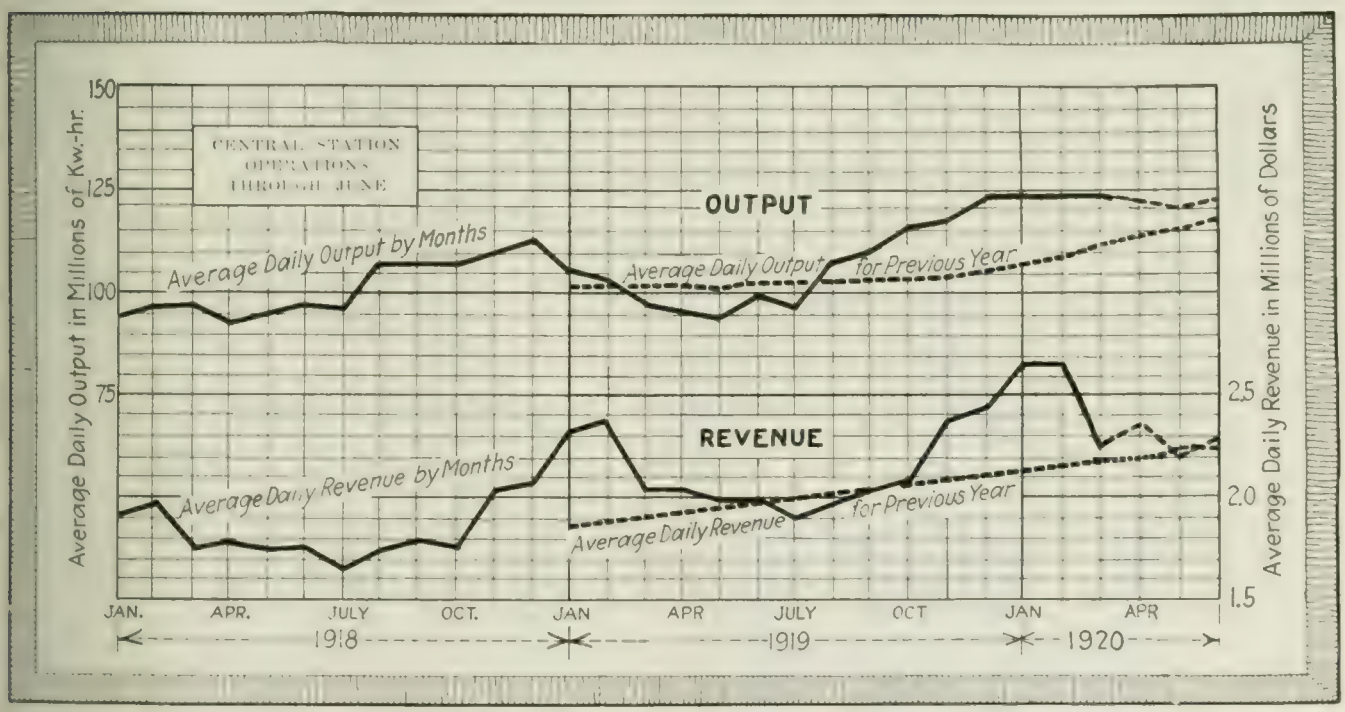
Test Object	Point-by-Point (1) Method	Sphere Reflectometer (2) Direct Light on Test Objects	Sphere Reflectometer (3) Direct Light on Sphere Wall
Cement Standard No. 1	17 7	18 4	21 9
No. 2	23 7	23 9	28 2
No. 3	31 5	31 6	35 2
No. 4	36 3	37 1	39 6
No. 5	42 9	42 9	46 4
No. 6	60 0	60 7	62 8
No. 7	67 4	67 3	70 2
No. 8	81 9	81 4	82 7
No. 9	86 5	85 5	86 8
No. 10	90 8	90 4	89 6
Magnesium carbonate	99 3	99 1	98 7

nesium carbonate has been verified by still another absolute method, so that there seems to be little room for doubt that the value of 99 per cent for this particular block is substantially correct. The value previously assigned to magnesium carbonate by another investigator, 88 per cent, is seen to be very much too low.

If the reflectometer is adapted for use with a portable photometer as herein suggested, it can be used to measure the reflection factor of any flat surface *in situ*, as the instrument can be placed against the surface to be tested. If the arrangement shown in Fig. 1a is used, all readings are referred to readings taken with the hole open and light escaping, but this arrangement is not recommended for accurate work. If the arrangement shown in Fig. 1b is used, it would be best to refer all readings to those obtained when a reference standard surface such as depolished milk glass is used. Such a surface is preferable to one painted with the sphere paint when routine tests are being carried out, as it is very easily restored to a cleanly condition by through washing.

In the use of this reflectometer certain precautions should be observed in order that the results may be reliable. More complete information regarding the use of the instrument and the complete derivation of equations may be obtained from Scientific Paper No. 391 of the Bureau of Standards, which will be issued in the near future.

Slightly Improved Industrial Conditions Increase Output



THAT slightly improved transportation and labor conditions resulted in an increased demand for electrical energy for the month of June as compared with May is indicated by returns received by the ELECTRICAL WORLD. The average daily output for June was only 2,150,000 kw.-hr. less than during December, 1919, which is the record month for central-station operation. The average daily output for the first half of the year was 123,600,000 kw.-hr., and at no time during that period did the output fall below 120,000,000 kw.-hr. A range of only 5,000,000 kw.-hr. in average daily energy demand between winter and summer is a clear indication of the leveling effect on central-station operation of the rapidly increasing power load.

The modification of the transportation congestion in most of the industrial centers, especially during the first part of June, is reflected in increased demand for central-station power. Every section of the country showed increased energy consumption over May. Several strikes involving about 28 per cent of the textile workers of the New England States took place during the first

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE MONTHS

	Percentage of Installed Capacities Represented	Revenue from the Sale of Energy			Percentage of Installed Capacities Represented	Kw.-Hr. Output		
		1919 Thousands	1918 Thousands	Per Cent Increase		1919 Thousands	1918 Thousands	Per Cent Increase
July	44	$25,794	$22,568	14.1	44	1,309,301	1,281,874	2.0
Aug.	54	32,756	29,006	13.0	54	1,801,836	1,793,706	0.5
Sept.	53	32,344	28,336	14.0	53	1,761,582	1,695,862	4.3
Oct.	55	35,492	30,077	18.0	60	2,175,636	1,987,004	9.0
Nov.	53	37,439	31,927	17.2	58	2,055,428	1,895,693	8.2
Dec.	59	44,125	37,978	16.0	65	2,509,571	2,270,833	10.0
		1920	1919			1920	1919	
Jan.	57	46,614	39,002	19.8	67	2,581,096	2,186,732	18.0
Feb.	63	45,881	37,502	22.1	69	2,494,764	1,986,493	25.3
Mar.	65	46,155	36,840	25.0	70	2,698,890	2,103,587	28.0
Apr*	65	45,547	36,541	24.5	70	2,603,692	2,098,559	24.1
May†	65	44,025	35,632	23.5	70	2,616,795	2,174,523	20.3
June‡	66	44,250	35,547	25.2	71	2,609,105	2,169,598	20.2

*Includes estimates for thirty-three companies, representing 6.9 per cent of the total installed capacity of all central statons.
† Includes estimates for thirty-two companies, representing 4.3 per cent of the total installed capacity of all central stations.
‡ Includes estimates for eighty-two companies, representing 18.8 per cent of the total installed capacity of all central stations.

part of June, but in some centers of this section shipping facilities improved considerably, resulting in general increased industrial activity and a consumption of power in excess of the May demand.

The steel industry continued to operate on a schedule that was much below capacity. During the first part of June transportation conditions improved considerably and increased operations were the general rule in practically all lines of industry in the Atlantic States, but the new outlaw strike of railroad workers in the latter part of the month caused more congestion in the large industrial centers of this section than was experienced in the tie-ups of early spring. The temporary increased activity during the first part of the month, however, was sufficient to increase the average daily energy demand of May by 1,180,000 kw.-hr.

Transportation continued to interfere seriously with industrial operations in the North Central States. Some automobile manufacturers estimate a production of not more than 35 per cent of that planned for this year, owing to lack of raw materials and inability to ship finished products, as well as insufficient fuel supply. Large strikes were also under way in the southern portion of this section, but despite these adverse conditions the average daily output of the central station exceeded that of May by 580,000 kw.-hr.

The public utilities in the South Central States suffered for lack of sufficient fuel, and in some instances temporary shutdowns were necessary.

The shipyard strike on the Pacific Coast was practically broken by the action of the United States Shipping Board against increasing wages. The strikes in the mining region were also settled, and mining on an extensive scale was resumed during June. This general resumption of industrial activity in the Mountain and Pacific States during June is reflected in an average daily increase of 1,020,000 kw.-hr. in central-station operations over those of May. During the first half of the year the average daily output of the central stations of this section has increased from 23,160,000 kw.-hr., recorded in January, to 24,570,000 kw.-hr. in June.

AGITATORS *who are trying to create trouble between employees and their employers as a rule are insincere and selfish. Generally they themselves have performed no hard labor nor had experience which qualifies them to lead or instruct. They strive for personal popularity and gain. Their business is better, their compensation increased, when others are in trouble. Assuming to be sympathetic and superior in intelligence, they mislead and often misrepresent. They promise reforms, but their methods lead to trouble and loss to others. In this list are included a few writers, lecturers, public speakers and self-appointed labor leaders, so called.*—E. H. GARY.

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

	Month	New England States				Atlantic States				North Central States				South Central States				Pacific and Mountain States			
		Percentage of Installed Capacities Represented	1919 Thousands	1918 Thousands	Per Cent Increase	Percentage of Installed Capacities Represented	1919 Thousands	1918 Thousands	Per Cent Increase	Percentage of Installed Capacities Represented	1919 Thousands	1918 Thousands	Per Cent Increase	Percentage of Installed Capacities Represented	1919 Thousands	1918 Thousands	Per Cent Increase	Percentage of Installed Capacities Represented	1919 Thousands	1918 Thousands	Per Cent Increase
REVENUE	July	70	$3,406	$2,995	13.7	40	$9,320	$8,375	12.0	39	$7,240	$6,121	18.1	38	$1,614	$1,321	21.9	49	$4,214	$3,756	12.1
	Aug.	74	4,225	3,693	14.4	57	12,174	10,995	11.1	47	9,295	7,924	15.8	39	1,647	1,385	18.4	61	5,415	5,009	8.5
	Sept.	73	4,019	3,536	13.6	53	11,429	10,069	13.5	46	9,671	8,278	16.6	38	1,724	1,488	16.0	63	5,501	4,965	10.9
	Oct.	72	4,127	3,453	19.1	53	12,684	10,822	16.9	52	11,401	9,484	20.2	38	1,840	1,519	21.1	62	5,440	4,799	13.9
	Nov.	71	4,432	3,800	16.2	56	14,738	12,761	15.7	44	10,541	8,689	21.2	39	2,063	1,694	21.8	63	5,665	4,983	13.9
	Dec.	73	4,908	4,254	15.1	57	15,926	13,806	15.8	49	11,660	9,833	18.3	44	2,496	2,070	20.0	77	9,135	8,015	14.2
			1920	1919			1920	1919			1920	1919			1920	1919			1920	1919	
	Jan.	78	5,635	4,718	19.8	59	17,659	14,625	20.9	51	12,885	10,799	19.6	53	3,047	2,538	19.9	75	7,388	6,322	16.1
	Feb.	82	5,354	4,368	22.1	61	17,245	14,343	20.4	55	13,191	10,403	26.0	53	2,949	2,360	24.7	79	7,142	6,028	18.3
	Mar.	82	5,136	4,044	27.0	63	17,696	14,299	23.7	57	13,270	10,469	26.5	54	2,910	2,287	27.8	79	7,143	5,741	24.2
	April	82	5,087	3,943	29.0	64	17,700	14,383	23.5	57	12,690	10,042	26.9	54	2,952	2,181	35.2	79	7,118	5,992	19.2
	May	82	4,895	3,750	30.1	64	16,761	13,749	21.9	57	12,478	9,860	26.8	54	2,829	2,140	32.0	79	7,062	6,133	15.1
	June	82	4,904	3,774	30.0	65	16,451	13,521	22.0	57	12,415	9,746	27.4	54	2,801	2,132	31.5	79	7,679	6,374	20.1
KW.-HR. OUTPUT			1919	1918			1919	1918			1919	1918			1919	1918			1919	1918	
	July	70	141,551	130,393	8.2	40	373,105	378,053	-1.5	39	371,425	355,664	4.5	38	56,945	52,501	8.1	49	366,275	365,263	0.1
	Aug.	74	161,431	153,266	5.1	57	640,616	662,120	-3.2	47	496,745	460,360	8.0	39	58,991	53,231	10.2	61	444,026	464,729	-4.2
	Sept.	73	153,837	146,209	4.5	53	610,254	610,179	0.1	46	515,519	463,929	11.5	38	58,316	54,838	6.3	63	423,656	420,707	0.5
	Oct.	72	162,859	142,326	14.4	53	694,584	659,859	5.3	67	815,284	709,665	15.3	38	67,155	56,742	18.5	62	435,754	418,412	4.1
	Nov.	71	153,171	140,240	9.2	56	724,667	707,347	2.4	60	686,486	597,855	14.9	39	68,352	59,507	14.7	63	422,812	390,744	8.2
	Dec.	73	180,493	152,304	18.0	58	803,165	733,222	8.9	67	825,313	713,959	15.8	44	88,658	73,728	20.1	77	611,942	597,620	2.5
			1920	1919			1920	1919			1920	1919			1920	1919			1920	1919	
	Jan.	78	207,158	159,773	29.8	60	853,057	717,303	19.2	69	841,841	731,758	15.2	56	140,736	117,677	19.9	75	538,304	460,221	16.2
	Feb.	82	187,264	148,103	26.2	62	809,865	672,836	20.1	73	858,939	663,523	29.4	56	130,473	98,098	33.0	79	508,223	403,933	26.1
	Mar.	82	188,760	146,813	28.7	64	897,327	711,828	26.1	74	913,659	711,751	28.1	56	137,350	102,545	33.6	79	551,995	428,041	28.6
	April	82	187,174	144,922	29.1	65	883,264	701,778	25.9	74	857,467	687,751	24.7	56	135,140	99,877	35.2	79	540,647	464,231	16.7
	May	82	188,517	148,065	27.3	65	852,500	709,256	20.2	74	861,300	699,900	23.1	56	137,779	98,815	39.2	79	576,899	510,502	12.7
	June	82	187,114	149,421	25.3	66	859,654	721,762	19.1	74	847,654	682,400	24.6	56	133,380	99,447	33.9	79	581,312	516,568	12.7

Financing Electric Public Utilities—I

Tremendous General Demand for Capital Reflected by Rise in Bond Yields—This Reacts Against Regulated Business Because Public Utilities Cannot Quickly Change Prices to Follow Upward Tendency

By Dr. W. F. GEPHART*
Vice-president of the First National Bank in St. Louis

ONE of the most interesting facts in economic history is that prices pass through periods extending over several years in which the level is upward or downward. While ordinarily observations disclose great irregularity in the price of a particular commodity over short periods of time, yet careful investigation shows that prices in general are subject to this upward and downward trend. There is no agreement as to any one cause producing these cycles of prices. The significant fact is that ever since there has been money certain forces operate to produce this change in the price levels. We are now in the midst of one of these remarkable cycles.

Beginning with 1897, the price level has been upward, and the forces producing this effect have been accelerated by the world war. Commodity prices in 1860, taken as 100, had increased to 130 by 1915, and by the close of the war they had reached 230. This was the case in the United States, and a similar result is shown in all other nations. These price changes are disclosed by the various index numbers, which are the only scientific method of measuring changes in prices. These index numbers show what is happening to prices in general.

Particular prices may increase or decrease over short periods of time. Some prices may not advance so rapidly as other prices, for the forces determining a single price may in some respects be peculiar to it. For example, when monopoly exists—that is, when there is control over the supply—a larger degree of control over the price is possible. Likewise, when there is governmental control the change in price is likely not to follow so closely the general upward tendency. This is especially true if the Government regulation is of an essential and one for which the public is accustomed to paying a certain price.

Rates Must Advance with Price

Custom is an enormously strong force in controlling prices, and governmental regulation only adds another force to restrain any change in price. This combined condition of customary price and governmental regulation is found in the case of public utilities. People become accustomed to paying a certain price for their gas, their light or their telephone and are not ready to admit, in a period of rising prices, that the rate—which is but one kind of price—should advance along with other prices.

Cost elements which go to make up all prices change quite as much in the case of a public utility as in the case of a cotton mill. The manufacturers of public service must increase wages like any other manufacturer. Parts of their machine or plant must be continually replaced and the new parts must be purchased on the higher price level. The public expects additional facilities and extensions to be ready whenever it wishes them, and these too must be bought at the increased price level.

In short, a public utility is no more free than any other producer of a commodity or service to resist the force of increased prices. Indeed, such companies are not so free as is a private manufacturer. Government regulation is established to see that the public gets good service at a fair price. The private producer can reduce his labor force or even temporarily close his factory as a measure of economy, but not so with the public utility. All the time the public must be served and its good will secured, and at a price fixed not by the producer but by the state.

A public utility company can never take advantage of the market as the private producer does and build up large profits and surpluses for the inevitable periods of no profits. The assumption of Government regulation is that the owner of public utilities will secure a fair return at all times, but in actual practice it is difficult to secure this for him.

No Sentiment in Capital

Whatever may have been the injustice of the conduct of such companies in the past, such injustices cannot now be corrected. It is water which has run under the bridge. The important fact is that private capital is invested in public utility properties just as in private corporations. This capital is subject to business risks as in a private enterprise. It is taxed. Its return is controlled by the state by largely inflexible rates. In short, the same considerations which determine the flow or investment of capital in any business govern the investment of capital in this field.

What is the situation then of many of our public utilities under prevailing conditions of an increasing price level, a regulated rate of return, or price, an unsympathetic public, a selfish capital, seeking as always the best possible investment, with an increasing number of bidders for the use of capital and a decreasing amount of capital for sale?

In the first place, there is a tendency toward a deterioration of the physical plant and force. Private industry producing its product for a sellers' market—that is, at high prices—is able both to pay more for materials and to pay higher wages to employees.

In the second place, extensions cannot be made with accustomed and desirable regularity owing to the high prices and dearth of material and labor, the reduced earnings and the lack of new capital. Public utility corporations operate very largely under the law of increasing returns; that is, the net return on increased units of service is greater than the proportional outlay required to furnish this increased service.

*Dr. Gephart has been a professor of economics for sixteen years and still maintains a nominal connection with Washington University as dean of the School of Commerce and Finance. He is a graduate of Columbia University and an author of note in the field of economics. Among his works are "Transportation and Industrial Development in the Middle West," "Principles of Investment" and "Insurance and the State." He was an editor of the American Economic Association, in which organization he has been active for many years, and recently has turned his attention to public utilities.—Editor.

In the third place, the most significant of all the effects is the refusal of new capital to flow into this field. A period of rising prices brings many opportunities to capital to receive a higher rate of interest, for it must never be forgotten that the rate of a return is a price—the price of capital—and, like all other prices, should and must advance if capital is to be forthcoming. There is a cost of money just as there is a cost of wheat or pig iron.

Experience shows that rising commodity prices are accompanied by a rise in bond yields. Superficially the cause for this would seem to lie in the fact that with rising prices, the investor finding his real income reduced, would demand a larger return for the use of his capital and hence bond yields would tend to rise. Another factor entering into the situation lies in the fact that with a rise in commodity prices the demand for capital must necessarily increase, as the higher prices require a larger volume of capital in the conduct of business. Likewise, during a period of falling commodity prices the situation is reversed, so that bond yields tend to follow commodity prices downward. As prices decrease the volume of capital required in industry is lessened and the demand for capital thus falls off, lowering its price.

The yield on bond prices follows the curve of commodity prices rather closely. From an average yield of between 7¼ and 8¼ per cent in 1873 they dropped to an average yield of from 4¼ to 4½ per cent in 1890, rising somewhat between 1890 and 1895. After 1895 they declined to their lowest point for the period in the year 1900, showing at that time an average yield of about 3¾ per cent. After 1900 they gradually rose and by the beginning of the world war the average yield on corporation bonds was between 4¾ and 5 per cent. By the close of the war the yield had risen to between 5¼ and 5¾ per cent. Since the close of the war the average yield has risen even more rapidly, and at present it averages about 7.05 per cent.

Cost of Money to Public Utility Corporations

In endeavoring to determine the cost of money at the present time to public utility corporations there are several important factors that must be taken into consideration. The cost of money incident to the acquisition of the first money needed by a new corporation would be different from the cost to obtain money for enlargements or improvements in a going concern. This is due to the fact that only a part of the total capital needs of a corporation can be secured by a first lien on the property. In other words, all of the securities issued by a corporation cannot be equally secured as regards assets.

Usually not above 60 per cent of the total bonded indebtedness of any corporation can be secured by assets termed the highest class. The remaining 40 per cent of the company's capital needs must thus be raised through the sale of junior issues. No corporation can hope to raise its entire capital needs by a single issue secured by a first mortgage on its entire property value. Since a large part of capital needs must be raised through junior issues, they can be sold only if the yield is considerably higher than that offered by a senior issue.

In the case of a going concern seeking additional capital it is practically impossible to offer the new securities in any volume on a parity with the senior issues of the company, even though the company is thoroughly sound and conservatively managed. Even aside from the nature of the security, new issues are always at a disadvantage in relation to the more seasoned issues which have been fairly digested by the investing public. The result is that new securities offered for the purpose of additions and betterments must usually not only compete with the yield afforded by the junior issues of the company, but, in order to attract new capital, must offer even a higher yield.

Utility Credit Waning

The credit of public utility corporations, on the whole, is at present more or less in disrepute so far as the general investor is concerned. This is not a matter of theory or opinion but one of fact. A glance at the price at which the highest grade of public utility securities in the United States are selling at the present time proves this beyond a doubt. The highest grade of American public utility securities can be purchased in the open market on a basis that will yield the investor anywhere from 1 to 2 per cent per annum more than the same sum would yield were it invested in any other similar grade of corporation securities.

TABLE I—BOND YIELDS BEFORE THE WAR AND SINCE

	Now	Month Ago	Jan., 1916	July, 1915	Before War
U. S. average five public utility	8.60	8.19	5.18	5.31	5.09
U. S. average five railroad	6.14	5.86	4.51	4.71	4.42
U. S. average five manufacturing	6.41	5.92	4.89	4.99	4.93

According to the bond yield computed on five average United States public utility bonds by "Brookmire's Economic Service," this type of security on May 1 could have been bought on a basis to yield more than 2 per cent in excess of the yield afforded by a similar investment in other railroad bonds or manufacturing companies. According to Brookmire's figures, the average yield on five public utility bonds considered as representative issues was 8.60 per cent on this date. On the same date the yield on five representative railroad bonds was 6.14 per cent. Table I, taken from Brookmire's *Financial Bulletin* of May 3, shows the changes in bond yields since before the war.

In another section of this article to appear in an early issue an analysis of the average yield of public utility bonds and the cost of money to public utility and other corporations will be presented.

THE *technical engineer is coming to the fore in power-plant work, this being chiefly on account of the greater need for engineering knowledge and the ability to analyze conditions, so as to get the best results out of every heat unit in the fuel field. I am also inclined to think that the present type of fireman will be obsolete in a few years, the so-called fireman being replaced by boiler-room engineers or combustion engineers. The engineer of the future will not be the throttling type, the opening and closing of the throttles being done by his assistants. His work will be to study plant conditions, work up data and analyze the general working conditions of his plant and make every heat unit count. The combustion engineer will study fuels, furnace designs, etc., so he can burn coal with minimum loss and at the same time give up greatest amount of heat to making steam.*—HENRY H. CARTER *in Southern Engineer.*

Auto-Transformers for Motor Starting

Heating, Ruggedness and Economical Production Are Principal Considerations in Design of Auto-Transformers for Synchronous and Induction Motor Starting—Effect of Voltage Tap and Speed of Motor Influence the Cost of Starter

By THEO. SCHOU
Chief Engineer the Ideal Electric & Manufacturing Company

ALTHOUGH the one-coil transformer, commonly called the auto-transformer, is superior to a two-winding, or normal, transformer as far as economy and performance are concerned, its application and use as a power transformer are limited to cases where the voltage ratio is low, owing to the fact that in an auto-transformer the primary and secondary circuits are not electrically separated. As part of the starting equipment, however, for squirrel-cage induction motors and self-starting synchronous motors, its application is general, and as such the design of auto-transformers is more or less special.

So far as the writer is aware the available information on this subject is meager, and therefore its discussion seems both timely and desirable. In what follows the discussion refers only to auto-transformers for starting duty in connection with motors of both the induction and synchronous type. Besides giving a brief theory it will contain information as to design and construction. It should be borne in mind that less consideration is given to regulation and efficiency than in the design of ordinary transformers and more to the heating, mechanical stability and economy of production.

Current and Voltage Relations Derived.—Fig. 1 shows diagrammatically a three-coil auto-transformer for three-phase operation where:

E_1 = line voltage, or voltage between incoming lines.
E_2 = reduced voltage applied to motor terminals at starting.
W_1 = total effective turns per leg, or primary turns.
W_2 = secondary effective turns per leg (being part of the primary and determined by voltage tap used).
I_1 = line current.
I_2 = current in motor circuit.

We have:

$$(E_1/E_2) = (W_1/W_2), \text{ or } E_2 = E_1(W_2/W_1)$$

and:

$$(I_1/I_2) = (W_2/W_1), \text{ or } I_2 = I_1(W_1/W_2)$$

The current circulating in the part of the winding designated $(W_1 - W_2)$ is I_1, but in the part designated (W_2) it is $I_2 - I_1$; therefore, winding W_2 may have smaller cross-section of effective conductor than the winding $(W_1 - W_2)$, and the proportion of copper weight to that of a normal two-coil transformer of the same duty would be $(E_1 - E_2)/E_1$.

The larger E_2 is, therefore, the more economical in saving in copper.

Determination of Design Constant.—If

E = phase voltage,
I = current per phase,
q_{fe} = iron core section in sq.cm.,
q_{cu} = Copper section (of effective conductor) in sq.mm.
L_{fe} = mean length of magnetic path in cm.,
L_{cu} = mean turn of winding in cm.,
B = magnetic density (Maxwells),
A = current density per sq.mm.,
g_{fe} = weight per cubic unit of iron,
g_{cu} = weight per cubic unit of copper,
W = number of turns in series,
f = frequency in cycles,

then for single-phase transformers we have:

$$\text{Kva.} = EI10^{-3}.$$

Now: $E = 4.44fW\phi 10^{-8}$,
$= 4.44fWBq_{fe}10^{-8}$,

and, as $I = Aq_{cu}$,

then: $\text{Kva.} = 4.44fWBq_{fe}Aq_{cu}10^{-11}$,

or, if B and A remain constant:

$$= K_1 fWq_{fe}q_{cu}10^{-11},$$

where: $K_1 = 4.44BA$.

Total iron weight (G_{fe}):

$$G_{fe} = q_{fe}L_{fe}g_{fe}10^{-3}Kg. \text{ (if in c.g.s. units)}$$

Total copper weight (G_{cu}):

$$G_{cu} = q_{cu}L_{cu}g_{cu}2W10^{-3} \text{ (if primary copper = secondary copper)}$$

$$\frac{G_{fe}}{G_{cu}} = \frac{q_{fe}L_{fe}g_{fe}10^{-3}}{q_{cu}L_{cu}g_{cu}2W10^{-3}} = K_2\frac{q_{fe}}{q_{cu}W}10^2,$$

when L_{fe}/L_{cu} remains constant throughout a certain line. We obtain from this:

$$Wq_{cu} = K_2(G_{cu}/G_{fe})q_{fe}10^2,$$

and, by substituting:

$$\text{Kva.} = 4.44BAK_2f(G_{cu}/G_{fe})q_{fe}^2 10^{-9}$$
$$= Kf(G_{cu}/G_{fe})q_{fe}^2BA10^{-9}.$$

Or:

$$q_{fe} = K\sqrt{\frac{\text{Kva.}(G_{fe}/G_{cu})10^9}{fBA}} = K\sqrt{\frac{\text{Kva.}\cdot\gamma 10^9}{fBA}}$$

Where $\gamma = G_{fe}/G_{cu}$.

If we calculate in inches and Kapplines, we have, as:

1 Kapp-line = 6,000 c.g.s. lines,
1 square inch = 646 cq.mm²,

$$q_{fe} = C\sqrt{\frac{\text{Kva.}\cdot(\gamma 10^6)}{fBA}},$$

or design constant:

$$C = q_{fe}\sqrt{\frac{fBA}{\text{Kva.}\cdot\gamma 10^6}}.$$

This equation holds good for all types of transformers.

Performance Duty Consideration in Starter Design.—Auto-transformers used in connection with motor-starting equipment are in service, or in circuit, for a short time period only—a minute or two—in the average application even less than that. Therefore the design constant of such transformers naturally differs from the usual normal transformers. Heating and stability,

both electrical and mechanical, together with economical production, are the main features to be given consideration. Efficiency and regulation naturally do not take the part they do in the case of ordinary continuous duty transformers.

Magnetic and Current Characteristics.—Both magnetic and current densities are of much higher value than in the case of normal transformer designs; therefore the

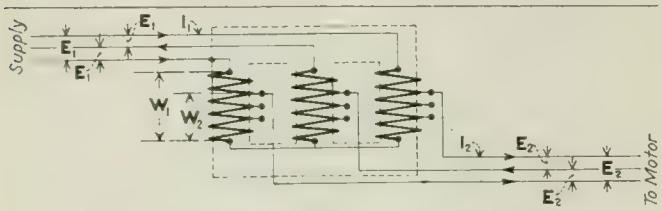


FIG. 1—CONNECTION OF AUTO-TRANSFORMER FOR MOTOR STARTING

proportion of net iron weight to net copper weight, or the constant γ, is also different from usual practice. These values vary, depending upon type, voltage, size and frequency, and will later be discussed more closely in connection with a certain type of auto-transformer construction.

Types.—Auto-transformers may be oil-cooled or air-cooled. They are built as core-type or shell-type. Considering its application and performance duty, the air-cooled core type seems to be the most popular recent design for ordinary line voltages.

Rating.—The kva. or horsepower rating of the auto-transformer is identical with the kva. or horsepower rating of the motor with which it is used. The design, however, of an auto-transformer is based on the starting characteristics of the motor as far as kva. inrush is concerned. It is, therefore, of importance that such starting characteristics of the motor shall be known before the design of the auto-transformer is attempted.

Kva. and Current Drawn from Line at Starting.—The kva. inrush to an induction or synchronous motor at standstill depends upon the applied voltage and the impedance of the motor. If:

E = applied voltage on motor (terminal-terminal),
I = current drawn from line,
Z = total motor impedance per phase, in ohms,

then:

$$I = E/\sqrt{3}Z \text{ for three-phase;}$$

$$I = E/Z \text{ for two-phase.}$$

Now:

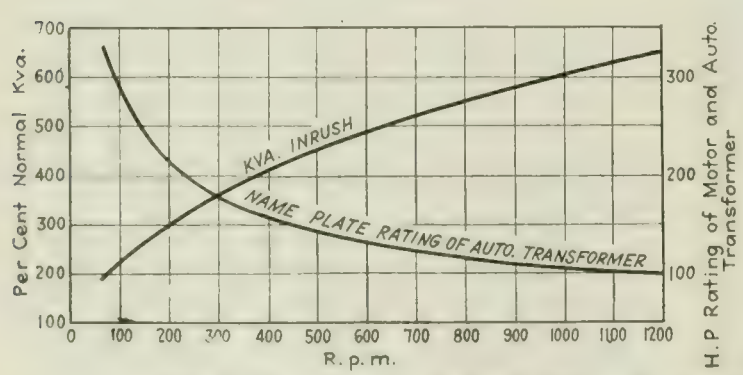
$$Z = \sqrt{(\Sigma R)^2 + (\Sigma x)^2}$$

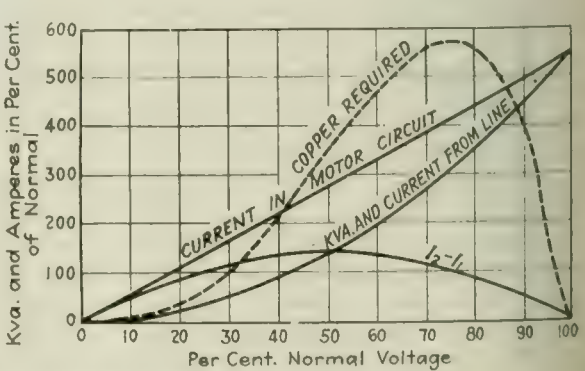
Where:

ΣR = total resistance per phase in ohms; *i.e.*, primary resistance per phase + secondary resistance per phase reduced on primary.
Σx = total reactance per phase in ohms; *i.e.*, primary reactance per phase + secondary reactance per phase reduced on primary.

For a symmetrical line of motors it will be found that the total reactance and also the total resistance (thus the impedance) will increase as the speed decreases. Therefore the current drawn from line, expressed in percentage of normal motor current, will at a certain applied voltage increase as the speed increases. Fig. 2 shows how the kva. inrush at normal or 100 per cent voltage will vary with the speed for a certain line of self-starting synchronous motors, and in connection with this a most interesting fact, *i.e.*, the possible change of name-plate rating of one and the same auto-transformer when applied to different speed motors. Referring to Fig. 2, the same auto-transformer applies both to a 100-hp., 1,200-r.p.m., and a 250-hp., 150-r.p.m. motor. The kva. inrush curve also indicates that for very low-speed synchronous motors the auto-transformer and its auxiliaries may be eliminated; or, in other words, the low-speed motor may be thrown directly on the line, provided that the field design of the synchronous motor will stand full applied voltage at the armature terminals. The starting kva. and also the line amperes vary directly as the square of the applied voltage, and taps are brought out from the auto-transformer winding so as to limit the line current to a commercial value. It should also be kept in mind that as the starting torque of the motor also varies with the square of the applied voltage such taps must be selected and used for a motor circuit as will meet both conditions; that is, taps which will limit the kva. inrush from line to a certain value and at the same time enable the motor to start its load. Fig. 3 gives the kva. inrush, current from line (I_1), current to motor circuit (I_2), and also current in the "W_2" part of winding "$I_2 - I_1$" (see Fig. 1) expressed in percentage of normal motor kva., or amperes. Fig. 3 also indicates, by the dotted curved line, how the copper weight changes with the voltage tap on which the design is based. Although only one tap is used the auto-transformer coil is usually provided with, say, three taps to meet different starting conditions, and the design must therefore be based on the worst condition.

It is to be noted (see Fig. 3) that approximately the 75 per cent voltage tap calls for the maximum copper, other things being equal and the magnetizing kva. neglected.





FIGS. 2 AND 3—EFFECT OF MOTOR SPEED AND PER CENT VOLTAGE ON AUTO-TRANSFORMER DESIGN

Note that the same auto-transformer will serve a motor three times as large at 100 r.p.m. as at 1,200 r.p.m. (Fig. 2) Copper required is maximum when starter is designed for 75 per cent voltage.

Owing to its simplicity of design, production, mounting and connections the two-coil, three-core, air-cooled type of auto-transformer seems to adapt itself most satisfactorily as a starting transformer where, as mentioned above, finer points as to performance and design are not of great importance. In order to have the same core for two-phase and three-phase operation the middle core is given approximately 40 per cent larger cross-section than the two outer ones. For a given voltage the coils are also the same for both two-phase and three-phase transformers of the same rating—being connected in open delta for three-phase and in the ordinary way for two-phase.

The only serious drawback in connection with this type of construction is that it can hardly be used in connection with three-phase, four-wire equipment. In this case, triple frequency current is free to circulate, and the flow of such current in the neutral wire is three times that of the line. If, however, the motor armature insulation will warrant it, and in most cases it will, this drawback can be eliminated by not grounding the motor.

Specific Values of Design Constants.—For auto-transformers of this type and construction, designed for 60-cycle operation and normal line voltages, the design constant C may vary from 1.5 to 2, and the constant γ from 3 to 5. The magnetic density may vary from 15 to 18 Kapp-lines, and the current density from 13,000 to 19,000 amp. per square inch. It is also of interest to note that in applying the above values the proportion for total net weight of effective material over horsepower rating—*i.e.*, $(G_{fe} + G_{cu})$/ hp.—varies from 0.80 for large to 2.25 for small transformers.

Auto-transformers made by a manufacturing concern which also builds other dynamo-electrical apparatus may conveniently be built as a by-product, using much of the scrap iron and copper left available from the manufacturing processes of other machines.

The cores may be built with lapp or butt joints. However, butt joints will be found to be the more economical and are about as good magnetically as lapp joints.

When butt joints are used care should be taken, however, that means be provided for holding the parts securely in place. The coils are subjected to rather heavy mechanical stresses when the current is thrown on, and it is important so to design the coil that the various layers of the winding cannot in any way change in relative position or telescope into each other. The coil proper, also, should be prevented from any movement on the core and should be rigidly supported and held in permanent position; otherwise breakdowns may easily occur.

THE *experience of generations shows that successful industry tends irresistibly toward the development of very large units. Such units are necessary to efficiency. The tendency is wholesome, and cannot be successfully resisted. Anti-trust legislation, trust-busting campaigns and government suits to dissolve the great industrial units cannot frustrate the fundamental economic law. Large units will emerge in spite of them, because they are economically necessary and sound. . . . While monopoly produced by unfair methods may be perpetuated as long as such methods are used, the monopoly produced by efficient management cannot be perpetuated, because efficiency cannot be monopolized.* —PHILIP CABOT.

Proposed Reorganization of the Electric Systems of Belgium

IN AN article which appeared in the *Revue Universelle des Mines, de la Métallurgie et des Travaux Publics* last year and was summarized in the *Revue Générale de l'Electricité* for March 27 last Fernand Courtoy gave the outlines of a plan of which he is the author for the interconnection of all the electric supply lines of Belgium with the object of conserving fuel and promoting economy in the production of energy. There is little water power in Belgium, and coal is the chief source of electricity, though gas from blast furnaces and from coke ovens is used in some districts.

Pointing to the great importance of a well distributed load such as could be brought about by the operation in parallel of a group of power stations, with the attendant regulation of demand, diminution of total necessary generating capacity and possibility of employing units of greater power than can be done under independent operation, the author favors the establishment of a number of great central stations in favorable localities, the transformation of the existing smaller generating plants into distributing stations, and their interconnection by a network of cables.

The statistics of 1911, which are the latest available, showed a total installation in the central stations of Belgium of approximately 563,000 kw., of which about 164,000 kw. was reserve power. The total annual production of electricity was 1,570,230,000 kw.-hr., with a load factor of 45 per cent. Assuming the same amount of business, a common supply of energy to all industries would, according to the author's figures, limit to 322,000 kw. the maximum power demand, which is now 399,000 kw.; the annual load factor would rise to 61 per cent; reserve capacity could be reduced to 25 per cent of output, and finally the total rating of generators installed could be reduced from 563,000 kw. to 382,000 kw. This method of operation in common could be realized either by operating in parallel installations indentical with those of 1911 or by means of two groups of great central stations—one group utilizing steam units of 20,000 kw. and the other group, built in localities where blast furnaces exist, utilizing gas engines rated at from 4,000 kw. to 8,000 kw.

The connections between central stations of the same group would be furnished by armored cable carrying three-phase current at 6,000 volts and 50 cycles. Interconnection of the groups would be provided by aërial conductors at 100,000 volts. The substations tying together the 100,000-volt and 6,000-volt networks would be equipped with automatic apparatus utilizing static transformers.

A comparison from the viewpoint of economy of four successive evolutionary plans of parallel operation shows yearly savings in coal, as contrasted with independent operation as in 1911, of from 1,769,315 tons to 2,257,800 tons; savings in yearly operating costs of from 74,583,855 francs to 135,959,925 francs, and savings in the net cost of producing a kilowatt-hour of from 2.75 centimes to 6.65 centimes. The lowest figures in each case are for the ultimate scheme—that involving the abadonment of all existing installations.

No legislative sanction has yet been obtained for the plan. As to financial organization, the author advocates a combination of all the supply companies, big and little, that existed before the war.

U. S. Census of Central Stations 1917

Analysis of Census for 1917, Just Issued, Indicates 6,542 Central Stations, with Installed Rating of 8,994,407 Kw. and Total Output of 31,044,049,234 Kw.-Hr.—Stationary Motors Served Number 555,924, with Continued Rating of 9,216,330 Hp.

THE 1917 census of electric light and power stations, which has just been published by the Bureau of the Census, Department of Commerce, is by far the most comprehensive census of the central-station industry yet issued by that bureau and contains a number of important changes in and additions to previous reports. Among these is a clear distinction between generators operated by water power and those operated by other power, a detailed classification of the current sold for electric lighting, power, to other public service corporations, energy used by the plant itself, distribution and line losses, in addition to the amount generated and purchased; separate data regarding income from the light and power business, data on fuel consumption and population of areas served with electric current.

Table I, a combination of Tables VIII and IX of this report, gives a comparative summary of the operation of the commercial and municipal plants for 1907, 1912 and 1917. It is interesting to note that while the commercial plants represented only 64.6 per cent of the total number, yet they served 82.7 per cent of all municipalities furnished with current and 80.5 per cent of the aggregate population of all districts served with electric current. In its analysis the Bureau of the Census states that "this is due to the fact that most commercial stations distribute current directly to consumers throughout an extensive territory, some supplying scores of separate localities, while almost without exception municipal plants serve only the municipalities in which they are located. On the other hand, frequently several commercial plants are located in the same city, one usually doing a general light and power business, while the others may incidentally do a little lighting, but will in the main supply power to other companies. There were 405 cases of this kind in 1917." While no effort was made in this census to secure data on the number of isolated or private plants, yet computations based on this census indicate that in 1914 there were 45,000 electric plants operated solely in connection with industrial enterprises. The output of all generating stations in 1917 was 25,438,303,272 kw.-hr. and the amount purchased was 5,605,745,962 kw.-hr., making a total central-station output of 31,044,049,234 kw.-hr.

The number of stations increased more rapidly (25.3 per cent) from 1912 to 1917 than during the previous five-year period, when the rate of increase was only 10.8 per cent. For both periods the numerical increase was considerably more rapid for municipal plants. Those items which show the greatest increase since the 1907 census are: Value of plant and equipment, 179 per cent; total income, 200 per cent; expense, 217.9 per cent; total horsepower of prime movers, 215.7 per cent; kilowatt capacity of dynamos, 232 per cent; kilowatt-hours generated, 333.9 per cent; number of customers, 268.7 per cent, and horsepower of stationary motors served, 458.9 per cent. There was a falling off in the rate of increase in investments for the five-year period from 98.3 per cent to only 40.7 per cent, though there was not so much difference in the absolute increase. The bureau attributes this to a more widely established business and the abnormally high cost of materials subsequent to 1914.

In 1917 there were eight states in which the number of municipal stations exceeded the number of commercial stations, this excess being most marked in Georgia, where it was 80, and in Kansas, with an excess of 70. The large increase in municipal plants indicated in Table I is not so remarkable when the fact is considered that these were mostly small plants serving but one locality, while one commercial plant may mean a territory served embracing many separate municipalities. It is also noticeable that the districts showing the largest growth in municipal plants are those in which oil, natural gas or

TABLE I—COMPARATIVE SUMMARY OF COMMERCIAL AND MUNICIPAL CENTRAL STATION OPERATIONS

	Commercial Plants			Municipal Plants			Total
	1907	1912	1917	1907	1912	1917	1917
Capitalization			$3,117,809,898			$127,375,200	$3,245,185,098
Number of stations	3,462	3,659	4,224	1,252	1,562	2,318	6,542
Value of plant and equipment	$1,054,034,175	$2,098,613,122	$2,933,016,941	$42,879,447	$77,065,144	$127,375,200	$3,060,392,141
Total income	$161,630,339	$279,054,409	$486,634,021	$14,011,999	$23,218,989	$40,260,219	$526,894,240
Light, heat and power	$156,000,257	$264,474,949	$462,473,917	$13,614,434	$22,663,708	$39,586,063	$502,059,980
All other sources	$5,630,082	$14,579,460	$24,160,104	$397,565	$555,281	$674,156	$24,834,260
Total expenses, including salaries	$123,880,291	$217,660,112	$395,127,395	$10,316,620	$16,917,165	$31,440,912	$426,568,307
Total number of persons employed	42,066	71,395	94,679	5,566	7,940	10,862	105,541
Prime movers:							
Number	8,981	9,326	10,387	2,017	2,576	3,408	13,795
Total horsepower	3,776,837	6,970,716	12,077,657	321,351	559,328	859,098	12,936,755
Dynamos:							
Number	9,778	9,843	9,991	2,395	2,767	3,437	13,428
Kilowatt capacity	2,500,209	4,768,762	8,411,944	209,016	396,677	582,463	8,994,407
Output of stations (total)	5,572,813,949	13,556,505,383	29,812,190,746	289,462,788	626,107,107	1,231,858,488	31,044,049,234
Kilowatt-hours generated	5,572,813,949	11,031,583,155	24,398,983,183	289,462,788	537,526,730	1,039,320,089	24,438,303,272
Kilowatt-hours purchased		2,524,922,228	5,413,207,563		88,580,377	192,538,399	5,605,745,962
Stationary motors served:							
Number	162,677	413,578	504,864	4,507	21,895	51,060	555,924
Horsepower capacity	1,617,337	3,966,328	8,790,707	31,689	164,291	425,623	9,216,330
Disposal of current, 1917:							
For light			4,445,217,785			667,299,164	5,112,516,949
For power			12,833,191,106			341,636,171	13,174,827,277
To other public service corporations			7,444,108,488			20,512,086	7,464,620,574
Other purposes (not revenue)			821,522,389			9,951,558	831,473,947
Distribution and line losses			4,268,150,978			192,459,509	4,460,610,487
Per cent of total output, 1917							
For light			14 9			54 2	16 5
For power			43 0			27 7	42 4
To other public service corporations			25 0			1 7	24 0
Other purposes (not revenue)			2 8			0 8	2 7
Distribution and line losses			14 3			15 6	14 4

waste products from sawmills is available, all of which fuels can be profitably used in small stations.

That a large number of companies are not doing a strictly central-station business is indicated by the following table. Commonly the operations carried on with that of furnishing electric current are those of supplying water and producing gas or conducting a street railway enterprise.

	Plants
Electric and water service	1,328
Electric and gas service	206
Electric, gas and water service	33
Electric, gas and street railway	14
Electric and street railway	11
Electric, gas, water and street railway	6
Electric, water and street railway	4
Electric and miscellaneous business such as heating, manufacture of ice, mining, telephones, etc	1064

The development of hydro-electric stations at the time the census was taken is shown in Table 2. Hydro-electric stations comprised only 5.1 per cent of the total number of central generating plants, but they supplied 22 per cent of all municipalities supplied by generating stations. They represented almost half the investments in plant and equipment, received nearly one-third of the total income, incurred about one-third of the total

TABLE II—ALL GENERATING STATIONS AND HYDRO-ELECTRIC STATIONS COMPARED, 1917

	All Generating Stations—	Stations Reporting Water Power of 1,000 Horsepower and Over	
	Number or Amount	Number or Amount	Per Cent of Total
Number of plants	5,124	259	5 1
Number of separate generating stations	5,824	684	11.7
Number of cities, towns, etc., served by generating plants	11,364	2,497	22 0
Value of plant and equipment	$2,952,423,577	$1,396,619,224	47.3
Total income	$494,972,405	$157,580,682	31.8
Light, heat, and power, including free service	$471,063,414	$149,224,378	31.8
All other sources	$23,908,991	$8,356,304	35.0
Total expenses, including salaries and wages	$400,445,429	$125,027,197	31.2
Total number of persons employed	99,666	25,590	25.7
Total horsepower	12,875,522	5,867,447	45.6
Steam engines and steam turbines:			
Number	7,300	654	9.0
Horsepower	8,391,816	1,764,203	21.0
Water wheels and turbines:			
Number	3,358	1,995	59.4
Horsepower	4,274,479	4,092,882	95.8
Internal-combustion engines:			
Number	2,914	45	1 5
Horsepower	209,227	10,362	5 0
Kilowatt capacity of dynamos	8,943,423	3,954,294	44 2
Output of stations	29,807,378,386	16,018,906,990	53 7
Kilowatt-hours generated	25,438,303,272	13,924,464,619	54 7
Kilowatt-hours purchased	4,369,075,114	2,094,442,371	47 9
Kilowatt-hours sold	24,661,331,266	13,148,946,560	53.3
For light	4,772,277,255	1,120,506,702	23.5
For power	12,622,123,027	7,523,445,685	59.6
To other companies	7,266,930,984	4,504,994,173	62 0
Stationary motors served:			
Number	509,778	145,032	28.5
Horsepower	8,765,570	3,360,371	38.3
Number of customers	6,570,430	1,686,284	25.7

expenses and employed a little more than one-fourth of all employees in generating stations. While they sold 53.3 per cent of all current sold, their proportion of current for lighting was only 23.5 per cent, while the proportion sold for power and to other companies was 59.6 per cent and 62 per cent respectively. The lower rates obtained for hydro-electric current is reflected in the fact that while such stations supplied 53.3 per cent of all current sold, their income from the sale of current was only 31.8 per cent of the total. The hydro-electric plants of California reported more horsepower in the aggregate, 1,114,356, than any other state. New York ranked second, 822,224, followed by Michigan, 504,719.

An examination of the different types of prime movers shows that steam engines were being rapidly displaced by the larger and more efficient steam turbines. In 1917 steam engines furnished 13.2 per cent of the total horsepower of central stations, while steam turbines furnished 52.2 per cent and water wheels 33.1 per cent. Internal combustion engines reported to the number of 2,934, furnished only 1.6 per cent of the total horsepower.

As shown in Table I the gross capitalization of the electric light and power industry in the United States was $3,245,185,098, of which amount $127,375,200, or 3.9 per cent, represents the investment in municipal stations. The principal items entering into this total for commercial stations are capital stock, amounting to 50

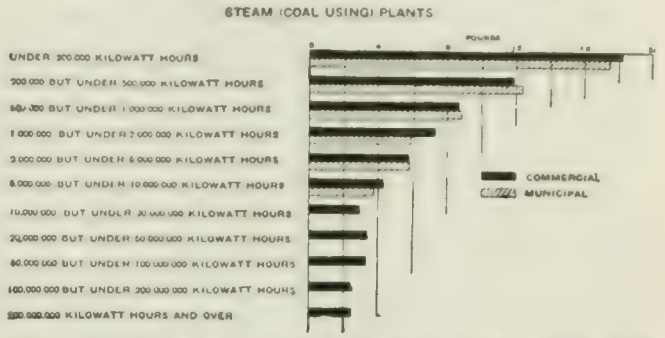


FIG. 1—NUMBER OF POUNDS OF COAL USED PER KILOWATT-HOUR GENERATED FOR COMMERCIAL AND MUNICIPAL STATIONS, 1917

per cent of their capitalization; bonds, to the extent of 41.7 per cent, and floating debt, amounting to 6.5 per cent. Cash investments, real estate mortgages and premium on securities issued amount together to only 1.8 per cent. A deduction of $313,539,988 for intercompany holdings, treasury securities and investments outside of electric light and power industry leaves a net capitalization of $2,804,269,910, equivalent to 95.6 per cent of the reported investment in plant and equipment.

It appears from Table III the average lighting rate for all plants in 1917 was 5.5 cents per kw.-hr. and the average power rate 1.2 cents per kw.-hr. The highest lighting rates were reported in New Mexico, 10.7, and North Dakota, 10 cents. The lowest lighting rates were reported by West Virginia, 3 cents. The highest average rates for power were reported by, in general, the same states that reported high lighting rates, North Dakota leading with 4.3 cents per kw.-hr., followed by New Mexico with 3.4 cents per kw.-hr. Several states reported an average power rate under 1 cent, the state of Montana being lowest with a power rate of only six-tenths of a cent. The average rates received by municipal plants for their current was much higher than those charged by commercial stations.

TABLE III—COMMERCIAL AND MUNICIPAL CENTRAL ELECTRIC STATIONS—AVERAGE RATE PER KILOWATT-HOUR, 1917 (CENTS)

Division and State	Total			Commercial			Municipal		
	Light	Power	Sold to Other Companies	Light	Power	Sold to Other Companies	Light	Power	Sold to Other Companies
United States	5 5	1 2	0 7	5.6	1 2	0 7	4 9	1 8	1 5
Geographic Divisions									
New England	6 9	1 7	0 9	6.9	1 7	0.9	6 8	2 1	2 0
Middle Atlantic	5 6	0 9	0 8	5 6	1 0	0 8	5 8	2 6	2 7
East North Central	4 9	1 6	0 7	5 2	1.6	0.7	3.7	1 7	1 6
West North Central	5 9	1 4	0 6	5 6	1.4	0.6	7 6	2 5	4 0
South Atlantic	5 4	1 [illegible]	1 0	[illegible]	0 9	0 7	6 7	2 0	0 5
East South Central	5 5	1 4	0 3	5 2	1 3	0 3	6 7	2 1	1 0
West South Central	6 4	2 1	1 1	6.2	2 1	1 0	7 8	2 [illegible]	[illegible]
[illegible]	6 5	0 8	0 5	6 6	0 8	0 5	5 5	[illegible] 0	2 0
[illegible]	4 5	1 2	0 7	5 0	1 2	0 7	2 [illegible]	[illegible]	0 4

Readers' Views and Comments

After Eighteen Years

To the Editor of the ELECTRICAL WORLD:

SIR: In the ELECTRICAL WORLD AND ENGINEER of Aug. 16, 1902, there appeared an article by a youthful engineer entitled "Direct Measurement of Wattless Power." After discussing methods of power-factor measurement and the elusive quantity termed reactive power, the writer made the following comment:

"Education is largely a matter of sensual experience. What we see, touch or measure directly is always more easily understood than the results of deductive reasoning. After one has measured the apparent watts in a circuit, the true watts and the reactive watts, he has all three sides of his vector triangle in the flesh, as it were; and there is then no excuse for difficulty in interpreting the theory."

A method for measuring the reactive power directly in a balanced three-phase circuit was then developed, after which this paragraph followed:

"The method also suggests an application to commercial metering. It is generally conceded that a customer of a central station should be made to pay something for his wattless power in addition to the charge for the power he consumes. An integrating wattmeter connected so as to rotate at a speed proportional to $EI \sin \Theta$ will, in conjunction with the regular meter, furnish the data for a more equitable system of charging. Such a system can have but one result—better voltage regulation, due to the stimulus that will be given to the manufacture of high-power-factor motors. A high-power-factor motor will be placed on the market just as soon as the purchaser finds it to his advantage to pay the necessarily increased price. He will pay that price if by doing so his bills are reduced a sufficient amount."

The editors were so pleased with the suggestions thrown out in that article that they gave it a full-page editorial, but they took exception to the idea of selling reactive power as suggested. Here is what they said:

"Imagine the perplexity of the ordinary consumer operating an alternating-current motor, in addition to incandescent lamps, from a three-phase alternating-current distributing system of street mains, when he saw two meters on his premises, one of which showed the kilowatt-hours he really used, while the other showed the kilowatt-hours that passed into and out of his motor in rapid succession without his being able to capture and use them, but for which he was called upon to pay a certain percentage. Apart from the difficulty of getting him to understand the situation, there would be the difficulty of persuading him to pay for those 'wattless' kilowatt-hours that he did not convert and use mechanically. A better plan, and one in extended use, is to meter the lamps and the motors separately and charge a price per kilowatt-hour for motor consumption higher than that for lamps, in accordance with the added cost of the reactive power involved."

The following is quoted from an editorial in the ELECTRICAL WORLD of July 17, 1920:

"This problem can be solved, as pointed out in a past issue, by using, in addition to the ordinary three-phase active watt-hour meter, a special three-phase reactive watt-hour meter which integrates the total number of reactive watt-hours applied to the customer's load."

This letter is not written to register any claim of foresight, but rather to point out that the profession has been woefully slow on a subject that has long been of vital interest to the power-station manager.

Los Angeles, Cal. BUDD FRANKENFIELD.

[Our progress in engineering is largely based upon results of experience. In the late eighties a prominent engineer fought the introduction of alternating-current distribution with some justification on the basis that experience with the system did not favor such a radical move. Today such an argument would meet little sane consideration. The ELECTRICAL WORLD judges all matters in the light of results of experience and current engineering practice. The writer of this letter has noted a point where experience has justified a change in opinion.—EDITOR.]

The Three-Phase Four-Wire System

To the Editor of the ELECTRICAL WORLD:

SIR: While no one can deny the economy in copper obtained by making use of the three-phase four-wire system of distribution, some objections brought up by those considering its adoption should be carefully considered and given their proper value. Most of these objections are of an operating nature and seem to be connected with the overhead installation of the system. It should be determined if these objections are the manifestation of the natural inertia toward change, if they are the product of misinformation or are real and to what extent they should detract from the use of the three-phase four-wire system.

The three-phase four-wire system can be operated with the neutral wire either grounded or ungrounded. Adherents to both methods of operation can easily be found. If the neutral wire is grounded the presence of ground potential wire on the pole is said to increase the danger to the lineman who is working on the live line. This danger, however, does not seem very serious as linemen treat all primary wires as equally dangerous. With more reason it is feared that if an accidental ground connection is made by a lineman through a wet pole, a grounded transformer case or a lightning arrester ground, while working on the line wire he will cause a destructive short circuit. It might be well to note here that one of the greatest dangers to linemen is a congested pole; the three-phase four-wire system will handle the same load with less wires and therefore eliminate some congestion. A grounded system is also thought to increase the number of transformer bushing failures and to suffer more from the effects of lightning.

If the neutral wire is not grounded the safety of the lineman is the same as that of any other ungrounded system, while it is known that accidental grounding of one of the line wires will often result in potentials on the other wires of a magnitude sufficient to be destructive to transformer windings or protective devices.

Some accurate comparative data, compiled by a company having made the change from some system to a three-phase four-wire system and having operated the latter for some years, would be of great interest.

New York City. O. P. REY.

Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Standard Accessories That Must Be Furnished with Transformers

RULES for standard accessories which will be furnished with single-phase distribution transformers as adopted by the Electric Power Club to become effective Jan. 1, 1921, are shown in the accompanying table. This table gives specifications for primary voltages from 440 to 66,000, 60 cycle and 25 cycle. The accessories specified are thermometer, oil gage, oil drain valve, oil drain plug, oil sampling valve, provision for filter-press connection, hanger irons and cut-outs.

ACCESSORIES WHICH MUST BE FURNISHED WITH TRANSFORMERS OF DIFFERENT RATINGS

Voltage.	Cycles	*Size of Transformer (Kva.), Which Must Have Equipment Shown: Oil Drain Plug, Hanger Iron Cut-Out	Oil Drain Plug, Hanger Irons	Oil Drain Plug	Oil Gage, Oil Drain Valves, Oil Sample Valve, Filter Press Connection	† Thermometer, Oil Gage, Oil Drain Valve, Oil Sample Valve, Filter Press Connection
440	60	0–10	11–50	51–100	150–249	250‡
	25	0–10	11–25	26–50	75–149	150‡
550	60	0–15	16–50	51–100	150–249	250‡
	25	0–15	16–25	25–50	75–149	150‡
‡2,300	60	0–50	.....	51–100	150–249	250‡
	25	‡	.....	‡	75–149	150‡
4,600, 6,600 and 13,200	60	....	0–50	51–100	150–249	250‡
	25	....	0–25	26–50	75–149	150‡
22,000 to 66,000	60	....	.....	0–37.5	50–249	250‡
	25	....	.....	0–15	25–149	150‡

*With a transformer of special rating such accessories will be regularly furnished as would be supplied with a transformer of standard rating using the same mechanical parts.

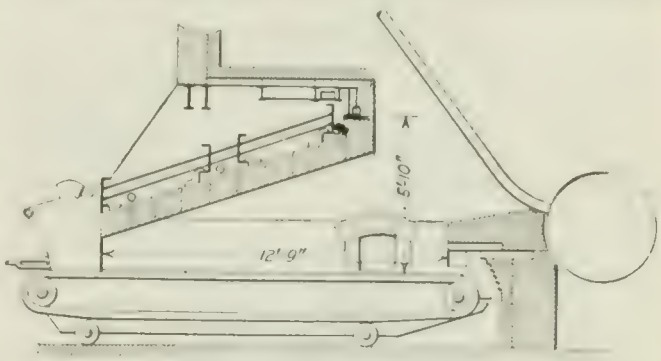
†Plain standard indicating thermometers will be furnished for the transformers as listed, except that indicating thermometers with alarm contacts will be furnished with self-cooled transformers 1,000 kva. and above, and with all water-cooled transformers.

‡With 2,300-volt, 25-cycle transformers of 0–25-kva. rating, hanger irons only are required, and with those of 26–50-kva. rating oil drain plugs and cut-outs are required.

Lignite Containing 23 per Cent Moisture Develops 275 per Cent Boiler Rating

SIXTY pounds of lignite containing 23 per cent of moisture are burned per square foot of grate area per hour in the Platte Street Station of the Denver (Col.) Tramway Company at 250 to 300 per cent of boiler rating. These unusual results are due to some unusual operating features, to suitability of furnace design and to intelligent supervision. The station is operated on a bonus system, which creates an interest from the operators which is reflected in the results, but two other features of operation are mainly responsible for this excellent performance. One is the exclusion of air around the stoker gate and even through the coal in the stoker hopper. The stoker hopper is fed by coal spouts and the hopper is provided with a covering fitting around the spouts. The other unusual procedure is the use of preheated air under the stokers. This air is exhausted from the generators and is delivered under the grates at 80 deg. F. (27 deg. C.).

An analysis of the fuel and the performance of the plant is shown in the accompanying table. The fuel is Leyden lignite and is mined in Jefferson County, Colorado. Wet as this fuel is when mined, it is found to be desirable to moisten it still more until it contains



THIS ARRANGEMENT IS USED FOR VERY WET COAL

Lignite containing 23 per cent moisture burned in this furnace at 60 lb. per hr. per sq.ft. of grate

about 23 per cent of moisture. This is done by sprinkling the coal just before it goes to the crusher. Approximately 5 per cent moisture is added in this manner. The furnace design is especially suited to this class of work. The boilers are six Class O, No. 29, Stirling type, each having 7,267 sq.ft. (225 sq.m.) of heating surface. Each boiler is fired by two Green "K" type chain grates each 6.5 ft. (2 m.) wide by 13 ft. (4 m.) long, having a combined grate area of 165 sq.ft. (15.3 sq.m.) and a 1-to-44 ratio of grate surface to heating surface.

It will be noted from the sectional side elevation of the furnace shown in the drawing that the stokers are long and that the furnace has a very long igniting arch, 10 ft. (3 m.) horizontal dimension. The arch is pitched at 4 in. per foot (30 cm. per m.) to reflect the heat up to the stoker gate as ignition of this high moisture fuel is one of the most important considerations. The furnace has 4.7 cu.ft. for each square foot of grate area (1.4 cu.m. per sq.m.), which would be enlarged if the installation were being made today. The

ANALYSIS AND PERFORMANCE OF HIGH-MOISTURE LIGNITE

Coal burned	Leyden (Col.) lignite
Proximate analysis	
Moisture, per cent	23.00
Volatile matter, per cent	32.13
Fixed carbon, per cent	34.37
Ash, per cent	10.50
Sulphur, per cent	0.20
B.t.u. per pound as fired	8,865
Combustible in ash, per cent	10.68
CO at damper, per cent	1.00
Boiler horsepower developed per blower	1,200
Per cent rating	275
Horsepower developed per sq.ft. grate surface	11.60
Kilowatt-hours generated, 4.14 lb. water rate	8.50
Kilowatt-hours per rated boiler horsepower	8.4
Coal per square foot of grate surface per hour	60.90

units are equipped with Stirling superheaters and served by individual induced-draft fans with variable-speed motors, drawing through economizers. The use of induced draft at altitudes of one mile or more is desirable and becomes practically necessary when economizers are used.

The thickness of fuel bed carried is 10 in. (25 cm.), which gives a substantial bed on the grate, ready to meet sudden demands for steam by simply increasing the draft and stoker speed.

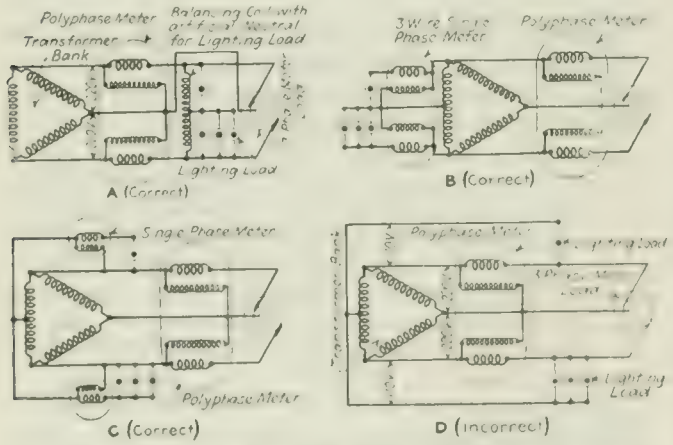
The boilers frequently carry from 250 to 300 per cent rating, and 60 lb. (27 kg.) of this fuel can be burned per square foot of grate surface per hour, which is an unusually high combustion rate with such high-moisture fuel.

Methods of Metering Combined Power and Lighting Loads

FOR metering three-phase power loads and single-phase lighting loads which are fed from the same transformer the correct methods of connecting are shown in the accompanying drawings. About the most satisfactory method (shown in *A*) makes use of a balance coil connected between two of the phases with an artificial neutral for the three-wire lighting. A polyphase meter is connected up to the circuit in the manner ordinarily used for measuring three-phase loads. The measurements of this meter will be accurate for any condition of unbalanced load on the lighting circuit or on the power circuit. This method has another advantage in that only one maximum-demand meter need be used for both power and light.

In the method shown at *B* the neutral for the lighting circuit is taken from the middle tap of one of the transformers. A three-wire, single-phase watt-hour meter is used for metering the lighting energy and a polyphase meter is used for the motor load. With the system shown in *C* two single-phase meters and one polyphase meter are employed respectively for the lighting load and the power load.

Another system of connecting which is incorrect but which might be used is shown in *D*. Only one meter



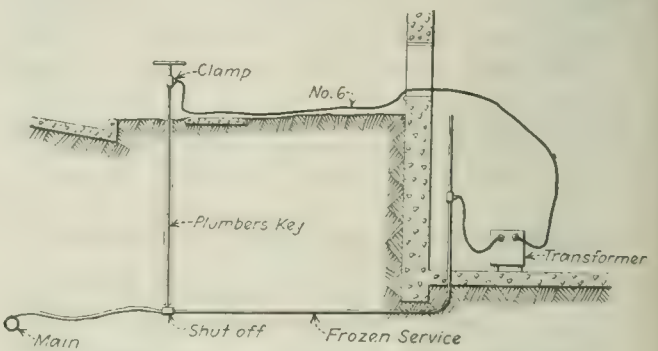
CORRECT AND INCORRECT METHODS OF METERING POWER LOADS AND LIGHTING LOADS

is used with this connection, and the neutral of the lighting circuit is taken off the middle point of one of the transformers. However, with this system, any unbalance in lighting load will give incorrect meter readings.

M. F. SMALLEY,
Meter Superintendent.
Ohio Power Company,
Newark, Ohio.

Pipe-Thawing Outfit for the Coming Winter

A PIPE-THAWING outfit which can be operated from a 110-volt or 220-volt house service has been developed that may be operated safely without requiring great skill. The equipment consists of a 1.5-kva. transformer having 110-volt and 220-volt primary windings and a 16-volt secondary, 100 ft. to 125 ft. (30 m. to 35 m.) of No. 6 weatherproof copper wire in pairs for the secondary connections and 50 ft. (15 m.) of No. 14 drop cord for the primary connections. The current supply is obtained from a connection at the entrance cabinet of the house-lighting service, using the 220-volt connection where the service is three-wire. One secondary connection is made to the water pipe in the building and the other by means of a plumber's key attached to the shut-off cock at the street end of the service pipe.



CURRENT FOR THIS OUTFIT IS TAKEN FROM THE HOUSE SERVICE

The transformer capacity of 1½ kva. has been found sufficient for ¾-in. (18-mm.) and 1-in. (25-mm.) iron and lead service pipes. The thawing time ordinarily ranges from ten to thirty minutes, which compares favorably with the former method using a 10-kva. to 15-kva. transformer connected to the 2,200-volt primary circuit. Should the service be frozen between the shut-off and the main the connection may be made to a neighboring shut-off.

The transformer used is of the ordinary core type having a core made of sheets of stovepipe iron. The laminations are 1⅞ in. x 6¾ in. (4.6 cm. x 17.1 cm.) and 1¾ in. x 9¾ in. (4.6 cm. x 24.7 cm.). The core is built up to a cross-section of 1⅞ in. x 1⅞ in. (4.6 cm. x 4.6 cm.), with the laminations dovetailing at the corners in groups of five. The opening through the core is 5 in. x 8 in. (12.7 cm. x 20.3 cm.). The primary winding consists of 520 turns of No. 12 magnet wire divided into two windings of 260 turns for paralleling when using 110 volts on the primary. The two halves of the primary winding are placed in series when using 220 volts. The secondary is made of 38 turns of No. 1 bare copper wire. The transformer is air-cooled and is mounted in a wooden case with a hole left through the box so that additional secondary turns may be threaded through to vary the secondary voltage if required. The complete transformer is 8½ in. x 14 in. x 13½ in. high (21.6 cm. x 35.5 cm. x 34.3 cm.) and weighs about 55 lb. (25 kg.).

The current depends upon the resistance of the service pipe, usually 80 amp. to 110 amp. on the secondary side and 11 amp. to 16 amp. on the primary.

H. S. RUSH,
Associate Professor of Electrical Engineering.
State School of Science,
Wahpeton, N. D.

Industrial Applications

The Economical Utilization of Electrical Energy
in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

Industrial Tractor Economies

ON THE docks at Seattle, Wash., electric tractors have been effective when used to move loaded trailers, the average load in one case being five 225-lb. (116-kg.) cases moved a distance of 120 ft. (36 m.) every 2.35 minutes. Five men are required for loading and two on the tractor. With the same equipment fifty-five 310-lb. (140 kg.) cases were moved 600 ft. (180 m.) in an average time of 4.55 minutes per trip. The docks were snow-covered at the time.

The American Steel & Wire Company has been able to operate Edison battery tractors more than twenty hours a day by charging them at twice normal rate one-half hour four times per day. Once a week a full charge is given. One tractor made 859 trips, covering a one-way distance of 812 ft. (358 m.) with an average load of 2½ tons (2 metric tons), returning empty, with a total input to the battery of 138 kw.-hr.

At the Akron plant of the Goodyear Rubber Company four tractors replaced sixteen men who were required to move 1,258,000 lb. (570,000 kg.) of material during an eight-hour shift. The man-power cost was $74 against $40 with tractors. By the use of spare batteries it was possible to operate the tractors twenty-four hours a day, and when the plant was working three shifts the four tractors saved the company $102 per day.

Chart for Easy Determination of Direct-Current Line Drop

FOR quickly determining any one of the factors, voltage drop, length of line, wire size and amperes, in a direct-current line the diagram shown here will prove useful. The accompanying table indicates briefly the method to follow in using the chart. For instance, to determine the voltage drop in a No. 10 conductor carrying 5 amp. a distance of 400 ft. (120 m.). According to the table, it is necessary to follow from the point on the right-hand side of the chart where the No. 10 wire size is indicated horizontally to the diagonal line marked 5 amp. From this point follow vertically down to the diagonal line marked 400 ft. From this point follow horizontally to the voltage scale on the right, where the voltage drop is seen to be 2 volts. The other calculations are made in a similar manner. It must be noted that this chart is compiled for a single conductor, and that with a two-wire circuit the total length of single conductor must be used. When using wire sizes No. 0000 to No. 9 inclusive, which are listed in the right-hand column, all values in the "drop in volts" column should be divided by ten.

FOR USE WITH CHART TO DETERMINE VOLTAGE DROP, ETC

To Find Unknown Factor	Follow from	Horizontally to	Vertically to	Horizontally to
Voltage drop...	Size wire	Amperes	Length	Voltage drop
Length circuit.	Size wire	Amperes	Voltage drop	Length
Size wire.....	Voltage drop	Length	Amperes	Size wire
Amperes ...	Voltage drop	Length	Size wire	Amperes

The range of the chart can be increased to an almost unlimited extent by remembering the following rules: First, all values in both columns representing amperes and drop in volts may be either multiplied or divided by ten or any multiple of ten; second, all values in both columns representing hundreds of feet and drop in volts may be either multiplied or divided by ten or any multiple of ten; third, if the values in the columns representing hundreds of feet and amperes are both multiplied or divided by ten or a multiple of ten, then the values in the drop in volts column must likewise be multiplied or divided by the product of the other two multipliers or divisors.

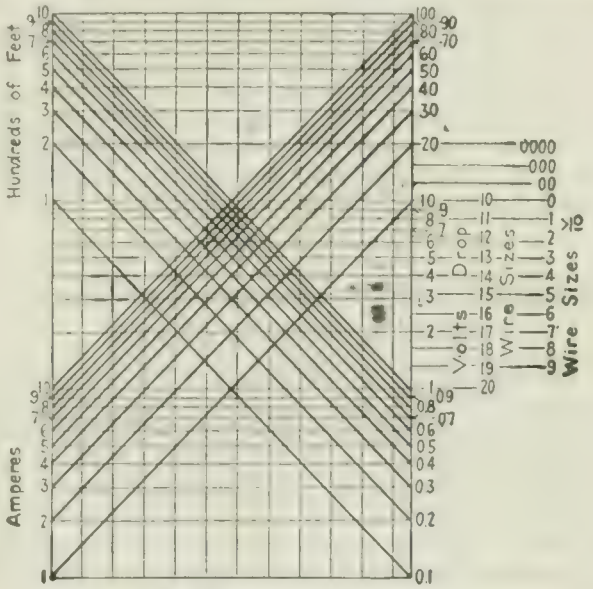


CHART FOR DETERMINING VOLTAGE DROP IN DIRECT-CURRENT CIRCUITS

The chart may be extended for wire sizes not shown. For instance, if wire smaller than No. 20 is used the column may be filled in from No. 20 to the bottom of the chart. The spacing will be the same as the sizes from No. 10 to No. 20, and No. 30 will come opposite the bottom of the chart. The larger sizes may be filled in at the top of the chart.

This chart is not absolutely accurate as slight errors have been permitted in order to gain uniformity, but in only one case does such an error exceed 2 per cent, which is close enough for a chart of this kind. The values from which this chart was constructed were taken from Circular 31, Bureau of Standards, 1914 edition, for B. & S. gage copper wire at a temperature of 20 deg. C., or 68 deg. Fahr.

L. J. VOORHEES.

New York, N. Y.

Pier Illumination Requires Far More Attention to Surrounding Surfaces

OF FIFTY-EIGHT large steamship piers which have been inspected, 42.6 per cent had illumination which was entirely inadequate and generally poor, 51.2 per cent had fair illumination and only 6.2 per cent had good illumination. The average watts per square foot of these electrically lighted piers was 0.16, varying from a minimum of 0.05 watt to a maximum of 0.34 watt. Very much better illumination results would have been obtained in nearly every case had the equipment been well maintained and the surroundings occasionally painted with white or other light paint. Only 3.6 per cent of the piers had white walls and ceilings; 9.1 per cent light-colored surroundings, 20 per cent medium-colored, 52.8 per cent dark, and 14.5 per cent very dark (almost black).

The results of the better conditions in those piers having well-maintained fixtures, light surroundings and adequate illumination were (a) greater actual speed of trucking, (b) markings more easily read, (c) fewer mis-sent shipments, (d) spoilage and theft reduced, and (e) relations with the public greatly improved. This information was supplied by A. L. Powell, lighting service department, Edison Lamp Works of the General Electric Company.

Eliminating Troublesome Crossing of Wires in Armature Coils

TROUBLE which originated at a point where the wires in an armature coil were crossed in winding was recently stopped in an Eastern industrial plant by rewinding the motor with a different type of coil, as outlined below: After a number of coils had burned out on this machine, an investigation showed that these coils were wound as in Fig. 1, with six turns of No. 12 double-cotton-covered wires, which were laid two wide and three deep in the slot. This meant that the

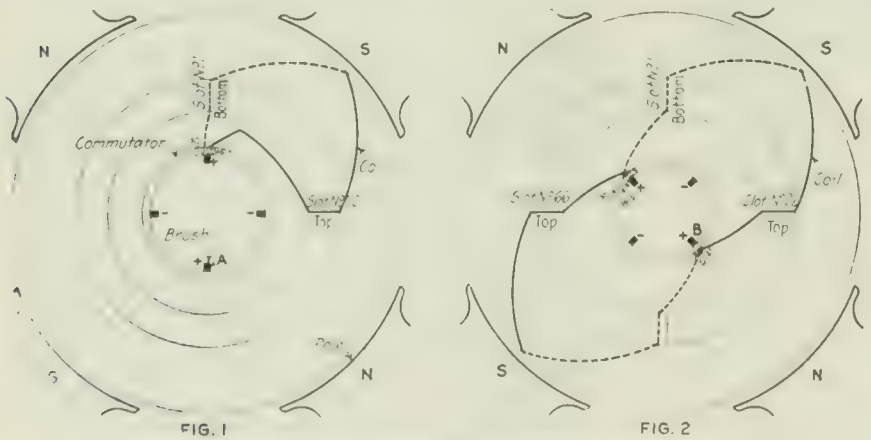


FIG. 1 FIG. 2

TROUBLE FROM CROSSED WIRES IN SIX-TURN COIL STOPPED BY SUBSTITUTING THREE-TURN COIL

wire had to be crossed when winding. These crossovers had been made at the nose of the coils at the lead end, the coil having been wound on a shuttle and pulled into shape. The inspection indicated that when the coils were put in the armature the wires had been pounded at this point, weakening the insulation so that the winding was later short-circuited. As the machine was wound on a single-parallel four-circuit progressive lap winding (Fig. 1), in order to eliminate the crossovers it was decided to rewind the motor with a single-series progressive wave winding, using two No. 12 d.c.c. wires wound in coils of three turns each. In such a coil, as both wires are in parallel, no crossing over is necessary. As the motor was changed from a parallel to a series winding and the two No. 12 wires were used in place of the one No. 12, the voltage of the machine remained the same. Since the motor was reconnected as shown in Fig. 2, it has been operating satisfactorily for more than a year without any trouble.

Bronx, N. Y. C. A. Johnson.

Starting a Synchronous Motor Without Starting Equipment

TO START a 250-hp. synchronous motor after its starting motor had been removed, the writer recently employed a method which consisted in turning over the motor by hand while energy was supplied to it from a generator which was slowly brought up to speed from standstill.

This 2,200-volt synchronous motor is used to drive a stamp battery in a large cyanide mill connected with a silver mine in Central America. An accident resulting in the burn-out of a 25-hp. motor driving some essential part of the mill machinery necessitated the temporary use of the 35-hp. starting motor belonging to the synchronous motor. Barring accidents, it was not anticipated that this would cause any inconvenience, since the stamps are in operation continuously and the synchronous motor is rarely shut down.

However, about three days after the change had been made and before the 25-hp. motor could be rewound, a broken stamp battery belt required the shutdown of the synchronous motor. To get the starting motor back into place would have taken three hours and would have left the mill without the section that the starting motor was then driving. To change the motor back and forth would have entailed a loss of from six to eight hours. Therefore the following course was taken. All load was taken off the two Pelton wheel hydro-electric plants which drive the mill and mine compressor, and both of them were shut down. The synchronous motor and a generator in one of the plants were then tied together by closing their respective oil switches. About ten men were then put on the belt of the synchronous motor and set to turning it as fast as possible. The generator was simultaneously started up, the field rheostat and the exciter rheostat of both the generator and the motor being carefully adjusted as the speed increased by watching the indicating instruments. Before the men turning the synchronous motor realized it the motor was turning under its own power. As soon as this fact was signaled to the power plant the generator speed and voltage were gradually brought up to normal, after which the other power plant and rest of the mill and compressor plant were again put in operation. By skillful handling the total time lost was less than an hour.

Frederick Krug.

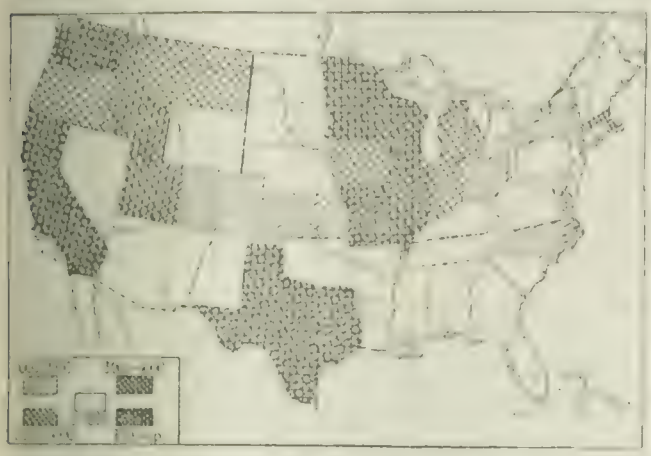
San Juancito, Honduras, C. A.

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

Market for 75,000 Electric Ranges in United States

ACCORDING to data compiled by the National Electric Light Association, there are at the present time about 75,000 electric ranges in use in the United States as compared with only about 10,000 in use in 1915. The map reproduced herewith shows the relative density of electric ranges in use by the states. It will be seen that



DISTRIBUTION OF ELECTRIC RANGES

the range has been generally adopted throughout the country and that its use is not confined to any one section. A conservative estimate shows a possible market during 1920 for approximately 75,000 ranges. Whether this figure will be reached depends largely upon the central stations' ability to finance the additional investment in line and transformer capacity required.

Comparative Costs of Central-Station and Oil-Engine Power

AS THE fuel cost of a private oil-engine plant is quite low, ranging, with the price of oil at 5 cents per gallon, from 4.3 mills to 6 mills per kilowatt-hour, the installation of an oil engine in preference to central-station power is sometimes considered. Some interesting data comparing the operating cost of an oil engine with purchased central-station power are given by W. H. Feldmann of the Consolidated Gas, Electric Light & Power Company of Baltimore.

The economy of oil consumption per brake-horsepower-hour or kilowatt-hour varies with the type and make of engine. However, it is safe to assume an economy of 0.45 lb. oil per brake-horsepower-hour with the Diesel type, and in the larger sizes of the semi-Diesel type 0.6 lb. oil per brake-horsepower-hour is a good figure to use. One oil-engine manufacturer makes the following guarantees on a semi-Diesel-type engine, the fuel oil to have a heat value of not less than 18,000 B.t.u. per pound and contain not less than 1 per cent of water:

Per Cent Load	Lb. Oil per Brake Hp.-Hr.
100	0.49
75	0.49
50	0.57

Several engines of this type installed in a Baltimore factory show that while these efficiencies are obtained when the carbon has been removed from the cylinders and the valves are well ground in, there is a falling off when the engines have been in operation a short time. Numerous tests of similar engines confirm the figure of approximately 10 kw.-hr. per gallon of oil with semi-Diesel engines of about 200 hp.

The fixed costs of an oil-engine plant by far exceed those of plants using other prime movers owing to the high cost of the engine, lack of overload capacity and also to a higher depreciation rate. A quotation recently received from an oil-engine manufacturer on a 360-hp. Diesel horizontal oil engine with twin cylinders is $35,810, f.o.b. factory, and therefore the flat figure of $100 per horsepower can be safely assumed for all engines of approximately this size. Installation charges are correspondingly high, as a very substantial foundation must be provided to eliminate vibration. The price of $100 per horsepower applies only to the engine. Tanks, oil pumps and necessary piping must also be provided.

Oil-engine supporters freely admit an annual depreciation of 8 per cent, and it is not uncommon in connection with estimates of cost of operation of oil-engine plants to use 12 per cent. The depreciation rate of 10 per cent should be adequate, however, and can easily be justified by an investigation of existing plants. It should be expected that the cylinders of an oil engine will wear very rapidly and must be rebored every three years when running under a continuous load. Maintenance records of an oil-engine plant having three 125-hp., two-cylinder semi-Diesel-type engines show that in three years two cylinder heads costing $400 each were broken, three crank shafts were broken and thirteen crank pin bearings were burned out. In this particular plant it is necessary to grind the valves and clean out carbon every two months.

In view of these conditions it would seem advisable to provide for maintenance charges an amount of 1 per cent of the cost of the engine, which may be more than necessary during the first years of operation but will certainly be required after the engine has been in operation for several years.

Because of the high cost of an oil engine and the troubles to which it is subject, it is necessary to provide labor of the highest type, for economy in this branch of the operating cost of the plant will result in higher maintenance charges and more rapid depreciation.

The ideal load for an oil-engine plant is constant and for a long period of the day, as the engine operates at highest efficiency with constant full load, and because of the large investment the engine should not remain idle many hours of the day. However, a drawback to the advantage to be gained by twenty to twenty-four hours' operation per day is the fact that duplicate equipment must be provided to permit necessary cleaning and repairing.

INVESTMENT AND YEARLY COST OF OIL ENGINE PLANT OPERATING TEN HOURS DAILY WITH MAXIMUM LOAD OF 200 KW AND 25 PER CENT DAILY LOAD FACTOR

Investments	Oil Plant	Central-Station Service
One 360-hp. twin-cylinder Diesel oil engine	$35,810.00	
One 250-kw. direct-connected alternator with belted exciter	5,325 00	
Oil tanks	1,500 00	
Foundations, installation charges, building alterations and piping	6,000 00	
Wiring	500.00	
	$49,135 00	
Yearly Operating Costs		
Interest at 6 per cent on $49,135 00	$2,948 10	
Depreciation at 10 per cent on $49,135.00	4,913.50	
Insurance and taxes at 2 per cent on $49,135.00	982 70	
Fuel oil, 331,200 kw-hr. ÷ 12 = 27,600 gallons at 5 cents	1,380 00	
One chief engineer at $50 per week	2,600.00	
One helper at $30 per week	1,560.00	
1,300 gal. lubricating oil at 50 cents	650 00	
Cooling water	541 00	
Waste and supplies	300 00	
Repairs, 1 per cent	358 10	
Breakdown electric service (used three times per year)	1,905 00	
Electric power purchased		$10,876 80
Total cost	$18,138 40	$10,876 80
Cost per kilowatt-hour	0.0547	0 0328

The accompanying tabulation of costs is based on the operation of an average plant for ten hours per day. The cost of energy generated by the oil plant is 5.47 cents per kilowat-hour, while purchased power would cost only 3.28 cents per kilowatt-hour, showing that energy generated by the oil-engine outfit costs 60 per cent more than central-station service. It should be noted that no profit is expected from the investment and no rental of space occupied has been charged.

These cost comparisons were made for normal times—that is, when oil was approximately 5 cents per gallon—and of course the present price of 12½ to 15 cents would still further widen the gap between costs. While the present price of oil is probably not the figure to be quoted in the future, yet it shows the instability of the oil market, in marked contrast with the more stable costs of power offered by central stations.

Thus at the present state of development of the oil engine and with the uncertainty of the oil market this type of prime mover cannot compete with central-station service, and it can be reasonably expected that power rates will more than keep pace with future oil-engine developments.

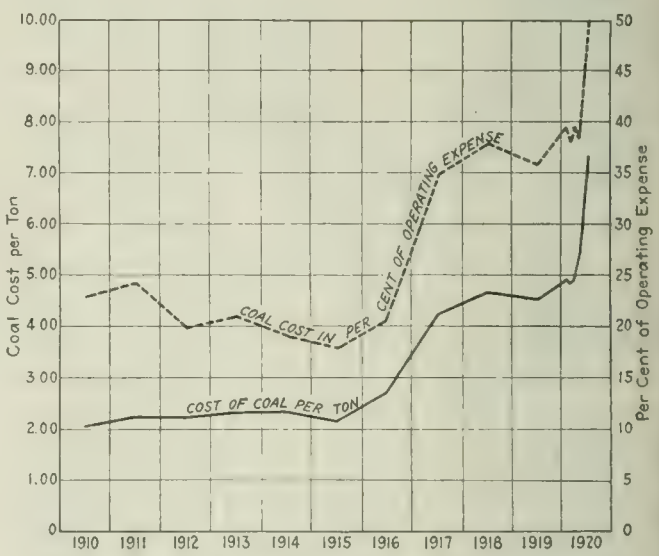
Denver Company Plans Another Record Vacuum-Cleaner Campaign

AS A RESULT of its summer vacuum-cleaner campaign conducted during the month of June, the Denver (Col.) Gas & Electric Company sold 960 Hoover sweepers in thirty days. Clare N. Stannard, secretary and commercial manager, reports that at least 1,500 could have been sold during the campaign had it been possible to secure the sweepers for immediate delivery. This company has been very successful in its vacuum-cleaner campaigns, which are conducted in the spring and fall. During the fall drive last year 1,015 sweepers were sold, bringing the total number connected to the company's lines up to about 12,000. This year the fall campaign is planned for September, when the bogie set is to sell twice the number of cleaners sold in any previous campaign and realize the schedule set by the Hoover company of two cleaners per thousand inhabitants in thirty days.

Ratio of Coal Cost to Total Operating Expenses

IN THE accompanying curves is shown the relation between fuel cost and total operating expense of the Detroit Edison Company during the past ten years. The cost of fuel per ton from 1910 to 1915, the first five years of the period, remained practically stationary, as shown by the solid curve. During the years 1916-1917 the price of coal rose steadily owing to labor shortage, inadequate transportation facilities and general inflation caused by the war.

In 1918 and 1919 the price per ton remained practically constant, but with the beginning of 1920 another sudden increase in price occurred, caused by the switchmen's strike and an increased demand for export purposes.



CURVES SHOWING RELATION OF COAL COST TO OPERATING EXPENSES

The broken line shows the percentage relation of coal cost to operating expense. In the period 1910-1915 this percentage line slopes slightly downward as new equipment and improved methods caused a decrease in the amount of coal required to produce a unit of energy. From 1915 to 1920 the broken line follows the same course as the solid line owing to the same cause in increased cost of coal.

When considered in terms of actual quantities these relations become more significant. While 80,900 tons sufficed for the needs of the company in 1906, the coal consumption had climbed to 450,400 tons in 1915 and to 975,800 tons in 1919. In the first six months of the present year 643,100 tons were used, being on the basis of 1,268,000 tons for the full year. In price the coal has increased from $2.21 per ton in 1915 to $7.37 per ton in June, 1920, or an increase of 233 per cent. The coal used by the Detroit Edison Company in 1920 will cost about $5,300,000 more than the same amount of coal would have cost in 1915.

Growth of Sales Managers' Association Last Ten Years

AT THE 1920 convention of the Sales Managers' Association, held at Association Island, N. Y., July 12 to 14, R. S. Hale, superintendent special research department, Edison Electric Illuminating Company of Boston, reviewed the growth of that organization during the last ten years. An abstract of his remarks follows:

"The idea of the Sales Managers' Association was started in the winter of 1909-10, when the growth of the electrical industry and of the National Electric Light Association and of the Association of Edison Illuminating Companies began to indicate the need of specialization. The Commercial Section of the N. E. L. A. was one development, but the Commercial Section took in companies of all sizes, while the sales managers of the very large companies were finding that each of them had some problems similar to the problems of the other large companies but quite different from the problems that formed the subject of the papers and discussions at the N. E. L. A. conventions. The idea then occurred to the writer, and undoubtedly to others at the same time, that a small convention, almost small enough for the delegates to sit around a table as at a committee meeting, would be of great value. The sales managers of the big companies found themselves getting together in groups at the big conventions, but so much else was going on that the discussions were left unfinished.

"After talking the matter over with the sales managers of the different companies the writer took it upon himself to initiate and plan for a small convention of sales managers only, and from the large companies only, with the hope that if the plan were successful it would be continued in later years. The first convention was called to meet at Briarcliff, N. Y., on July 11, 1910, and the following companies were represented: Edison Electric Illuminating Company of Boston, Detroit Edison Company, Commonwealth Edison Company of Chicago, Philadelphia Electric Company, United Electric Light Company of New York, Edison Electric Illuminating Company of Brooklyn, New York Edison Company and Cleveland Electric Illuminating Company.

"The meeting was so successful that a committee was appointed to arrange for continuing such gatherings. As a result the second convention was held at Briarcliff, July 10 and 11, 1911, with the following additional companies: Union Electric Light & Power Company of St. Louis, Consolidated Gas, Electric Light & Power Company of Baltimore, Potomac Electric Company of Washington, General Electric Company of Minneapolis and Seattle Electric Company.

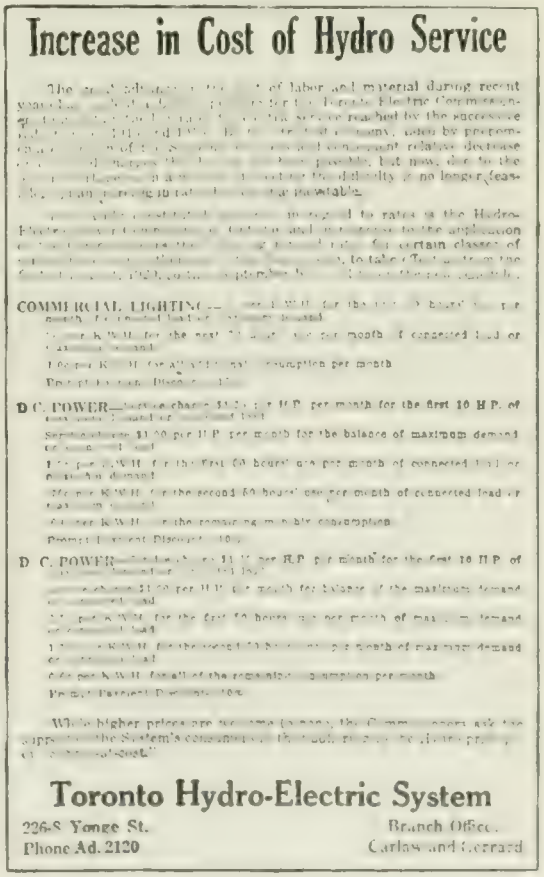
"In 1912 the convention was invited to meet at Association Island, N. Y., and met on Aug. 5, 6 and 7. The two Western companies, Seattle and Minneapolis, omitted to send delegates, but the Toronto Electric Company was a welcome addition. In 1913 the convention again met at the island. The Toronto Electric Company has dropped out, but the Union Gas & Electric Company of Cincinnati and the Public Service Company of New Jersey were represented for the first time. In 1914 the convention was again held at the island under the direction of E. W. Lloyd. In 1915 A. A. Pope was chairman and the convention held at York Cliff, Me. The New York & Queens County Electric Light & Power Company was a welcome addition to the membership. In 1916 J. D. Israel was chairman and the convention was held again at Association Island. The Public Service Company of Northern Illinois was a new number, making fourteen in all.

"At that convention Mr. Beardslee of St. Louis was chosen chairman for 1917, but on account of the war no conventions were held in 1917 and 1918. In the winter of 1918-19, as Mr. Beardslee had left the St. Louis company, Mr. Becker of the New York Edison Company was appointed chairman for 1919 and very ably got the association together again at Association Island. In 1920 the convention was held at the island under the direction of T. I. Jones of Brooklyn, and at its close R. H. Tillman of Baltimore was elected chairman for 1921, with R. R. Young of New Jersey and E. A. Edkins of Chicago on the executive committee.

At this convention the idea of having a formal constitution and bylaws was discussed, but the rule followed up to that time was maintained in force—that the chairman and his executive committee can do anything they choose until their successors are elected, but that in fact they will arrange the program so that the convention will continue to follow the methods of the past."

Toronto Hydro-Electric System Increases Rates

AS A RESULT of the continued high cost of labor and electrical equipment the Toronto Hydro-Electric System has been forced to increase its rates for commercial lighting and power. The increased rates


Increase in Cost of Hydro Service

COMMERCIAL LIGHTING —

D. C. POWER—

D. C. POWER—

Toronto Hydro-Electric System

226-S Yonge St. Phone Ad. 2120

Branch Office Carlaw and Gerrard

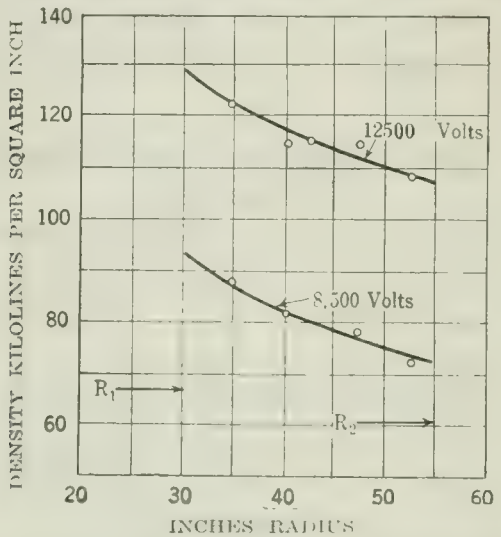
were approved by the Hydro-Electric Power Commission of Ontario to take effect from Aug. 1. The accompanying announcement was issued by the Toronto Hydro-Electric System.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Motors, Generators and Transformers

Flux Distribution in the Core of a Turbo-Alternator.—CARL J. FECHHEIMER.—Tests were made on an axially ventilated alternator. Thus in the center there are axial holes at different radii, and single insulated conductors were inserted in one of each of the various groups of holes. A voltmeter and an oscillograph were connected to the terminals of each of these conductors in turn, and by means of this arrangement the voltages, as well as the wave forms of the voltage, at various depths of



VARIATION IN FLUX DENSITY WITH DEPTH OF CORE OF AN ALTERNATOR

core were determined. The normal voltage of the generator is 11,000, but oscillograms were taken with the terminal voltages of 8,500, 10,000 and 12,500, all at no load. The variation of flux density through the stator core is shown in the accompanying curves, and it is interesting to note that there is comparatively small change in density with the depth, even with negligible saturation, as at 8,500 volts. Much of the flux reaches the back of the core, even though the length of its path is considerably longer than at the inner radius.—*Journal A. I. E. E.*, July, 1920.

Generation, Transmission and Distribution

Losses in Electric Networks.—R. CAPRARO.—The relations between earth impedance and earth voltages, currents and losses in electric networks are studied. With the basis of experiment on a three-phase high-tension system, the author describes a method for controlling, discovering and localizing insulation defects, for the determination of the impedance between neutral and earth and for calculating overvoltages that may be developed.—*Technical Review*, July 20, 1920. (Abstracted from *Elettrotecnica*, Feb. 25, 1920.)

Tidal Water-Power Stations.—G. MANGIN.—One of the chief difficulties in the way of an economical harnessing of tidal motions of the seas is the pronounced periodicity of water supply and the resulting necessity to shut down the plants entirely during one to three hours four times every day. The author, however, shows that by electrically connecting two tidal plants so situated that the tidal motions are displaced with respect to time one plant may be made to supplement the other so that no interruptions need occur. Two such tandem plants could be built in France, one in the neighborhood of Brest, the other at St. Malo, and the article gives a rather detailed discussion of this interesting project. The interconnecting line would be about 200 km. (124 miles). It is shown on tidal diagrams how completely the two plants would co-operate, but owing to slight irregularities in the tide, there would be during twenty days in the year brief periods, of one or two hours at most, when both stations would be short of water simultaneously. If the tandem system is joined to a larger distribution system with other power stations, the supply may be kept up by temporarily overloading the generating equipment in these plants. Because of the different amplitudes of the tidal motion at Brest and at St. Malo, different-size basins would be built at the two stations, an area of 2,000 hectares (4,950 acres) at St. Malo being equivalent in capacity to 6,900 hectares (17,100 acres) at Brest. The average electrical power available in this development is estimated at 70,000 hp., with a maximum of supply of 400,000 hp. and a minimum of 40,000 hp. except for certain periods during at most twenty days of each year, when the supply would be lower. The author points out the high cost of necessary dams and the difficulties of constructing turbines for such low heads.—*Revue Générale d'Electricité*, May 8, 1920.

Traction

The Safety Car.—W. D. BEARCE.—Among the advantages resulting from the introduction of the safety car are: (1) Improvement in service, (2) freedom from accidents, (3) increase in riding habit, (4) lower maintenance cost, (5) reduction in labor cost, and (6) reduction in power consumption. The data in the table illustrate the economies and increased earning possibilities for each car displaced by the lighter safety cars, according to the author. The figures in column A are based on running equal mileage with no increase in cars, those in column B are based on running 40 per cent more mileage with 30 per cent more cars:

Savings Made in	(A) Equal Mileage	(B) 40 Per Cent Increase
Maintenance of equipment, annual saving	$840	$370
Power	1,232	760
Crew wages	3,726	2,280
Total savings	$5,798	$3,410
Increased receipts at 20 per cent		4,222
Increase in net earnings	$5,798	$7,632
Annual percentage of return on cost of safety car, approximately	80	78

The increased service brought about by the use of safety cars is shown by records from eight cities.—*General Electric Review*, July, 1920.

Systems, Installations and Appliances

Testing of Magnetic Compasses.—R. L. SANFORD.—Information gathered at the request of the War Department and the United States Shipping Board. The paper gives a brief discussion of the principal performance characteristics of magnetic compasses together with a description of some of the apparatus which is used at the bureau for testing.—*Scientific Papers No. 382, Bureau of Standards*, June 18, 1920.

Automatic Apparatus for Intermittent Testing.—G. W. VINAL and L. M. RITCHIE.—This apparatus has been devised to meet the needs of the Bureau of Standards in making tests of dry cells and storage batteries, but is applicable to nearly any form of intermittent testing requiring the closing of electrical circuits at regular time intervals. The particular advantages of this type of apparatus for making these tests are: (1) Elimination of rapidly moving parts; (2) accuracy of the time intervals; (3) possibility of making a number of different tests simltaneously with the same apparatus.—*Technical Paper No. 171, Bureau of Standards*, Aug. 14, 1920.

Electrophysics and Magnetism

Loss of Current from Track Circuits.—GIROUSSE.—The present paper forms a continuation of a previous publication which was referred to here some time ago. The author now attacks the very general problem of determining the distribution of equipotential lines around a current-carrying conductor of arbitrary form, which is placed on the surface of and in electrical contact with a semi-infinite body of relatively poorly conducting material. General expressions are obtained by integrating Laplace's equation, but these being rather cumbersome and complicated, they must give place to certain simplified formulas of very satisfactory accuracy. The results of computations according to the new formulas of the potential distribution in several practical cases are demonstrated graphically.—*Revue Générale d'Electricité*, June 26, 1920.

A Rule for Determining the Direction of the Induced Emf.—E. THOVEZ.—The author sets forth a rule for determining the sense of the emf. induced in a conductor in relative motion in a magnetic field. In the case of a conductor in which a current flows the magnetic lines generated by such a current are traced by the corkscrew rule. In the case of a conductor forced through a field by an external force the author gives as the rule that the magnetic lines of the current generated in this conductor are of the same sense as the lines of the magnetic field it meets in its motion. As the lines of the field are deflected, it follows that a force opposite to the driving force acts upon the conductor.—*Science Abstracts, Section B*, July 30, 1920. (Abstracted from *Elettrotecnica*, April 5, 1920.)

Some Applications of Thermionic Valve Rectifiers.—R. L. SMITH-ROSE.—The development of the kenotron rectifier in its application to X-ray tubes and measurement of peak voltages is described. In the second installment the utility of the kenotron rectifier in the production of high-voltage direct current and also the two-electrode valve as a low-voltage rectifier are considered.—*Beama*, June and July, 1920.

Telegraphy, Telephony and Signals

Radio Direction Changes and Variations of Audibility. CARL KINSLEY and ALBERT SOBEY. As a result of a large number of systematic measurements on the direction of incoming signals, using loop reception, variations of considerable magnitude in the apparent direction and occurring within short periods of time were found. Their dependence on length and character of wave are studied. There are certain possible theories of transmission proposed to account for the observed phenomena, notably reflection at the atmospheric isothermal layer (6.2 miles, 10 km. high) and the production of rotating fields at the receiving station.—*Proceedings Institute of Radio Engineers*, August, 1920.

Use of Electric Filters for Elimination of Harmonics in Machine Transmitters for Radio.—K. W. WAGNER.—Because of the very troublesome disturbances from the Nauen overtones, the problem of eliminating harmonics in radio transmitters has had much attention in Germany. In the present paper certain experiments are reported, which were carried out in the Siemens & Halske Wernerwerk with high-frequency wave filters. An impure wave was generated by a 9,500-cycle machine and stepped up by two frequency doublers to 38,000 cycles, that is, 7,800 m. wave length. The audibility of the second harmonic, when using beat reception, was about 16.7 per cent of the audibility of the fundamental, while the relative audibility of the third harmonic was about 12.5 per cent. By interposing between the frequency doublers and the antenna an electric filter consisting of two T-sections (inductance in series, capacity in shunt) the audibility of the second harmonic was brought down to a few per cent, while the higher harmonics were almost entirely suppressed. The absolute audibility of the fundamental was diminished only about 5 per cent by the filter.—*Jahrbuch für drahtlose Tel. und Tel.*, May, 1920.

Miscellaneous

New Swedish Water-Power Legislation.—R. GARDING.—Heretofore hydro-electric development of smaller waterfalls has often been delayed for years owing to the difficulty of reaching an agreement in case, for instance, different interests control the two sides of the river. A law therefore has been passed which makes it impossible for one man to hold up the development of a waterfall where he is part owner. If one of the owners, say *A*, offers to the others to enter upon a joint enterprise for the exploitation of the fall, but the other owner, *B*, declines, then *A* has full right to develop all the available water power on his own account, and the law provides what damages he shall pay to *B*. Such damages do not take the form of money, but *A* has to deliver to *B* a certain amount of electric power (in kilowatts) corresponding to *B's* quotum of the available undeveloped power. However, since *A* has to stand all costs, allowance should first be made for first cost, for loss in machinery and for cost of operation, and finally also for the yearly cost of the transmission from the power plant to the place where *B* receives the power. These various cost items are converted into electric energy (kilowatt-years) and subtracted from *B's* part of the total developed number of kilowatts. Mathematical expressions are given showing how the joint owner *B's* net quotum of energy should be computed.—*Teknisk-Tidskrift, Elektroteknik*, June 2, 1920.

APPLICATION for a certificate of public convenience has been filed by the Pacific Gas & Electric Company to develop 358,000 kw. on the Pit River at a cost of $125,000,000.

ENGINEERING COUNCIL has offered its services to the Federal Power Commission to act in an advisory capacity on technical matters and will confer through its waterpower conservation committee with the commission next Friday.

APPLICATIONS for preliminary permits have been made to the Federal Power Commission for developments in southeastern Alaska, on the Withlachoochee River in Florida, on the Des Plaines and Illinois Rivers in Illinois, on the Susquehanna River in Maryland, on the New River in West Virginia and at Priest Rapids on the Columbia River in Washington.

MORE THAN 1,700 employees of the General Electric Company have completed twenty-five years of service with the company, with a combined term of employment of 47,709 years.

SUCCESSFUL TESTS have just been completed by the Navy in electrically piloting vessels into harbor by means of a submerged armored cable.

ARRANGEMENTS have been completed for the annual convention of the Association of Iron and Steel Electrical Engineers, to be held in New York at the Hotel Pennsylvania Sept. 20 to 24.

FROM NOW until Oct. 1, and possibly until November, except on Saturdays and Sundays, electric lighting is barred for advertising purposes, ornamental outdoor lighting and excessive street lighting in northern California because of power shortage due to low water.

CLASSIFICATION and reindexing of the California Electrical Safety Code and the National Electrical Code is now under way in California to secure in one place all rules on the same subject in order that inconsistencies may be eliminated and uniform inspection followed throughout the State.

PENNSYLVANIA ELECTRIC ASSOCIATION'S plans for its thirteenth annual convention, at Bedford Springs, Sept. 8-11, have been completed and the program has been announced.

LONGER MATURITIES and higher yields characterized the August electric light and power utility financing, of which a total of $13,620,000, the lowest of any month since February, is reported.

TELEPHONIC AMPLIFICATION of the human voice was used for the first time in Boston, Mass., at an outdoor meeting on Aug. 28, when Gov. Coolidge, Senator Lodge and other speakers addressed the Massachusetts Republican League.

A SLIGHT IMPROVEMENT in collections was noted at the end of last week in New England jobbing circles. Room for much better credit conditions exists, but an optimistic note was sounded by a number of widely separated jobbers as to the outlook.

News in Brief

Summary of Market Conditions and of Recent and Approaching Happenings of Importance to the Industry

BETTER LABOR CONDITIONS are here, asserted a number of New England electrical manufacturers, to whom inquiry was directed last week by the ELECTRICAL WORLD.

A VERY FAVORABLE reaction is coming from those societies which were invited to join the Federated American Engineering Societies, from almost all of which replies have now been received.

BECAUSE COAL was accumulating at tidewater shipping points the Interstate Commerce Commission has suspended until Sept. 6 the order granting to New England priority of coal shipments by water.

THE Water Power League of America has arranged for a two-day convention in Washington on Oct. 7 and 8.

A $5,000,000 ISSUE of 7-per cent ten-year gold notes of the Hartford Electric Light Company has just been placed on the market at a price to yield 7⅛ per cent.

WESTERN MEMBERS of the A. I. E. E. are urging that the annual convention be held next year at Salt Lake City in conjunction with the Pacific Coast convention.

ESTABLISHMENT by the Ford Motor Company of an educational department, to be known as the Ford Technical Institute, with university rank, which will grant degrees in mechanical, electrical and chemical engineering, has been announced.

THE Worcester (Mass.) Electric Light Company, it is reported, will increase its coal-excess rate for power on account of the advance in freight rates probably from the present excess of 1½ mills per dollar advance in coal to 2 mills.

STRONG BELIEF in a gradual and natural readjustment of business conditions without financial or economic disorder is expressed by the committee on statistics and standards of the Chamber of Commerce of the United States in its semi-annual review of crop and general business conditions issued on Monday.

THE RIGHT of the Interstate Commerce Commission to issue coal shipment priority orders to the Northwest, New England and to utilities has been raised by certain Ohio cities.

REPRESENTATIVES of the Michigan, Wisconsin, Illinois and Indiana electric associations on Aug. 27 organized the Great Lakes Section of the N. E. L. A.

THE AMERICAN Telephone & Telegraph Company announces that it intends to change as quickly as practicable all its press news service over to printing telegraph.

STOCKHOLDERS of the Philadelphia Electric Company have ratified the proposal to authorize $15,000,000 of 8 per cent cumulative preferred stock, $6,000,000 of which will be offered to stockholders shortly.

FUEL AND CAR shortage has shortened the supply of bare wire, although copper rods are plentiful.

GENERAL ELECTRIC'S business for the first six months of the year was running at an annual rate of $380,000,000 and Westinghouse business during the second quarter of the year at $160,000,000 a year.

SOME IMPROVEMENT is beginning to be noticed in the electrical business as the first of the fall buying appears, although generally summer market conditions continue to prevail.

STOCKS CONTINUE to get better and deliveries are improving, but nowhere are there any complete stocks reported.

PUBLIC UTILITIES of New England, according to a survey made by the Boston News Bureau, have on hand but 28.7 per cent as much coal as they should have at this time.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Engineering Council May Advise Federal Power Commission

NEXT Friday the Federal Power Commission will confer with the water conservation committee of Engineering Council, which has tendered its services to the commission to act in an advisory capacity on technical matters. The proffer carries the provision that the committee is to advise on technical matters only, mainly the financial features of the law, such as depletion, amortization of reserves, rental charges and allocation of earnings. Calvert Townley is the chairman of Engineering Council committee. Other members are Charles T. Main, H. Hobart Porter, M. O. Leighton, Allen Hazen, Arthur P. Davis, Arthur E. Morgan and F. W. Scheidenhelm.

Federated Engineering Societies Favorably Received

REPLIES to the letter of invitation to join the Federated American Engineering Societies have been received from nearly every society, according to R. L. Humphrey, chairman of the joint conference committee. While the matter will have to be placed before the membership of each society for action, the replies to the invitation to join show a very favorable reaction.

In addition to the A. I. E. E., A. S. M. E., Detroit Engineering Society and Technical Club of Dallas, which were mentioned in the ELECTRICAL WORLD last week, the Cleveland Engineering Society has joined the federation.

The matter is actively before a number of societies and a decision in most cases is expected prior to the November meeting of the federation. The American Society of Civil Engineers' governing board already has ordered a letter ballot to be taken. The mining engineers have referred the matter to their finance committee, which is expected to take favorable action, and formal acknowledgment is expected at the fall council meeting. The American Society for Testing Materials is about to send out a questionnaire to its membership.

California Power Administrator Curtails Lighting to Save Power

FURTHER tightening of the power use in California, necessitated by the power shortage caused by lack of rainfall last winter, is seen in the following order issued on Aug. 31, 1920, by State Power Administrator H. G. Butler to power companies and city mayors of central and northern California. The order, which is effective immediately and continues in effect until Oct. 1, excepting only Saturdays and Sundays, states that "No electric energy shall be furnished or used for advertisements, notices, announcements or signs designating the location of an office or a place of business or nature of any business; for the external illumination or ornamentation of any building; for lights in the interior of stores, offices or other places of business when such stores are not open for business; for excessive street lighting intended for display or advertising purposes. This order shall not be construed to prohibit furnishing or using electricity for such lights as may be required by law or public safety."

New England Coal Priority Suspended for Few Days

SHORTAGE of vessels at tidewater coal-shipping ports was given by the Interstate Commerce Commission as its reason for issuing an amendment to Service Order No. 11, which suspends from Sept. 2 to Sept. 6 the order giving New England fuel priority. Large accumulations of coal have taken place, especially at Baltimore. The amendment may be extended if the congestion at ports is not relieved.

Manufacturers Attend N.E.L.A. Executive Committee Meeting for First Time

REPORTS of progress were made and budgets presented for approval by the national sections and geographic divisions at the executive committee meeting on Wednesday of the National Electric Light Association. A net gain during the year of 297 Class A members was reported. The publicity program was outlined and approved. Indorsement was given to the action of the American Water Works Association in approving at its recent convention the grounding of secondaries of electric light systems to water piping.

This meeting was the first of a series of three big meetings of the association's executive committee planned for the year. The next will be held in the East in December and the third in Chicago in March.

For the first time manufacturers appeared at an executive committee meeting. Under the new classification adopted at the Pasadena meeting E. W. Rice, General Electric Company; E. M. Herr, Westinghouse Electric & Manufacturing Company, and W. A. Layman, Wagner Electric Manufacturing Company, were appointed members of the committee. Messrs. Rice and Herr were present and Mr. Layman unfortunately was detained en route by transportation delays.

Others who attended the meeting were: President Martin J. Insull, Vice-Presidents M. R. Bump and Frank W. Smith; H. C. Abell, treasurer; W. H. Atkins, Edison Electric Illuminating Company of Boston; T. D. Crocker, president North Central Division; C. R. Hayes, president New England Division; E. W. Lloyd, Commonwealth Edison Company, Chicago; W. C. Lounsbury, president Great Lakes Division; W. R. Kenney, presi-

dent Pennsylvania Electric Association; Walter Neumuller, New York Edison Company; E. A. Phinney, president Rocky Mountain Division; O. H. Simonds, president Middle West Division; M. S. Seelman, chairman Commercial Section; Leon H. Scherck, president Eastern New York Section; M. S. Sloan, vice-chairman Public Relations Section; J. C. Van Duyne, chairman Accounting Section; M. H. Aylesworth, executive manager; S. A. Sewall, acting secretary; A. J. Marshall, committee secretary; Fred W. Herbert, superintendent service department; George F. Oxley, director of publicity; W. J. Canada, electrical engineer; Eugene Vinet, secretary Canadian Electrical Association; and by invitation A. B. Lisle, Narragansett Electric Lighting Company, Providence, R. I.; H. T. Sands, A. B. Tenny Company, Boston, Mass.; R. S. Hale, Edison Electric Illuminating Company of Boston, and R. V. Prather, secretary of the new Great Lakes Division.

Right of I. C. C. to Issue Coal Priorities Questioned

IN A petition for modification of the Interstate Commerce Commission's Service Order No. 10, for priority of coal shipments to the Northwest, Cleveland, Akron and other Ohio cities have raised the question whether the commission has exceeded its authority under the transportation act to issue priority orders.

"If the commission did not have the power to issue Service Order No. 10," said Chairman Clark, "then it follows that it had no power to issue priority orders with respect to supplying coal to public utilities and public institutions. If that is true, then there is nothing to do but to keep hands off and let the coal go where it will."

At the request of the commission briefs will be filed by all those who care to give their view as to the emergency powers of the commission under the car service sections of the transportation act.

Pending the filing of these briefs, an attempt will be made to work out a plan for relieving the cities of Cleveland and Akron and other Ohio cities.

Great Lakes Section of N. E. L. A. Organized

AT A MEETING of representatives from the electric associations of Michigan, Wisconsin, Illinois and Indiana held in Chicago on Aug. 27 the Great Lakes section of the National Electric Light Association was organized. The following officers were elected at that time: President, W. C. Lounsbury, Superior, Wis.; vice-president, Phil Palmer, Lafayette, Ind.; secretary-treasurer, R. V. Prather, Springfield, Ill. Chairman of the various sections were appointed as follows: Public Relations Section, A. C. Marshall, vice-president Detroit Edison Company; Commercial Section, John G. Learned, vice-president Public Service Company of Northern Illinois; Technical Section, George E. Lewis, Detroit Edison Company, Ann Arbor, Mich. The chairman of the Accounting Section has not yet been appointed, but it is expected the selection will be from Indiana.

The general conference of the Great Lakes Section will be made up of three delegates from each member state, each delegation having one vote. Semi-annual meetings of the delegates are to be held in April and July of each year and special meetings may be held upon the call of the president. At the present time it is not the intention to hold an annual convention of the section other than the executive committee meeting. The associations of the four states comprising this geographic section will continue their annual conventions.

Great Western Company Issues Bonds to Complete Caribou Plant

TO COMPLETE its Caribou power project and a new 165,000-volt steel tower transmission line from the Caribou plant to Valona the Great Western Power Company of California has issued $3,500,000 in 8 per cent ten-year bonds. This plant will have an initial installed capacity of 44,000 kw. and the hydraulic development will be sufficient to increase the capacity to 66,000 kw. by the addition of another unit.

It is expected to have the Caribou plant in operation early in the spring of 1921 and the additional capacity of 44,000 kw. will materially relieve the power shortage in San Francisco and the territory served by the Great Western Power Company. H. P. Wilson, vice-president of the company, stated, however, that practically the entire capacity of the new plant was already contracted for and that the installation of the additional unit probably would be made in the near future.

Original estimates on the cost of this project, including the transmission line, were $6,057,430. It is now estimated that the cost will be $10,674,897. Increases in cost of all materials and supplies, increases in wages and difficulty in keeping employees permanently engaged on the construction work were given as reasons for the increased costs.

Further Applications for Water Power Permits

THE Tongass Pulp & Paper Company has applied to the Federal Power Commission for a preliminary permit for the utilization of Fish Creek, Swan Creek, Big Lake, Mirror Lake and Swan Lake, in southeastern Alaska, for power purposes and authority to construct power plants, pulp and paper mills on Carroll inlet. The application is made by M. M. Lyter, attorney, Alaska Building, Seattle, Wash.

The Cove Company of Oscala, Fla., has applied for a preliminary permit to erect a dam and power house on the Withlachoochee River above Stokes Ferry for the purpose of generating hydro-electric power.

The State of Illinois, in the person of Gov. Frank O. Lowden, has applied for license covering power development on the Des Plaines and Illinois Rivers.

W. A. Bromgold of York, Pa., has applied for a preliminary permit to erect a dam on or across the Susquehanna River at or near Cumberland, Md., below the mouth of Yellow Breeches.

The Tri-State Power & Milling Company of West Virginia and the Tri-State Power Company of Virginia have asked for a preliminary permit to erect a dam and a power house for hydro-electric purposes at a point below Anderson Falls of New River, in Summers County, W. Va. The application was filed by O. L. Stearnes of Salem, Va.

The Priest Rapids Irrigation District has made application for a preliminary permit to develop power on the Priest Rapids of the Columbia River. The application was filed by W. J. Kincaid of White Bluffs, Wash.

Geographic Division of Institute Arousing Interest

CONSIDERABLE interest is being taken throughout the country in the division of the membership of the A. I. E. E. into geographic districts, from each of which a vice-president will be elected. This action was decided upon by vote of the membership last spring.

As a result a special committee has been appointed to make recommendations to the directors regarding the number of districts and how they shall be defined. H. H. Barnes is chairman of this committee, which will hold its first meeting on Sept. 9.

Unification of Codes in California

CONSOLIDATION of the California Electrical Safety Code and the National Electrical Code (Fire Code) is now under way by a California committee, with S. J. Lisberger, engineer of the San Francisco district of the Pacific Gas & Electric Company, as chairman. The consolidation will largely be a subject classification and a reindexing so that all similar rules of both codes relating to the same subjects will be congregated in one place under the correct index heading. At the same time inconsistencies will likely be removed and uniform inspection will follow throughout the state. It has also been suggested that the new code recognize the labels of the Underwriters' Laboratories.

The committee of revision is representative of manufacturers, jobbers, contractor-dealers, commercial bodies and labor unions.

Co-operative Movement in British Columbia

FURTHER plans of the British Columbia Electrical Association have been announced by the advisory committee, whose names were printed in the ELECTRICAL WORLD, Aug. 28, 1920, page 448. The foundation of the association will be educational in nature and it will not be the intention to seek directly the sale of more electric appliances or service but to advocate such business methods and co-operation as will result in better business and more general prosperity of the industry. The association will broadly follow the plan of the California Electrical Co-operative Campaign and that to be followed by the Northwest Electric Light & Power Association. The plans of the latter were reported in the ELECTRICAL WORLD, July 17, 1920, page 140.

In detail the British Columbia Association plans to (1) promote the use of proper accounting methods by dealers; (2) assist contractor-dealers to improve their merchandising methods; (3) encourage the use of more advertising by dealers and urge the use of sales helps and advertising issued by manufacturers and jobbers; (4) assist dealers to improve the appearance of their stores and window displays; (5) promote the use of high quality material and workmanship by contractors; (6) encourage contractors to adopt standard practice methods of estimating costs; (7) urge upon contractors and architects the installation of sufficient outlets for the convenient use of all electrical appliances; (8) urge contractor-dealers to make reports to headquarters of appliances sold for the proper guidance of the advisory council; (9) urge non-member contractor-dealers to become members of the Electrical Contractor-Dealer Association of British Columbia; (10) promote better acquaintance and co-operation between central station employees and contractor-dealers and their employees.

385,000-Kw. Pit River Development to Require $125,000,000

THE development of the 385,000 kw. available on Pit River in Shasta County, Cal., 220 miles north of San Francisco, by the Pacific Gas & Electric Company has reached the step where the company has filed an application with the Railroad Commission of California for a certificate of public convenience and necessity.

An ultimate expenditure of $125,000,000, divided equally between power plants and distribution systems, will add 7,000,000 kw.-hr. to the daily capacity of the company's system, which is about double the present capacity of all their plants. The peak load in 1920 is estimated to reach 254,000 kw. and in 1928 388,000 kw., with an output in the latter year of 2,170,000,000 kw.-hr. The present plant capacity of 350,875 kw. will be increased to 590,875 kw. by the addition of 159,000 kw. of hydro-electric plant capacity.

The present plans call for transmission of the Pit River output at 110,000 volts to a point of connection with the 110,000-volt line now in operation between San Francisco and the Drum power station, 144 miles northeast of San Francisco. It is planned that the Pit River power will ultimately be transmitted at 220,000 volts directly to the San Francisco Bay district.

Longer Terms and Higher Yields in August Financing

LONGER maturities and a slightly higher average yield characterize the electric light and power public utility financing for August. The total of $13,620,000, the lowest for any month since February, is made up of bond issues of five companies with no new stock issued. For the first time in three months there is a yield as low as 7 per cent. This is a $1,500,000, twenty-year first mortgage bond issue of the Lawrence Gas Company with a 7 per cent interest rate, which was offered at par. One other issue appears at par offered by the Great Western Power Company of California and bearing 8 per cent. This last issue, however, amounting to $3,500,000 in ten-year bonds, is to be redeemed at 105 and will yield the investor from 10.31 to 8.33, the exact amount to depend on the date of recall. The following table gives the five issues in detail:

Company	Amount of Issue	Period	Class of Security	Rate of Interest	Per Cent Yield	Offered at
Lawrence (Mass.) Gas Company	$1,500,000	20-year	First mortgage	7	7	Par
Adirondack Power & Light Corporation	5,620,000	30-year	First and refunding mortgage bonds	6	7.25	84.50
Pacific Power & Light Company	1,000,000	10-year	First lien and refunding mortgage bonds	8	8.25	98.25
Southwestern Power & Light Company	2,000,000	5-year	Bond secured gold notes	8	8.50	98
Great Western Power Company of California	3,500,000	10-year	General mortgage convertible bonds	8	10.31 to 8.33 according to date called	Par
Total	$13,620,000					

Radio Engineers Discuss Progress in Germany and Austria

AT THE first monthly meeting of the Institute of Radio Engineers for the 1920-1921 season, which was held in New York City last Wednesday night, a paper describing types of radio apparatus developed in Germany and Austria during and after the war, read by Dr. A. N. Goldsmith, was a careful translation of the original, "Recent Progress in Radio Communication in Germany and Austria," submitted by Dr. Eugene Nesper of Vienna, Austria. The consensus of the discussion was that, while the types of radio telephone and telegraph sets described showed facilities for wide ranges in adjustment and consummate skill in getting a great amount of apparatus into a small space, this appeared to have been accomplished at some expense in simplicity and reliability.

Dr Goldsmith presided in the absense of the president and the attendance indicated a promising season for the radio engineers.

Europe's Trade More Valuable than Bonds

THE cancellation of the loans our allies obtained from us during the world war would be of great benefit to the electrical industry, is the opinion of Festus J. Wade, president of the Mercantile Trust Company, St. Louis, who was chairman of the committee which represented the American Bankers' Association at the recent meeting of the International Chamber of Commerce in Paris, and who was for many years a director in the North American Company, which controls the St. Louis, Milwaukee and other central-station properties.

In discussing the details of his proposed plan with a representative of the ELECTRICAL WORLD Mr. Wade said:

"It is not with charitable, philanthropic or altruistic motives, but to help keep our factories running and our people employed, that I advocate the cancellation of the $10,000,000,000 that our allies borrowed from us after we entered the world war. It is simply a straight business proposition.

"Manufacturers of electrical and other goods are looking overseas for orders to keep their factories running to capacity, but, owing to the great depreciation of foreign exchange, our European customers cannot buy so much for their money in the United States as they can obtain elsewhere. Furthermore, the depreciated rates of exchange permit European manufacturers to undersell American-made goods in the United States, and the fact that England's exports in July, 1920, were the greatest in her history indicates that serious foreign competition in our home markets is not so far off as some people seem to think.

"Under the circumstances I believe the business of our allies is worth much more to the people of this country than our allies' bonds. We need Europeans as buyers of our products, not as sellers of their goods, so I propose that the United States pay our allies $10,000,000,000 (by cancelling their debts to this country) if they will agree to re-establish the rates of exchange on their currencies at par and hold the exchanges at their normal value for a period of five years.

"It is not intended that the debtor nations should profit by our cancellation of their obligations. It would be done primarily to restore the credit of European countries in the United States to a point where they could buy more in this country with their pound sterling or franc than in any other part of the world. The stronger nations of Europe whose debts we cancel should be required to cancel the debts of smaller and weaker nations to an equal extent. This would aid materially in bringing the finances of the entire world back to a peace basis and would greatly increase the purchasing power of some of the best present and prospective buyers of American products."

Iron and Steel Electrical Engineers Complete Convention Plans

ARRANGEMENTS for the annual convention of the Association of Iron and Steel Electrical Engineers, to be held Sept. 20 to 24 in New York, at the Hotel Pennsylvania, have been completed. The plans call for an extensive program of technical sessions, entertainment and exhibits. The following official program has been announced:

MONDAY, SEPT. 20

Morning—Registration and business session (for members only) with reports of committees and election of officers.

Afternoon—"Practical Education of Steel Mill Electricians," by W. A. Cornwell; "Relation of Standardization in Electrical Equipment to Safety," by Walter Greenwood.

TUESDAY, SEPT. 21

Morning—"Power Transmission for Industrial Plants," by D. M. Petty; "Underground Transmission," by A. L. Freret.

Afternoon—Excursion.

WEDNESDAY, SEPT. 22

Morning—"Some Considerations in the Determination of Auxiliary Drives," by Gordon Fox; report of electrical development committee, E. S. Jefferies, chairman.

Afternoon—"The Reversing Electric Mill Considered from the Standpoint of Tonnage," by K. A. Pauly.

Evening—Annual banquet.

THURSDAY, SEPT. 23

Morning—"Centralized Turbine Generating Stations for Steel Mills," by T. E. Keating; "Current Limit Reactance," by R. H. Keil.

Afternoon—Report of electric furnace committee, E. T. Moore, chairman.

FRIDAY, SEPT. 24

Morning—Standardization committee report, W. T. Snyder, chairman.

Afternoon—Excursion.

Ship Successfully Guided Into Harbor by Radio Detectors

TESTS of a method of guiding ships into port during fogs by means of a cable laid in the channel and energized electrically were successfully carried out at New York harbor last Tuesday under the direction of Commodore R. F. McConnell of the U. S. Navy.

The system consists of a 500-cycle, 500-volt, 2-kw. generator connected to a single-conductor armored cable through a sending key. A current of about 5 amp. is sent through the conductor, returning through an earth connection, and the current is interrupted according to a fixed series of characters in the Morse code. Two detectors, consisting of identical coils of wire, are let down over the sides of the vessel approaching the harbor and a telephone receiver may be connected to either detector, through vacuum tube amplifiers. If one coil is nearer the cable than the other

a louder signal is received from that side and the two give equal reception when the ship is over the cable.

For the purpose of trying out this method of guiding ships a cable was laid from the Ambrose Channel light ship to Fort Lafayette, a dredged channel difficult of navigation. Ships are guided to this point by means of radio compasses or goniometers, located along the coast. Having reached the light ship the guiding cable may be picked up without difficulty. In the tests already referred to a tug, making 10 knots, was piloted over the length of the cable without difficulty, being directed entirely by means of the telephone detectors.

Publicity a Constructive Force When Properly Used

PUBLICITY properly used is a constructive force, J. B. Wooten of New York maintained in his address on "Publicity" at the Michigan Section, National Electric Light Association, at Ottawa Beach, Mich., held on Tuesday to Thursday of last week. He asserted that publicity was a constructive force that has been largely used for destructive purposes. That the utility problem in its relation to publicity must be considered as a problem of the public, otherwise publicity can quickly degenerate into pure propaganda, was pointed out.

The meter maintenance methods of the Consumers' Power Company were outlined by J. C. Langdell. The minimum time interval between alternating-current residence meter tests is believed to be about thirty months, though the possibility of an extension is seen particularly with the newer types of meters, which do not seem to require as close supervision as the older types. Large capacity alternating and direct-current meters require testing from a monthly period in some cases to a maximum period of one year. The adoption of one type of demand meter by a company tends to eliminate operating difficulties because men are not forced to become familiar with different types.

Standardization of materials simplifies and reduces store-room stocks, permits economies by quantity purchasing, provides for interchangeability of parts and effects labor savings by having construction men always familiar with apparatus and materials used, was stated in B. L. Huff's paper on "Standardized Construction—a Money Saver."

Training of the farmer to the use of electrical apparatus as a means of better farm working and living conditions, and the duty of the central station in assuming its part in this training, was urged by Prof. A. R. Sawyer of the Michigan Agricultural College in discussing "Standardization of Electric Farm Equipment."

Expense per consumer has been reduced 14 per cent, errors have practically been eliminated and complete relief from nervous strain for the clerical force has been secured by the substitution of machine billing and ledger posting on the Consumers' Power System, it was stated by Charles H. Hunberger of Grand Rapids. Also it was brought out in the discussion between Mr. Hunberger and J. D. Jacobus of Detroit that by the substitution of higher caliber meter readers and closer supervision a necessary increase of 50 per cent in salaries has increased the cost per consumer only 2.2 per cent.

The necessity of putting statistics in form for ready reference for those central-station executives and employees who must use them was emphasized by H. A. Snow in describing the statistical department of the Detroit Edison Company.

The committee on valuation and rates emphasized the necessity of educational work along these lines. Where utilities have suffered for a long period by reason of rising operating costs, the effect of rising fixed charges due to increased construction and financing costs, it was pointed out, is yet to be felt in its full force. This was also pointed out in the address of President Insull of the national association, who also called to attention the small portion of increased gross receipts that are going to net and the using up of reserve station and system capacity.

The following officers were elected: President, George E. Lewis, Ann Arbor; first vice-president, J. K. Swanson, Jackson; second vice-president, E. Holcomb, Alma; secretary and treasurer, H. Sylvester, Ann Arbor; executive committee, W. M. Lewis, Muskegon; S. B. Tuell, Houghton; H. A. Fee, Adrian; R. E. Keller, Kalamazoo, and B. E. Waltz, Ludington. It was regretted by those in attendance that President W. M. Lewis was unable to be present because of illness.

Pennsylvania Electric Association Meets Sept. 8-11

FOR the thirteenth annual convention of the Pennsylvania Electric Association, state branch of the N. E. L. A., to be held at the Bedford Springs Hotel, Bedford Springs, Pa., on Sept. 8, 9, 10 and 11, the following program has been prepared:

WEDNESDAY, SEPT. 8

Afternoon—Registration.
Evening—Entertainment.

THURSDAY, SEPT. 9

Morning—Address of President W. R. Kenney and routine reports.

Afternoon—Commercial session: Report of rate committee, Henry Harris, chairman; "Power Service," by G. M. Gadsby, West Penn Power Company, Pittsburgh; "Electrical Merchandising," by Thomas W. Berger, Philadelphia Electric Company; "Value of Purchased Power," by Joseph McKinley, Duquesne Light Company, Pittsburgh.

Evening—Entertainment.

FRIDAY, SEPT. 10

Morning—Technical session: Report of engineering committee, Paul Spencer, chairman; "Coal Supply and Distribution," by J. D. A. Morrow, vice-president National Coal Association, Washington, D. C.; Charles J. Russell, Philadelphia Electric Company, will present an abstract of the report on power factor by Messrs. Russell, Gaskill and Currier of the Philadelphia Electric Company; "Coal Storage," by O. P. Hood, chief engineer, Bureau of Mines, Washington, D. C.

Afternoon—Operating session: "Economical Arrangement of Pole-Line Transformers," by George S. Humphrey, West Penn Power Company, Pittsburgh; "Family Spirit in the Organization," by Frank F. Hennaman, Penn Central Light & Power Company, Altoona; and addresses on safety by S. B. Hare, president Railway Claim Agents' Association of the United States, and H. B. Harmer, safety engineer Philadelphia Electric Company.

Evening—Addresses by H. M. Aylesworth, executive manager National Electric Light Association, New York, and Hon. William D. B. Ainey, chairman Public Service Commission of the Commonwealth of Pennsylvania.

SATURDAY, SEPT. 11

Morning—Accounting and executive sessions: Report of accounting committee, H. R. Kern, chairman; an address on "Income and Excess Profits Taxes," and report of public policy committee.

Hartford Company Issues $5,000,000 of Notes for Additions

A NEW issue of $5,000,000 of ten-year 7 per cent gold notes of the Hartford (Conn.) Electric Light Company, due Sept. 1, 1930, has been placed on the market at 95.68, yielding about 7⅜ per cent. Proceeds of these notes will be used to provide additions to the company's power plants and distribution system.

It is interesting to note that this company has no mortgage or other funded debt. The company has outstanding $10,000,000 of capital stock, all of one class, par $100 and selling at $140 per share.

To Use Printing Telegraph for Press Service

AS FAST as it is practicable to do so the American Telephone & Telegraph Company expects to change its press news service over to printing telegraph machines. For several years the company has used the printers for a portion of this service in New York, Boston and Chicago, and much of the company's interoffice communication between New York and Chicago has been carried on by this means.

The printing telegraph has now been developed so that, depending on the class of service, a transmitting speed of twenty to sixty words per minute can be obtained, and by means of synchronized machines sixteen messages, eight in each direction, have been sent over one wire.

At the office of the American Telephone & Telegraph Company it was stated to a representative of the ELECTRICAL WORLD that while the change from the manually operated telegraph to the printers would be gradual there was no doubt but that the printing telegraph would eventually become universal.

Duty of Commissions to See That Utilities Prosper

SPEAKING before the convention of the United States Independent Telephone Association at Winona Lake, Ind., recently, Paul P. Haynes of the Public Service Commission of Indiana declared that there had been entirely too much wailing on the part of utilities and unthinking criticism on the part of the public, and entirely too little constructive effort along educational lines on the part of all. "We all know," Mr. Haynes continued, "that the public has a common interest with the utility, that there is a natural and proper reciprocal relationship between the producer and consumer of the utility product.

"The public interest demands improvements which can only be made by the expenditure of millions upon millions of dollars. These millions of dollars cannot be expended unless the corporations are able to secure them. The corporations cannot secure them unless they are able to show the financial houses from which the money must be secured that the business into which these millions are going is a solvent, healthy and profitable business. The business of utilities cannot be solvent, healthy and profitable unless the public safeguards and protects the utility by adequate rates.

"I may add that it is not only the duty of regulatory bodies to maintain the solvency of these enterprises, but it is their bounden duty to see to it that the utilities they regulate are also healthy and profitable."

Additional Plant Capacity Rushed by San Joaquin Company

ON THE heels of the starting of the new Kerckhoff power house of the San Joaquin Light & Power Corporation announcement is made that ground was broken for a natural-gas-burning steam plant in Kern County, 28 miles from Bakersfield, Cal. The new plant will be rushed to completion to meet the heavy power demand of next summer. All machinery for the first unit, consisting of a battery of tubular boilers, a steam turbine and generator of 17,500 hp., has been ordered and will begin to arrive as soon as the steel and concrete power house is completed, which is scheduled for Dec. 15. It is expected that this new plant will be in operation by next April.

Five units are planned for this plant, which will be one of the largest natural-gas-burning steam plants in the world. About 7,000,000 cu.ft. of gas will be consumed per day for each unit. A transmission line of 110,000 volts with a capacity of 30,000 kw. will connect with the Kerckhoff power line at the Corcoran substation. Another line will connect with the McKittrick substation, from which will be served the West Side oilfield districts of Kern County. The cost of the plant will be $1,750,000 for the first unit and $1,250,000 for each additional unit.

General Electric Has More Than 1,700 Twenty-five-Year Service Employees

MORE than 1,700 employees of the General Electric Company have completed twenty-five years or more of service with that organization. Their combined term of employment totals 47,709 years and their total age is 91,550 years.

At the fourth annual outing of the company's Quarter Century Club, composed of these long-service workers, which was held at Schenectady last week, G. E. Emmons, vice-president in charge of manufacturing, was presented with a gold replica of the Quarter Century Club insignia in recognition of his completion of twenty-five years as manager of the Schenectady works.

Guarding Against Fuel Shortage



COAL being stored for winter months by United Electric Light Company seven miles from its main steam station at State Street, Springfield, Mass. Increased facilities to store 50,000 tons are also being provided at the State Street station.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest

Electrolytic Zinc Smelter in Norway.—The electrolytic zinc smelter which has been under construction at Glanfjord, Norway, is soon to be opened. It will be the first of its kind in Norway and it is thought that its opening will greatly stimulate the development of new mines and increased production of the old workings. The production of zinc ore in Norway, according to the latest available statistics for the years 1916 and 1917, was respectively 1,121 and 296 short tons.

Electricity on British Canals.—Horses are to be replaced by electricity on an important section of the canal connecting Birmingham, England, with the Severn River. In this way it is expected that the speed of the boats will be doubled. The overhead trolley system will be used. An investigation into the practicability of hauling canalboats by storage batteries is also being made.

Louisville Show Postponed.—The Louisville (Ky.) Electrical Exposition, which was scheduled for Oct. 25 to 30 inclusive, has been indefinitely postponed. The reasons given by the management are the high cost of decorations, labor and advertising matter and the reluctance on the part of manufacturers and jobbers to spend any money in this class of advertising at the present time.

Progress in Electroculture.—Experiments in the Conservatoire des Arts et Metiers at Boulogne-sur-Seine, France, on electroculture by brush discharge are reported to have had encouraging results. From July to October last year the experimenter employed currents of about 20,000 volts, burying the negative pole in the soil and suspending iron wires 6 ft. 8 in. above the ground and about 2 ft. 8 in. apart. The current was applied twice every day for one and a half or two hours. All the plants were fairly advanced when the treatment began. Tobacco plants grew to more than twice the height of those that underwent normal treatment and blossomed in September when the others did not; cabbages improved; potatoes increased by 25 per cent in yield and by 4 per cent in starch, and sugar beets gave 20 per cent more sugar.

Comparison of Norwegian and Swedish Water Powers.—According to a recent comparison, potential water power in Norway amounts to 7,500,000 hp. as compared with 6,000,000 hp. in Sweden; actual development is put at 1,250,000 hp. in Norway and 1,100,000 hp. in Sweden, or 0.5 hp. per capita in the first named country and 0.2 hp. in the second.

Electrical Progress in Argentina.—Judged by the figures given in the annual report of the electrical company of Rosario, Argentina, which has its headquarters in Brussels, Belgium, electrical progress in the Argentine Republic is rapid. The total receipts of the Rosario company for 1919 were 50 per cent greater than those for 1915, and the company had 21,630 customers as against only 1,284 in 1915 and generated 29,812,600 kw.-hr. The great increase of customers is, of course, due to the general wiring of private residences. Flatirons and other domestic electrical appliances also are in very general use.

Peat as Fuel May Aid Irish Railroad Electrification.—High cost of coal has led to a suggestion, made at a meeting of Irish electrical engineers, that railroad electrification be undertaken in Ireland by means of power derived from peat. This semi-fuel, which exists in great quantities in the Emerald Isle, can, it is estimated, be worked and distilled at a cost that will be fully covered by the value of the solid and liquid products and will in addition yield gas available for power production. One of the advocates of the scheme says that electricity thus generated can be delivered to the railways at 1.4 cents per kilowatt-hour. It would take fifteen years to complete the work of electrification and the cost would be $60,000,000.

Penn State Graduates May Connect with Western Electric Company.—Arrangements have been completed by the faculty of the engineering school of Pennsylvania State College so to arrange certain branches of its curriculum that graduates will be available for employment in the technical and factory departments of the Western Electric Company. Particular attention will be devoted to developing executive possibilities in the students. The Western Electric Company has similar arrangements with several other educational institutions at the present time and in addition maintains a post-graduate course for its own personnel at Columbia University.

German Wireless.—A comprehensive wireless telegraphic system to supplement the ordinary lines and serve as a substitute in case of breakdown is being put into operation by the German post office department. Already transmitting and receiving stations are in operation in most of the large Prussian cities, and Bavaria and Württemberg are to be linked up. A station in Königsberg, East Prussia, permits communication with that district independently of the Polish corridor which separates it from the rest of Germany.

Electrical Development in New Zealand.—The sum of £3,500,000 is named in the budget presented to the New Zealand House of Representatives by the government as that needed for public works, very largely of a hydro-electric character. In addition many municipal electricity supply schemes are under consideration by borough councils, and an era of electrical activity is anticipated.

Electric Service for Conventions.—Electrical service at the Springfield (Mass.) Auditorium is featured by the local Chamber of Commerce in its publicity material welcoming conventions to the city. The auditorium is provided with four-wire, two-phase, 220-volt and single-phase, 110-volt service, besides energy for the operation of motion-picture machines in the convention hall, exhibition hall and "mahogany room." In calling attention to the facilities offered, the chamber points out that all 220-volt, four-wire, two-phase motors used by exhibitors will require a feed line at least 150 ft. in length from the main switchboard, 25 hp. being available on this special line. It is also made known that at the top of every column in the exhibition hall is a 10-amp. plug, installed primarily for lighting purposes and limited to ½ hp. in each case. In the rear and front of the hall are three 50-amp. plugs limited to 4 hp. from each plug. Electric elevator and truck service is also featured in this connection.

Volcanic Electricity.—A recent report on Italy's efforts to use the natural heat emitted from the soil in volcanic regions in lieu of fuel says that a heating plant of 16,000 hp. is operating without interruption at Larderello, in Tuscany, and that electricity generated at this plant is distributed to Florence, Livorno and Grosseto.

Paris Plans to Get Rid of Steam Locomotives.—The electrification of all railway traffic in Paris and its suburbs, which was held up by the war, is now to go forward again, and it is hoped that in two years steam locomotives with their smoke and dirt will be abolished entirely from the metropolitan area.

Additional Rate Increases in New England.—Ten per cent increase in power rates has been declared effective by the Vermont Hydro-Electric Corporation and affiliated properties of Rutland, Vt., resulting from the increased cost of coal to the New England Power Company and interconnected systems. One and one-quarter mills per kilowatt-hour fuel charge above a base of $5 a ton was established on power bills on Sept. 1 by the Cambridge (Mass.) Electric Light Company.

Toledo Rates to Advance.—The Toledo Railways and Light Company has filed with the Public Utilities Commission of Ohio a new schedule of rates showing increases as follows: Lighting service outside Toledo, 9 mills per kilowatt-hour plus 50 cents per month customer charge; low-voltage power service, 5 mills; high-voltage power service, 4 mills; temporary power service, 15 mills; advertising service and flat-rate lighting service, 30 per cent. Ornamental 600-cp. street lamps in Toledo are to cost $70 a year and overhead lighting $60 a lamp.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Utility Cannot Operate at a Loss.—It is not practicable, the Connecticut Public Utilities Commission recently declared, to expect or to compel a utility company to supply service to the public at a continuing, positive and absolute loss.

Agricultural Service.—According to a decision of the California Railroad Commission, flat electric rates for agricultural purposes, the charge being based upon the connected load or the maximum demand of the installation, are not conducive to economy and tend to encourage wasteful use of both water and power.

Free Service Condemned.—The furnishing of free service was declared recently by the Arkansas Corporation Commission to be contrary to the theory of state regulation of public utilities, whether it is done voluntarily or in conformance to a municipal requirement or franchise, since no service can be rendered that does not require some expense and free service to some customers necessitates an additional burden upon others.

Allowances for Past Services.—In granting increased rates to a telephone company the Nebraska State Railway Commission declared that some consideration must be given to past unremunerated services of stockholders and officers where the value of the plant was approximately $30,000 and only $10,000 had been contributed by the stockholders in cash, and where the rates of the company had been uniformly low throughout its history.

Intercompany Rates.—The rates for electricity supplied by one utility to another, the California Railroad Commission has held, should not be based solely on the cost of hydro-electric power produced in that community but on the average cost to the producing company of both steam and hydro-electric power where other communities dependent upon the producing company for power were being served with hydro-electricity generated in that locality prior to any local demand for service.

Pennsylvania Commission on "Going Concern" Value.—In a hearing of complaints made by various municipalities against the Pittsburgh Railways Company, the Public Service Commission of Pennsylvania declared that " 'going concern' value was a factor to be dealt with in every valuation case," distinct from good will, which is not to be allowed, and that the "cost of establishing business" or "losses in early years of operation while building up the patronage" is a factor in determining the fair value of a property.

Short-Term Service.—Granting increased rates for electric service to the Iola Light, Power & Manufacturing Company, the Wisconsin Railroad Commission dwelt on the fact that all but three of the company's customers are seasonal uses of its service and should provide sufficient revenue to cover continuous fixed charges which accrue to the plant because of the facilities which the utility maintains the year around. "The short-term consumer," the commission said, "receives service of a special character, and as a consequence his rate should be special and adapted to such service in order not to raise the presumption of discrimination."

Rates for Purchased Energy Should Rise with Cost of That Energy.—In granting an increase in rates to the Electric Light & Power Company of Hightstown, N. J., which had been operating under a reduced schedule filed in 1916, the New Jersey Board of Public Utilities Commissioners said that inasmuch as the reduction of the rates in effect in 1916 was based upon the advantages derived through the purchase of energy by wholesale power contract from the Public Service Electric Company, it would appear only equitable that the increase in cost for this power to the Hightstown company should be reflected in the rates which it is allowed to charge. The company's retail power schedule is the same as the Public Service Electric Company's.

Municipal Franchises and Commission Jurisdiction in Virginia.—Finding that an attempt of a municipality to fix the rates of a telephone company outside of the municipality's boundaries was *ultra vires* and that such rates were subject in their entirety to the jurisdiction of the Virginia Corporation Commission, the commission held that nevertheless those portions of the franchises that covered service within the corporate limits were valid and that as regarded this territory the commission could not fix a rate in excess of the maximum rate specified in the franchise.

"Going Value."—In denying an increase of gas rates to the Niagara Falls Gas & Electric Light Company, request for which had been predicated largely on "going value" covering expenditures through many years, important parts of the plant having become obsolete in the meantime and the legitimate field of the company's business not having been, in the commission's opinion, followed up and occupied, the New York Public Service Commission, Second District, declared: "The theory of respondent's counsel seems to be that a public guaranty is behind a public utility in such wise that the public can be called upon to make good the losses of the utility without regard to their causes or origin. We can find no authority for such a doctrine and are of the opinion that upon the facts shown in this record no 'going value' has been established."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Privilege of Using Streets.—The grant by a municipality of the right to use its streets becomes when accepted, a decision of the New York Supreme Court declares, a contract not a mere privilege or gratuity. (182 N. Y. S. 73.)

Power of Cities in Florida.—Where it is doubtful whether a statute authorizes a municipality to fix rates for a public utility company such doubt must, according to a recent decision of the Florida Supreme Court, in State vs. Railroad Commissioners, be resolved against the authority of the city. Even if authority is given by statute to a municipality to fix rates for a public service corporation operating therein such authority is subject to legislative control. (84 So. 444.)*

Company Liable for Death from Uninsulated Wire Passing Through Tree.—A boy who climbed a tree on his father's premises came into contact with a high-tension transmission wire and was killed. The Supreme Court of Iowa has, in Graves vs. Interstate Power Company, found the company liable in damages, since it was its duty properly to insulate its wires at all points where it might reasonably be anticipated that a person lawfully engaged might be. The right of the boy to climb the tree was sustained. In dwelling upon the duty of the electric company so to construct and maintain its lines as to "prevent" injury and death the trial judge was not acting to the prejudice of the company by throwing upon it the liability of an insurer. (178 N. W. 376.)

Powers of Municipalities in Ohio.—The Supreme Court of Ohio, in City of Toledo vs. Weiler, an action arising in connection with the proposed acquiring by the city of transportation system, found that municipalities of the state are empowered by constitutional provision to acquire any public utility whose service is to be supplied to the inhabitants and may issue bonds for such purpose, a grant of power from the legislature not being a prerequisite, and that the indebtedness which may be thus incurred is subject only to the limitation prescribed by the legislature as to the extent of general tax levies and the aggregate amount of indebtedness that may be incurred for all local purposes. Municipalities must determine for themselves the part of taxing or debt-incurring power to be used for any authorized purpose. (128 N. E. 88.)

*Left-hand numbers refer to the volume; right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

H. W. Eales, chief electrical engineer of the Union Electric Light & Power Company, St. Louis, Mo., has been relieved of the duties of system operation in order that he may devote his entire time to the engineering and construction work of the company. Mr. Eales will immediately begin an investigation of the future power requirements of the St. Louis district, will determine the power-plant capacity needed to supply that service, and will select the most economical site for a new power plant. Before being appointed chief electrical engineer for the company in 1913, Mr. Eales had held the position of assistant superintendent of distribution and assistant chief electrical engineer. Previous to that he was for six years with the General Electric Company, two years at the company's factories and four years as engineer of the St. Louis office. He was graduated from Yale in 1904, is a member of the American Institute of Electrical Engineers and is first vice-president of the Engineers' Club in St. Louis.



H. W. EALES

George F. Williams, who has been general superintendent of the Central Maine Power Company, Augusta, Me., has resigned to become associated with the Androscoggin Electric Company, Lewiston, Me., succeeding Fred E. Gordon, who resigned recently.

C. C. Chesney, general manager of the Pittsfield (Mass.) works of the General Electric Company, has been elected president of the Engineering Society of Western Massachusetts.

Dr. H. J. Van der Bijl, an engineer in the research laboratories of the Western Electric Company of New York City, has been appointed scientific and technical adviser to the bureau of mines and industries of the Union of South Africa. His duties will consist for the main part in establishing a bureau of standards. Dr. Van der Bijl was born at Pretoria, British South Africa, and was graduated from Victoria College. Later he received a doctor's degree from the University of Leipsig. In 1912 he came to the United States and joined the engineering department of the Western Electric Company. In the last few years he has been identified with developments of the vacuum tube and the radio telegraph. Dr. Van der Bijl will sail for England within a few weeks and will report to the British Colonial Offices at London before proceeding to Pretoria.

Karl H. Bronson has become associated with the Square D Company, Detroit, Mich., as director of research engineering and will be actively engaged in the safety campaigns which the Square D Company is undertaking. Mr. Bronson is a graduate of the University of Michigan. Previous to joining the Square D Company he was engaged in sales promotion and advertising work for Dodge Brothers and later for Packard Motor Car Company.

Wiggington E. Creed, who has recently been appointed president of the Pacific Gas and Electric Company of San Francisco, succeeding Frank G. Drum, who has held that position for twelve years, is well known as the attorney-president of the Hooper Lumber Company and for his work in the reorganization of the East Bay Water Company, of which he is also president. Mr. Creed is recognized as one of the most able business men in the West. Besides his interests in public service corporations he has organized some important industrial plants, the most notable of which is the Columbia Steel Company at Pittsburg, Cal. of which he is president. He is a member of the board of directors of the Contra Costa Bank and of the Wells Fargo Nevada National Bank of San Francisco.



W. E. CREED

F. J. Burd, superintendent of the electrical work at the Franklin plant of the Cambria Steel Company at Westmont, Pa., has resigned to enter the sales department of the Cutler-Hammer Manufacturing Company. Mr. Burd entered the Cambria Steel Company in 1918 and a year ago installed two patented automatic-control devices, saving belt and motor. He is a member of the American Iron and Steel Institute and the American Institute of Electrical Engineers.

C. O. Mailloux, president of the International Electrotechnical Commission and past-president of the A. I. E. E., recently sailed for Europe on the Red Star steamship Kroonland. Dr. Mailloux expects to remain abroad for two or three months. He will visit England, France, Belgium and Italy, primarily for business purposes; but he will also confer with M. le Maistre, secretary of the I. E. C., at headquarters and possibly with committees of the I. E. C. in other countries which he will visit.



C. O. MAILLOUX

J. C. Lamb of the commercial department of the Tampa (Fla.) Electric Company has been appointed commercial agent of the Baton Rouge (La.) Electric Company, succeeding W. R. Bell, who has accepted a similar position with the Haverhill (Mass.) Gas Light Company.

E. P. Williams, who had been identified with the Baton Rouge (La.) Electric Company since 1913 and served as assistant treasurer since August, 1916, has resigned to accept a position as assistant comptroller of the Godchaux Sugars, Inc., New Orleans. Mr. Williams is succeeded by W. D. Chalmers, formerly with the Columbus (Ga.) Electric Company. The Columbus Electric Company is under the management of Stone & Webster, Inc.

Eric A. Lof, electrical engineer, power and mining engineering department of the General Electric Company, Schenectady, N. Y., has just returned from a five months' trip in Europe. Mr. Lof visited industrial plants in Sweden, Norway, England, Belgium and France.

Trade and Market Conditions

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

Standardization of Plugs and Receptacles

ONE of the great difficulties which campaigns for promoting the widespread use of electrical appliances have had to contend with has been the existing confusion caused by there being so many different types of plugs and receptacles on the market. As a step toward rectifying this condition the report of the regulations and standards committee of the Association of Municipal Electrical Utilities of Ontario, which was presented at the association's convention held in Niagara Falls recently, is especially important.

The committee in its report stated that inasmuch as there is no standard practice covering the design of plugs and receptacles for permanent installations and as there is great need of having interchangeable attachments, it would make certain recommendations regarding the standardization of plugs and receptacles. These recommendations were as follows:

1. Receptacles shall have parallel contacts or contacts suitable for both parallel and tandem caps.
2. Plug bases shall have parallel contacts or contacts suitable for both parallel and tandem caps.
3. Caps shall have parallel contacts.
4. Contact dimensions of caps shall be as follows: Outside, 0.560; inside, 0.436; width, 0.250; thickness, 0.062;

The report met with the hearty approval of the delegates and was unanimously carried. It was explained that there are twelve different plugs made by the same number of manufacturers, all of which are now interchangeable. The opinion was generally expressed in the discussion which followed that local managers in the various hydro municipalities should specify these plugs when making their next purchases.

Electrical Manufacturing Industry Progressing in England

NOTWITHSTANDING the difficulties of reorganization and the increased cost of raw materials, according to the *Electrician* the reports of several electrical manufacturing companies of England show excellent results for the past year. These companies report that they have more orders than they can fill and various plans for expansion and extensions are either in progress or projected.

Crompton & Company, controlled by the Armstrong, Whitworth Company, made a net profit of £52,900 for the year ended March 31, against £38,500 for 1918-19. The General Electric Company profits increased from £64,400 to £490,400 in the same period. Plans are under way for expansion of the present plants and the erection of new works for the General Electric Company and its subsidiaries. Provision is being made for doubling the output of the turbine department, and plans are also under way to double the output of lamps. The company has purchased about 100 acres of land and some factories at Wembley for the greater development of the engineering works, the lamp and glass industries and its research laboratories, buildings for which are now being erected. It has acquired considerable interest in a French telephone company, for the purpose of building up a telephone business in France.

The report of the British Thomson-Houston Company is also an interesting document, indicating progress and expansion both at home and abroad. The company contemplates increasing its share capital to £4,000,000, of which £2,000,000 will be ordinary shares of £1 each and £2,000,000 preferred shares of the same denomination. Of the 2,000,000 ordinary shares, 400,000 will replace the 40,000 ten-pound ordinary shares now outstanding and 400,000 will replace the 40,000 ten-pound 7 per cent cumulative preferred shares. New arrangements have been made for extending the territorial and patent rights of the company, while a closer relationship has been established with the French Thomson-Houston Company and an interest has been acquired in the Société d'Electricité et de Mécanique (Thomson-Houston & Carels) of Belgium.

Deliveries of Bare Copper Wire Impeded by Fuel and Car Shortage

ALTHOUGH raw copper is in an easy position and copper rods are plentiful, the supply of bare wire has suffered from unfavorable conditions of manufacture. Chief among the latter are insufficient supplies of fuel and a shortage of cars. Labor has also caused some concern, for though no strikes have been experienced recently, it is reported that a certain indifferent attitude in the past has materially reduced the output of work per man. Some improvement in that respect is now noticed, however. Production is in most cases close to normal, although a few wire manufacturers report a subnormal output. The operation of drawing the wire seems to be causing some delay, consequently the finer sizes of copper wire are much the hardest to obtain.

Demand at present is not exceptionally heavy, and in several quarters it is said to be slackening. Foreign demand is also decidedly off and seems likely to remain so until exchange rates improve. The increase in freight rates granted to steam railroads, however, is expected to result in larger orders on their part, but this buying has not yet begun to materialize. Electric railways are not heavy purchasers of copper wire at present, nor have they been for some time past, because financial relief in the form of rate increases seems to be necessary before appreciable orders can be expected from that quarter.

One of the reasons why bare copper wire has not been as plentiful as might be expected is the very large call which exists for insulated wire. This demand has been so great that much of the bare copper wire which would normally supply the market has been insulated to meet the demand which exists for the covered wire. Consequently, in order to safeguard their needs, some consumers largely overbought and pyramided their orders, with the result of eventually causing demand to slow up, as is now happening. Some few cancellations are reported as the result of this inflation of orders.

Producers seem to be optimistic about the future volume of business, for transportation is easing up slightly and many new projects long held up are expected to go forward. One representative company is buying little copper now, however, as it considers 19 cents too high a price for the raw product and expects this price to drop in view of the present light demand for copper. Other wire makers believe the price of copper, and hence of wire, must advance and not decrease, in view of the estimated increase of a cent per pound in the cost of transportation of copper. Still others hold that no price increase is possible until foreign demand once more makes itself strongly felt here. One of the leading producers is quoting copper wire on a 22½-cent base.

Deliveries are slightly improved. One of the largest buyers of copper wire, who was formerly unable to obtain supplies under six to ten weeks, is now securing deliveries in from ten days to three weeks. This is apparently not a representative case, however, as in general manufacturers are quoting from about six to eight weeks' delivery on large orders.

Business of G. E. and Westinghouse Rapidly Increasing

AS AN indication of the growth of the electrical industry, the current amount of business transacted by General Electric Company and Westinghouse Electric and Manufacturing Company is interesting evidence.

In the first six months of 1920 General Electric Company booked total sales of $190,000,000, or at an annual rate of $380,000,000. The best figure recorded previously was about $230,000,000 of gross sales in 1919. No longer ago than in 1916 the company was transacting business at an annual rate of only $134,000,000. During the first half of this year orders were shipped at a rate of $260,000,000 per year, but an improvement in transportation facilities is evident from the recent increase in billings which were going forward at an annual rate of approximately $275,000,000 the latter half of July. Bookings, however, have slightly dropped off, for in the same period orders were received at a rate which would only amount to $375,000,000 for the year's total. The summer trade slackness is held accountable for this decrease.

The Westinghouse Electric and Manufacturing Company, it is reported, booked orders for the first quarter of its current fiscal year, ended June 30, amounting to approximately $41,000,000, as compared with about $34,000,000 in 1919. This is at an annual rate of more than $160,000,000. During the same period the amount of goods shipped totaled approximately $31,000,000, or almost $7,000,000 ahead of the figures for 1919. However, outstanding orders on the company's books on April 1, 1920, the beginning of the fiscal year, were about $71,000,000, it is learned, while on July 1 the total was approximately $85,000,000, indicating the increasing transportation difficulties. During the month of July the shipping situation eased up sufficiently to allow orders to be shipped at close to an annual rate of $160,000,000. Bookings also increased during that time and at present a yearly rate of about $180,000,000 is said to be a close approximation.

Demand for Electric Ranges Exceeding Production

MANUFACTURERS of electric ranges report a very strong demand for their product. Some producers state that sales are decreasing but even so in most cases the output is so inadequate to meet this call that a large number of unfilled orders have piled up. Even in the metropolitan district, which has long been a most unfertile market for electric ranges, sales are decidedly on the increase, and one manufacturer recently disposed of three carloads in that territory alone. A feature of the demand is the active interest which is being taken in heavy types of ranges for use in hotels, bakeries, etc. Export sales seems rather off, however, the demand from South America, Australia and other foreign countries which have offered good markets heretofore now apparently slackening because of such unfavorable factors as money tightness and an unfavorable exchange rate.

The production of ranges is being materially affected by the car shortage with consequent difficulty in securing raw material. Shipments of steel from the mills are very slow and uncertain, and as a result the present output of ranges is in many cases far below normal capacity. One factory is even so far behind that it will only accept orders for delivery next year. In several other cases manufacturers are applying their output on back orders as fast as the ranges can be made, and only in rare cases have any reserve stocks been accumulated.

Delivery quotations cover quite a range, as in exceptional cases shipments can be made from stock up to about two weeks' time, but in the majority of cases deliveries cannot be made in less than from two to three months. No appreciable trouble with labor has been experienced in this field, and it is also reported that the unit efficiency of workmen is increasing.

Prices have remained steady for some time past, and manufacturers are divided in their opinion as to the probable trend of prices. On one side it is said that higher freight rates and increasing costs of raw material may serve to increase prices, but on the other it is even predicted that cancellations of orders will be made unless lower prices prevail. This viewpoint holds that the upward tenor of costs has reached its maximum level commensurate with the public's ability and willingness to pay. Better merchandising methods and closer attention to missionary work in this field will counteract such a tendency and open up new markets, it is stated.

Metal Market Situation

DULLNESS is still the prevailing feature of the copper market. Conditions now seem to favor the producer, however, as consumers are disturbed by the closing down of some of the mines following the refusal of producers to sell for less than 19 cents. Several inquiries are reported, but actual sales are light. Buyers are seemingly holding off to see how the price breaks, as up to this time producers have been absorbing the increased freight cost of about a cent per pound. Any substantial buying would precipitate a price increase, it is thought. Some few demands for export are being received. The actual number of orders placed is light, but producers are encouraged by the increasing number of inquiries from abroad. Another favorable factor is that interest in copper buying is apparently reawakening in Germany.

Freer offerings of copper are found in the outside market where prices are being shaded from ¼ to ⅜ cent and even as much as ¾ cent for spot delivery. Second hands are not anxious to sell for later than September or October shipment. Standard copper at London remains rather dull, but prices are surprisingly firm, spot advancing almost £1 within the last week.

The lead market is quiet and presents an easier tone by reason of the arrival of foreign shipments. Demand for zinc is off, the reshipment of American zinc from England at a price of about 8 cents having killed domestic interest. The price of tin seems rather weak as there is little or no demand here. The dullness is making holders uneasy, as even their attempts to offer tin down have met with small response. Little change is evident in the scrap metal market.

NEW YORK METAL MARKET PRICES

	August 24	August 31
Copper	£ s d	£ s d
London, standard spot	94 5 0	95 0 0
	Cents per Pound	Cents per Pound
Prime Lake	18.75	18.50-18.75
Electrolytic	19.00	18.75-19.00
Casting	18.00	18.00
Wire base	22.50-23.00	22.50-23.00
Lead, trust price	9.00	9.00
Antimony	7.00	7.00
Nickel, ingot	43.00	43.00
Sheet zinc, f.o.b. smelter	12.50	12.50
Zinc, spot	8.50	8.30-8.40
Tin	45.75	46.00
Aluminum, 98-99 per cent.	35.10	35.10

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	15.50 to 16.00	15.50 to 16.00
Brass, heavy	9.25 to 9.50	9.00 to 9.25
Brass, light	7.25 to 7.75	7.25 to 7.75
Lead, heavy	7.25 to 7.50	7.50 to 7.75
Zinc, old scrap	5.25 to 5.50	5.25 to 5.50

THE WEEK
IN TRADE

SOME improvement in trade is noted in New England, where the fall buying movement begins to make itself felt. The electrical business in other districts, however, continues about on its recent summer level. Reports from Southern territory and the Pacific Coast are optimistic nevertheless, and the outlook in the Intermountain section depends upon the harvesting of the crops in sight. The plight of the wool industry in that region has seriously embarrassed business, and dealers at present are retrenching.

Building construction in the Northwest is proceeding at a brisk pace, but has fallen off in New England. In the South and Middle West large construction programs are being held up by high prices and difficulty in obtaining building material. This condition is seriously affecting electrical sales.

Tighter money and slower collections are troubling jobbers in the Middle West and Intermountain section, and in the former district some cancellations are resulting, as they are also in Puget Sound territory, though in the latter section money for credit purposes seems readily available. In the New England states, however, collections are said to be improving.

Stocks, taken on the whole, appear to be in much better shape than some time ago as deliveries continue to improve, but there are no complete stocks in any section. Shortages are felt particularly in rigid conduit and hollow ware.

NEW YORK

In some quarters reports are heard of better business resulting from the first of the anticipated fall buying, but most jobbers state that no increase in their sales volumes has as yet materialized. Trade with these latter distributers is proceeding rather slowly but at about a normal pace for this time of the year. A decided improvement is said to be looked for in business conditions, however, following the week-end holiday which marks the close of the vacation season.

Stocks on the whole are better and continue to build up. Plentiful supplies of weatherproof wire, flush switches, flexible armored conductor and lamps are generally reported. There is still a considerable shortage felt in conduit, outlet boxes and porcelain items, however, and stocks in some other lines of material are spotty.

Business in this territory is still feeling the pinch of the car shortage, though transportation seems to be improving despite pessimistic reports from some distributers, whose viewpoint is perhaps explainable by the fact that deliveries are not improving as rapidly as they would like. Money seems to be tight in the electrical trade here, for though there are jobbers who say their collections are good there are many more who characterize them as slow or even very bad.

Rigid Conduit.—Recent receipts appear to have been but a temporary relief, as stocks are mostly depleted except where an occasional carload arrives. The insistent demand more than absorbs the irregular supply that is available. Prices are more or less arbitrary and cover a wide range, with some jobbers not quoting. Price for ½-in. black ranges from about $87 to $103 per 1,000 ft., and the 1-in. size from about $170 to $189.

Weatherproof Wire.—Stocks are in good shape inasmuch as demand is not very heavy at present and no trouble with shipments is experienced. A representative quotation on No. 6 and No. 8 is 32 cents per pound in carload lots.

Outlet Boxes.—Considerable scarcity is felt in this material, and stocks for the most part are poor. Demand is heavy and some jobbers are sold ahead and will not quote on new orders. Deliveries are extremely irregular. A current discount of 25 per cent is quoted on galvanized boxes and on black boxes, 30 per cent

Washing Machines.—Demand has greatly increased and a heavy volume of sales is reported. The condition of stocks varies, some jobbers being unable to obtain enough machines to supply the demand, while shipments for others are said to be good.

Metal Molding.—There is a medium demand but stocks are spotty. Shipments with some jobbers are poor while others are experiencing no difficult. The three and four wire molding is listed at $160 per 1,000 ft., less about 57 per cent in lots of 5,000 ft.

Flush Switches.—Good stocks are on hand in spite of the fairly heavy demand. The scarcity of porcelain is holding up some items, but in general shipments are coming through nicely.

Flexible Armored Conductor.—Demand is decidedly less and with fairly regular shipments considerable stocks are accumulating. Prices are being cut, the current quotation for No. 14, two-wire, ranging from $98 to $104 per 1,000 ft., and in a few cases slightly above that figure.

Non-Metallic Flexible Conduit.—A normal demand is reported which in some cases is even ahead of the supply, as one leading jobber is sold ahead and will accept no new orders. Shipments are only fair and stocks are spotty. The price for $\frac{3}{8}$-in. is quoted at about $33, and for the ¼-in. size, $35 per 1,000 ft.

Lamps.—Demand is fairly good but the expected fall increase in sales has not as yet begun to make itself felt, and stocks are still building up. Some jobbers are complaining of slow deliveries in their efforts to obtain supplies, especially in type "C" lamps.

CHICAGO

Business is subnormal in this district even for the summer months and watchful waiting is the order of the day. Building construction estimated at $150,000,000 is now being held up in Chicago by prohibitive costs of material, and a continuation of the present curtailment of building will mean that construction will practically come to a standstill within sixty days. Cancellations and slow collections are the principal troubles experienced by electrical jobbers. Stocks are in such shape that almost any standard line can be obtained in the territory but no jobber has a complete stock. Jobbers and manufacturers are both busy filling back orders, but comparatively little new business is being booked. For this reason there is small interest in deliveries that jobbers or manufacturers can make at present, even though orders are now being filled in much better time. Dealers are working hard to move the stocks that are being accumulated but without much success as retrenchment is the present policy of the public.

Dry Cells.—Stocks are in fair condition and demand is being well maintained. The price for standard Red Seal batteries, f.o.b. factory, is $32 per 100.

Insulating Material.—Stocks of mica, varnished fiber, etc., are not in very good shape, but better deliveries are now promised by the factories because of the falling off in the demand from the automobile industry.

Electric Road Trucks.—Factories are busy filling back orders. The increasing cost of gasoline is responsible for many inquiries which will result in business later, it is expected.

Marine Fittings.—The demand is steady though the volume of business has dropped off considerably since the war.

Schedule Material.—Demand has fallen off and factory deliveries are improving. Some attachment plugs can even be obtained from stock.

Rigid Conduit.—Jobbers' stocks have been almost depleted by the rush to get shipments before the freight increase became effective.

Fans.—Factories are nearly all cleaned out. Many retailers will carry over fans through the winter but by far the major portion of the unsold fan production is in jobbers' stocks. The smaller sized fans have been the best sellers this season and it is the larger ones, especially 16-in. which have been left unsold. Practically no industrial demand has been felt.

Hollow Ware.—There have not been as many cancellations as in some other lines, and manufacturers report that it will take some months for them to catch up with back orders at the rate new business is coming in.

Irons.—This is a line for which orders are still being received by manufacturers. However, factories are catching up, and deliveries are improving.

Lamps.—Manufacturers have built up good stocks of practically all standard lamps. There is still some shortage of 10-watt lamps and of series lamps for street lighting. The demand for lamps of 200 watts and above is increasing more rapidly than for lamps of the smaller sizes.

BOSTON

Electrical supplies and material are moving well as the fall buying begins to take shape. Collections have a slightly better tone. Stocks are improving in most lines, barring small motors, rigid conduit and porcelain. It seems doubtful if stocks will run to excess during the coming winter, judging by present accumulations and the conservative ordering now evident. Labor is quiet this week and indications of a widespread improvement in its attitude in the electrical industry are beginning to appear. Prices are still firm, except for occasional cuts to move products at once. Brass wire advanced ½ cent per pound and brazed tubes 1 cent on Aug. 21. Building and engineering contracts in New England for the week ended Aug. 26, 1920, total $5,171,000, compared with $5,097,000 for the same week last year. A gradual recession in the weekly volume of new building construction can be seen. Business in the leather industry is very dull, and the textile manufacturers have not yet resumed production in numerous closed mills, although it is expected that conditions will improve this month. Reduced buying of electrical supplies is an outcome of textile manufacturing curtailment.

Insulators.—Jobbers report 2,300 and 4,600-volt insulators very scarce, especially in lower Connecticut. Neither glass nor porcelain can be had in the desired quantities.

Sockets.—Manufacturers are hard pressed to obtain porcelain, and the effect of recent labor troubles in the brass industry has not yet been overcome. Jobbers' stocks, however, are in good shape, and a healthy demand exists. Pulls quote 50 cents net, keys 28 cents and keyless 26 cents in case lots.

Rigid Conduit.—Stocks are very spotty and deliveries highly unsatisfactory. Current requirements are being met by "pick-up" orders, and long overdue carload shipments hardly arrive before they are sold. Last week a leading jobber had fair supplies of 1-in. and smaller pipe, but could not obtain 2-in. pipe, though it is the small sizes that are generally scarce in New England shipments.

Motors.—Demand holds up strongly for small sizes. One large jobbing house normally carrying a stock of 600 motors had only twenty on hand at the beginning of the week. Immediate orders are being filled only after extensive canvassing of the market.

Wire.—Rubber-covered No. 14 is selling at $11.75 per 1,000 ft. in 5,000-ft. lots. Weatherproof base is 27¼ cents, bare base, 22¾ cents. On weatherproof deliveries of six months are being quoted on quantity orders at the factories. Bare wire can be had in four to eight weeks according to size and quantity. Flat wire is quoted on seventeen weeks' delivery by a leading manufacturer.

Non-Metallic Flexible Conduit.—Good stocks are in hand, and buying is steady with even prices. There is no change from last week in quotations.

Heating Appliances.—Irons are plentiful in this territory, and demand is brisk. Hollow ware is scarce, and the outlook for the supply of toasters, percolaters and small grills is none too good for the holidays. It is reported that one prominent manufacturer of hollow ware is refusing orders for delivery prior to Jan. 1. Buying of reflector-type heaters has begun for fall business. Dealers admit that present prices are an obstacle to buying, but the growth of domestic and industrial heating applications of electricity is so great that a large volume of business is being handled notwithstanding current price levels.

Fans.—Jobbers who ordered large consignments for this year will probably carry over larger stocks than they prefer. Neither wholesale nor retail stocks are exhausted. Some jobbers would be glad to sell their present stocks close to cost in order to get rid of them, and price cuts within the next fortnight would not be surprising.

Lamps.—Careful buying is encouraged by distributers to avoid a shortage in the winter. The 150, 100 and 75-watt gas-filled lamps are hardest to get just now. Sign lamps are in good supply for fall trade. Dullness in textile and leather manufacturing plants is expected to curtail the demand from these quarters. Prices are steady.

ATLANTA

The dull summer season, combined with the recent spell of inclement weather, has served to slow up all lines of business throughout the section. Apparently, however, the bad weather is over, and this together with the approaching fall season gives hope of the resumption of demand on a par with earlier this summer, though the increasing difficulty in obtaining building material is causing serious delays in construction already under way. This, of course, is holding up electrical construction and somewhat easing the shortage in electrical supplies. The coal situation has caused a number of the large cement plants to curtail production, and in some instances to shut down altogether. This condition, unless shortly relieved, will cause serious difficulties in this section.

Agricultural conditions throughout the section on the whole are quite satisfactory, though sufficient time has not elapsed since the recent rainy weather to determine the extent of damage done the cotton crop, which is already about two weeks late. While the corn crop in Georgia is stated to be below the average, the shortage will be largely offset by the tobacco and sweet potato crops. Conditions in Florida are excellent, with the estimated citrus crop running about 5,000,000 boxes above the 1919-1920 season.

Bank deposits are approximately 20 per cent above those of last year. Bank clearings for the section as a whole show a fair increase, while the local clearings are practically the same as for last year.

Distributing Transformers.—Local stocks except in very small sizes are completely exhausted, and great difficulty is experienced in meeting a very insistent demand. Central stations are being compelled to hold up connections of large power consumers because of the inability to obtain transformer equipment. Manufacturers say little relief from the present situation is to be expected unless the demand eases off considerably.

Portable Lamps.—In anticipation of a heavy holiday demand jobbers are placing large orders for all types. Silk shades have been stocked more heavily than last year. Orders from retailers have not yet begun to materialize. No further price reduction in silk shades is expected.

Holiday Toys.—Jobbers have accumulated unusually heavy stocks and report that buying by the retail trade for the holiday season is already under way. A record business in this line is expected and retailers are being urged to place orders far in advance.

Outlet and Switch Boxes.—Recent receipts of large shipments have served to materially ease the situation and boxes in assorted sizes and types are reported on hand in fair quantities. A brisk demand is to be noted in the face of shipments quoted at from three to four weeks.

Non-Metallic Flexible Conduit.—Large receipts have served to fill all back orders and several jobbers report the accumulation of quite sizeable stocks. Demand is reported as holding up quite well with a price on lots of 1,000 to 2,500 ft., ⅝-in. of $4.62; ½-in., $4.24, per 100 ft.

Flexible Armored Conductor.—The shortage continues acute, as with most galvanized products. Shipments are entirely insufficient to meet the demand, and such quantities as are received are forwarded on an allotment basis. Price, 2-wire, No. 14, lots of from 1,000 to 2,500 ft., $11.60 per 100 ft.

SAN FRANCISCO

Although construction work has decreased and appliances, considering the territory as a whole, are slower, yet the sales of real estate, especially in the home tracts, and the decreasing number of such sales as a speculation, are proof of heavy electrical work to be undertaken during the remainder of this and next year. In fact, prophets of what is termed the "big crash" have postponed its arrival beyond next Christmas because of unmistakable signs of a banner holiday season, and there is doubt that it will materialize at all. The past three winters have been dry, but weather experts are foretelling a much needed wet season. A note of conservatism is apparent, which will have a beneficial effect on firms who have been rather spoiled by easily acquired business.

With the closing of the successful electrical home in Sacramento, another has been opened in Oakland and is attracting more interest than the first. More emphasis is being placed upon the outlet demonstration, and architects report many interesting inquiries.

Vacuum Cleaners.—Good stocks are reported and sales campaigns on special types have made these the best-selling household device at the present time. Better shipments of attachments are reported, but orders are still far in excess of supply.

Motors.—Deliveries are better on all motors except the single-phase type. Deliveries on 10-hp. and larger sizes are especially good.

Schedule Material.—Pull-chain sockets have been in high demand during the past week. There are better shipments from the factory. Lock sockets, urgently needed and almost impossible to obtain during the spring, are now much slower.

Conduit.—Deliveries are again bad. Several jobbers report that despite empty racks they have not even a car en route.

Boxes.—Deliveries are very slow, and the shortest stocks are on the best sellers, such as the 4-in. round and octagonal.

Water Heaters.—Nearly all firms say that these are selling better, although many of the orders being shipped now were taken during the early spring. It is hoped that present and future deliveries will cope with the demand.

Heating Appliances.—There is quite a call for medium and heavy soldering irons. Percolators are once again to be found on the shelves after a dearth that has endured since last Christmas.

Lamps.—The Coast to date has not experienced any shortage. White Mazdas are selling much slower than formerly.

SEATTLE—PORTLAND

Jobbers in the Puget Sound district report a small volume of business during the past week, although the movement of heating appliances, which has begun earlier than usual this year, will in a measure offset dullness in other lines. Sales of schedule material and household devices such as ranges and washing machines are dropping off, while buying of the larger-sized motors and heavy power apparatus is practically at a standstill. Retail sales of vacuum cleaners, electric tableware, ornamental glassware and socket heating appliances are reported satisfactory. Spokane jobbers report trade is holding up well, and seasonable weather has benefited retail business. Washing machines, cleaners, table ware, etc., are moving especially satisfactorily. Stocks are much improved and collections throughout the entire inland empire are good.

Retailers in the Portland district are finding business fairly good, some stores reporting that the volume of sales is just about holding its own with a year ago, while others say that there is an appreciable improvement. There seems to be a falling off in purchases of high-priced appliances such as ranges and washing machines, with a noticeable increase in the movement of smaller appliances. Contractors report that enough business is booked to carry them through for at least the next sixty days, by which time they will have passed the ordinarily dull season. More men are being employed in electrical installation work than last month. Collections are slow but contractors in good standing do not find serious difficulty in getting credit extended when they need it. A résumé of building activities as given by the city Building Department shows a total both in number and value of new buildings substantially greater than for the corresponding period of 1919. Increased freight rates and consequent cancellation of orders in great volume are the big problems now confronting the lumber industry. Plans are completed for the new Cedar Falls hydro-electric plant of Seattle's municipal power system, which is capable of developing 20,000 additional horsepower and will cost $1,000,000.

Switch Boxes.—Demand has been falling off and at present is at a minimum. Stocks are in good condition and shipments are fairly easy to obtain.

Porcelain Sockets, Receptacles, Etc.—Stocks are sufficient to care for the good demand existing, though the call is growing lighter from week to week.

Lamps.—It is believed that the fall season has started. Trade is picking up and from all indications sales will compare favorably with last year. Stocks are in fine condition and shipments are easy. Prices are tending upward.

Lead-Covered Wire.—Demand is only fair with good stocks the rule. Shipments are good but prices are expected to show further increases.

SALT LAKE CITY—DENVER

Tighter money is hindering irrigation construction and electrical power projects in the West. As a result labor is plentiful in all lines of building. No new projects are being launched, as present work is confined to finishing jobs already begun.

The adoption of the American plan of labor has caused a considerable influx of non-union laborers, but on the other hand, many union men have gone to parts of the country where the union plan prevails, but they have not left in sufficient numbers to offset the increase.

The strike of the International Brotherhood of Electrical Workers is over in Salt Lake City, and union labor in other cities has also compromised its disputes. It is conceded, however, that the settlement is only temporary and that the adoption of the American plan was made imperative on the union men by the pinch of being long unemployed. They virtually yielded under protest and will probably renew the fight when an opportune time is at hand.

The demoralized wool market continues to affect the intermountain region adversely. Millions of dollars that would normally be in circulation are this year not available. The condition of the metal market is another serious setback to the mountain states.

The recovery of business to its normal state hinges on the marketing of crops, particularly of sugar beets, though it is believed that the wheat crop alone will not alleviate the situation materially, since banks are demanding that farmers take up their notes.

Jobbers expect little if any improvement in trade during September. They are getting in ample stocks and doing everything possible to awaken dealers to the need of being prepared, but the latter are prone not to stock until they are confronted with an actual demand for their wares.

Washing Machines.—These are moving slowly. Buying is stimulated by some dealers by liberal time payment terms. Factories are caught up with back orders and are anxious in many cases to unload on jobbers. As a result there is an overstock in some quarters.

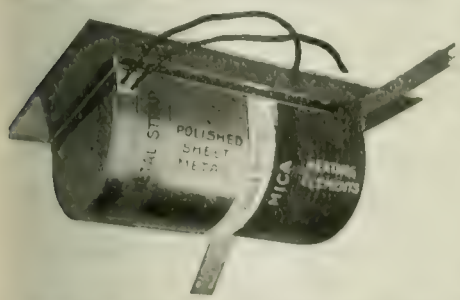
Heating Appliances.—Demand is rated fairly good considering the general recession in trade. Dealers report that buyers are not averse to paying the prevailing high prices, and jobbers' stocks are pretty well filled up. There is some scarcity of hollowware, however.

NEW APPARATUS & APPLIANCES

A Record of Latest Developments
and Improvements in Manufacturers' Products
Used in the Electrical Field

Candy Maker's Chocolate Heater

The Cutler-Hammer Manufacturing Company, Milwaukee, is introducing an improved electric heater for melting chocolate used in making candy. As this work requires a constant definite

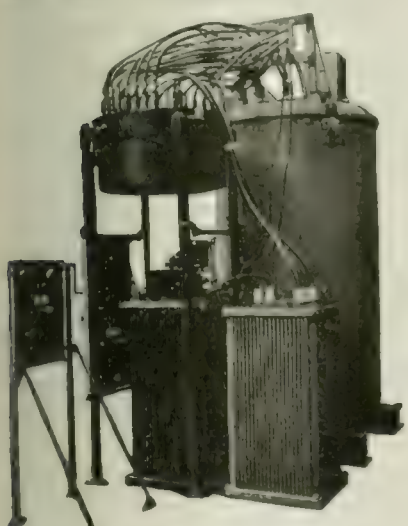


KEEPS SIX QUARTS OF CHOCOLATE HOT

temperature, a low heat is provided which exactly maintains the required temperature. A medium and a high heat under control of a snap switch are used when new supplies of chocolate are introduced. The three heats provided are 55 watts, 110 watts and 220 watts. The weight boxed is 17 lb., and the capacity is 6 qt. or 15 lb.

Regulator for Electric Furnace Voltage Control

For controlling the energy input for large electric furnaces the Westinghouse Electric & Manfacturing Company, East Pittsburgh, Pa., is manu-

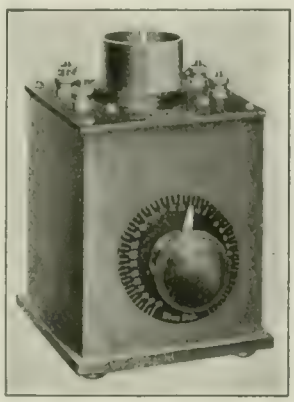


FURNACE REGULATOR WITH TRANSFORMER AND CONTROL PANEL

facturing a step induction regulator to give a uniform voltage over a wide range. The regulator consists of a furnace transformer, an induction regulator, switches and push-button control. This apparatus utilizes the principle of varying the high-voltage tap on the transformer for controlling the energy input to the furnace. The function of the induction regulator is to vary the voltage between taps. After the voltage of the adjacent tap is reached, the selector and transfer switches automatically transfer the inductor regulator so that it will function between the next two taps.

Very Small Amplifiers and Detectors

A single-stage amplifier and a detector developed by the Acme Apparatus Company, 27 Windsor Street, Cambridge, Mass., each have over-all dimensions approximately only 3½ x 3½ x 5½ in. The amplifier contains all the essential parts except the vacuum tube and batteries. An Acme



VERY SMALL RADIO APPARATUS

amplifying transformer is included. The binding posts on these pieces of apparatus are so arranged that it is an easy matter to make a detector and two-stage amplifier with separate filament control and the same batteries.

Notes on Recent Appliances

Radio Transmitting Key

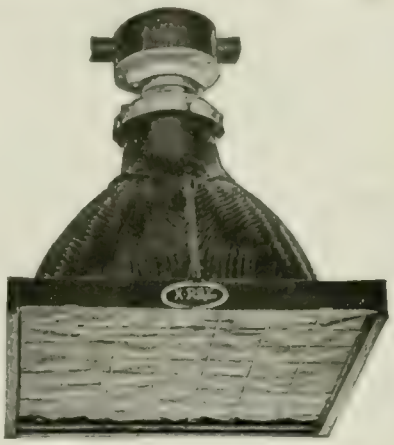
The Eastern Precision Electrical Instrument Company, Rockville Center, N. Y., has placed on the market a navy-type, heavy-duty radio transmitting key.

Regenerative Receiver

A. H. Grebe & Company, Richmond Hill, N. Y., have placed on the market a short-wave regenerative receiver, type CR-3.

Color Screen for Window Lighting

A means of producing colored light in show windows has been developed by the National X-Ray Reflector Company, 235 West Jackson Boulevard, Chicago. This "Color-Ray" consists of a metal frame which supports a slide of colored gelatine held in place by fine steel meshes. The color can be changed readily or the slides may be left out altogether. The frame is fastened to

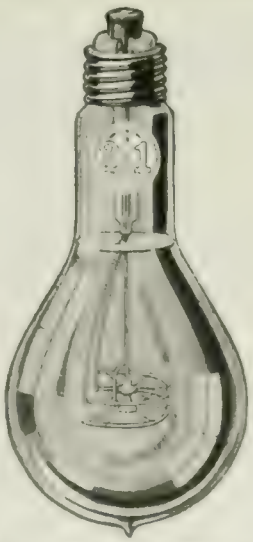


COLORED SCREEN ATTACHABLE TO REFLECTOR

an X-Ray reflector by an asbestos cord harness without disturbing either the reflector or the lamp. Colored gelatine, it is claimed, will not fade under the heat of the Mazda "C" lamp.

Lamp Has Two Filaments

When one filament has burned out the second filament may be put in service in the "Dualite" lamp, developed by the Whitelite Electric Company, 368 Broome Street, New York, N. Y. The lower filament is connected to light when a cap is screwed in at the base of the lamp. When this filament has



TOP FILAMENT USED AFTER BOTTOM BURNS OUT

burned out the other filament is put into the circuit by unscrewing the cap. It is claimed that the gas in the bulb makes discoloration improbable.

MANUFACTURERS' ACTIVITIES

Record of Changes Affecting Sales and Distribution Together with Trade Personals and Notes on Foreign Trade, Jobbers' News and New Trade Literature

THE NATIONAL LAMP WORKS, of the General Electric Company, Nela Park, Cleveland, Ohio, is planning to erect two factories in Indianapolis, Ind., for the manufacture of incandescent and automobile lamps. The proposed plants will have a capacity of 160,000,000 lamps a year and will cost about $2,000,000.

A. W. DODGE, formerly assistant production manager in the fractional-horsepower-motor department, Lynn works of the General Electric Company, has been appointed production manager of the D & W Fuse works, General Electric Company, Providence, R. I.

THE SUNLITE PRODUCTS COMPANY, Plymouth Building, Minneapolis, Minn., has made arrangements for the distribution of the Peerlite lighting fixtures, manufactured by the Peerless Light Company, Chicago, in the states of Minnesota, Iowa, North and South Dakota.

THE WESTERN RED CEDAR ASSOCIATION held its fifteenth annual meeting at Spokane, Wash., on July 30. Nine companies were represented, including the E. T. Chapin Company, Lindsley Brothers Company, Metropolitan Cedar Company, National Pole Company, Northern Cedar Company, Sandpoint Lumber & Pole Company, Searl-Waterman Company, Valentine Clark Company and Western Lumber & Pole Company. The officers elected for the following year are: Morton Macartney, president; E. A. Lindsley, vice-president, and G. A. Clark, secretary and treasurer.

WESTINGHOUSE AWARDS ENGINEERING SCHOLARSHIPS.—The war memorial scholarship committee of the Westinghouse Electric & Manufacturing Company has announced as winners of the four scholarships for the coming year, 1920-21, Alva C. Corroa, small-motors drafting department; Henry Gardiner Symonds, son of N. G. Symonds, manager industrial sales livision, Chicago office; J. Dale Seabert, transformer engineering department, and Herbert Hillman, son of William A. Hillman, who has been a machinist in the works of N. D. Nuttall for twenty-seven years. The four awards for the coming year are in addition to the four scholarships awarded last year, all of which have been continued for the coming year. Four new scholarships will be awarded, and eventually the company will be maintaining sixteen scholarships in the leading schools of the United States.

THE NATIONAL CONDUIT COMPANY, Hastings-on-Hudson, N. Y., shows from net sales approaching $7,000,000 for six months ended June 30, 1920, a profit of $499,183, whereas a loss of $516,300 was incurred in the previous year on net sales of $4,760,000. Through writing off $129,396 to depreciation and organization expenses, the books showed a loss for the half year to June 30, 1920, of $80,213, as against a loss of $643,000 in the corresponding six months of 1919.

THE VOSS BROTHERS MANUFACTURING COMPANY, Davenport, Iowa, has nearly completed a new factory, which will be devoted largely to the manufacture of a new type of motor-driven washing machine. The company also contemplates the construction of a foundry, on which work will soon begin.

THE ACME DIE-CASTING CORPORATION, Bush Terminal, Brooklyn, N. Y., has recently opened a branch office in the machinery exhibition sales department of the Philadelphia Bourse. This office is in charge of Edward McK. Hunt, and it will handle the company's rapidly growing business in New Jersey, eastern Pennsylvania, Maryland, Delaware and the District of Columbia.

RECAPITALIZATION OF MANHATTAN ELECTRICAL SUPPLY COMPANY.—Stockholders of the Manhattan Electrical Supply Company, 17 Park Place, New York City, have approved a plan for recapitallzation which provides for an authorized issue of 250,000 shares of capital stock without par value, of which 70,000 shares will be exchanged for the present preferred and common, while the balance will be sold to provide additional working capital for the company.

THE MONO CORPORATION OF AMERICA announces the removal of its main office from Buffalo, N. Y., to 25 West Broadway, New York City, where a complete line of its automatic continuously recording gas-analyzing instruments for CO_2, CO, O_2, SO_2, H_2, N_2 CH_4, etc., will be displayed.

THE STROMBERG ELECTRIC COMPANY, 209 West Jackson Boulevard, Chicago, manufacturers of time-recording systems, announces that it has opened an office at 803 Lexington Building, Baltimore, Md., with C. F. Ressiguie in charge.

THE DRENDELL ELECTRICAL & MANUFACTURING COMPANY, San Francisco, Cal., manufacturer of switchboards, panelboards and safety products, has recently made several changes in its organization. A. E. Drendell, former president of the company, has sold his interest in it to L. Siebert and J. Gensler, who will continue the business at a new plant at 1345-1353 Howard Street, San Francisco. Mr. Gensler, who was formerly manager of the Electrical Construction Company, Oakland, is president of the Drendell company, and Mr. Siebert, who has been associated with the company for the past fourteen years, is secretary and treasurer.

LANDERS, FRARY & CLARK, New Britain, Conn., are planning to erect a three-story addition, 60 ft. x 210 ft., on Ellis Street, to cost about $115,000.

THE BURKE ELECTRIC COMPANY, Erie, Pa., announces the appointment of L. L. Myers as general Western sales manager, with headquarters in the Illuminating Building, Cleveland, Ohio, where he has been for several years as sales representative of the Burke Electric Company for the Cleveland territory. L. B. Ritchie has been appointed Eastern sales manager, with headquarters at 30 Church Street, New York City, where has for some time been sales representative of the company for the New York district. The direction of the Eastern and Western sales management was formerly centered at Erie in charge of H. A. Brown, who has resigned.

THE ILLINOIS ELECTRIC PORCELAIN COMPANY, Macomb, Ill., has nearly completed extensions to its plant, which will increase its output 30 per cent. The additions consist of a porcelain testing department, 72 ft. x 84 ft.; a new sagger department, 50 ft. x 96 ft.; an addition to kiln room, 70 ft. x 72 ft., and an addition to warehouse, 76 ft. x 175 ft., all being one-story buildings.

THE ROLLER-SMITH COMPANY, 233 Broadway, New York City, announces that C. H. Mohr has been added to the sales force of its Baltimore representative, the Perkins-LeNoir Company, 113 East Franklin Street. He will devote his attention to the various lines of electrical apparatus handled by the Perkins-LeNoir Company and will specialize in the Roller-Smith products, comprising electrical instruments, meters and circuit breakers. Mr. Mohr has been connected in the past with the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., and with the Standard Electric Elevator Company, Baltimore.

W. WOODWARD WILLIAMS, formerly vice-president of the Reading (Pa.) Iron Company, has been appointed assistant to the president of the Pittsburgh Gage & Supply Company, manufacturer of the "Gainaday" electric washing machines, ironing machines and vacuum cleaners, etc. Mr. Williams was graduated from Harvard in 1905, after which he spent six years in the mills of the Carnegie Steel Company. His first selling experience was with the Bourne-Fuller Comapny, Cleveland, Ohio, and in January, 1914, he became general sales manager of the company. He left the latter company to become general manager of the Reading Iron Company and later was elected vice-president and in charge of sales and operations.

THE NATIONAL INDUSTRIAL CONFERENCE BOARD announces the removal of its headquarters from Boston, Mass., to 10 East Thirty-ninth Street, New York City, effective Aug. 23.

THE JOHN C. DOLPH COMPANY, 168 Emmett Street, Newark, N. J., manufacturer of insulating varnishes and compounds, announces the appointment of Baker-Joslyn, 183 First Street, San Francisco, Cal., with branches in Los Angeles, and Seattle, Wash., as general sales agents and distributers of its products on the Pacific Coast. L. L. Fleig, 212 West Austin Street, Chicago, Ill., has been appointed general Middle Western sales agent, covering Chicago, Cleveland, Detroit, St. Louis and territory comprising the Middle Western States. The Edgar O. Oeters Company, the Bourse, Philadelphia, will represent the company in Philadelphia and contiguous territory.

KLIEGL BROTHERS, 240 West Fiftieth Street, New York City, manufacturers of electric lighting devices, have acquired property on West Fiftieth Street, between Eighth and Ninth Avenues, on which it will erect a new four-story plant. Upon completion of the building the present works of the company, in the same block, will be removed to the new location.

THE DIFFERENTIAL STEEL CAR COMPANY, Findlay, Ohio, recently incorporated with a capital stock of $300,000, has purchased the government munition plant at Findlay, Ohio, formerly occupied by the Grant Motor Car Company. The company proposes to manufacture electric dump cars and other equipment.

Supply Jobbers' Notes

THE NORTHWESTERN ELECTRIC EQUIPMENT COMPANY, 35 Vestry Street, New York City, has filed notice of increase in capital stock from $10,000 to $200,000.

THE CHESAPEAKE ELECTRIC COMPANY, 205 North Calvert Street, Baltimore, Md., will move to 38 South Calvert Street on Sept. 1. T. H. Hardesty, Jr., is purchasing agent.

THE SOUTHERN ELECTRICAL SUPPLY COMPANY, Atlanta, Ga., will shortly move into its new warehouse on Whitehall Street, Atlanta. The new quarters will give it approximately 30,000 sq.ft. of floor space.

P. R. BOOLE, formerly general sales manager of the Electric Appliance Company, Chicago, Ill., has been appointed vice-president and general manager of the G. Q. Electric Company, 25 Erie Street, Milwaukee, Wis., electrical jobbers. Mr. Boole will have charge of sales.

Foreign Trade Notes

DEVELOPMENT OF HYDRO-ELECTRIC PROJECTS IN NEW ZEALAND.—In the budget recently presented to the House of Representatives in New Zealand funds were provided for the development of various industries and trades of the State. An additional sum of £3,500,000 was appropriated for the development of hydro-electric projects and other public works. There are also many municipal electric supply schemes under consideration. There is a good demand for electrical machinery transmission-line material, motors, lamps and other electrical apparatus.

THE HURLEY MACHINE COMPANY, Chicago, Ill., has recently commenced manufacturing its dishwasher in Canada, having taken over part of the Canadian Rumeley Building in Toronto. It is reported that later the company intends to manufacture the clothes-washing machine at the same plant. It is also reported that the shortage of motors is holding back the Canadian output.

INCREASE IN CAPITAL ISSUES OF ELECTRICAL COMPANIES IN THE UNITED KINGDOM.—To provide for important developments many electrical companies have recently made or contemplate new issues of capital. The Brush Electrical Engineering Company, Ltd., will soon issue 339,512 ordinary shares of £1 each at par. This company is building an entirely new factory at Loughborough for the manufacture of "Ljunstrom" turbines and is making extensive additions to its present factories. The Midland Electric Corporation for Power Distribution, Ltd., is making an issue of 250,000 ordinary shares of £1 each at par; the Calcutta Elec

tric Supply Corporation Ltd., is inviting applications for £500,000 convertible debentures; the directors of Vickers, Ltd., are also inviting applications for £1,500,000 seven-year notes, and the Fuller's United Electric Works, Ltd., have issued £200,000 five-year notes. The appointment of the Electricity Commissioners and the associated changes in the electrical legislation are generally regarded as a guarantee that there will be a great demand for electrical apparatus and equipment for many years to come.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A firm in Switzerland (No. 33,551) desires to secure the representation of firms for the introduction into that country of small boats, driven by electricity, of a capacity of five to ten persons, for sporting purposes; also motors and batteries for such boats.

An agency association in the Netherlands (No. 33,554) desires to get in touch with manufacturers who are not represented in that country, with a view of securing exclusive agencies for the sale of all kinds of electric cable and wire, including electrolytic copper wire for overhead feeding lines, etc.

An importer in Italy (No. 33,564) desires to purchase a large quantity of small electric lamps from 105 volts to 110 volts with filaments.

Trade Publications

ELECTRICAL SUPPLIES.—The Frank H. Stewart Company, 37-39 North Seventh Street, Philadelphia, dealer in electrical supplies, has issued general catalog No. 22. The book is cloth-bound and contains 667 pages, covering electrical apparatus handled by the company.

HEAT-TREATING CONTAINERS.—The Driver-Harris Company, Harrison, N. J., is distributing bulletin N-2 describing its cast "Nichrome" heat-treating containers, and bulletin R-21, entitled "Alloys for Electrical Resistance," covering practical uses of the D-H alloys, manufactured by the company.

ADJUSTABLE-SPEED MOTORS.—The General Electric Company, Schenectady, N. Y., has issued a second edition of bulletin No. 41,921 A, superseding bulletin No. 41,921 and describing the latest design of RF, form A, direct-current, adjustable-speed motors, rated from 2 to 50 intermittent horsepower.

DEFLECTION POTENTIOMETER.—A second edition of bulletin No. 46,112, describing the deflection potentiometer, has been issued by the General Electric Company, Schenectady, N. Y.

STREET-LIGHTING UNITS.—Bulletin No. 43,503B, superseding bulletin No. 43,503A, entitled "Novalux," has been issued by the General Electric Company, Schenectady, in which it describes and illustrates the Novalux ornamental street-lighting units.

INDEXES.—The General Electric Company, Schenectady, N. Y., has issued indexes to its descriptive bulletins and sheets and supply-parts bulletins, both dated July, 1920.

SCIENTIFIC ILLUMINATION.—The "Holophane Datalog" is the title of a 128-page illustrated handbook published by the Holophane Glass Company, 340 Madison Avenue, New York City, which is a combined data book and catalog. There are also forty-six reproductions of night photographs showing actual installations of illuminating systems.

New Incorporations

THE TAYLORSVILLE (GA.) LIGHT & POWER COMPANY has been incorporated with a capital stock of $8,000 by William M. Dorsey, C. D. Shaw and A. R. McGinnis.

THE TOWNVILLE (S. C.) WATER LIGHT & POWER COMPANY has been organized to establish an electric plant. Dr. Webb is president and E. B. Farmer secretary.

THE RIDGELEY (W. VA.) LIGHT & POWER COMPANY has been incorporated by James T. Vandegrift, Howard R. Knight and Elmer E. Biggs. The company is capitalized at $25,000 and proposes to furnish electricity for lamps and motors in Ridgeley.

THE RUDOLPH (OHIO) LIGHT & POWER COMPANY has been incorporated with a capital stock of $10,000 by W. J. Shuler, F. T. Hillabrand, J. H. Moore, H. Richardson and F. Mercer.

THE VIOLET (LA.) ICE & ELECTRIC COMPANY has been organized with a capital stock of $50,000 to install an electric plant. E. Vaughn is president and T. Vaughn secretary and treasurer.

Construction News

Projects, Plans, Bids and Contracts. Contemplated or Under Way

New England States

PORTLAND, ME.—St. Joseph's Convent, Deering, contemplates the erection of a convent building at Deering, to cost about $300,000. Electric lighting will be installed. O'Connell & Shaw, 18 Boylston Street, Boston, Mass., are architects.

ATTLEBORO, MASS.—A petition from the residents of Cherry Street for the installation of electric lights has been referred to the street lighting committee.

FALL RIVER, MASS.—The American Printing Company contemplates improvements to its plant including the erection of a power house to cost about $16,000.

MILLBURY, MASS.—A town meeting was held recently for the purpose of considering appropriation for local improvements including $1,250 for the installation of a new fire alarm system.

MIDDLETOWN, CONN.—The Goodyear Rubber Company, 144 Church Street, has plans under way for the construction of a new power plant, 30 ft. x 40 ft. Buck & Sheldon, Inc., 60 Prospect Street, Hartford, are architects and engineers.

Middle Atlantic States

CANANDAIGUA, N. Y.—A meeting of the common council, representatives of the Rochester Gas & Electric Company and of the O'Connell Electric Construction Company has been held for the discussion of a proposition to install a modern street-lighting system in this city.

CAMDEN, N. J.—Contract has been awarded to the White Construction Company, 95 Madison Avenue, New York, N. Y., by the Victor Talking Machine Company, Front and Cooper Streets, for the erection of a power house, 53 ft. x 200 ft.

GLASSBORO, N. J.—Bids will be received by Francis H. Bent, state architect, 142 West State Street, Trenton, until Sept. 14 for electrical work to be done on the State Normal School at Glassboro. Specifications may be obtained on application to the Department of Architecture at the Trenton address.

NEWARK, N. J.—Contract will soon be awarded by the Merchants' National Bank, 770 Broad Street, for the erection of an office building, 100 ft. x 200 ft. Electric lighting equipment will be installed. J. H. & W. C. Ely, Firemen's Trust Building, are architects.

NEWARK, N. J.—John Ebersberger, operating a cooperage at Paris Street and Wilson Avenue, contemplates the erection of a new power house on Passaic Avenue and Blanchard Street.

NEWARK, N. J.—The Celluloid Company, 24 Niagara Street, has plans under way for improvements to its power house including new brick stack to cost about $15,000.

NEWARK, N. J.—The City Commission is considering the establishment of a municipal electric light and power plant to be operated in conjunction with the city waterworks. It is proposed to submit the proposition with a bond issue to the voters at the next regular election.

TRENTON, N. J.—The Mutual Pottery Company, Clinton Avenue, has awarded contract to Stone & Webster, 120 Broadway, New York, N. Y., for the construction of a pottery plant and power house to cost about $500,000.

WEST HOBOKEN, N. J.—The erection of a factory at Homestead is contemplated by the American Chocolate Products Company, 206 Broadway, New York, N. Y., to cost about $350,000. Electric light and power equipment will be installed. Andrews, Tower & Lavalee, 33 Lyman Street, Springfield, Mass., are engineers and architects.

WEST ORANGE, N. J.—The Board of Education contemplates the erection of a school to be known as the Gregory School at a cost of about $450,000. Electric light equipment will be installed. Guilbert & Betelle, 2 Lombardi Street, Newark, are architects.

CLEARFIELD, PA.—Application will be made for the incorporation of the Union Township Clearfield Electric Company, for the purpose of supplying light, heat and power to the residents of Union Township.

BALTIMORE, MD.—Bids will be received by the Board of Awards, care of City Register, until Sept. 8 for furnishing, delivering and installing fire alarm telegraph central office equipment for fire department, including receiving and sending apparatus, batteries, switchboards, etc., to cost about $90,000.

BALTIMORE, MD.—The water department has an appropriation of $45,000 available for the installation of a new pumping unit at the eastern pumping station.

BALTIMORE, MD.—Contract has been awarded to the McLain Contracting Company, Fidelity Building by the Consolidated Gas, Electric Light & Power Co., Lexington Building, for the construction of a substation at Port Covington to cost about $80,000.

BALTIMORE, MD.—The Coca-Cola Company, S. L. Willard, resident manager, Pratt Street and Market Place, has awarded the contract to the Arthur Tufts Company, Chandler Annex, Atlanta, Ga., Louis Wilcox, 921 Munsey Building, Baltimore, local manager, for the erection of a Coca-Cola factory and cooperage plant, to cost about $1,250,000. Electric light equipment and elevators will be installed.

GALAX, VA.—J. K. Caldwell of Galax, and others, contemplate the erection of a hydro-electric plant at Pinnacles of Dan to develop 10,000 hp. The cost of the project is estimated at about $500,000.

North Central States

DETROIT, MICH.—The Fort Shelby Garage, care of John Gillespie, Fort Shelby Hotel, contemplates the erection of a garage 130 ft. x 150 ft. Wiring for electric light and motors will be installed. Albert Kahn, Marquette Building, is architect.

DETROIT, MICH.—The City Council has ordered estimates to be prepared for the erection of a memorial building, 250 ft. x 600 ft. Complete electrical equipment will be installed. John A. Kronk, City Hall, is in charge.

DETROIT, MICH.—The Temple Beth El, 580 Woodward Avenue, contemplates the erection of a temple to cost about $1,000,000. Electric lighting equipment will be installed. Albert Kahn, Marquette Building, is architect and engineer.

OWOSSO, MICH.—An electric lighting system for the boulevards will be installed at a cost of about $30,000. Plans call for furnishing and installing 178 mono-light standards, 23,000 ft. of 5,000-volt armored cable, transformers, switchboards, etc. John C. Parker, Ann Arbor, is engineer.

CAREY, OHIO.—The City Council contemplates the reconstruction of its distribution system which will involve either the construction of a power plant or the erection of transmission lines, to cost about $90,000. Froehlich & Emery, Second National Bank Building, Toledo, are engineers.

CLEVELAND, OHIO.—The Babies' and Children's Hospital, care of Abram Garfield, architect, National City Building, contemplates the erection of a children's hospital to cost about $500,000. Plans include a power house, electric elevators, etc.

CLEVELAND, OHIO.—The Board of Education, care of F. Hogan, Sixth Street and Rockwell Avenue, contemplates the erection of a school for crippled children to cost about $500,000. Electric light equipment will be installed.

IRONTON, OHIO.—The Kelly Nail & Iron Company, Monroe Street, plans to erect a power house, 40 ft. x 60 ft., by day labor. Ralph Murray, Masonic Temple Building, is architect.

JACKSON, OHIO.—Bids will be received by C. O. Brown, clerk of the Board of Education, until Sept. 20 for furnishing material and labor for the construction of an electrical service line in Jackson Township Rural School District.

MASSILLON, OHIO.—Work will soon be started on the construction of a new plant for the Lewis Electric Company, capitalized at $100,000, for the manufacture of the Lewis safety entrance switch.

WARREN, OHIO.—The General Fire Extinguisher Company, Dana and Page Avenues, has plans under way for the construction of a power house addition, 30 ft. x 75 ft. H. M. Lane, 701 Owen Building, Detroit, Mich., is engineer.

INDIANAPOLIS, IND.—Contract has been awarded to the J. G. Karstedt Construction Company, Lemcke Building, by the Methodist Hospital for an addition to the institution to cost about $300,000. Wiring for the entire building and fixtures will be installed.

INDIANAPOLIS, IND.—The Republic Creosoting Company, 1614 Merchants' Bank Building, contemplates the erection of a power plant at its works. C. Brossman, 1503 Merchants' Bank Building, is engineer.

INDIANAPOLIS, IND.—Contract has been awarded to the State Construction Company, Pythian Building, by the W. Steinhart Company, Eleventh and Meridian Streets, for the erection of a five-story service station to cost about $400,000. Electric light equipment will be installed.

EAST ST. LOUIS, ILL.—The Eagle Pitcher Lead Company, Railway Exchange Building, St. Louis, Mo., has awarded the contract to the Wimmer Contracting Company, Victoria Building, St. Louis, Mo., for the erection of a lead products factory to cost about $600,000. A power plant will be installed.

EMBARRASS, WIS.—The Matteson Light & Power Company of Matteson has been recently incorporated with a capital stock of $15,000 for the purpose of generating and distributing electric light and power.

LONE ROCK, WIS.—A site between Lone Rock and Gotham is being surveyed for the construction of a dam for power purposes. A. H. Fries is city clerk.

BEMIDJI, MINN.—Contract has been awarded to the Naylor Electric Company for the installation of an ornamental street-lighting system, at $29,883.46. Plans include 126 posts and 440-cp. series lamps.

KINNEY, MINN.—The City Council contemplates the erection of an ornamental street-lighting system on Main Street. E. L. May is city clerk.

ST. LOUIS, MO.—The Bowen Motor Railway Company, Title Guaranty Building, contemplates the erection of a proposed factory and power house to cost about $385,000. O. J. Popp, Odd Fellows' Building, is architect.

ST. LOUIS, MO.—Bids will be received by the Lowenstein Brothers Real Estate Company, Wainwright Building, until Sept. 15 for the erection of an office building to cost about $750,000. Electric light wiring and special equipment will be installed.

ST. LOUIS, MO.—The Bridge & Beach Manufacturing Company, 503 South First Street, has awarded the contract to the Fruin Colnon Contracting Company, Merchants' Laclede Building, for the erection of a factory and power plant to cost about $800,000.

ST. LOUIS, MO.—Contract has been awarded to the John Hill Construction Company, Syndicate Trust Building, by the Boyd Clothing Company, Seventh and Olive Streets, for the construction of a mercantile building to cost about $400,000. Wiring for electric light and power will be installed.

CANDON, N. D.—The city officials contemplate the purchase of an electric lighting plant. W. A. Martin is manager of city light committee.

SCOTTSBLUFF, NEB.—The City Council has been petitioned to make extension to the street-lighting system in the residential district.

WAKEENEY, KAN.—Bids will be received by the city clerk until Sept. 17 for furnishing labor for the erection of a power plant and providing all necessary equipment, including generators, exciters, etc. Black & Veach, Mutual Building, Kansas City, Mo., are engineers.

Southern States

JACKSONVILLE, FLA.—The Ford Motor Company, Highland Park, Mich., will soon award the contract for the erection of a service station. Separate light and power systems requiring conduits, electric motors, etc., will be installed. Albert Kahn, Marquette Building, Detroit, Mich., is architect.

MOBILE, ALA.—The Kelly Drydock & Shipbuilding Company, Commerce Street, contemplates the erection of a machine shop, power house, etc., to cost about $150,000. E. L. Whitney is president.

ROGERSVILLE, ALA.—It is reported that the municipal electric light plant has been destroyed by fire, causing a loss of $5,000.

RAYVILLE, LA.—An election will be held on Sept. 21 for the purpose of submitting to the voters an issue of $50,000 in bonds for improvements to the waterworks, electric light and power plants.

EUREKA SPRINGS, ARK.—A special improvements district has been created by the city commissioner for the installation of a street-lighting system.

PURCELL, OKLA.—An election will be held soon for the purpose of submitting to the voters an issue of $382 000 in bonds for municipal work, including improvements to the electric light plant to cost about $18,000. Johnson & Benham, Firestone Building, Kansas City, Mo., are engineers.

BEAUMONT, TEX.—An electric crane will be installed by the Beaumont Iron Works in its proposed new foundry and pattern shop.

CORSICANA, TEX.—The Chanway Mattress Company contemplates the installation of electrically driven machinery for the manufacture of mattresses, to cost about $30,000. C. W. Rogers is president.

DALLAS, TEX.—The Rick Warehouse & Stores Company contemplates the erection of an exposition building and warehouses to cost about $1,000,000. Electrical freight-carrying devices will be installed.

EL PASO, TEX.—The Southern Baptist Sanatorium contemplates the erection of a power plant. H. F. Vermillion is superintendent.

Pacific and Mountain States

BANDON, ORE.—The city officials have filed preliminary application with the state engineer for permission to divert 25 sec.-ft. water from Wilson River for power purposes. Proposed plans include the erection of a lighting plant to develop 1,000 kw. and the construction of an 18-mile transmission line.

SALEM, ORE.—M. J. Anderson of Portland contemplates extensive development of power on the south fork of the Coquille River. The cost of the project is estimated at about $750,000.

SALEM, ORE.—Application has been made by R. J. Hendricks of Salem for permission to construct a reservoir and divert water from the Trask River for power purpses.

TOLEDO, ORE.—Application has been filed with the state engineer by the city officials for permission to divert 300 sec.-ft. water from the Siletz River for power purposes. Plans include the erection of a dam. The total cost is estimated at about $250,000.

HOLLYWOOD, CAL.—Hunt & Burns, architects, Laughlin Building, Los Angeles, have plans under way for the construction of a hospital to include a power house at Highland and Cahuenga Avenues.

SAN DIEGO, CAL.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., contemplates the installation of a fire alarm system at San Diego.

BRIGHAM, UTAH.—At an election to be held on Sept. 10, an issue of $250,000 in bonds will be submitted to the voters for the erection of an addition to the municipal electric plant. C. O. Roskelley is engineer.

SALT LAKE CITY, UTAH.—Application has been filed with the state engineer by R. H. Peale of Salt Lake City for permission to divert water from the San Rafael River for electric light and power purposes. Plans include the erection of a power house and dam.

MILES CITY, MONT.—A corporation to be capitalized at $500,000 is being promoted by the Yellowstone Irrigation Company for irrigation and also for power purposes.

Canada

FORT ERIE, ONT.—The submission of a by-law covering an appropriation of $10,000 for changes to the electric system, improvements to the pump house, etc., is under consideration by the Fort Erie Council.

KINCARDINE, ONT.—Work will soon be started on remodelling the present electric distribution system in this town. Wiring, transformers and general equipment such as switches, poles, lighting equipment will be required. E. McLeod, Kincardine, is superintendent.

LONDON, ONT.—Contract will soon be awarded by the Grand Trunk Railway Company for lighting its entire local yards by electricity, including all switch lamps, signals and other lights requiring special conduits, switches and all general wiring and equipment. C. Forrester is superintendent.

LONDON, ONT.—The Benson Hines Hotel Company has awarded the contract to George A. Fuller Company, 45 St. Alexander Street, for the erection of a hotel to cost about $1,500,000. Electric lighting system will be installed.

LONDON, ONT.—The Daughters of the Empire will soon award the contract for the erection of a children's hospital to cost about $250,000. Electric lighting equipment, interphone system, motors, triplex pumps, etc., will be installed. Watt & Blackwell, Bank of Toronto, are engineers.

LONDON, ONT.—The Utilities Commissioners contemplate extensions to the waterworks, including the installation of one 500,000 Imp. gal. electrically driven pump. E. V. Buchanan, Hydro Offices, London, is general manager.

NEWBURY, ONT.—At an election to be held on Sept. 14 a by-law authorizing the construction of an electric light and power distribution system to cost about $10,000 will be submitted to the ratepayers of the town. Charles Tucker of Newbury, is engineer.

NEW TORONTO, ONT.—Bids will soon be received by E. A. James Company, engineers, 36 Toronto Street, Toronto, for two three-stage electrically-driven centrifugal pumps under a head of 329 ft.

TORONTO, ONT.—Bids will be received by Mayor T. L. Church, room 12, City Hall, until Sept. 14, for two 300,000 Imp. gal. per day, vertical centrifugal pumps with electric motors against 320-ft. head.

TORONTO, ONT.—Contract has been awarded to J. B. Nicholson & Company, 36 Toronto Street, at $35,000, by the J. A. Harrison Coal Company, Ltd., 57 Brock Avenue, for the erection of a coal elevating and cold storage plant. Electrically driven machinery will be installed.

(Issued Aug. 17, 1920)

1,349,979. ELECTRIC DARNING BALL; Lucinda Ritter, Riverside, Cal. App. filed April 10, 1920. Illuminated by flashlamp.

1,349,995. CONTROLLING SYSTEM FOR METAL-WORKING MACHINES; Edward V. Wurts, Newark, N. J. App. filed Sept. 24, 1917. For machines punching structural shapes.

1,349,999. PROCESS OF AMALGAMATING STEEL BODIES; Clarence W. Balke, Highland Park, Ill. App. filed May 31, 1918. For amalgamating the inner surfaces of the hollow stems of mercury-cooled valves.

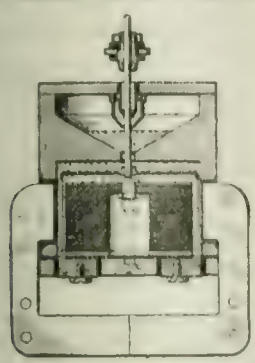
1,350,003. ELECTRIC CONTROLLER; Emil J. Carroll, Cincinnati, Ohio. App. filed Nov. 23, 1916. For controlling a number of machines.

1,350,019. SELF-PROTECTING CONDENSER; William Dubilier, New York, N. Y. App. filed Jan. 16, 1918. Plates melt away from hole when pierced or ruptured.

1,350,022. RADIATOR AND PROCESS OF AND APPARATUS FOR PRODUCING SAME; George B. Jackson, Chicago, Ill. App. filed April 28, 1917. Unequally deposits metal, thus producing a one-piece seamless radiator.

1,350,038. STREET-CAR ANNUNCIATOR; James L. Scroggins, Bennington, Okla. App. filed Sept. 16, 1919. Automatically indicates consecutive stops as car proceeds.

1,350,077. VALVE-OPERATING MECHANISM; Warren P. Loudon, Niagara Falls, N. Y. App. filed March 25, 1918. For operating the radiator valves of railway cars.



1,350,485. Graphic Recording Instrument.

1,350,100. RADIO-SIGNALING; John L. Hogan, Jr., Brooklyn, N. Y. App. filed Nov. 27, 1916. Uses two antennas or absorbing systems equally affected by disturbances, whereby the effects of disturbances neutralize each other, but differently affected by incoming signal impulses.

1,350,170. ARC-LAMP SYSTEM; Thomas J. Murphy, Rochester, N. Y. App. filed Jan. 12, 1917. For starting arcs in lamps having tungsten terminals in a neutral gas.

1,350,174. AUTOMATIC RECORDING MECHANISM; Harry Y. Norwood and Frederick W. Stalker, Rochester, N. Y. App. filed May 20, 1916. Records temperatures of several points.

1,350,188. AUTOMATIC BURGLAR ALARM; Franklin A. Terry, San Francisco, Cal. App. filed July 9, 1917. Phonograph calls alarm over telephone.

1,350,196. ATTACHMENT FOR CABLE RECORDERS; Frederick S. Whitney, New York, N. Y. App. filed March 25, 1918. Controls tape-punching devices.

1,350,214. DEVICE FOR REGULATING AND MAINTAINING CONSTANT THE SPEED OF MOTORS; Richard Eisenmann, Berlin, Germany. App. filed Dec. 29, 1914. Automatic brake prevents high speed.

1,350,243. TROLLEY CONTROL; Mike Shuklitsch, Jr., Johnston City, Ill. App. filed Feb. 27, 1918. Trolley drops if it leaves wire.

1,350,279. ADJUSTABLE CONDENSER; Paul J. Howe, Ridgewood, N. J. App. filed Feb. 7, 1918. Rotary switch.

1,350,280. ADJUSTABLE RHEOSTAT; Paul J. Howe, Ridgewood, N. J. App. filed Feb. 7, 1918. Rotary switch.

(Patents Issued Aug. 24, 1920)

1,350,300. INTERRUPTER-SPARK-SUPPRESSION METHOD AND DEVICE; William J. Crumpton, Evanston, Ill. App. filed April 26, 1917. Condenser in shunt is disconnected and discharged before contacts reclose.

1,350,317. ALLOY FOR ELECTRIC WELDING; Edward J. Kingsbury, New York, N. Y. App. filed Nov. 20, 1919. Containing iron, carbon, manganese, vanadium, phosphorus, sulphur and silicon.

1,350,328. SWITCHBOARD AND THE LIKE; Frederick A. Muschenheim and Frederick W. Blasdale, New York, N. Y. App. filed Jan. 12, 1918. Hotel room rack.

Record of Electrical Patents

Notes on United States Patents

1,350,331. METHOD OF AND MEANS FOR ESTABLISHING ELECTRICAL CIRCUITS; Albert A. Radtke, Chicago, Ill. App. filed Sept. 8, 1919. Pointer of galvanometer causes spark to jump across distributor.

1,350,345. TELEMETRIC DEVICE; Harry L. Tanner, Brooklyn, N. Y. App. filed June 7, 1918. Repeats at a distance the movements of an indicator.

1,350,355. RECORDING APPARATUS FOR RAILWAY SIGNALS; Leon S. Brach, New York, N. Y. App. filed March 6, 1913. Indicates time and duration of a signal.

1,350,369. CIRCUIT-CONTROLLING MECHANISM; Achilles de Khotinsky, Chicago, Ill. App. filed April 29, 1916. For use with thermostatically-controlled electric heating appliances.

1,350,382. ELECTRIC CONTROL SYSTEM; Percy R. Owens, Mount Kisco, N. Y. App. filed Aug. 3, 1918. For regulating clocks.

1,350,423. ELECTRIC-LAMP SUPPORT; Albert C. Runkel, Milwaukee, Wis. App. filed Sept. 5, 1918. Movable.

1,350,424. POWER-TRANSMISSION SYSTEM; Jacob Schurch, Holtville, Cal. App. filed Jan. 12, 1916. For motor vehicle.

1,350,426. ELECTRICAL CONTROL SYSTEM FOR AUTOMOBILES; Wendelin P. Seng, Chicago, Ill. App. filed Feb. 24, 1917. Controls lights and locks magnet.

1,350,437. ELECTRIC SYSTEM; Mark C. Cosgray, Sandusky, Ohio. App. filed Jan. 30, 1919. Charging of batteries.

1,350,446. SPEED-REGULATING APPARATUS; Valere A. Flynn, St. Louis, Mo. App. filed May 27, 1918. For internal combustion engines.

1,350,447. SPEED-REGULATING APPARATUS; Valere A. Flynn, St. Louis, Mo. App. filed May 27, 1918. For internal combustion engines.

1,350,485. GRAPHIC RECORDING INSTRUMENT; Jacob W. Bard and Otis White, Springfield, Ill. App. filed Oct. 14, 1916. Mercury supported element.

1,350,536. TELEPHONE-EXCHANGE SYSTEM; Joseph L. Wright, Cleveland, Ohio. App. filed Feb. 26, 1912. Phonograph asks subscriber for number.

1,350,540. FEED MECHANISM FOR PLANERS; Harold L. Blood, Plainfield, N. J. App. filed Oct. 19, 1916. Controls driving motor.

1,350,557. WELDING CONDENSER PARTS; Ralph D. Mershon, New York, N. Y. App. filed Dec. 8, 1919. For welding aluminum with other metals.

1,350,561. STORAGE BATTERY; Irvine M. Noble and Walter E. Gossling, Indianapolis, Ind. App. filed Aug. 26, 1918. More compact battery.

1,350,572. WELDING APPARATUS; Herbert M. Smith, Great Barrington, Mass. App. filed Sept. 30, 1918. For line welding of tubes.

1,350,586. ELECTRIC HEATER; Charles A. Xardell, Utica, N. Y. App. filed April 13, 1920. Self-regulating.

1,350,594. TELEPHONE-RECEIVER; William W. Dean, Rochester, N. Y. App. filed May 10, 1916. Simplified construction.

1,350,631. ELECTRIC HEATER; Charles A. Xardell, Utica, N. Y. App. filed Jan. 8, 1920. Resistance type.

1,350,695. RADIOTELEGRAPHY; Ralph R. Beal, Palo Alto, Cal. App. filed Oct. 8, 1917. Using arc transmitter.

1,350,703. STARTING MECHANISM FOR INTERNAL-COMBUSTION ENGINE; Alexander Churchward, New York, N. Y. App. filed May 28, 1919. Electric starter applied to flywheel.

1,350,714. PROCESS OF TREATING METALS AND ALLOYS; Charles Bruce Foley, Brooklyn, N. Y. App. filed June 29, 1917. Temperature in induction furnace controlled by static head of metal above heated portion.

1,350,734. MEANS FOR ELECTRICALLY MARKING UPON METALS; William S. Overlin, Portland, Oregon. App. filed Nov. 24, 1919. Vibrating pen.

1,350,737. TELEPHONE-OPERATING DEVICE; William H. Riess, Cincinnati, Ohio. App. filed March 2, 1917. Receiver hook electrically operated from exchange.

1,350,752. HIGH-FREQUENCY SIGNALING; Hendrik Johannes van der Bijl, New York, N. Y. App. filed Aug. 21, 1915. Modulation of waves.

1,350,790. TELEGRAPHY; Patrick B. Delany, South Orange, N. J. App. filed June 12, 1918. Wets tape with solution for reception of messages.

1,350,801. RADIOTELEGRAPHY; John Hays Hammond, Jr., Gloucester, Mass. App. filed May 28, 1913. Transmitting apparatus for selective receiving.

1,350,828. HOLLOW PROJECTILE-SHELL OF SHEET METAL; Thomas E. Murray, Jr., and Joseph B. Murray, Brooklyn, N. Y. App. filed July 15, 1918. Halves welded together electrically.

1,350,833. PROCESS OF ELECTRICALLY WELDING TRANSVERSE PLATES TO TUBES; Thomas E. Murray, Brooklyn, N. Y. App. filed Dec. 16, 1919. Toothed holes in plate.

1,350,837. PORTABLE ELECTRIC LIGHT; Frank Rampp, New York, N. Y. App. filed Jan. 25, 1918. Improved flashlamp switch.

1,350,856. EXPANSION-JOINT FOR ELECTRIC-CURRENT-COLLECTOR BARS. Elmer A. Davis, Harvey, Ill. App. filed March 24, 1919. Flexible.

1,350,867. ELECTRIC FLATIRON; Henry Kocourek, Chicago, Ill. App. filed Aug. 21, 1919. Guard for plug.

1,350,875. MEASURED-SERVICE TELEPHONE SYSTEM; Tablot G. Martin, Chicago, Ill. App. filed Dec. 24, 1917. Registers calls when lines are busy.



1,350,734. Means for Electrically Marking Upon Metals

1,350,876. ELECTRIC FURNACE; Walter S. Mayer and Walter C. Kennedy, New Brighton, Pa. App. filed Dec. 15, 1916. Plurality of resistance units.

1,350,877. METHOD OF OXIDIZING MATERIALS IN ELECTRIC FURNACES; Walter S. Mayer and Walter C. Kennedy, New Brighton, Pa. App. filed March 17, 1917. Controls air admission.

1,350,882. AUTOMATIC TELEPHONE SYSTEM; Winfred T. Powell, Chicago, Ill. App. filed April 14, 1917. For two classes of service.

1,350,895. HEATING DEVICE AND CONTROL THEREFOR; Stuart Thomson, Washington, D. C. App. filed Feb. 26, 1918. Using auto transformer.

1,350,899. ELECTRICAL SYSTEM OF POWER TRANSMISSION; Magnus Unger, Pittsfield, Mass. App. filed Nov. 15, 1918. Regulates load power factor.

1,350,907. METHOD FOR FORMING CONDUCTING-SEALS FOR INCANDESCENT-LAMP BULBS OR THE LIKE; Teizo Yanai, Tokyo, Japan. App. filed Sept. 30, 1916. Copper oxide forms seal.

1,350,910. ELECTRIC HEATING UNIT; Charles C. Abbott, Pittsfield, Mass. App. filed June 20, 1918. Using sheathed wire.

1,350,911. WIRELESS SIGNALING SYSTEM; Ernst F. W. Alexanderson, Schenectady, N. Y. App. filed Jan. 20, 1917. Receiving apparatus neutralizes waves from the same station.

1,350,912. RADIO RECEIVING SYSTEM; Ernst F. W. Alexanderson, Schenectady, N. Y. App. filed Aug. 25, 1917. Receives messages at same time that messages are being transmitted from a station near-by.

1,350,920. ELECTRICAL SYSTEM OF POWER TRANSMISSION. James R. Craighead and Henry R. Summerhayes, Schenectady, N. Y. App. filed April 17, 1919. Load, power factor or both indicated.

1,350,921. POWER-LIMITING SYSTEM; James R. Craighead, Schenectady, N. Y. App. filed Jan. 26, 1920. Maintains voltage on regenerative-braking railway systems.

1,350,922. HIGH-TENSION TELEPHONE SYSTEM; Frank C. Doble, Winchester, Mass. App. filed July 30, 1919. Insulated for high voltage.

Directory of Electrical Associations

Printed in the First Issue of Each Month

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co.

AMERICAN ASSOCIATION OF ENGINEERS. Secretary, C. E. Drayer, 63 East Adams St., Chicago, Ill. Annual convention, Buffalo, N. Y., May 10, 1921.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, E. B. Burritt, 8 West 40th St., New York City. Annual convention, Atlantic City, N. J., Oct. 11-15.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, Bethlehem, Pa. Annual meeting, Cleveland, Ohio, Sept. 30-Oct. 2.

AMERICAN ENGINEERING STANDARDS COMMITTEE. Secretary, P. G. Agnew, 29 W. Thirty-ninth Street, New York City.

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AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary-treasurer, C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

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ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, Preston S. Millar, Electrical Testing Laboratories, New York City. Annual meeting, New London, Conn., Sept. 13-16.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, John F. Kelly, Empire Building, Pittsburgh, Pa. Annual convention, New York, Sept. 20-24.

ASSOCIATION OF MUNICIPAL ELECTRICAL UTILITIES OF ONTARIO. Secretary, S. R. A. Clement, 190 University Ave., Toronto.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Joseph A. Andreucetti, Chicago & Northwestern Railway, Chicago, Ill. Annual meeting, Chicago, Ill., Oct. 28-31.

BRITISH COLUMBIA ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary-treasurer, Capt. W. J. Conway, 406 Yorkshire Building, Vancouver, B. C. Annual meeting, Vancouver, B. C., Oct. 19.

CANADIAN ELECTRICAL ASSOCIATION, affiliated with N. E. L. A. Secretary-treasurer, Eugene Vinet, Shawinigan Water & Power Co., Montreal, Canada.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary-treasurer, M. B. W. Baker, Denver, Col. Annual convention, Glenwood Springs, Col., Sept. 13-15.

CONFERENCE CLUB. Secretary, Sullivan W. Jones, 19 West 44th St., New York City.

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ILLUMINATING ENGINEERING SOCIETY. General secretary, Clarence L. Law. Sections in New York, Philadelphia, Pittsburgh, Cleveland, Chicago and Boston. Annual convention, Cleveland, Oct. 4-7.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Thomas Donohue, Lafayette, Ind. Annual convention, Sept. 15-17, French Lick, Ind.

INDUSTRIAL ELECTRIC HEATING ASSOCIATION. Secretary, Homer Kunz, Toledo Railways & Light Co., Toledo, Ohio.

INSTITUTE OF RADIO ENGINEERS. Secretary, Alfred N. Goldsmith, College City of New York, New York.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex. Annual convention, New Orleans, La., Oct. 19-22.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria Street, Westminster, London, S. W., England.

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NATIONAL COUNCIL OF LIGHTING FIXTURE MANUFACTURERS. Secretary, C. W. Hoffrichter, 8410 Lake Ave., Cleveland, Ohio.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, William L. Smith, Northeastern College, Boston, Mass.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive assistant to president, M. H. Aylesworth, 29 West 39th St., New York City.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1350 Marquette Building, Chicago, Ill.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

NEBRASKA SECTION, N. E. L. A. Secretary-treasurer, E. H. Conley, Nebraska Gas & Electric Co., Beatrice, Neb. Annual meeting, Omaha, Neb., Sept. 8 and 9.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 15 State St., Boston, Mass.

NEW ENGLAND GEOGRAPHIC DIVISION, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass. Annual convention, Kineo, Me., Sept. 13-16.

NEW MEXICO ELECTRICAL ASSOCIATION. Secretary-treasurer, Charles E. Twogood, Albuquerque, N. M.

NEW YORK ELECTRICAL CREDIT ASSOCIATION. Secretary, E. Donald Tolles, 52 Broadway, New York City.

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NORTHWEST GEOGRAPHIC DIVISION, N. E. L. A. Secretary, L. A. Lewis, Washington Water Power Co., Spokane, Wash. Annual convention, Spokane, Wash., Sept. 8-11.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus.

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PENNSYLVANIA ELECTRIC ASSOCIATION, State Section N. E. L. A. Secretary, H. M. Stine, 211 Locust St., Harrisburg, Pa. Annual convention, Bedford Springs, Pa., Sept. 8-11.

PUBLIC RELATIONS SECTION, N. E. L. A. Chairman, J. E. Davidson, Omaha, Neb.

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ROCKY MOUNTAIN DIVISION, N. E. L. A. Secretary-treasurer, A. C. Cornell, Denver, Col. Annual convention, Glenwood Springs, Col., Sept. 13-15.

SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. General manager, J. M. Wakeman, Guaranty Building, 522 Fifth Ave., New York City.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

SOUTHEASTERN DIVISION, N. E. L. A. Secretary-treasurer, Charles A. Collier, Georgia Railway & Power Co., Atlanta, Ga. Annual convention, Miami, Fla., Nov. 17-19.

SOUTHWESTERN DIVISION, N. E. L. A. Secretary, H. A. Lane, Oklahoma Utilities Association, Oklahoma City, Okla.

SOUTHERN CALIFORNIA ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary-treasurer, J. E. Wilson, 425 Consolidated Realty Building, Los Angeles, Cal.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, H. S. Cooper, 403-4 Slaughter Building, Dallas, Tex.

SOUTHWESTERN SOCIETY OF ENGINEERS. Secretary, C. E. Barglebaugh, 721 First National Bank Building, El Paso, Tex.

TECHNICAL SECTION, N. E. L. A. Secretary, W. C. Anderson, 29 West 39th St., New York City.

TORONTO ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, E. F. W. Salisbury, 615 Yonge St., Toronto, Ont.

TRI-STATE WATER AND LIGHT ASSOCIATION. Secretary-treasurer, W. F. Steiglitz, Columbia, S. C.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, A. B. Marsden, Rutland, Vermont.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 175 West Jackson Blvd., Chicago, Ill. Annual convention, Detroit, Mich., Jan. 25-27, 1921.

WESTERN SOCIETY OF ENGINEERS. ELECTRICAL SECTION. Secretary, E. S. Nethercut, 1735 Monadnock Block, Chicago, Ill.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, L. P. Pulliam, 1108 First National Bank Bldg., Milwaukee, Wis.

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At Peace with the Public

THE chairman of a public service commission has expressed the belief that the relations of the public and utilities are exhibiting marked improvement, due in a large measure to the broader viewpoint that the men responsible for utility management are taking. That men who stand as umpires between utilities and the public are able to say that a marked change for the better is observable is encouraging because it indicates that utility management in general is studying its problems from the standpoint of the value of its service to the public rather than the value of the public to the utility. A thorough appreciation and application of this viewpoint will do more to solve utility difficulties than any other one factor, because it makes for the giving of full value for what is received. This, after all, is what the average human being wants.

Coal Clause Justification

A SOMEWHAT unusual and what appears to be a narrow point of view is contained in a decision of the Public Utilities Commission of the District of Columbia handed down this week in the Potomac Electric Power Company rate increase case. The company was granted a rate increase, but it was denied its request to include in its tariff schedule a coal clause on the grounds that there would be less incentive to secure coal at the most advantageous price when it is known that the cost is automatically passed on to the consumer. Aside from the manifest unfairness of an almost inflexible rate under existing rapidly changing costs, does it seem reasonable that any utility would grow careless in its purchasing simply because its costs were guaranteed? From a public policy point of view, if from no other, a utility would naturally do everything in its power to prevent a rate increase. It appears as though the Public Utilities Commission in its eagerness to keep the faith with the public has overlooked a fundamental consideration in the psychology of public utility management.

Advertising a City

NOT long ago the Union Gas & Electric Company of Cincinnati engaged in an extensive advertising campaign in the large metropolitan dailies in the East calling attention to the advantages of Cincinnati as an industrial center. Not the least of these advantages is an abundant supply of electrical energy. More recently the Consolidated Gas, Electric Light & Power Company of Baltimore engaged in a similar campaign locally, dilating on the commercial and shipping advantages of Baltimore, and here, too, attention was called to the asset which Baltimore possesses in an abundant supply of steam and hydro-electric energy. This same tendency to accentuate the advantages of abundant electricity supply, pure water, etc., will be evident to the observer traveling throughout the country. Boards of trade, chambers of commerce, and other civic organizations usually publish such facts about their communities on billboards along the railroad lines for the benefit of industries seeking to establish themselves in strategic places. The practice is commendable, but what is sauce for the goose is sauce for the gander, and if electricity is an asset to communities seeking new industries, townspeople should be made to appreciate it as much as strangers. As a matter of fact their appreciation means more to the utility. Hence the advantage of advertising locally as well as nationally.

Frankness the Best Policy

SOME central station companies lucky enough to have accumulated fair stocks of coal during recent trying times (by no means over) are tempted to draw the veil of secrecy over their fuel situation through fear of curtailment of shipments should the exact quantity on hand become public. It is laudable for such companies to strive to render the best possible service to their customers by storing coal well in advance of its use, but do not some of our good friends betray needless alarm over divulging the size of their stocks? "A city set upon a hill cannot be hid," and neither can a coal field of ten to fifty thousand tons unless under-water storage be utilized to an uncommon degree. Granted that the competition for fuel is terrific, the present and prospective needs of operating companies for many months to come can be estimated with excellent accuracy. The difference between hoarding and between fuel conservation should be easily discovered, and, in the face of clear-cut demonstrations of requirements, frankness ought to win over both public and private agencies concerned with the equitable apportionment of the mining yield. Regulation is the answer to continued profiteering, whatever may be its nature, and an open-book policy would seem best in the long run for those who are dependent in the last analysis upon public opinion for fair treatment in securing their reasonable necessities.

What Not to Do

IN MATTERS of public policy managers of electric light and power properties have much to learn from their brothers in other public utility fields. They have also much to avoid. For instance, there are two large railway strikes under way at present in the East; one at Bridgeport and the other in Brooklyn. Strikes, of course, are not uncommon occurrences, but these differ radically because in Bridgeport it is the railway company which has taken upon itself to cease operations, hoping thereby to redress certain grievances

against the city, while in Brooklyn the men have gone out for higher wages. The effect on the traveling public, however, is the same in both cases; it is without street railway service and must walk or employ whatever means of transport is available, which leads us to remark that every strike on public utilities should be made a penal offence. The strike in Bridgeport, we are told, is for purposes of demonstration. Now demonstrations are excellent in themselves, although in Bridgeport winter would have been a better time to show the superiority and adequacy of electric railways over jitneys; but no utility has the right to shut down and subject the public to inconvenience just for purposes of demonstration. Imagine the railroads of the country shutting down because auto trucks and pleasure cars eat into their freight and passenger earnings. As public servants it is just as obligatory for electric light and power companies, street railway companies, gas and water companies to continue to render service as it is for the municipal authorities to afford police and fire protection. Let there be no mistake about that. Competition in the utility field succumbs to better and cheaper service, and that not for a day or a month, but year in and year out. Certainly no properly financed and managed electric railway, if it has any justification for existence at all, should have any trouble in proving the superiority of its service over that of the jitney. Service is what counts, but how can a utility expect to win public approval and support if it renders no service at all?

French Version of Electron-Tube Development

THE electron has ceased to be a name for an abstract laboratory conception. An electron is a useful device in commercial engineering. It is a very small device, hopelessly ultramicroscopic at present; but there are billions of them available, and when they are organized in a vacuum tube, in such a manner that each will carry an electric charge, and release the same at the surface of an electrode, under command of the operator, the service of the electron is a very noteworthy commodity.

So rapidly has the vacuum-tube electron device come into service during recent years that it promises to be an important factor in electrical-engineering progress. It is quite possible that vacuum-tube engineering may become a recognized specialty in design, construction and use. Aside from its well established place in communication systems, the vacuum-tube finds important applications in measurement work and may even become a part of power plant relay systems in the future.

The theory of vacuum-tube operation has already made notable advances, and cannot be ignored by those who desire to specialize in this branch of electrical application. An interesting contribution to the subject is made by Marius Latour in this number. The material has already made its appearance in French, but it is here translated and collected into a useful summary. The method of analysis adopted is that of resolving emfs. into perpendicular components.

The theory of the self-oscillation of a triode vacuum-tube is of great utility, and is very simple when only a single tube is involved. When, however, a number of tubes are used in cascade, the case becomes very complicated, and various unexpected reactions may arise. There is much room for developing the theory and technique of multiple amplifiers, in such a manner as to exclude the extraneous factors, and retain under control the fundamental elements of the system.

A Basic Power Investigation

SELDOM does the publication of an engineering report nearly two years after its field work is done yield conclusions of so much value as are embodied in Major Carroll H. Shaw's résumé of the War Industries Board report on the New England power situation, printed in this issue. Prepared under his direction to insure continued adequate electrical service in that crowded area of the nation's workshop, this investigation commanded from the outset the respect and hearty co-operation of utilities and industrial plants. Released for publication at a time when economic conditions have attained an abnormality little expected at the close of hostilities, the report naturally contains prophetic figures which would require extended verification if applied today in detail to the changing trend of electrical supply conditions, and yet its inferences and deductions are so sane and so thoroughly determined that the investigation will long stand as a basic inquiry into the power resources of the territory that is covered.

Interconnection and centralization of power production were in process in New England in the pre-war period. The work of Major Shaw and of his predecessors, however, focused attention upon the existing and potential resources of the district and undoubtedly quickened the movement toward more efficient energy supply. Electric plants of all kinds took account of stock, learned anew the possibilities of pooled resources and were brought closer to a solution of the ever-growing problem of conserving fuel, expanding plants in the face of rising overhead and operating costs and analyzing facilities and their use on behalf of more efficient service.

The completeness of the data assembled in the report leaves little to be desired in summarizing the industrial and public utility power resources of this area to the close of the war. The information presented came straight from headquarters; it represents full and cordial co-operation between the representatives of industry and of the government, and is of permanent value. In some cases the conduct of the survey by central-station men working in harmony with the power section of the War Industries Board disclosed new prospective business, and in many ways the turning of the light of inquiry inward revealed conditions of unsuspected interest and significance to utility and industrial plant executives.

Power development since the armistice has proceeded in New England along many of the lines forecasted in the report. The magnitude of individual plant expansion has varied a great deal because of conditions unexpected by many companies eighteen months ago. The anticipated hydro-electric development has been greatly curtailed by the high cost of capital, although several large and important plants are under construction or recently have been completed. Steam plant expansion has been notably large. Interconnection has progressed rapidly toward larger achievements from one end of New England to the other, and the public mind has ripened toward a comprehension of the benefits of

centralized generation, concentrated power production and trunk line transmission hitherto conspicuous by its absence. Electric railways and industrial plants are turning in increasing numbers to central-station service. The latter maintains a lead of at least 30 to 50 per cent in fuel economy, but much more remains to be accomplished in improving the efficiency of both central station and industrial power supply. Later studies of plant operation indicate that at present far more fuel is being wasted in both types of plants than was apparent when Major Shaw and his assistants combed the field. So clear a statement of the resources, tendencies of development and opportunities for increasing the efficiency of power production and distribution as this report establishes may well be characterized as fundamental.

Improved Permanent Magnet Theory

A PAPER on this subject, by S. Evershed, was recently read before the Institution of Electrical Engineers in London and abstracted in the *Electrician*. The paper is a valuable contribution to the literature of the subject. Since Hopkinson's work we have had a good working theory of the electromagnet, and we have been able to design electromagnets fairly well, for the purpose of dynamo-electric machinery. We have had, however, no corresponding good working theory of permanent magnets and their design has been largely empirical. The Evershed paper, however, offers an improved working theory and gives design criteria, as well as rules for design procedure.

The keynote of the paper is available magnetic volume energy, or the magnetic ergs per cubic centimeter of permanent magnet available in the useful magnetic field. The purpose of the permanent magnet is to supply a reliable flux density within a certain region between the poles. This means a corresponding definite number of magnetic ergs in this polar region. The smaller the number of cubic centimeters of permanent magnet used to supply this external energy the more effective is the magnet. Good design calls for the greatest external available energy from a given volume and weight of permanent magnet.

A number of interesting byproducts accompany the paper, such as an estimate of the velocity of the electrons in their atomic orbits, which, according to the Amperian hypothesis, give rise to the molecular property of permanent magnetism. The estimated velocity is about 600 km. per second, or enough to encircle our globe in a little more than a minute.

The theory of permanent magnetism is more abstruse than that of electromagnetism, because of the reaction of the flux in the magnetomotive force of the circuit. A bar magnet is to be considered as a magnetic battery, formed by a series association of a vast number of atomic magnetomotive forces. The bar magnet has a certain internal resistance and also a certain external resistance in the air. Neither of these quantities can be easily computed in the ordinary case. The drop of potential across the air sets up a counter mmf. which tends to demagnetize the bar. It actually does demagnetize it to a certain extent. The bar settles down to a fairly stable condition, in which its retentive force produces a flux that cannot shake out any more magnetism, through the action of the counter mmf. All this has to be digested mathematically and simplified in such a manner that magnetic engineers can use the theory. A very distinct advance in this direction has been given by the papers.

Power Developments in the High Sierras

IN CERTAIN sections of the West it is now apparent as never before that the industrial development of the future depends largely upon the availability of electric service. In the fertile valleys of southern California, for instance, the general power load is increasing annually at the rate of 15 per cent. Under such circumstances a development program over a period of years is not only essential but compulsory, since the sources of power in the high Sierras not only require years for completion but, to keep the cost per unit capacity within economic limits, groups of power stations, rather than isolated plants, must be constructed to utilize the entire power available on a stream. Elsewhere in this issue an example of the thorough development of an entire watershed is given in the description of several co-related projects on the San Joaquin and Kings Rivers in the Sierra Nevada Mountains by the Southern California Edison Company and the San Joaquin Light & Power Corporation. An ultimate development of nearly 900,000 kw. is outlined which will be available in an area of 1,500 square miles and will use the energy of the water from elevations of 7,000 ft. down to 1,000 ft. In addition to the power realized, a great benefit to the state will come through the regulation of the stream flow permitting water to be released during the late summer when it will be of inestimable value in the irrigation of the productive San Joaquin Valley, into which the rivers referred to flow.

Financing of Public Utilities

THE outstanding problems in public utility work at the present time have to do with regulation and finance. In a measure both are really one, since for their solution they require public confidence, above everything else. Without that neither the financing of utilities nor their proper regulation can make much headway. The rank and file in the industry know fairly well what regulation means, but have but a faint comprehension of the financial burdens under which public utilities labor. For that reason the contribution by Dr. Gephart on Financing Electric Public Utilities is both opportune and instructive.

The public has absolutely no appreciation of the heavy investment in public utilities compared with the infrequency of capital turnover and the necessity of adequate rates to safeguard that instrument. For instance, the total income of the largest hydro-electric plants in the country is a little more than one-sixteenth of the investment.

Hence, with the heavy fixed charges which must be incurred any decrease in income, however slight, jeopardizes the entire property. The ratio of income to investment in steam-driven systems is much more favorable, but ridiculous compared with that of other industries, some of which do a tremendous business on a "shoestring." Dr. Gephart's article speaks for itself and his observations ought to go far toward clarifying the thought of every man in the industry on the important question of finance.



George Herbert Harries

A distinguished soldier and public utility executive, whose services to his country and to the public have gained well-merited recognition

YEARS of successful leadership as a public utility executive and a military career marked with such signal honors as have come to Brig.-Gen. George H. Harries is a combination of public service that is rare. General Harries' military days date back to the frontier wars with the Indians, when he served as scout under Generals Miles and Crook. In the Spanish-American War, as Colonel of infantry volunteers, he participated in the siege of Santiago. In the World War, as Brigadier-General in the National Army, he was in the thick of things at Verdun, then at Brest, and finally at Berlin as American commissioner on the repatriation of allied prisoners of war, the first American to reach the goal coveted by the soldiers of all the allied nations. Nine months of distinguished service in Berlin amid revolutionary turmoil brought to him decorations from several countries, including that of Commandeur of the French Legion of Honor and the Distinguished Service Medal of the U. S. A.

General Harries' career in civil life has been equally as active. As a reporter on the Washington (D. C.) *Star* in his early twenties he became familiar with electric railway affairs, and at thirty-five he was elected president of the Metropolitan Railroad of Washington. Later, as a member of the board of directors and vice-president of the Washington Railway & Electric Company, he participated in the consolidation of electric light, power and railway properties of the capital city. In 1911 he became identified with H. M. Byllesby & Company as vice-president and for some years was stationed at Louisville, Ky., in charge of the affairs of the Louisville Gas & Electric Company and the Omaha (Neb.) Electric Light & Power Company as president of both companies, and assisted also in the general administration of several other of the Byllesby properties.

In the public utility field General Harries brought, besides an unusual organizing ability, a comprehensive knowledge of central-station operation and a close familiarity with the finesse of financing. These characteristics of leadership have elected him president of the American Electric Railway Association, president of the Association of Edison Electric Illuminating Companies and caused appointments to the executive and public policy committees of the N. E. L. A., the honorary degree of Doctor of Laws from the University of Kentucky, and just recently his election as president of the Illuminating Engineering Society. General Harries was born in Haverfordwest, South Wales, in 1860, the son of an officer in the British Army.



LOOKING SOUTH FROM ELEVATION OF 10,000 FT. ACROSS HUNTINGTON LAKE AND BIG CREEK TOWARD THE KINGS RIVER COUNTRY

High Sierras Hydro-Electric Developments

Generating Stations with a Total of 850,000 Kw. Which Will Produce 4,000,000,000 Kw.-Hr. per Annum Are Included in the 1920 to 1930 Construction Programs of the Southern California Edison Company and the San Joaquin Light & Power Corporation of California

PLANS that have been completed for the development of power sites in the high Sierras in Central California embrace an area totaling approximately 1,500 sq. miles (3,750 sq.km.) and call for a generating station rating of 850,000 kw. The ultimate total annual output for all the contemplated plants will be in excess of 4,000,000,000 kw.-hr., of which 2,400,000,000 kw.-hr. will be generated by water stored in reservoirs at high elevations. This seasonal and annual storage of water will so control the stream flow to the valley that the often-destructive floods during the snow-melting period in the spring will be prevented and the water will be more uniformly released during the summer and fall, when it is so greatly needed for power and for irrigating the fertile but semi-arid sections of the San Joaquin Valley, well over a mile lower in elevation.

The mountainous area referred to is drained by the San Joaquin and Kings Rivers, shown on the large map on page 514. The San Joaquin River and its many tributaries drain the northern portion of the area and the Kings River the southern portion. Two companies, the Southern California Edison Company and the San Joaquin Light & Power Corporation, are making the developments. The latter is just starting the work of developing the Kings River, which will ultimately produce 200,000 kw. by means of seven power houses, ranging in elevation from 890 ft. (271 m.) to 6,300 ft. (1,920 m.) above sea level.

That company has, among its thirteen hydro-electric

SAN JOAQUIN AND KINGS RIVERS DEVELOPMENTS

RESERVOIRS

Southern California Edison Company	Capacity Acre-Ft.	Drainage Area Sq. Miles	Elevation Ft.
Vermillion Valley	90,000	91 2	7,500
Blaney Meadows	15,000	144 0	7,500
Florence Lake	40,000	77 5	7,300
Huntington Lake *	88,000	71 0	6,950
Shaver Lake **	146,000	55 5	5,370
Granite Creek Reservoir	22,000	66 6	6,980
Tacuaya Creek Reservoir	27,000	33 5	7,000
Chiquito Creek Reservoir	18,000	60 0	5,000
Mammoth Pool Reservoir	28,000	665 0	3,000
Total	474,000	1104 2	
San Joaquin Light & Power Corporation			
Lake Wishon	128,000	178	6,550
Meyer Lake	21,000	19	6,850
Peart Lake	53,200	65	5,650
Crane Valley ***	17,000	40	4,500
Total	219,200	302	

* Huntington Lake now completed to 88,000 acre-ft.
** Partially completed.
*** Completed to 14,000 acre-ft

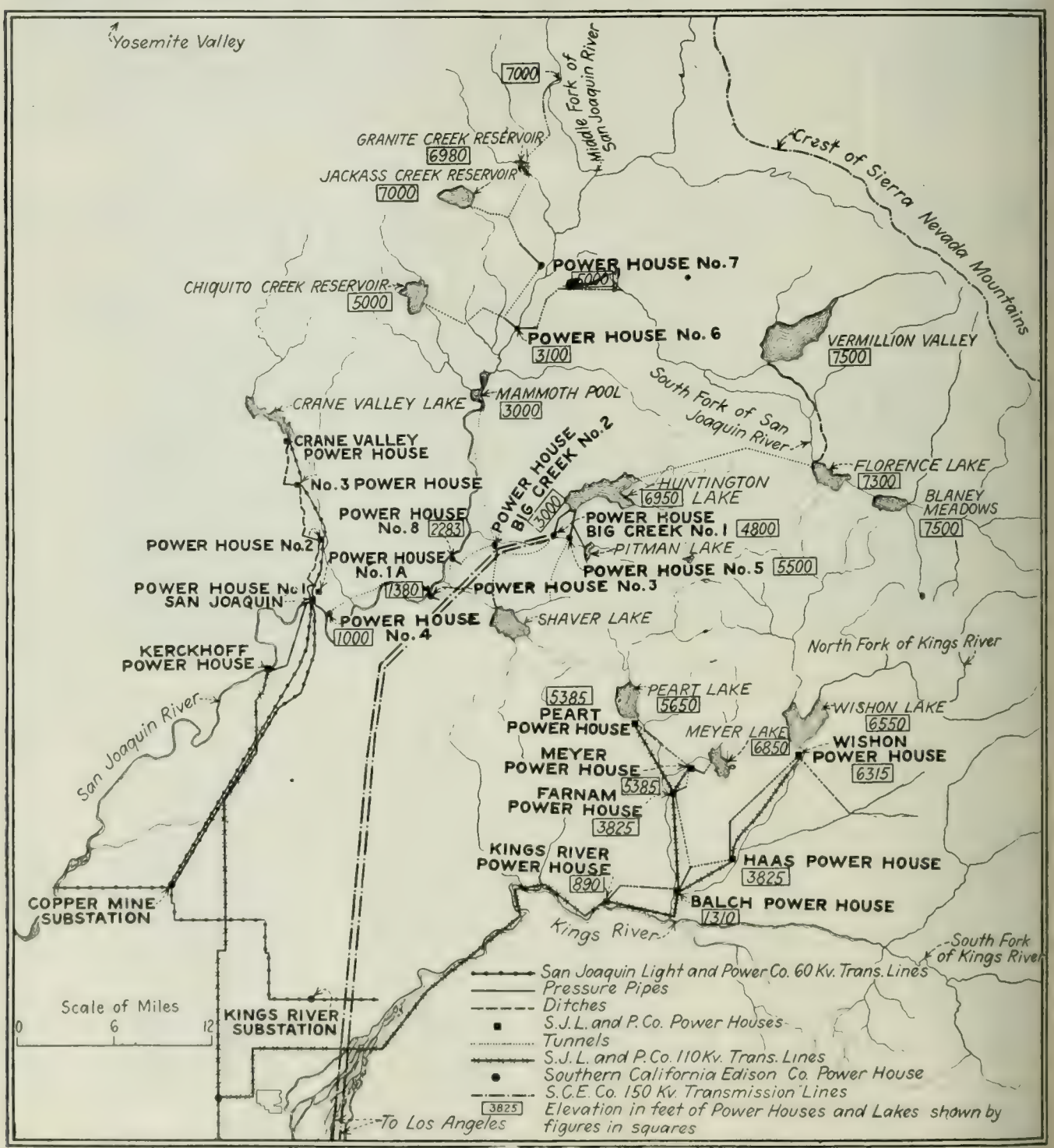
POWER HOUSES

Southern California Edison Company	Kilowatt Capacity	Ft. Head	Elevation
Power House No. 1*	64,000	2,130	4,800
Power House No. 2*	143,000	1,860—2,400	3,000
Power House No. 3	90,000	825	1,380
Power House No. 4	40,000	380	1,000
Power House No. 5	80,000	1,480	5,500
Power House No. 6	110,000	1,650	3,100
Power House No. 7	30,000	1,900	5,000
Power House No. 8	90,000	717	2,283
Total	647,000		
San Joaquin Light & Power Company			
Wishon	5,000	235	6,315
Haas	61,500	2,475	3,825
Balch	92,500	2,500	1,310
Peart	1,950	265	5,385
Meyer	5,000	1,465	5,385
Farnham	19,500	1,545	3,825
Kings River	17,000	410	890
Total	202,450		

*Now in operation with capacity of 32,000 kw. each.

generating plants in operation at the present time, six power stations of a total rating of 48,000 kw. on one of the lower forks of the San Joaquin River. One of these power houses, No. 1, is at the junction of this fork with the main stream of the San Joaquin River and another, the Kerckhoff, which was placed in operation Aug. 15, 1920, on the main stream with its intake below power house No. 1. The Kerckhoff station therefore obtains the benefit of the regulation of the stream flow controlled by the reservoir systems in operation and planned on both the North Fork and main stream.

Above the junction of the fork noted, with the main stream of the San Joaquin River, the developments are being made by the Southern California Edison Company. In operation at the present time by that company are two power houses, known as Big Creek No. 1 and Big Creek No. 2, on Big Creek, which is a tributary to the main river and drains an area of 95 sq. miles (246 sq.km.). A reservoir known as Huntington Lake, with a capacity of 88,000 acre-ft. (108,000,000 cu.m.), stores water above Big Creek No. 1 power house at an elevation of 7,000 ft. (2,100 m.). The Kings River development and the San Joaquin River development are separate from a hydraulic standpoint, but as the transmission systems fed by the power houses on the two rivers will be closely interconnected the programs for the development of the power available on the two streams are closely inter-related.



IN THIS SECTION OF THE HIGH SIERRAS 850,000 KW. WILL BE GENERATED, USING THE FALL OF THE RIVERS FROM ELEVATIONS OF 7,000 FT. DOWN TO 900 FT.

The catchments planned by the Southern California Edison Company for construction on the San Joaquin River system, beginning with those at the highest elevations, are as follows. The Blaney Meadows Reservoir, at an elevation of 7,500 ft. (2,280 m.), with a storage capacity of 15,000 acre-ft. (18,500,000 cu.m.) and an ultimate yield through all the power houses below of 66,000,000 kw.-hr.; the Vermillion Valley reservoir, at an elevation of 7,500 ft. (2,280 m.), with a capacity of 90,000 acre-ft. (110,000,000 cu.m.) and a yield of 396,000,000 kw.-hr. Other reservoirs on this system are Florence and Huntington lakes and Shaver Lake, feeding the various power houses, as outlined in the June 7, 1920, issue of the ELECTRICAL WORLD, page 1334, and noted in the accompanying table.

The output of the two plants now in operation on Big Creek is transmitted 240 miles (386.2 km.) to Los Angeles over a double-circuit, 150,000-volt, steel-tower transmission line. A substation under construction north of Bakersfield will step-up from 75,000 to 150,000 volts for transmission to Los Angeles the energy from the nearly completed 30,000-kw. Kern River No. 3 plant of the Southern California Edison Company, now being built on Kern River. This plant was described on page 116 of the July 19, 1919, issue of the ELECTRICAL WORLD. This substation will also supply energy to the system of the Mt. Whitney Power & Electric Company, a subsidiary of the Southern California Edison Company, and will also serve as a point of interconnection with the San Joaquin Light & Power Corporation, through a 15,000-kw., 50-cycle and 60-cycle frequency changer.

Since the economical limit of capacity of the two 150,000-volt Big Creek lines is approximately 125,000 kw., there will soon be required either additional circuits or higher voltage to transmit the rapidly-to-be-increased output from the San Joaquin River power system. Design and economy studies of 220,000-volt transmission are now under way by the Southern California Edison Company, which include the reconstruction and reinsulating of the present 150,000-volt lines for 220,000-volt operation and will double their capacity. Line insulation is being given particular consideration. Various arrangements of shields for better distribution of the duties of the individual insulator units in suspension strings have been tested and the results indicate that a satisfactory solution will be found.

KINGS RIVER NORTH FORK DEVELOPMENT

The development by the San Joaquin Light & Power Corporation on the North Fork of the Kings River includes power houses as follows: Wishon, 5,000 kw., head 235 ft. (71 m.); Haas, 61,500 kw., head 2,475 ft. (755 m.); Balch, 92,500 kw., head 2,500 ft. (762 m.); Peart, 1,913 kw., head 265 ft. (81 m.); Meyer, 500 kw., head 1,465 ft. (445 m.); Farnham, 19,500 kw., head 1,545 ft. (470 m.), and Kings River, 17,000 kw., head 410 ft. (124 m.). Especially noteworthy are the high heads of the Haas and Balch plants. Other details of this development appeared in the ELECTRICAL WORLD March 20, 1920, page 669.

The reservoirs on this river are not quite as extensive as those planned on the San Joaquin River, there being but three reservoirs planned, known as Lake Wishon, at an elevation of 6,550 ft. (1996 m.), having a capacity of 128,000 acre-ft. (177,500,000 cu.m.), drainage area 178 sq. miles (461 sq.km.); Meyer Lake, elevation 6,850 ft. (2,087 m.), capacity 21,000 acre-ft. (25,870,000 cu.m.), drainage area 19 sq. miles (49 sq.km.), and Peart Lake, elevation 5,650 ft. (1,722 m.), capacity 53,200 acre-ft. (65,500,000 cu.m.), drainage area 65 sq. miles (168 sq.km.). The plants on the Kings River will be tied in with the rest of the system of the San Joaquin Light & Power Corporation by 110,000-volt transmission lines.

The irrigation load in the San Joaquin Valley has grown at a very rapid rate. The rate of increase in the next few years will far exceed that in the past. It is therefore anticipated that the peak load of 62,000 kw. for 1920 will have increased in 1928 to a peak of 217,000 kw. The output in 1920 of about 363,540,000 kw.-hr. is estimated for 1928 at 1,340,280,000 kw.-hr. Thus, in order to be prepared to supply the load without retarding the necessary development of the immense fertile areas in the San Joaquin Valley, the development of the Kings River must proceed at a rapid pace. With the increased cost of fuel oil, plans for the further extension of the steam plants of the San Joaquin Light & Power Corporation will only be carried out by the construction of such steam plants which will use the natural gas now produced in the oil fields surrounding Bakersfield.



PRINCIPAL HIGH-VOLTAGE TRANSMISSION LINES OF SOUTHERN CALIFORNIA
Shaded portion is shown on larger scale in another illustration

The projects planned on the Kings River are to be constructed as follows: 31,000 kw. to be in operation in 1924, 15,500 kw. additional in operation in 1925, 15,500 kw. additional in operation in 1926 and 31,000 kw. additional to be placed in operation in each year 1927 and 1928, reaching a capacity at that time of 124,000 kw. The average cost per kilowatt up to a capacity of 124,000 kw. on the north fork of this river is estimated to approximate $197 per kilowatt, which will, however, be greatly reduced upon the extension of the project to the ultimate output of 200,000 kw.

THE *general public, whether it is represented by governmental heads, by Congress or otherwise, should co-operate with and assist private enterprise. Every department of government has responsibilities and opportunities of magnitude at this particular period in our history, remembering that general prosperity is the first essential. They can by precept and example contribute in rehabilitating and re-establishing the affairs of this country. For constructive statesmanship which will add to stability and progress in the moral, economic, social and political life of the nation they will be entitled to the commendation of all mankind; while a destructive policy will create distress.*—E. H. GARY.

Financing Electric Public Utilities—II

Tremendous General Demand for Capital Reflected by Rise in Bond Yields — This Reacts Against Regulated Business Because Public Utilities Cannot Quickly Change Prices to Follow Upward Tendency

By DR. W. F. GEPHART
Vice-President of the First National Bank in St. Louis

CREDIT of public utility corporations, on the whole, is at the present time more or less in disrepute as far as the general investor is concerned. This was shown in the first installment of this article, published last week, in which the yields from five average public utility bonds were compared with the yields from five average railroad bonds and five average industrials. The yields from the utility bonds were more than 2 per cent higher than either of the others.

Believing that deductions as to the average yield afforded by public utility investments as indicated on the basis of only five companies were not likely to give a fair average, a compilation was made covering seventeen highest-grade American public utility issues. Only issues rated by Moody in his "Analysis of Public Utilities" as A, AA or AAA were used.

A compilation was made showing the yield to the investor, should any of these securities have been bought at their market price during the period from April, 1919, to May 1, 1920 (Table III). On the basis of this compilation the following results were obtained: The average yield on the seventeen highest-grade public utility securities between April, 1919, and December, 1919, was found to be 6.11 per cent. The average yield from January, 1920, to May 1, 1920, was found to be 6.75 per cent.

A similar compilation was made for three of the highest-grade bond issues of the Atchison, Topeka & Santa Fé Railroad and two of the highest-grade issues of the Union Pacific. The average yield on these highest-grade railroad bonds from April, 1919, through December, 1919, was found to be 5.52 per cent. The average yield from January, 1920, to May 1, 1920, was found to be 5.75 per cent, thus showing that even the highest grade first mortgage public utility securities have recently been selling at a price which would yield the investor 1 per cent more income per annum than could be obtained from the same class of railroad securities.

A further tabulation covering the average yield on nine second-class public utility securities—that is, bonds rated by Moody as B, BA, BAA—during this same period showed that they sold at a price which would have yielded the investor, had they been bought between April, 1919, and December, 1919, 6.58 per cent. Had they been purchased at the average market price between January, 1920, and May, 1920, they would have yielded 7.20 per cent, the yield on this class of securities being almost a full point above that afforded by the highest-grade public utility security (Table IV).

Handicap of New Securities

Since the seasoned bonds of our largest public utility corporations rated by reliable investment houses as bonds having the highest grade of security can be bought on a yield basis of 6.75 per cent and those of the second class on a yield basis of 7.20 per cent, it would scarcely be expected that new securities of public utility companies could be sold on even so favorable a yield basis as that afforded by a seasoned second-grade bond.

Experience shows that new securities of the highest grade cannot be sold for the same price that a similarly secured bond can command that has been seasoned.

TABLE II—COST OF MONEY TO PUBLIC UTILITY CORPORATIONS EXCLUDING MARKETING PROFIT TO UNDERWRITERS

Date	Yield, Per Cent
Jan. 1, 1919, to July 1, 1919	6.86
July 1, 1919, to Dec. 1, 1919	6.90
January, 1920	7.10
February, 1920	7.11
March, 1920	7.59
April, 1920	7.62
May, 1920	7.83

Thus a company endeavoring to raise money through the issuance of new securities is handicapped at the very start by the fact that the securities it is offering are new and unseasoned. In addition to this the new securities of a going concern seldom rank as high in regard to the security behind them as do the seasoned issues secured by a first mortgage on the property.

New issues usually compete with the yield afforded by second-grade or junior issues, and even in competition with such issues new securities are at a disadvantage. The extent of the disadvantage in this regard is convincingly shown by a comparison of the yield basis on which new securities of public utility corporations have been offered between Jan. 1, 1919, and May 15, 1920. A study of the yield afforded by the principal representative offerings to the public of public utility securities of $1,000,000 or over in the period above mentioned was found to be as shown in Table II.

TABLE III—AVERAGE YIELD ON SEVENTEEN CLASS "A" PUBLIC UTILITY BONDS

on a basis of a fair average sale, or best bid price, computed from quotations taken from the *Commercial and Financial Chronicle* for the period April 1, 1919, to May 1, 1920. For list of bonds used, see Table IV.

Date	Yield, Per Cent	Date	Yield, Per Cent
April, 1919	5.97	November, 1919	6.38
May, 1919	5.93	December, 1919	6.49
June, 1919	5.92	January, 1920	6.47
July, 1919	5.96	February, 1920	6.69
August, 1919	6.11	March, 1920	6.78
September, 1919	6.13	April, 1920	6.99
October, 1919	6.18		
Average yield, April, 1919, to December, 1919			6.11
Average yield, January, 1920, to April, 1920			6.75
Average yield, April, 1919, to April, 1920			6.30

Variation in the yield on five highest grade railroad bonds from April, 1919, to May 1, 1920. The following bonds were used and yield was computed on the basis of sale or best bid price as shown by quotations in *Commercial and Financial Chronicle*: Atchison general 4s, 1995; Atchison adjustment 4s, 1995; Atchison convertible 4s, 1995; Union Pacific 1st 4s, 1947; Union Pacific convertible 4s, 1927.

Date	Yield, Per Cent	Date	Yield, Per Cent
April, 1919	5.35	November, 1919	5.82
May, 1919	5.28	December, 1919	5.74
June, 1919	5.35	January, 1920	5.42
July, 1919	5.32	February, 1920	5.93
August, 1919	5.61	March, 1920	5.82
September, 1919	5.76	April, 1920	5.85
October, 1919	5.52		
Average yield, April, 1919, to December, 1919			5.52
Average yield, January, 1920, to April, 1920			5.75
Average yield, April, 1919, to April, 1920			5.59

The figures in Table II were compiled from a list of bond underwritings issued by the Standard Statistics Company in its weekly service and from the *Commercial and Financial Chronicle.* (For a complete list of the bond underwritings, see Table V.)

Since the signing of the armistice interest rates the world over have been gradually rising at an accelerating rate. The weekly statistics issued by Brookmire's Economic Service in its pamphlet entitled "Brookmire's Forecaster," dated May 17, 1920, throw some interesting sidelights on current interest rates and the changes that have taken place within the last few years. Sixty-day money, New York Stock Exchange, in May, 1913, was 3½ to 4 per cent. Two years ago it was 6 per cent. For the week ended May 15 of this year it was quoted at from 8 to 8½ per cent. Discounts, prime, four to six months, New York, were 5¾ to 5½ per cent in May, 1913; 5¾ to 6 per cent two years ago; 7 per cent May 15.

How rapid the increase has been since January of this year is shown by statistics taken from the same source. Four to six months prime discounts, New York, were 6 per cent in January and 7 per cent in May of this year. Sixty-day money, New York Stock Exchange, was 7 to 7½ per cent in January and 8 to 8½ per cent in May. This tightening of the money market is reflected in every class of security in the world. United States government bonds have been selling at a price to yield the investor in many cases in excess of 6½ per cent. This situation is not due to any question or doubt as regards the security involved but is primarily indicative of the tremendous demand for capital funds, depleted by the war.

TABLE IV—AVERAGE YIELD ON NINE CLASS "B" PUBLIC UTILITY BONDS

On a basis of a fair average sale, or best bid price, computed from quotations taken from the *Commercial and Financial Chronicle* for the period April 1, 1919 to May 1, 1920. The following are the bonds used: Alabama Power 1st 5s, 1946; Chicago Railway 1st 5s, 1927; Home Tel. & Tel. 1st 5s, 1933; Lachede Gas Light 1st 5s, 1934; Pacific Gas & Electric 5s, 1942; Peoples Gas Light Co. 5s, 1947; Texas Power & Light 5s, 1937; Utah Power & Light 5s, 1944; Montana Power 5s, 1943.

Date	Yield, Per Cent
April, 1919, to December, 1919	6.58
January, 1920, to May 1, 1920	7.20

TABLE V—COST OF MONEY TO PUBLIC UTILITY CORPORATIONS EXCLUDING MARKETING PROFIT TO UNDERWRITERS

Period—Jan. 1, 1919, to May 14, 1920

	Yield, Per Cent
(a) Average yield on twenty-three representative issues of $1,000,000 and over, offered to the public between January 1, 1919, and July 1, 1919	6.86
(b) Average yield on twenty-four representative issues of $1,000,000 and over, offered to the public between July 1, 1919, and Dec. 1, 1919	6.90
(c) Average yield on seven new representative issues of $1,000,000 and over, offered to the public in January, 1920	7.10
(d) Average yield on eight new representative issues of $1,000,000 and over, offered to the public in February, 1920	7.11
(e) Average yield on seven new representative issues of $1,000,000 and over, offered to the public in March, 1920	7.59
(f) Average yield on seven new representative issues of $1,000,000 and over, offered to the public in April, 1920	7.62
(g) Average yield on five new representative issues of $1,000,000 and over, offered to the public in May, 1920	7.83

How seriously this situation is handicapping new improvements of public utility corporations is well illustrated by the following quotation from the *Wall Street Journal* for April 12, 1920:

Chicago Telephone Company Withdraws $10,000,000 Note Application

President Sunny has informed the Illinois Public Utility Commission that Lee, Higginson & Company and five leading Chicago bankers jointly bid 94½ per cent for the company's proposed issue of $10,000,000 three-year 7 per cent notes, or yield basis of 8.99 per cent, which is a prohibitive price for public utility credit, and therefore the company has withdrawn its application to issue these notes for needed improvements this year. The company placed a similar amount of notes with the syndicate a few years ago slightly above a 5 per cent basis.

When the cost of money to a public utility property is specifically considered at the present time, it must be realized that the cost of money to industry in general does not necessarily determine its cost to a public utility corporation. Capital does not flow so freely in actual practice as might theoretically be supposed; it is flexible only within narrow limits. The total capital fund available for investment at any time is not in active competition for all types of investment.

Flow of Capital

Capital is controlled by various individuals and moves only in accordance with their preferences and prejudices. These preferences and prejudices are the determining factors controlling the flow of capital into the various fields of investment. Psychological forces play a very prominent part in the cost of money to industry. Very often the actual security behind a given investment proves to be of less importance than is the popular opinion regarding the security held by a large group of investors. In other words, the attitude of the investing public toward a given type of investment often becomes the dominant factor controlling the price of money in that field.

TABLE VI—COST OF MONEY TO RAILROADS EXCLUDING MARKETING PROFIT TO UNDERWRITERS

Period—Jan. 1, 1919, to May 14, 1920

	Yield, Per Cent
(a) Average yield on eight representative issues of $1,000,000 or over, offered to the public between Jan. 1, 1919, and Dec. 31, 1919	6.15
(b) Average yield on nine representative issues of $1,000,000 and over, offered to the public between Jan. 1, 1920, and May 1, 1920	6.95

Of the total fund of capital available for investment in the United States today there is only a given amount available under any circumstances for railroads, public utilities, industrials, farm loans, real estate loans, certificates of deposit, savings bank accounts, stocks or government bonds. Thousands of individuals having considerable investment capital at their disposal would under no circumstances purchase a corporation security. Even a very high yield would not attract them. An illustration of this is found in the ability up to just a few months ago of the Federal Land Bank to float its farm loan bonds on a yield basis of 4½ per cent at a time when tax-free government bonds were being offered on a yield basis of close to 6 per cent. Investigation has shown that in a large measure these bonds were purchased in small lots by farmers and residents of small towns, individuals whose income is so small that the tax-free covenant in these bonds would have no particularly attractive force.

There are likewise thousands of individuals in the United States who have a strong preference for 6 per cent real estate loans. Still others have a strong preference for municipal securities. The result is that there are millions of dollars of available investment funds in the United States that would under no circumstances compete in the market for corporation bonds.

It is quite obvious from the abnormally high price-

that public utility corporations have been compelled to pay for capital recently that investments of this type are rather generally considered as less desirable than many other classes of investments. There are two factors that seem to have been dominant in producing this situation.

First, public utilities because of their special and privileged position in the past took in some cases undue advantage of this position. The result was that thousands of small investors lost heavily in investments of this type.

In other cases some few of the public utilities abused their semi-monopolistic position and charged an excessive price for their services. Public opinion finally revolted and there were enacted various restrictive laws which so limited the control of public utilities over the selling price of their services as to place them entirely at the mercy of various rate-making bodies. Each of these two forces has had its period of ascendency, and as a result most public utility properties in the United States are in difficult financial straits. They are hampered by restrictive legislation and are suffering from what amounts in many instances to a financial boycott on the part of the investing public.

The problem today is to meet the existing situation. The abuses and prejudices of the past must be overcome. Public confidence in our public utilities must be restored. The service they render is a necessity and is in a large measure fundamental to the proper development of industry as a whole. A survey covering the investment field for public utility securities has clearly shown how serious the situation is at the present time. Every effort should be made to improve conditions lest the public be denied those services and facilities to which it is entitled. No improvement in this regard can be expected until public utility properties afford as attractive a field for capital investment as that offered in other fields of business enterprise.

TABLE VII—COST OF MONEY TO INDUSTRIALS EXCLUDING MARKETING PROFIT TO UNDERWRITERS
Period—Jan. 1, 1919, to May 14, 1920

	Yield, Per Cent
Average yield on five representative issues of $1,000,000 and over, offered to the public between Jan. 1, 1919, and July 1, 1919	6 23
Average yield on thirty-one representative issues of $1,000,000 and over, offered to the public between July 1, 1919, and Dec. 31, 1919	6.51
Average yield of eight representative issues of $1,000,000 and over, offered to the public in the month of January, 1920	6 60
Average yield of nine representative issues of $1,000,000 and over, offered to the public for February, 1920	6 62
Average yield of thirteen representative issues of $1,000,000 and over, offered to the public for March, 1920	6.92
Average yield of nine representative issues of $1,000,000 and over, offered to the public for April, 1920	7.42
Average yield of four representative issues of $1,000,000 and over, offered to the public up to May 14, 1920	7 17

Central-Station Expansion in 1920

Analysis of Returns Received Indicates That About 1,500,000 Kw. Will Be Added to Generating Capacity of Central Stations in 1920

IN SPITE of the unusually high cost of money, labor and materials, a substantial addition to the generating capacity and transmission lines of the electric light and power industry has been planned for 1920. While some new plants of large size are under way, for the most part the new equipment will simply mean additional plant and line facilities for systems already loaded to capacity. In certain sections of the country, especially in the East and far West, there has been an acute shortage of power. The new equipment will in most cases, therefore, merely act to help the utilities serve those whose needs are most pressing.

Generally speaking, the utilities are not undertaking any program of expansion except where necessity dictates. With money costing from 8 to 12 per cent, as at present, and other costs proportionately high or higher, the operators are not anxious to undertake a liberal expansion program.

In an endeavor to ascertain the extent to which the central stations are expanding during the present year, the ELECTRICAL WORLD has undertaken a survey of the central-station industry, the results of which are to be found in the accompanying tables. The number of companies rendering returns totaled 212, representing 54 per cent of the total installed capacity of the central-station industry. Of this number eighty-six, representing 15.8 per cent of the total installed capacity, reported no plans for additions in equipment during 1920. Of the remaining 42.2 per cent which reported definite plans for additions or improvements to their plants and transmission systems during 1920, about 30.5 per cent are steam plants and 11.7 per cent are hydro-electric. In only a few instances did the small plants contemplate additions, and it is probably safe to state that the total of $141,868,000 represents at least 80 per cent of the value of the total contemplated central-station new plant and additions and transmission-line extensions for the present year.

It will be noticed that several companies do not contemplate plant additions but are undertaking line extensions only, while others report both new generating units and transmission-line extensions. It is not a true indication, therefore, of the cost per kilowatt installed to divide the total value of all additions by the increased plant installation.

A summary of the proposed extensions shows a total

TABLE I—SUMMARY OF ADDITIONS TO CENTRAL-STATION CAPACITY AND TRANSMISSION LINES DURING 1920

Section of Country	Steam Plants											
	Capacity Jan. 1, 1920, Kw	Proposed Additions to Plant Units, Kw.	Capacity Jan. 1, 1921, Kw.	Value of New Plant Units and Extensions in Transmission Lines	Capacity Jan. 1, 1920, Kw.	Proposed Additions to Plant Units, Kw.	Capacity Jan. 1, 1921	Value of New Plant Units and Extensions in Transmission Lines	Per Cent of Installed Capacity Represented	Total Additions in Plant Units, Kw.	Total Value of New Units and Extensions in Transmission Lines
New England	509,610	104,500	614,110	$8,630,000	188,200	34,225	222,425	$4,151,969	60	138,725	$12,781,969
Atlantic	2,059,171	323,800	2,382,971	43,608,000	758,635	112,800	871,435	9,116,000	65	436,600	52,724,000
South Central	259,257	29,600	288,857	2,567,000	177,900		177,900		45	29,600	2,567,000
North Central	1,069,825	373,375	1,443,200	37,893,232	323,513	14,325	337,838	1,215,200	34	387,700	39,108,432
Mountain and Pacific	442,265	61,458	503,723	5,976,855	1,124,957	186,500	1,311,457	28,709,591	86	247,958	34,686,446
United States	4,340,128	892,733	5,232,861	98,675,087	2,573,205	347,850	2,921,055	43,192,760	54	1,240,583	141,867,847

Total installed capacity of all central stations on January 1, 1920 . . . . . 12,760,000 kw.
Probable total installed capacity of all central stations on January 1, 1921 . . . . . 14,310,000 kw

TABLE II—ADDITIONS TO CENTRAL-STATION CAPACITY AND TRANSMISSION LINES DURING 1920

Name of Company	Steam Plants: Capacity Jan. 1, 1920, Kw.	Steam Plants: Additions 1920, Kw.	Steam Plants: Value of Additions	Hydro-electric Plants: Capacity Jan. 1, 1920, Kw.	Hydro-electric Plants: Additions 1920, Kw.	Hydro-electric Plants: Value of Additions	Total Additions, Kw.	Total Value of Additions
SOUTH CENTRAL STATES								
Choctaw Power & Light	9,000		$120,000					$120,000
Dallas Power & Light	17,500		650,000					650,000
Houston Lighting & Power Co	14,500	8,000	450,000				8,000	450,000
Jackson Railway & Light Co	1,200	600	50,000				600	50,000
Little Rock Railway & Electric Co	13,600	5,000	310,000				5,000	310,000
Memphis Gas & Electric Co	14,000	14,000	812,000				14,000	812,000
New Orleans Railway & Light Co	58,700		50,000					50,000
Southwestern Gas & Electric Co	2,125	2,000	125,000				2,000	125,000
Union Light, Heat & Power Co	Included in United Gas & Electric report.							
NORTH CENTRAL STATES:								
Beloit Water, Gas & Electric Co	5,500	6,750	250,000				6,750	250,000
Central Power Co., Grand Island	2,250	5,000	650,000	2,000			5,000	650,000
Kearney	750			600	1,500	$150,000	1,500	150,000
Cleveland Municipal Electric Light Plant	28,500	11,750	500,000				11,750	500,000
Clinton Gas & Electric Co	3,000	3,200	156,000				3,200	156,000
Columbia, Delaware & Marion Electric Co	4,250	7,000	950,000				7,000	950,000
Columbus Railway, Power & Light Co	48,310	7,500	750,000				7,500	750,000
Consumers' Power Co	72,250	27,500	7,000,000	76,610	.....		27,500	7,000,000
Dayton Power & Light Co	45,195	20,000	1,000,000		.....		20,000	1,000,000
Detroit Edison Company	199,300	109,000	8,000,000	4,475	.....		109,000	8,000,000
Detroit Municipal Electric Light Co	11,200		800,000					800,000
Dubuque Electric Co	11,150		160,000					160,000
Illinois Northern Utilities Co	6,600	3,000	200,000	3,000			3,000	200,000
Indiana & Michigan Electric Co	13,250	9,500	275,000	14,750	4,000	182,000	13,500	457,000
Indiana Service Corp	16,250		50,000					50,000
Interstate Public Service	5,150	5,775	129,232	400	400	33,200	6,175	162,432
Iowa Railway & Light Co	17,000	10,000	350,000	1,200			10,000	350,000
Kansas City Power & Light Co	42,250	40,000	3,000,000				40,000	3,000,000
Kansas City Municipal Electric Light Plant	20,000		90,000					90,000
Lincoln Traction Co	4,000		50,000					50,000
Madison Light & Railway Co	820		1,000		.....			1,000
Milwaukee Electric Railway & Light Co	88,000	40,000	6,500,000	425	.....		40,000	6,500,000
Moline Rock Island Manufacturing Co	42,500		200,000	4,250				200,000
Northern States Power Co	59,280		200,000	27,455				200,000
Otter Tail Power Co	1,285	1,500	150,000	4,275		25,000	1,500	175,000
Peninsula Power Co	3,200	.....	60,000	9,000	2,000	50,000	2,000	110,000
Richland Public Service Co	10,000	10,000	350,000				10,000	350,000
Richmond Municipal Light & Power Plant	4,250	5,000	300,000	.....	.....	.....	5,000	300,000
St. Cloud Public Service	2,500	3,500	600,000	2,200	.....		3,500	600,000
St. Paul Gas Light Co	8,000		20,000	3,000				20,000
South Illinois Light & Power Co	1,750	2,000	100,000				2,000	100,000
Superior Water, Light & Power Co	1,700		2,000					2,000
Terre Haute, Indianapolis & Eastern Traction Co	11,500	7,500	600,000				7,500	600,000
Union Gas & Electric Co	101,000	30,000	2,700,000				30,000	2,700,000
Union Light & Power Co	2,150		850,000					850,000
United Light & Power System:								
Riverside plant	2,100			650	350	50,000	350	50,000
Rocky Ford plant	1,400	2,900	150,000	1,400	2,800	200,000	5,700	350,000
Blue Rapids plant				450	275	25,000	275	25,000
Wisconsin Public Service Co	7,500	5,000	750,000	6,000			5,000	750,000
Wisconsin Valley Electric Co	2,250			1,600	3,000	500,000	3,000	500,000
MOUNTAIN AND PACIFIC STATES:								
City of Tacoma Light Dept				24,000		30,000		30,000
Colorado Power Co	4,775	1,475	135,000	26,900			1,475	135,000
Eastern Oregon Light & Power Co	450	1,500	175,000	2,550		30,000	1,500	205,000
Great Western Power Co	26,000			65,000	44,000	8,500,000	44,000	8,500,000
Los Angeles Bureau of Power & Light				30,500	30,000	2,750,000	30,000	2,750,000
Los Angeles Gas & Electric Corp	22,908	13,333	681,480				13,333	681,480
Pacific Gas & Electric Co., Phoenix, Ariz	750	.....	250,000					250,000
†Pacific Gas & Electric Co	117,000	12,500	950,000	194,875	1,000	2,096,200	13,500	3,046,200
Pacific Power & Light Co	6,240	3,750	1,300,000	15,775			3,750	1,300,000
San Joaquin Light & Power Corp	16,750	11,900	930,375	32,000	40,000	2,698,391	51,900	3,628,766
Seattle Municipal Light & Power Co	22,500	15,500	1,250,000	14,875	15,000	1,075,000	30,500	2,325,000
Southern California Edison Co	107,482			119,190	46,500	10,000,000	46,500	10,000,000
Utah Power & Light Co	16,000			113,457	10,000	1,530,000	10,000	1,530,000
Wenatchee Valley Gas & Electric Co	0	1,500	190,000	2,750			1,500	190,000
Western States Gas & Electric Co	2,250			6,075				
NEW ENGLAND								
Androscoggin Electric Co	1,500	0		6,500	2,250	$250,000	2,250	$250,000
Bangor Railway & Electric Co	0			12,460	4,600	213,894	4,600	213,948
Cambridge Electric Light Co	13,250	11,750	$450,000				11,750	450,000
Central Maine Power Co	10,375			15,650	10,750	1,300,750	10,750	1,300,750
Connecticut River Power Co. of N. H.				20,000	8,000	1,000,000	8,000	1,000,000
Cumberland County Power & Light Co	7,110			16,700	3,325	402,325	3,325	402,325
Danbury & Bethel Gas & Electric Light Co	1,300		100,000					100,000
Derby Gas Co	10,000	5,000	350,000	600	300	35,000	5,300	385,000
Edison Electric Illuminating Co. of Boston	143,000	30,000	2,000,000	.....	.....		30,000	2,000,000
Hartford Electric Light Co	36,000		150,000	1,600	.....			150,000
Holyoke Municipal Gas & Electric Light Plant	10,250		125,000					125,000
Lynn Gas & Electric Co	18,700		200,000					200,000
Manchester, Traction, Light & Power Co., Nashua	1,500		25,000					25,000
Meriden Electric Lighting Co	5,250	3,000	100,000				3,000	100,000
Narragansett Electric Lighting Co	50,000		1,000,000					1,000,000
New Bedford Gas & Edison Light Co	52,000	20,000	1,850,000				20,000	1,850,000
North Adams Gas Light Co	2,000	3,000	150,000				3,000	150,000
Pittsfield Electric Co	5,000	5,000	750,000				5,000	750,000
Rockingham County Light & Power Co	14,500		180,000	200				180,000
Twin State Gas & Electric Co	3,000	2,000	150,000	9,000	2,000	250,000	4,000	400,000

† Includes Pacific Gas & Electric, Northern California Power Co., Sierra & San Francisco Power Co.

(Table II continued on page 520)

TABLE II (CONTINUED)—ADDITIONS TO CENTRAL-STATION CAPACITY AND TRANSMISSION LINES DURING 1920

Name of Company	Steam Plants: Capacity Jan. 1, 1920, Kw.	Steam Plants: Additions 1920, Kw.	Steam Plants: Value of Additions	Hydro-electric Plants: Capacity Jan. 1, 1920, Kw.	Hydro-electric Plants: Additions 1920, Kw.	Hydro-electric Plants: Value of Additions	Total Additions, Kw.	Total Value of Additions
NEW ENGLAND:								
United Electric Light Co	33,250	24,750	1,000,000	3,600			24,750	1,000,000
Vermont Hydro Electric Corp				7,600	3,000	700,000	3,000	700,000
Webster & Southbridge Gas & Electric Co	6,200		50,000					50,000
ATLANTIC STATES:								
Albany Southern Railroad	4,000			3,700		250,000		250,000
Appalachian Power Co	18,750	20,000	1,000,000	25,000			20,000	1,000,000
Athens Railway & Electric Co	3,500		60,000	4,350				60,000
Binghamton Light, Heat & Power Co	9,500	5,750					5,750	
Consolidated Gas Co. of N. J.	2,000		20,000					20,000
Consolidated Gas, Electric Light & Power Co	80,000	20,000	1,500,000	600			20,000	1,500,000
Duquesne Light Co	156,200	60,000	11,000,000				60,000	11,000,000
Durham Traction Co	3,300		44,500					44,500
Edison Light & Power Co	7,350		21,000					21,000
Harrisburg Light & Power Co	9,500	6,500	852,000				6,500	852,000
Jamestown Municipal Electric Light Plant	2,000	3,000	250,000				3,000	250,000
Kentucky & West Va. Power Co., Tug River District	7,125	3,750	250,000				3,750	250,000
Miami Electric Light & Power	6,500		800,000					800,000
Monongahela Valley Traction Co	23,750	23,750	3,100,000				23,750	3,100,000
Morris & Somerset Electric Co	2,750	3,200	419,000				3,200	419,000
Newport News & Hampton Railway Gas & Electric Co	14,000		75,000					75,000
New York Edison Co. and United Electric Light & Power Co	467,000	22,000	1,600,000				22,000	1,600,000
*Niagara Falls Power Co				285,000	100,000	8,000,000	100,000	8,000,000
Old Dominion Power Co	2,000		20,000					20,000
Orange & Rockland Electric Co	2,175	3,000	200,000				3,000	200,000
Orange County Public Service Corp	3,575			1,200	400	18,000	400	18,000
Paul Smith's Electric Light & Power Co				3,000		40,000		40,000
Pennsylvania Utilities Co	23,500		175,000	2,100				175,000
Philadelphia Electric Co	260,504	60,000	10,000,000				60,000	10,000,000
Public Service Electric Co, (New Jersey)	277,500	12,500	2,500,000				12,500	2,500,000
Queensborough Gas & Electric Co	8,700		250,000					250,000
United Hudson Electric Corp					5,000	450,000	5,000	450,000
United Service Corp	24,250	8,500	1,100,000	1,500			8,500	1,100,000
Utica Gas & Electric Co	13,250	7,000	400,000	21,200	6,400	300,000	13,400	700,000
Virginian Power Co	47,500	23,750	900,000				23,750	900,000
Virginia Railway & Power Co	76,000			11,500	1,000	25,000	1,000	25,000
Virginia-Western Power Co	4,500		45,000	2,350				45,000
Ware County Light & Power Co	500	500	65,500				500	65,500
Washington Railway & Electric Co	87,000		481,000					481,000
West. Penn. Railways System	98,328	40,000	6,100,000	105			40,000	6,100,000
Wilkes-Barre Co	7,000	600	380,000				600	380,000
York Haven Water & Power Co						25,000		25,000

* This does not include the Canadian plant. Part of the addition given under 1920 was done in 1919

addition of 1,240,583 kw. in generator installations. Assuming that this figure represents 80 per cent of the probable additions to all central stations during the present year, it appears probable that about 1,500,000 kw. will be added to the plant installation of 12,760,000 kw. as estimated by the ELECTRICAL WORLD for Jan. 1, 1920. The Atlantic States show the largest proposed expansion both in plant units and in total value. The Mountain and Pacific States reported by far the largest extensions by hydro-electric plants.

Electrically Operated Switchgear for Street-Lighting Control in Germany

THE city of Charlottenburg, which forms a part of Greater Berlin, has installed an interesting system of electric distance control for its street-lighting plant which enables the operator at the central station to flood the entire city with light in a minute's time. European conservatism does not permit the use of high-voltage arc-lamp series systems. Street-lighting practice over there consequently has to dispense with this labor-saving device and employ the old man-on-a-bicycle method for the switching service. Rising wages, however, have emphasized the poor economy of this practice, and the new machine switching system, whereby all switching is done from a control board in the main power house, is interesting as indicating what remarkably good economies may be obtained by installing such labor-saving electric control.

Charlottenburg is lighted by arc lamps, connected in series groups of three and fed from a 150-volt alternating current supply. The city is divided into several districts, with a number of lamp groups in each, and in every district there is a machine switching station, connected to the main control board by two circuits of No. 16 copper wire with a common ground return. Each switching station has a controller with cam contacts for the several lamp groups, different cams being provided for the all-night and for the half-night groups. The controller is rotated by a small motor, fed through one of the control circuits and operated by a switch on the central board. The other control circuit in each switching station is utilized for a telltale service with relays and signaling lamps, so that the operator at the control board is constantly informed about the position of each controller. Special trouble lamps are provided, which light up if any group of lamps goes out of service because of fault.

The operation simply consists in pushing the controller-motor switch until the signal lamps indicate that the controller has been rotated to the desired position.

The net cost of manual operation is estimated at 28,600 marks per year, but owing to the considerable time lag remote districts must be switched on earlier than illuminating conditions require, and a corresponding overshooting will occur in the mornings, resulting in an annual waste in carbons and kilowatt-hours to a value of 18,600 marks. The operators' salaries in the case of the electric remote-control system come to only 10,500 marks, to which amount must be added an interest of 7,800 marks and 1,500 marks for maintenance. The total costs thus compare as 47,200 to 19,800 in favor of the new control system.

Development of Electron Tubes—I

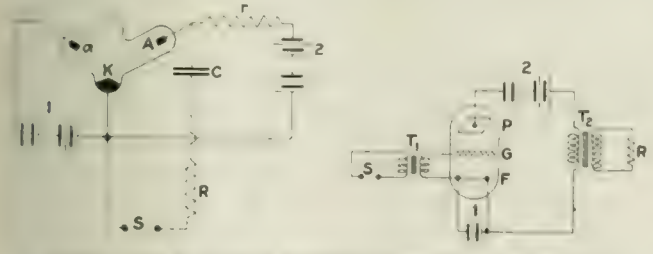
Various Arrangements of the Tubes Are Analyzed to Show What Conditions Are Necessary for Maximum Amplification—Historical Development of the Three-Electrode Tube Is Also Discussed

By MARIUS LATOUR.
Consulting Engineer, Paris, France

THE search for a relay without inertia that would amplify very weak currents has long occupied both physicists and engineers. Nor is the idea of utilizing the electrical phenomena in exhausted tubes containing an excited cathode (in form of an auxiliary arc or an incandescent filament) of very recent date. In recent years, however, the electron tubes have been developed to the point where they have assumed great commercial importance, pre-eminently in communication service, but also in the rectification of small and moderate currents and in measurement work. With the idea of setting forth the exact theory of these amplifying devices for the proper design of circuits in which they are used and also to show what has been contributed by the various investigators of the subject this discussion is offered.

As far back as 1905 Latour and Weintraub had conceived the idea[1] of utilizing the negative resistance of a specially designed mercury-vapor tube for purposes of amplification. The mercury-vapor tube used had a mercury cathode K and two anodes A and a (see Fig. 1, full line). a is the anode of an auxiliary arc fed by battery 1; the cathode K thus kept alive is a source of ions which insure the electrical conductivity of the tube throughout its whole volume. A battery 2 is connected to anode A through resistance r and is of such a voltage that an arc cannot establish itself so that only weak currents pass through the tube. Under these conditions Weintraub and Latour found experimentally that the potential drop between A and K for certain values of current decreases when the current increases (part ab of the curve, Fig. 3). For these weak currents the tube acts like a negative resistance.

Let us now introduce the tube thus constituted into a circuit containing a source S the reactance of which is compensated for the given frequency by the capacity C (see dotted circuit Fig. 1). The weak current generated by the source S is amplified, because the negative resistance of the tube tends to balance both the positive output resistance R and the internal resistance of the source. Theoretically, for nearly perfect balance there is no limit



FIGS. 1 AND 2—EARLY FORMS OF AMPLIFIER CIRCUITS

Fig. 1, full line, shows original circuit of Latour and Weintraub. Fig. 2, De Forest's audion.

to the magnitude of current that can be made to flow by ever so small a voltage. By a sufficient reduction of resistance R the total resistance of the circuit could even be made negative. In this case current could be obtained and spontaneous oscillations could be generated with voltage of the source S equal to zero. Experiments confirm this conclusion.[2]

The amplifier just described operates near the critical value at which spontaneous oscillations of the system start. This is a special case of a general principle that I had formulated in May, 1915,[3] and it is as follows: "Whenever free oscillations are possible an amplifying system is obtained when the critical value at which the oscillations start is approached."

Following a different line of thought, Lee de Forest proposed in 1907 a three-electrode amplifier named by him "audion."[4] Von Bayer in 1908 expressed similar ideas. The audion consists of an exhausted tube or lamp containing three electrodes (see Fig. 2): the filament F brought to incandescence by battery 1, the principal anode or "plate" P, connected to battery 2, and the auxiliary anode or "grid" G, in form, for instance, of a metallic gauze. The incandescent filament represents the "excited" cathode and replaces the auxiliary arc (*i.e.*, both the anode a and cathode K) of Fig. 1. By its incandescence it maintains the conductivity of the tube. The grid G introduced by De Forest is a new supplementary electrode.

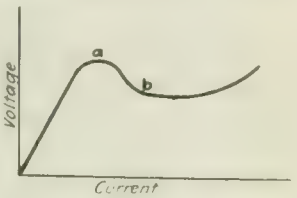


FIG. 3—CHARACTERISTICS OF ARRANGEMENT IN FIG. 1

Transformer T_1 brings the current to be amplified coming from source S to the terminals of grid and filament; transformer T_2 feeds the amplified current into the output resistance R.

The auxiliary electrode G is, so to speak, a control electrode, which causes the current between plate and filament to decrease or increase according to whether its potential with reference to the filament is negative or positive. One can compare the tube to a pipe line conveying a liquid and the grid to a valve alternately opened and closed by action of the alternating current to be amplified. The extent to which the valve is open is regulated by the potential impressed on the grid.

The Austrians von Lieben and Reids, undoubtedly influenced by the work of Latour and Weintraub, have, in 1911, designed three-electrode amplifiers containing an atmosphere of mercury vapor. The engineers of the General Electric Company in America have more recently constructed amplifiers in which the vacuum, on the contrary, is pushed as far as possible. The Western Electric Company has, on the other hand, developed amplifiers in which the vacuum is only moderate, but which contain an oxide-coated filament for the purpose of increasing the thermionic emission and consequently the conductivity of the space.

Finally, in the years preceding the war, German as well as American engineers published a number of different circuit connections for the three-electrode

[1] See U. S. patents Nos. 921,930 and 1,041,210 of 1907.

[2] Such a generator has been used by me for heterodyne radio reception instead of the three-electrode generator (Meissner).

[3] French patent No. 491,186.

[4] U. S. patent No. 841,387 describes it very explicitly.

amplifier. These publications undoubtedly anticipate some of the work done in France during the last few years. One must not forget, however, that the amplifier of audion type was little known in 1914 and that an exact theoretical study permitting from an engineering point of view the rational use of the apparatus was not at hand. It was under these conditions that the French Military Radio-Telegraphy Department, under the direction of General Ferrie, developed the amplifiers needed in its service. Mr. Abraham soon determined all the characteristics of the tube and all its useful constants. A special type was devised which offers the advantage of simplicity, ruggedness and cheap manufacture.

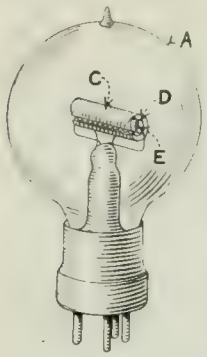


FIG. 4 — TUBE DEVELOPED FOR FRENCH MILITARY

In this type[5] (see Fig. 4), the filament, the grid and the plate are disposed concentrically and fastened directly to the leading-in wires, which are all sealed in the same glass tube fused onto bulb A. The filament E is placed in the center of the system and is attached to two conductors having a certain degree of elasticity. The grid g is in form of a wire wound in a spiral and supported at its ends. The cylindrical "plate" C surrounds the two other elements and is attached to its leading-in wire by means of one or two hooks.

Whatever the model used—*i.e.*, whatever the shape and dimensions of the electrodes or the degree of vacuum and the nature of the residual gases or vapors may be—it is always possible to establish general formulas for the rational calculation of the characteristics of the two transformers T_1 and T_2 as a function of certain easily measured constants of the tube.

A first approximation is obtained by treating the tube as a microphone. The variable potential applied to the grid causes a variation of the conductivity of the tube and on this basis the transformer T_2 is calculated by analogy with the induction coil of a microphone.

A second approximation is obtained by considering the tube as an alternating-current generator, the seat of an internal voltage proportional to the voltage impressed on the grid, the current being determined by the external resistance R and the internal resistance of the lamp.

I have treated these approximations mathematically in notes submitted to General Ferrie in 1915 and 1916 under the title "Optimum Output Resistance in Relay-Lamps."

This treatment, sufficiently accurate for most purposes, has since become classic. It happens, however, that the complete exact theory can be developed without great difficulty and that it is therefore not necessary to stop at approximations.[6]

Let I be the plate current. This current is a function of the plate potential V and the grid potential v, both measured with reference to a definite point of the filament (say the minus pole of the filament). Therefore one has

$$I = F(V,v)$$

The plate potential V, neglecting the resistance of the primary of the transformer T_2 in series with the plate, is equal to the voltage V_0 of the battery 2. The grid potential v can be assumed to be fixed in a similar manner by an auxiliary battery connected to the grid and in series with the secondary winding of the transformer T_1. In certain amplifier sets such a battery is actually used.

Let I_0 be the value of the plate-filament current for the values V_0 and v_0 of the plate and grid potentials.

For values I, V, v, in the neighborhood of I_0, V_0, v_0, the relation holds:

$$(I - I_0) = \left(\frac{\delta I}{\delta V}\right)_{\substack{v = v_0 \\ V = V_0}} (V - V_0) + \left(\frac{\delta I}{\delta v}\right)_{\substack{v = v_0 \\ V = V_0}} (v - v_0)$$

The coefficients of $(V - V_0)$ and $(v - v_0)$ are the partial derivatives of the above-mentioned function $I = F(V, v)$ for $V = v_0$ and $v = v_0$. These coefficients are easily determined experimentally. Maintaining the grid potential, v_0 constant, the variation ΔI of the current I_0 corresponding to the change ΔV of the potential V_0 is measured.

The quotient $\frac{\Delta I}{\Delta V}$ represents the value of $\left(\frac{\delta I}{\delta V}\right)_{\substack{v = v_0 \\ V = V_0}}$

Similarly, by maintaining the plate potential V_0 constant, the variation ΔI of the current I_0 corresponding to the variation Δv of the potential v_0, is measured. The quotient $\frac{\Delta I}{\Delta V}$ represents the value of $\left(\frac{\delta I}{\delta V}\right)_{\substack{v = v_0 \\ V = V_0}}$

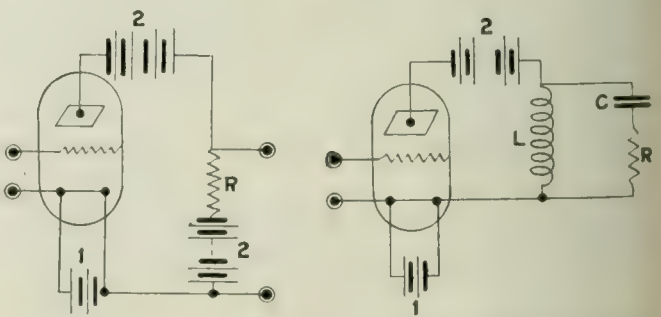
In a more general way, these coefficients are determined by tracing the curve $I = F_1(V)$ for a given v_0 and also the curve $I = F_2(v)$ for a given V_0 and drawing tangents to these curves at the point V_0 for $F_1(V)$ and at the point v_0 for $F_2(v)$.

The derivatives $\frac{\delta I}{\delta V}$ and $\frac{\delta I}{\delta v}$ have the dimensions of the inverse of a resistance; one can therefore put

$$\left(\frac{\delta i}{\delta V}\right)_{\substack{v = v_0 \\ V = V_0}} = \frac{1}{R_p}, \quad \left(\frac{\delta I}{\delta v}\right)_{\substack{v = v_0 \\ V = V_0}} = \frac{1}{R_g}$$

The subscripts p and g indicate that the corresponding resistances are related respectively to the plate or grid potential. One therefore derives

$$I - I_0 = \frac{V - V_0}{R_p} + \frac{v - v_0}{R_g}.$$



FIGS. 5 AND 6—MODIFICATIONS OF FUNDAMENTAL CIRCUIT OF FIG. 3

A similar analysis can be applied to the grid current $i = f(v, V)$ by putting

$$\left(\frac{\delta i}{\delta V}\right)_{\substack{v = v_0 \\ V = V_0}} = \frac{1}{r_p}, \quad \left(\frac{\delta i}{\delta v}\right)_{\substack{v = v_0 \\ V = V_0}} = \frac{1}{r_g},$$

and calling i_0 the grid current for the potentials v_0 and V_0, we derive the similar equation

[5] English patent No. 126,658 in the names of Biquet and Perl.

[6] The complete theory has been incorporated in my patents of March-April 1916. Other writers have since duplicated my work.

$$i - i_0 = \frac{v - v_0}{r_g} + \frac{V - V_0}{r_p}$$

If now we assume that $(v - v_0)$ corresponds to a very small alternating voltage u, $(i - i_0)$ becomes a very small alternating current j; $(V - V_0)$ and current J, amplifications of u and j. We have the two equations:

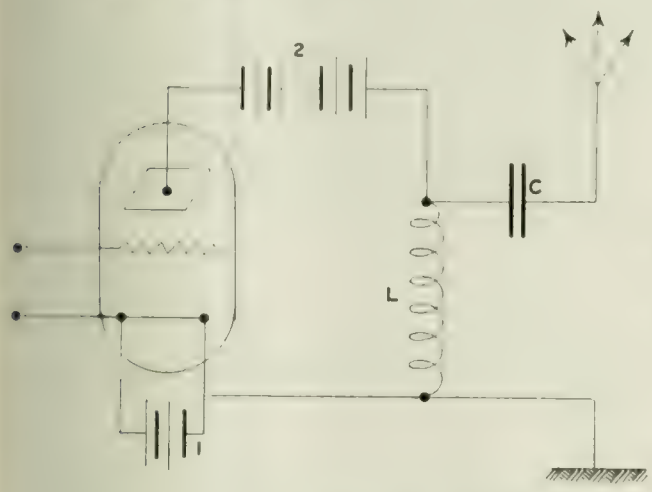
$$J = \frac{U}{R_p} + \frac{u}{R_g}, j = \frac{u}{r_g} + \frac{U}{r_p}$$

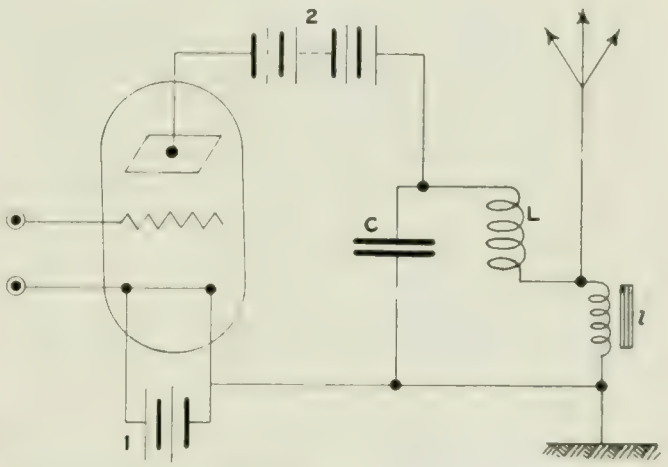
The value of the current J in the primary of the transformer T_2 is limited by the output resistance R across the secondary. Assuming an ideal transformer (magnetizing current, capacity and losses all zero), the equivalent resistance in the primary is equal to $\eta_1^2 R$, where η_1 is the transformer ratio of T_2. From this follows:

$$U + \eta_1^2 RJ = 0.$$

We have thus finally arrived at the following system of equations:

$$J = \frac{U}{R_p} + \frac{u}{R_g}, j = \frac{U}{r_p} + \frac{u}{r_g}, U + \eta^2 RJ = 0$$





FIGS. 7 AND 8—CONNECTIONS OF TUBE FOR RADIO TRANSMISSION

which is solved by

$$i = \left[\frac{1}{r_g} - \frac{R_g \eta^2 R}{r_p R_g (R_p + \eta^2 R)}\right] u$$

$$U = -\frac{R_p \eta^2 R}{R_g (R_p + \eta^2 R)} u$$

$$J = \frac{R_p}{R_g (R_p + \eta^2 R} u$$

A comparison of the power uj supplied to the grid-filament circuit with the power UJ liberated in the plate-filament circuit shows whether a relay effect exists or not. For this ratio one finds

$$\frac{UJ}{uj} = rg \left[\frac{R_p}{R_g}\right]^2 \frac{\eta^2 R}{(R_p + \eta^2 R)\left[(R_p + \eta^2 R) - \frac{r_g R_p}{r_p R_g}\right]}$$

From this formula follows the important result that there exists a value of $\eta^2 R$ for which the relay effect is maximum. This value is given by

$$\eta^2 R = \frac{R_p}{\sqrt{1 - \frac{r_g R_p}{r_p R_g}}}$$

This means that the relay effect becomes maximum for a transformer ratio η of the transformer T_2 given by

$$\eta = \frac{\sqrt{R_p}}{\sqrt{R}\sqrt{1 - \frac{r_g R_p}{r_p R_g}}}$$

For the tube developed by the French military telegraphy with a voltage of 70 to 100 impressed on the plate, one has the following values for the different resistances:

$R_p =$ 15,000 to 20,000 ohms,
$R_g =$ 2,000 to 3,000 ohms,
$r_g =$ 250,000 to 400,000 ohms,
$r_p =$ 50 to 100 megohms.

In general, for most tubes, the ratio $\frac{r_g R_p}{r_p R_g}$ is small compared to unity, so that the value of η for optimum is $\eta = \sqrt{\frac{R_p}{R}}$, where R_p is preferably given the larger value.

The transformer T_2 is thus perfectly determined. If it is desired that the transformer operate with a good power factor (as we have assumed by hypothesis), its open-circuit reactance (secondary open) at the given frequency must be made large in comparison to $\eta_2 R$. In practice for 800 cycles it is enough to make the reactance two or three times larger than $\eta_2 R$. It is easily shown that if this reactance is chosen too small, the conditions are improved by increasing the value of η. For the weak inductions prevailing here the permeability of the magnetic circuit is of the order of 200. The volume of the transformer is mainly dependent on the amount of insulation considered sufficient. Enameled wire or wire with one layer of silk will naturally lead to a much less voluminous transformer at the same efficiency than a wire with two silk layers or with cotton insulation. On the other hand, in small volume transformers the windings are closer, the effect of their capacity therefore greater, and the danger of speech distortion more serious.

CALCULATION OF TRANSFORMER IN GRID CIRCUIT

Let us now determine the transformer ratio for transformer T_1. The amplified power UJ is, other things being equal, proportional to uj; it is therefore desirable

to give uj the maximum possible value; in other words, to extract from the source S the maximum power. To accomplish this it is necessary to make the apparent grid-filament resistance, measured by its effect in the primary of transformer T_1, equal to the impedance Z of the source. From the equation of the grid current j, one finds the apparent grid-filament resistance equal to

$$Y = r_g \frac{R_p + \eta^2 R}{R_p + \eta^2 R \left[1 - \frac{r_g R_p}{r_p R_g}\right]}$$

Assuming $\frac{r_g R_p}{r_p R_g}$ very small, one finds $Y = r_g$. Under these conditions the transformer T_1 should have a ratio r^1 such that

$$(r_1^1)^2 Z = r_g, \quad r_1^1 = \sqrt{\frac{r_g}{Z}}$$

Always supposing $\frac{r_g R_p}{r_p R_g}$ small, the expression of the relay effect given above becomes for $r_1^2 R = R_p$:

$$\frac{UJ}{uj} = \frac{1}{4}\left(\frac{R_p}{R_g}\right)^2 \frac{r_g}{R_p}$$

To have a large amplifying effect the tubes must be so designed as to give the largest possible value to the quotient R_p/R_g and to possess as low an internal resistance R_p as possible (tubes with strong thermionic emission). Taking the grid potential for one's starting point, one can say that the tube behaves like an alternator of internal resistance R_p and internal electromotive force $\frac{R_p}{R_g} u = ku$ (the Americans call this quotient, k, the "amplification constant").

This simple interpretation is the one now generally used by American writers on the subject; it is also the one I had adopted in the note of January, 1916, mentioned above.[7]

The battery voltages 1 and 2 do not enter directly into the above expression of the relay effect. They enter, however, indirectly by modifying the values of R_p, R_g and r_g.

An increase in the voltage of battery 2 does not therefore necessarily cause greater amplification. Instead of an amplifier of power utilizing transformers T_1 and T_2, one can obtain a *voltage* amplifier by simply placing in series with the plate circuit a resistance R, as shown in Fig. 5.

In this figure the battery 2 is shown as subdivided into two parts, 2′ and 2″, in such a manner that at rest the voltage of battery 2′ just compensates for the ohmic drop in resistance R. In such a "resistance coupled" amplifier one has the following two equations:

$$J = \frac{U}{R_p} + \frac{u}{R_g}, \quad U + JR = 0,$$

from which one derives:

$$U = -\frac{R_p}{R_g}\left(\frac{R}{R_p + R}\right) u$$

As the resistance R increases, the ratio U/u is seen to approach the limit $R_p/R_g = k$, provided that battery 2″ is kept constant and battery 2′ is constantly adjusted so as to compensate for the ohmic drop in R.[8]

In what precedes we have made no assumption as to the frequency of the current that is to be amplified. Ordinary transformers with an iron magnetic circuit can therefore be used in the amplification of radio-reception currents. Special precautions must, however, be taken in the construction of the transformer to reduce the capacity effect between the different turns and separate layers of the winding; otherwise, the number of turns being rather larger, the capacity may assume such a dangerous value as to obliterate the transformer action. It is also necessary in order to obtain satisfactory efficiency to use very thin iron sheets—0.07 mm. or 0.08 mm. thick—or iron wire 0.10 mm. to 0.15 mm. in diameter. With these precautions I have constructed apparatus serviceable at the highest frequencies.

In case of very high frequency one may, however, dispense with the transformer in the plate circuit and use instead a combination of inductance and capacity in shunt (see Fig. 6). The output resistance is then placed in series with one of these elements.

For these connections I have shown some time ago (1915) that for a given R and a given oscillatory potential impressed on the grid there exists a definite ratio L/C which makes the amplified power maximum. This ratio is determined by the condition that the apparent resistance of the L-C circuit be of the order of magnitude of the internal resistance R_p of the tube.

In order that the combination L-C shall behave like a resistance, the relation

$$1 = \frac{\omega^2 CL}{2} + \frac{C\sqrt{L^2\omega^4 + 4R^2\omega^2}}{2} \qquad (1)$$

must be verified.

This condition being fulfilled, the apparent resistance is equal to

$$R + 1/C^2\omega^2 R. \qquad (2)$$

If R is small compared to $L\omega$ or $1/C\omega$, relation, (1) becomes the condition of resonance and the value of the apparent resistance (2) becomes L/CR. We thus arrive at the result that L/C must be independent of the frequency and must satisfy the equation $L/CR = R_p$. Resistance R may be represented by the antenna as shown on Fig. 7.

The resistance R may also be introduced into the inductance branch. When this resistance is the antenna itself I have suggested the use of a coil l with iron core, which lets the direct current of the plate circuit pass but opposes a large impedance to the high-frequency current (Fig. 8).[9]

A station of large power obtained through amplification of a smaller power controlled by a microphone or other means is assumed here. The controlling power can be brought up, as I have suggested, by means of a transformer with an iron magnetic circuit.

This discussion, which is a translation by Dr. E. Weintraub of a lecture before the Société Française des Electriciens, will be completed in an early issue.

[7] This interpretation was omitted in my article in the London *Electrician* of Dec. 1, 1916, in order not to make public the constants of the tubes used by the French military telegraphy.

[8] Resistance-coupled amplifiers have been used in America by White. Multistage amplifiers of greater interest have been developed in France by Beauvais and Brillouin, and also by Abraham and Block.

[9] The antenna connections of Figs. 7 and 8 were proposed by me in 1915. The connections of Fig. 7 are anticipated by a patent granted to Marconi in 1914. They are the ones usually employed. The connections of Fig. 8 are, however, also of interest.

Survey of New England Power Situation

Analysis of Reports Received by Power Section of War Industries Board Indicates Total Production of More Than 5,000,000,000 Kw.-Hr. by Central Stations During 1924 Estimated Increase of 1,400,000 Kw., 1919-1924 Inclusive

By MAJOR CARROLL H. SHAW

Formerly in charge of the New England District of the Power Section of the War Industries Board

SOON after the organization of the Power Section of the War Industries Board early in 1918 it became evident that a power shortage might be expected in New England. The industries and public utilities had already suffered severely from the restrictive order of the Fuel Administration which became effective early in 1918, in accordance with which it was necessary for nearly all manufacturing industries to close down for stated periods. This order was due to the inability of the railroads to handle the freight and coal offered to them and also to the lack of sufficient coal for the war-essential industries throughout the country.

Great difficulty was experienced by nearly all of the utility companies in securing coal to continue the operation of their stations. Fortunately, however, the situation did not become as critical in New England as in Ohio and Pennsylvania, where, in a number of cases, the plants had to be shut down because of the lack of coal. None of the New England utilities was obliged to close down because of the difficulty of securing sufficient coal.

The result of a preliminary survey among the utilities throughout New England in the spring of 1918 showed that either the existing equipment of the isolated operating companies would be sufficient to handle all of the anticipated load for the winter of 1918-1919, or that the new equipment which had been ordered would give them sufficient capacity. Among the larger power companies, however, there was need for much additional generating equipment, which was to be obtained in part by the completion of the generating plant of the Eastern Connecticut Power Company, south of Norwich, Conn.; by the addition of a 40,000-kw. turbine by the Narragansett Electric Lighting Company at Providence, and a 10,000-kw. turbine by the New England Power Company at Uxbridge, Mass. These additions were to become more generally available through further interconnection of the respective systems by means of high-tension transmission lines.

Estimates

In preparing estimates of the power and energy requirements of the New England States for the next five or six years it has been assumed that the normal growth of each class of business will continue in the manner indicated by the records of previous years. Detailed information was obtained from all of the public utility companies covering their operations for the years of 1915, 1916, 1917 and 1918, and in addition to this, data contained in Census Bureau reports as far back as 1869 were made use of.

Table I shows in combined form the actual and estimated future installed rated capacity and energy production of all of the manufacturing and utility power plants in New England for the years between 1915 and 1924 inclusive. By utilizing the Census reports on electric light and power plants for 1907, 1912 and 1917 in conjunction with the reports received from individual companies, it has been possible to determine the normal increment of output of the electric light and power stations during this period. With these data it has been possible to estimate the total amount of energy that may be expected to be generated by these stations during the following five years.

TABLE I—INSTALLED RATING AND OUTPUT OF NEW ENGLAND POWER PLANTS

Source	Installed Rating, Thousands of Horsepower						Output, Millions of Kilowatt-Hours					
	1915	1918	1919	1920	1921	1924	1915	1918	1919	1920	1921	1924
Steam: Street railways	449	466	490	490	490	490	619	600	630	630	630	630
Electric light and power	765	1,027	1,225	1,440	1,710	3,140	752	1,311	1,467	1,764	2,095	3,852
Railroads	50	50	50	50	50	50	101	78	77	77	77	77
Manufacturers	1,900	1,975	1,985	2,000	2,015	2,030	2,480	2,580	2,580	2,610	2,640	2,[illegible]
Total	3,164	3,518	3,750	3,980	4,265	5,710	3,952	4,569	4,754	5,081	5,442	7,2[illegible]
Hydro: Street railways	45	45	48	48	48	48	11	11	12	12	12	[illegible]
Electric light and power	304	432	492	549	625	775	568	863	1,054	1,177	1,340	1,[illegible]
Manufacturers	758	758	758	760	765	780	1,490	1,490	1,490	1,492	1,50	1,532
Total	1,107	1,235	1,298	1,357	1,438	1,603	2,069	2,364	2,556	2,681	2,8542	3,209
Internal-combustion engines:												
Electric light and power	6	10	....	....	....	....	....	....	....	....	....	....
Manufacturers	50	60	....	....	....	....	....	....	....	....	....	....
Total	56	70	....	....	....	....	....	....	....	....	....	....
Total installation	4,327	4,823	*5,048	*5,337	5,703	*7,313	6,021	6,933	7,310	7,762	8,296	10,428

*Internal-combustion engines not included

After having estimated the probable annual energy production that will be required of electric light and power stations from 1919 to 1924 inclusive, it has been possible to determine how much additional generating capacity will be required to enable these stations to produce the increase of output. It has been found that very little new steam generating equipment will be put in by street railways except for the new 25,000-kw. turbine installed by the Boston Elevated Railway during 1919, and as some obsolete equipment now carried on the records as installed capacity will be abandoned it has been assumed there will be no increase of the rating of street railway generating equipment after 1919.

A careful study of the records which are available

*This is an extract of a report on an investigation of the power service of New England by Major Carroll H. Shaw. Engineers made during the latter part of 1918 and the first part of 1919, under the authority of the Power Section of the War Industries Board of the War Department, the investigations of which Frederick Darlington, consulting engineer, had general supervision. Major Shaw is now consulting engineer with the engineering firm of Jackson & Moreland of Boston.

indicates that very little, if any, increase can be expected in energy production by street railways, electrified railroads, or manufacturing establishments in either steam, hydraulic or hydro-electric power.

Apparently, the electric light and power companies are the only class of business that will continue to maintain a substantial increase. The inherent advantages of electric power and the large economies that can be secured from super-power stations indicate the probability of energy production becoming more and more a specialized industry, not necessarily financially interrelated with power transmission and distribution companies.

The most important factor in the production of steam-electric energy is the supply and utilization of coal. A summary of the returns made by the electric light and power companies showed that their total consumption of coal in 1918 was approximately 1,610,000 net tons and that from 1,606,226 tons of this total they produced 1,283,154,000 kw.-hr. This leaves a net balance of 28,227,000 kw.-hr. unaccounted for in the total

TABLE II—ESTIMATED INVESTMENTS BY CENTRAL STATIONS FOR NEW INSTALLATIONS

Year in Which Investment Is Made	—Hydro-Electric— 1,000 Kw	Cost per Kw	Investment (Thousands of Dollars)	—Steam Turbine *— 1,000 Kw	Cost per Kw	Investment (Thousands of Dollars)	— Total Increase — 1,000 Kw	Cost per Kw.	Total Investment (Thousands of Dollars)
1919	37	260	9,620	144	110	15,840	181	141	25,460
1920	57	250	14,250	100	100	10,000	157	154	24,250
1921	40	250	10,000	150	100	15,000	190	132	25,000
1922	38	250	9,500	300	100	30,000	338	117	39,500
1923	42	250	10,500	340	100	34,000	382	116	44,500
	214	$252	$53,870	1,034	$101	$104,840	1,248	$128	$158,710

* The above estimate does not include the cost of transmission lines or substations

of electric energy generated by steam in electric light and power stations for that year.

A careful study has been made of the individual coal consumption of each of the steam stations in the electric light and power class, from which it has been found that 685,000,000 kw.-hr. (approximately half the total) were generated in 1918 by the consumption of 685,000 net tons of coal, indicating an average efficiency of 2 lb. of coal per kilowatt-hour.

If the entire energy production of steam stations in 1918, which amounted to 1,311,481,009 kw.-hr., had been produced at an average rate of 2 lb. of coal there would have been 1,311,481 tons of coal required, indicating a possible saving at this assumed coal rate of approximately 300,000 tons; but as a very considerable portion of this coal was used at efficiencies closely approximating 2 lb. per kilowatt-hour and as one of the larger and most inefficient stations is to be immediately superseded by a new hydro-electric development, the actual feasible saving which might be looked for in these electric plants can hardly exceed 150,000 tons.

Probably the largest single class of coal consumer in New England is the steam railroad. Conservation of fuel by means of railroad electrification offers tremendous opportunities. Adopting the estimate of the Fuel Administration that the New England steam railroads consumed 7,800,000 net tons of coal in 1918, and assuming that electrification of trunk lines would displace 5,000,000 tons with electric power, it seems probable that a net saving of 60 per cent of this 5,000,000, *i.e.*, 3,000,000 tons, could be secured. This estimate is based upon the further assumption that electrical energy could be delivered to the electric locomotives at a net coal consumption of 2 lb. per kilowatt-hour and that the average saving over locomotive coal consumption would be 60 per cent. The records of the N. Y., N. H. & H. R.R. indicate that at this 2-lb. rate the savings in the various classes of service would be as follows: (1) Express passenger, 59 per cent; (2) local passenger, 76 per cent; (3) fast freight, 63 per cent; and (4) slow freight, 58 per cent.

Future Developments

An estimate of the future development of power production in New England is to all practical purposes an estimate of the future development of the electric utility industry. Nearly all increases of power production from other sources have ceased. The total output of central electric power stations during 1918 was 2,174,000,000 kw.-hr. and it has been estimated that during 1924 it will have increased to 5,517,000,000 kw.-hr. The installed generating capacity of electric stations in 1918 was 1,050,000 kw. The total capacity that will be required for the 1924 output will be approximately 2,500,000 kw., indicating that nearly 1,400,000 kw. of combined steam and hydro-electric generating capacity must be added if the estimated increase in output occurs. Table I shows the estimated values of installed capacity and energy output for 1921 and 1924.

Table II indicates the probable net investment that will be required to provide for these additional capacities. During the period just preceding the war it was possible to construct large steam-electric power stations at from $60 to $70 per kilowatt, but during the period of the war this cost increased in some cases of record to $125 per kilowatt. At the present time the cost is probably still higher. A study of this table indicates that nearly $11,000,000 a year may be absorbed by the construction of hydro-electric plants and that more than $20,000,000 will be spent for steam-electric stations.

An estimate has been made of the undeveloped hydro-electric projects in New England that appear to be feasible—*i.e.*, that appear to offer, either now or in the near future, such opportunities for development as to make them financially profitable. The total additional hydro-electric power that will be available after 1919 is figured at 323,000 kw., and it is estimated that this new power would produce 1,378,000 kw.-hr. per annum, under usual operating conditions. The estimated probable installation of additional hydro-electric capacity which may be expected to take place after 1919 through 1924 is 214,000 kw., from which it is evident that after the above additions have been made there will remain only about 109,000 kw. of undeveloped hydro-electric power which it appears feasible to attempt to use.

The increase in production of hydro-electric energy by electric power stations during 1924 is estimated at 863,000,000 kw.-hr. more than during 1918, but as the total estimated available and feasible increase in energy production from hydro-electric units, including that becoming available during 1919, has been figured as only 1,496,000 kw.-hr., it will be seen that after 1924 there will remain a net available annual production of only 633,000,000 kw.-hr. per year from feasible undeveloped hydro-electric projects.

If the annual increase in output of the New England electric light and power stations continues at the rate of more than 15 per cent, as has prevailed for more than six years, further extensive interconnections by means of high-tension transmission lines between large power stations and manufacturing districts must be accomplished. At the present time there are but five steam-electric generating stations which operate at an efficiency of 2 lb. of coal per kilowatt-hour or better. The new stations of the Turners Falls Power & Electric Company at Chicopee and of the Eastern Connecticut Power Company below Norwich will undoubtedly be able to produce energy at the 2-lb. rate under reasonable load factors. The five most efficient utility stations mentioned above are located at Providence, R. I.; New Bedford, East Bridgewater, Boston, and Salem, Mass.

A study of the reports of the various companies in the western half of Connecticut indicates that a modern super-power station should be developed in that territory. Assuming a possible location intermediate between Bridgeport and New Haven, it is probable that a development of nearly 300,000 kw. will be required in this territory by 1924 if the additional increase in steam-electric energy that has been estimated occurs. A similar development of 300,000 kw. may be made along the northeastern shore of Massachusetts or in New Hampshire, possibly at Salem, Newburyport or Portsmouth.

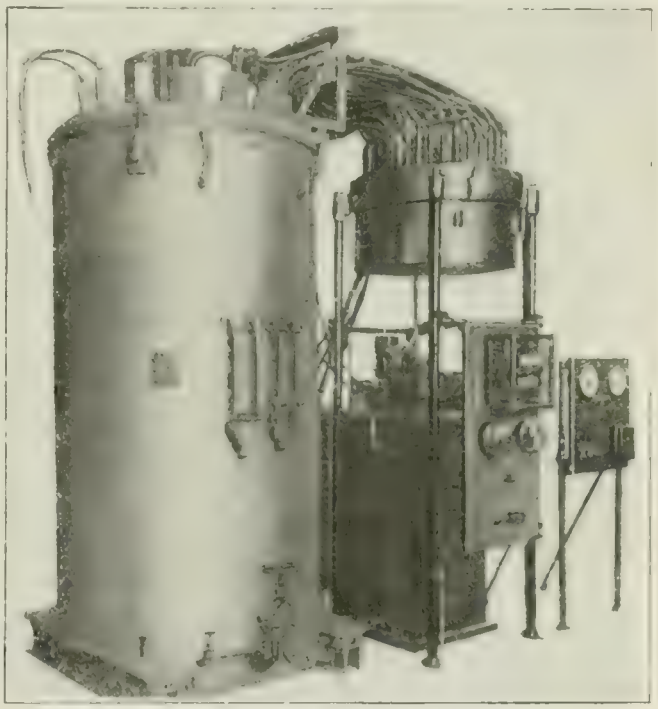
The total estimated addition in steam-electric stations is 1,152,000 kw. An increase of 60,000 kw. over and above the present contemplated addition at Boston, 50,000 kw. addition at Providence, 75,000 kw. at New Bedford, 70,000 kw. at Norwich and 75,000 kw. at Chicopee would provide, together with the two new stations above, approximately 1,000,000 kw., and these assumed additions are located in those territories where a large increase in electrical energy consumption is anticipated.

The generation of such tremendous quantities of electrical energy from steam stations will mean the consumption of much larger quantities of fuel than has heretofore been contemplated. The increasing use of fuel oil in the operation of steam stations has become of considerable interest to the utilities recently and will undoubtedly become a very important factor in the construction and operation of steam stations. The possibilities of storage of oil without attendant depreciation and the facility with which it may be handled make it particularly desirable for steam stations that may be operated only as reserve units.

To summarize the work of the survey, except for slight increases in large isolated industrial plants, practically no increase in generating capacity may be expected in the future except for electric light and power companies. The efficiency of the super-power stations in the generation of electrical energy indicates clearly that this method of power production must prevail over former methods. The recent falling off in the growth of isolated-plant power production indicates that the isolated plants are no longer to be the principal source of power for manufacturing industries. Electrical energy produced in modern, efficient generating stations, operated both by steam and by water power, delivering their product to high-tension electric transmission systems, and interconnected in such a manner that there exist numerous reliable power sources, apparently is to become the universal method of furnishing power for manufacturing purposes. The investment that will be required to provide this additional generating equipment and the attendant transmission and distribution lines will be very large. There still remain a comparatively large number of small systems that should abandon their generating stations and obtain their electrical energy through the high-tension transmission lines that are connected to the most efficient generating stations.

Combined Electric Resistance Furnace and Control Unit

RESISTANCE furnaces and furnaces requiring a variable voltage supply are rapidly increasing in number, and are now employed with graphite, brass, zinc and carbon-bisulphide and for heat treating and numerous other uses. It has been found that one of the most satisfactory means for supplying power to a furnace of the resistance type is the use of a combination step and induction regulator. This consists principally of a furnace transformer with taps in the primary winding and an induction regulator for bridging between the voltages given by the transformer taps. With this combination a continuous voltage without breaks can be obtained over a wide voltage range. A complete unit for this service consists of a furnace transformer, an induction regulator, a selector switch, a transfer switch, a series transformer and a panel containing the necessary meters and control for the equipment.



1,100-KVA. STEP INDUCTION FURNACE-REGULATOR EQUIPMENT

An 1,100-kva. equipment of this type built by the Westinghouse Electric & Manufacturing Company is shown in the illustration. This is one of twenty equipments that were recently manufactured for service on zinc furnaces to be installed in Norway. This information was brought out in a paper by Philip B. Short at a recent meeting of the American Electrochemical Society.

Readers' Views and Comments

Electric Stove in Service Twenty Years

To the Editor of the ELECTRICAL WORLD:

SIR: I have a little three-heat hot plate about the size of a saucer and two inches high that I have made my coffee on for twenty years, and I have just burned it out for the first time, by accidentally placing it on a 220-volt circuit. Being an electrician by trade, I took it apart with a view to repairing it and found the elements set in porcelain and stamped "May 8, 1899, made by American Electric Heating Corporation, Boston, Mass., 110 V.-1.9A." I think mine is about the oldest hot plate in existence and, with never a cent for repairs, I'll venture to say it has been in actual service 10,000 hours and has used 1,650 kw.-hr. of electricity at an average rate of 10 cents, totaling $165 worth of electrical energy. It has used energy in thirty-two states of our Union.

W. F. BOGGS.

Port Angeles, Wash.

Interchange of Electrical Energy Between Central Stations and Industrial Power Plants

To the Editor of the ELECTRICAL WORLD:

SIR: In view of the large opportunities for fuel saving disclosed by C. E. Weber in an article on the interchange of industrial and central station energy, which appeared in the July 24 issue of the ELECTRICAL WORLD, page 173, it is desirable for all to express their views who, by their experience along these lines, may be able to help bring about the results sought. With this idea in mind, I have set down some of the more important considerations which have occurred to me after a careful reading of the article.

It is quite generally known that the opportunity exists for a large saving of fuel in connection with the operation of industrial power plants, but it is indeed a sad reflection on power-plant engineers when a plant is taken as typical in which 5,000 lb. per hour of live steam is used for low pressure requirements which could be supplied from the exhaust available. In the writer's opinion, the plant selected for a detailed analysis is not typical. From our observations, which cover a large number of industrial power plants, we know that there are few plants indeed where exhaust steam is wasted to the air when it could be utilized in process work. In unusual cases only have we found plants which are operating power-generating units condensing when exhaust steam could be utilized in heating or process work.

That a considerable saving can be effected by the interconnection of industrial and other plants with the lines of a central station and the resultant interchange of electrical power has been recognized by central-station companies or their subsidiaries in some of our larger cities. Plant-operating agreements have been made under the terms of which such interchange of power is provided for. In cases where the central station has been unable to increase its capacity as rapidly as the demand for power has increased or where there is particular fear of a shutdown, due to coal shortage, such interconnection and interchange is particularly attractive from the standpoints of both the public and the utility company, and in such cases agreements of this kind are not uncommon.

There are many limitations to a general extension of this plan. We will call attention to them so that in subsequent discussions there may be brought forward suggestions by which these limitations could be removed. At the present time the application of uniform rate schedules for the sale of electric power is quite general. Under the terms of most of these schedules it would not be advantageous for an industrial power plant of any considerable size to purchase its power over the summer months for, by so doing, it would be able to balance only the cost of fuel and labor saved against the cost of power purchased, and it is very seldom that the cost of buying power would work out cheaper under these conditions. On the other hand, the average central station would not be interested in the purchase of power from an industrial power plant unless the rate were such as to compare favorably with what might be termed "the variable coal cost per kilowatt-hour." Limitations of lesser importance but which tend to restrict the application of the idea are:

1. Direct current generating equipment is still extensively used in industrial power plants. Rotary converters would be required in such cases. Large fixed charges and continuous losses are then brought into the problem.

2. In order for the central station to be interested special protective devices would have to be installed to insure freedom from interruptions, and the question arises as to who will buy and maintain this equipment.

3. The fact is that in all but the very large industrial power plants the operating conditions cannot be foreseen with any degree of accuracy, with the result that the central station could not depend upon these interconnections to carry a portion of the load at any definite time.

The limitation as to existing rates could be overcome if state railroad commissions would approve special contracts, covering individual cases upon the recommendation of engineers employed by both parties to the contract, provided there is sufficient opportunity to save fuel to warrant an agreement for the public good and provided at the same time that the contract would be profitable to the contracting parties.

In our opinion, there will be some tendency in this direction in large communities on the part of large industrial power plants where the electric demand exceeds 1,000 kw. and the floor space occupied exceeds 200,000 sq.ft. and where the demand for steam for process work is a considerable item. There are many small communities where there are several industrial power plants whose capacity compares favorably with that of the central station, and in these cases a plan such as Mr. Weber suggests would work out advantageously. There will also be an increasing tendency along this line in the case of hotel and office building electric and heating plants. In any case, it is clearly the duty of the consulting engineer who installs the industrial power plant to provide the same characteristics of current, frequency and voltage as are supplied to the district from the lines of the central station company.

S. J. GATES,

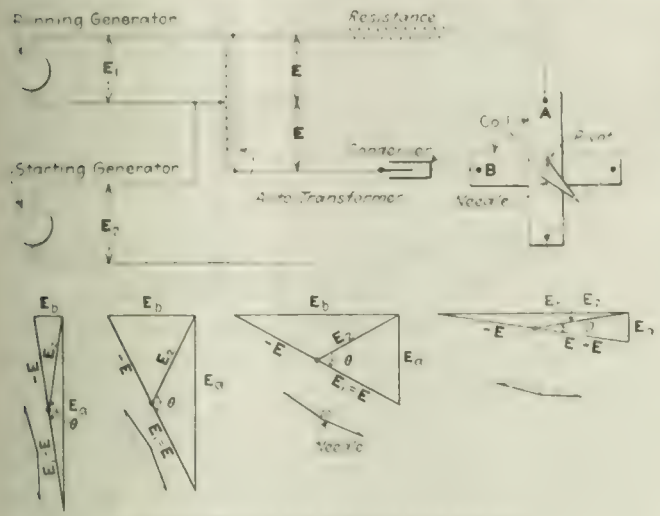
Milwaukee, Wis. Gates Engineering Company.

Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Easily Constructed Synchroscope for Instruction Purposes

AN EASILY and cheaply constructed synchroscope which may be used by laboratories where the expense of a regular manufactured instrument is not warranted is shown in the accompanying drawing. This consists essentially of two coils, *A* and *B*, each wound with a few turns of small wire, placed at right angles



CONNECTIONS FOR SIMPLE HOME-MADE SYNCHROSCOPE

to each other. Above the center of these coils is pivoted a needle of soft iron. For this a demagnetized and annealed compass needle serves well. The two coils are connected to the extremities of an auto-transformer respectively through a resistance and a condenser. A center tap of this auto-transformer is connected to the common lead from the running generator and the generator to be started. The other connections of the generators are as indicated.

When the connections are made as shown in the drawing the needle will revolve until the machines reach the same speed. When they are at the same speed the needle will stand still, and when the needle points parallel to the axis of the coil *B* the generators are in synchronism. Provided the voltages are the same the generators may now be connected in parallel.

To understand the reason for the rotation of the needle the vector diagram must be consulted. In this diagram E_1 and E_2 represent the respective generator voltages. E_b and E_a represent voltages across coils *B* and *A*, and the angle θ is the difference in angle between the voltages at any instant. Neglecting inductance and resistance of the coils, it is seen that the magnetic flux linking the coils varies as the voltage across the coils.

As the angle θ becomes smaller, as shown in the small diagrams, the voltage E_b increases and the voltage E_a decreases. The needle consequently swings in the direction of *B*, and when θ is zero it lies along the axis of *B*.

LESLIE F. CURTIS.
University of Washington,
Seattle, Wash.

Charts Show Tension and Sag for Transmission Lines

TO FIND the proper sag and tension to give a line when stringing so that the allowable stress will not be exceeded in cold or windy weather, as well as to determine what sag will correspond to any given tension under present conditions, the charts shown here have been prepared. The values for deflection are shown in per cent of the span length, while the stress is in pounds per square inch per foot of span length. The chart also gives the length of wire in per cent of the span length.

Suppose, for example, it is desired to find the sag in a span 600 ft. (180 m.) long with an average tension on

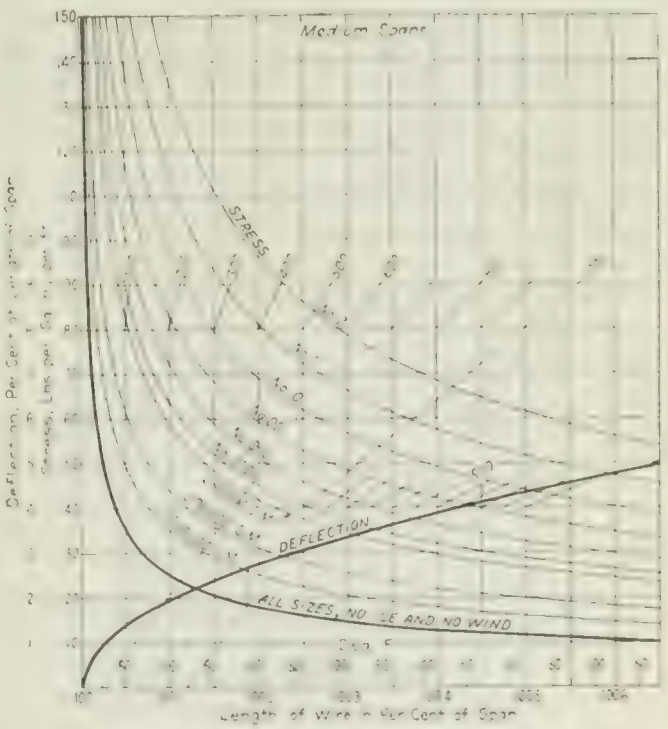


CHART FOR CALCULATING SAG AND TENSION WITH OR WITHOUT ICE AND WIND

the wire of 30,000 lb. per sq.in. (2,100 kg. per sq.cm.). This is a tension of 50 lb. per ft. (72 kg. per m.) of line length. Therefore, on the chart for medium spans, from the "50" on the stress scale draw a horizontal line to the right until it intersects the heavy "no ice and no wind" curve. From this intersection drop vertically

to the deflection curve. The deflection is found on the deflection scale to be about 1 per cent of the length of the span, which amounts to 6 ft. (1.8 m.). By continuing the vertical drop downward to the bottom of the chart the length of the wire is seen to be about 100.03 times the length of span.

The second use for which the charts were drawn is to find to what tension a stranded copper wire should be stretched and what sag it should have in order that it shall not be overstressed when subject to ½ in. (1.3 cm.)

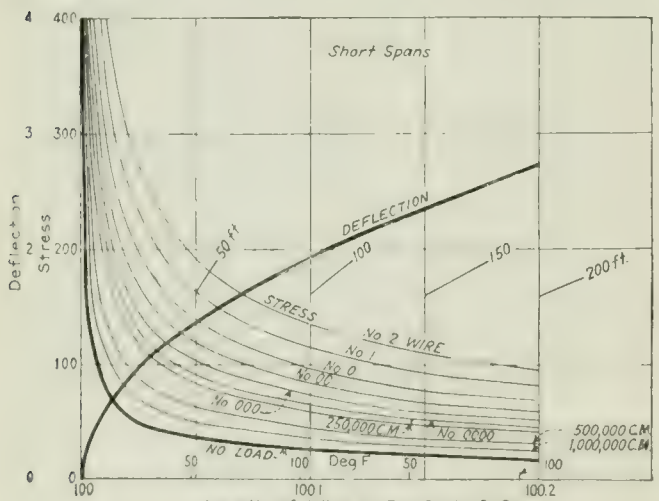
CORRECTIONS (IN PER CENT) FOR STRESS AT SUPPORT AND AT MIDDLE OF SPAN

Per Cent Sag	For Stress at Point of Support Add to Stress Curves	For Stress at Middle of Wire Subtract from Stress Curves
1	0 06	0 03
2	0 22	0 10
3	0 49	0 22
4	0 88	0 40
5	1 36	0 62
6	1 98	0 89
7	2 58	1 21
8	3 35	1 58
9	4 17	1 99
10	5 08	2.44

of ice and an 8-lb. wind pressure (39 kg. per sq.m.).

As an example let it be supposed that No. 000 wire is being strung on a 600-ft. (180-m.) span when there is no wind and the temperature is 100 deg. Fahr. What sag and tension must be given so that under conditions of ½-in. ice and 8-lb. wind pressure at 0 deg. Fahr. the stress shall not exceed 30,000 lb. per sq.in.? This is a stress of 50 per foot of span; therefore from "50" on the stress scale draw horizontal to the No. 000 wire curve.

Through the intersection draw a line parallel to the diagonal 600-ft. span line. To the intersection with the temperature scale add 100 deg. Fahr. along the temperature scale and draw another line parallel to the 600-ft. line to intersect with the "no ice and no wind



GIVES SAG AND TENSION FOR SHORT SPANS

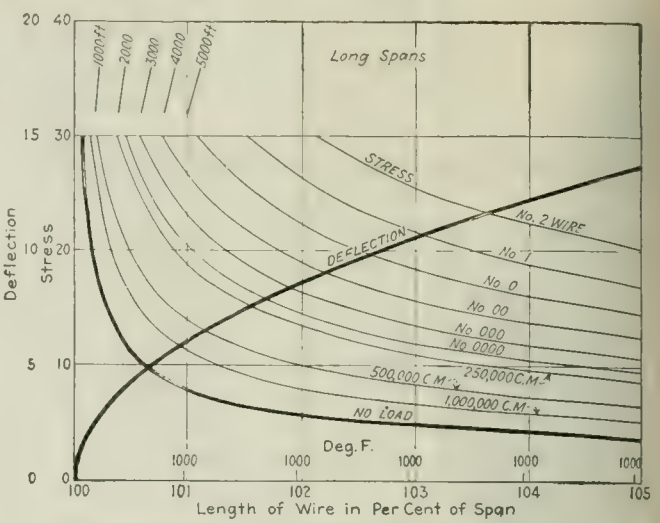
curve." The intersection with this curve and the vertical to the deflection curve give:

Stress = 18.2 × 600 = 10,900 lb. per sq.in.

Sag = 2.65 per cent of 600 = 15.9 ft.

This stress is the average value. For the stress at the point of support and at the middle of the span the corrections shown in the table must be taken into account.

These curves are prepared for stranded copper wire of the following specifications: Modulus of elasticity, 16,000,000 lb. per square inch; temperature coefficient, 0.0000096; elastic limit, 30,000 lb. per square inch, and



SHOWS SAG AND TENSION FOR LONG SPANS

breaking strength, 50,000 lb. per square inch. Wind pressure, in pounds per square foot of projected area, is figured as 0.00252 × (actual velocity in miles per hour)².

Generator Used to Correct Power Factor After Engine Breakdown

SHIFTING of the reactive load between two generators in a Texas plant when one became inoperative made it possible for the other generator to operate more effectively and thereby continue satisfactory service. In this plant a small turbine and a 225-hp. Diesel engine operated in parallel, and owing to disabling of the engine from overheating of the cylinders the turbine was required to carry the load. To relieve it as far as possible from overheating, the generator of the Diesel engine was operated as a synchronous condenser by increasing the field excitation, thereby causing it to compensate for the lagging current required by the motor load. Decreasing the engine-driven generator field resistance did not increase the excitation sufficiently, and it was necessary to raise the exciter voltage and also cut resistance into the field of the turbo-generator. This maintained the station voltage at normal.

Under ordinary conditions it is better for the reactive current to be divided between the generating units as well as the actual load; but if one unit is more efficient than the other, the more efficient unit should carry the greater portion of the actual power and the less efficient unit the reactive current. One point to be remembered is that the copper loss is proportional to the resistance of the generator windings, and for minimum total losses these resistances should be known and the copper losses computed.

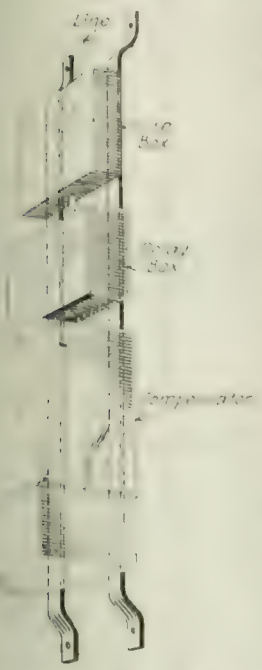
To shift the load from one generator to another the governor on the unit to have its load increased must be adjusted so that it will tend to operate at higher speed. To shift the reactive current from one generator to another, decrease the field resistance of the unit to be loaded until the line current of the other generator becomes a minimum.

W. A. Darter.
Brenham Compress, Oil & Manufacturing Company,
Brenham, Tex.

Industrial Applications

The Economical Utilization of Electrical Energy
in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

Compensator Mounted on Strap-Iron Support



COMPENSATOR MOUNTED ON BRACKET AND WIRED TO FUSES IN SHOP

BY ASSEMBLING the starting compensator and fuse box on a strap-iron support before putting them up in the plant, the job of mounting or replacing such equipment is made quick and easy in the shops of McCleary, Wallin & Crouse, Amsterdam, N. Y. Furthermore, the various installations present a uniform appearance and tend to increase interest in maintenance. This strap-iron support is of 3-in. x 2-in. (7.5-cm. x 5-cm.) material and is about 5½ ft. (1.6 m.) long. It is drilled to take bolts for holding the equipment which is to be mounted upon it and also for fastening it to walls or pillars in the plant. The compensator, relay and fuse box are bolted to this strap and connections are made in the shop so that it takes very little time to set up the assembled outfit in the plant when it becomes necessary. The box for the fuses is made of No. 16 gage iron and measures 13 in. x 11 in. x 4 in. (33 cm. x 27.5 cm. x 10 cm.).

A. R. McDONALD.

McCleary, Wallin & Crouse,
Amsterdam, N. Y.

Contest Which Reduced Armature Repairs in Large Steel Mill

A CONTEST which pitted different operating sections against each other has been very effective in reducing the number of damaged armatures and the time lost in repairing motors in a large steel manufacturing mill. There are two prizes given to the sections of the mill which qualify. The first prize is given for the greatest relative improvement in reducing the number of changes of armatures necessitated by trouble in the electric motors. The second prize is for the greatest improvement in reducing the amount of time lost in different operations by reason of motor trouble. Honorable mention is given to four other sections, respectively for the best standing as regards armature changes, the best standing as regards lost time, the fewest armature changes in the present month and the least time lost in the month.

Although this plan is based on time lost, which may be evaluated, the general scheme might readily be referred to decreased output.

"Improvement" is based on the gain of the present standing over last month's standing and is expressed in percentage. What is called the "present standing" is based on a comparison of the last three months' operation with the last two years' operation. For instance, the standing as regards armature changes is expressed by equation (2). The top member of the equation expresses the number of armature changes per motor in use per ton of steel produced for the last two years. This is divided by the number of armatures replaced per motor in use per ton of steel produced for the last three months. The total is divided by 10,000 for convenience.

The section of the mill which has the highest value as derived by this equation is said to have the best standing as regards armature changes. The best standing as regards lost time is figured in the same manner. In calculating the "greatest improvement," for which the two prizes are given, the percentage gain in standing of the present month over the standing of last month is figured. The awards are made each month.

This system is well suited for a comparison of the carefulness of operators even in sections which have widely different equipment, functions and working conditions, as it takes into account the number of motors used in each section and the number of tons produced,

TABLE OF AWARDS IN CONTEST WHICH REDUCED NUMBER OF MOTOR TROUBLES

First Prize. Greatest improvement in armature changes.
Second Prize. Greatest improvement in time lost.
Honorable Mention. (1) Best standing, armature changes. (2) best standing, lost time. (3) fewest armature changes in month. (4) least time lost in month.

$$\text{Improvement} = \frac{\text{Present standing} - \text{Former standing}}{\text{Former standing}} \times 100 \qquad (1)$$

Standing. Comparison of last three months with last two years
Armature changes:

$$\text{Standing} = \frac{A_3 / M_3 T_3}{A_2 / M_2 T_2} \times \frac{1}{10\,000} \qquad (2)$$

A_3 = Number armatures changed in last three months.
A_2 = Number armatures changed in last two years.
M_3 = Number motors in use last three months.
M_2 = Number motors in use last two years.
T_3 = Tons produced last three months.
T_2 = Tons produced last two years.

Lost time:

$$\text{Standing} = \frac{t_3 / M_3 T_3}{t_2 / M_2 T_2} \times \frac{1}{10\,000} \qquad (3)$$

t_3 = Number minutes' delay in last three months.
t_2 = Number minutes' delay in last two years.
Other letters are same as for armature changes above.

as well as the performance in the section for the last two years, which is indicative of the kind of service which the motors are performing.

Pittsburgh, Pa. D. W. BLAKESLEE.

Reconnecting a Two-Phase Motor for Three-Phase Operation

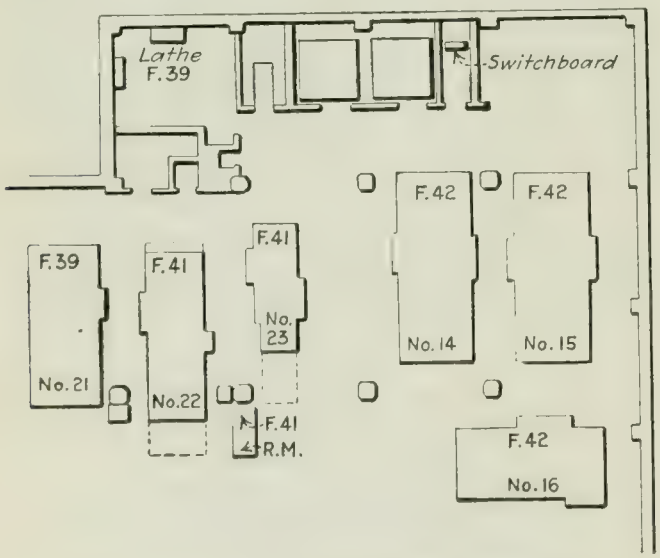
BY REWINDING a burned-out two-phase, 220-volt motor with twice the number of turns per coil but with wire of half the original cross-section the motor was prepared for easy reconnection to three-phase, 550-volt operation later. The motor was 5 hp., 60 cycles, 1,700 r.p.m., four poles, and had forty-eight slots and twenty-four coils, one coil per slot, connected as a basket-type winding. Each coil originally consisted of twenty-two turns of two No. 14 double-cotton-covered wires in parallel with the coils in series for 220 volts, two-phase. The pitch was 1 and 10.

As a two-phase motor has approximately 25 per cent more turns than a three-phase motor of the same voltage, and as 550 is 25 per cent more than 440, it follows that the windings of a 440-volt, two-phase motor are equivalent to a 550-volt, three-phase motor. This motor was therefore rewound for two-phase, 220-volt parallel operation, or two-phase, 440-volt series operation, by winding the coils with forty-four turns of No. 14 double-cotton-covered wire, which was twice the previous number of turns and half the conductor cross-section. The same coil pitch was used.

Bronx, New York City. C. A. JOHNSON.

Floor Map Near Board Helps to Replace Blown Fuses

TO LOCATE quickly which fuses on the distribution switchboard have blown, a floor plan showing the individual machines with numbers corresponding to numbers stamped opposite the fuses on the switchboard buses has been prepared in a New York printing



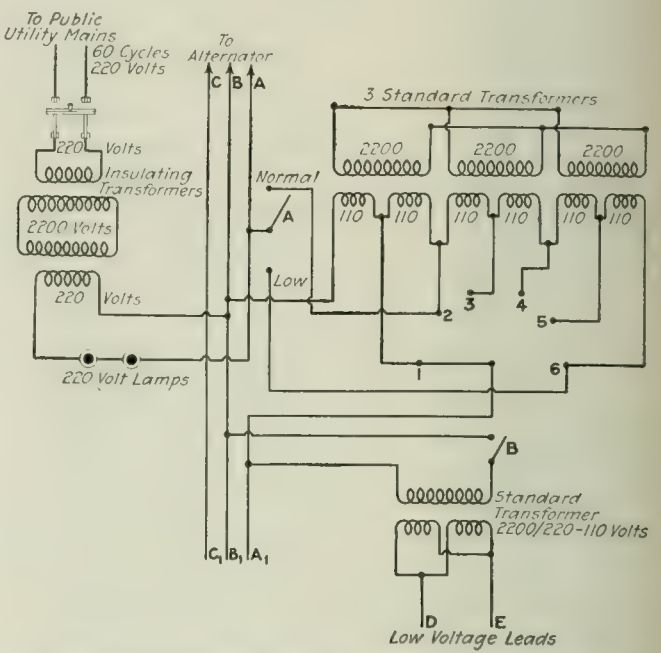
MACHINES IN THIS PLAN ARE NUMBERED CORRESPONDING TO NUMBERS OPPOSITE FUSES ON SWITCHBOARD

plant. These numbers are stamped opposite to each set of fuses on the copper busbars of the switchboard which controls each floor. Corresponding numbers are printed on the plan at each machine which is fed through the fuses. On the plan are also printed the numbers of the machines in the shop. Where a machine does not have a number the name of the machine is written on the plan, as, for instance, "lathe," shown in the upper left-hand corner of the drawing. This plan is framed and hung close by the switchboard. When the energy fails on any machine, by consulting the plan the fuses on the circuit feeding the machine may be removed and replaced by new ones. This saves the time of testing out the fuses to see which ones are blown.

New York, N. Y. W. A. HARRIS.

Various Single-Phase Voltages from Three-Phase Generator

TO OBTAIN various single-phase voltages from a 220-volt, three-phase alternator for testing, no auto-transformer being available, an industrial company in the East used three standard 2,200/220-110-volt transformers which were connected up as shown in the



SINGLE-PHASE VOLTAGES MAY BE OBTAINED FROM THIS COMBINATION AS WELL AS THREE-PHASE

diagram and so used as an auto-transformer, the primary of one transformer furnishing the exciting current for the two others. The 2,200-volt windings were connected in multiple and the 220-110-volt windings were all connected in series. Taps were brought out from each of the 110-volt windings to a sliding contact so that from one-half to three times the normal voltage of the alternator could be obtained across *A*1 and *B*1.

To use the alternator as a three-phase machine the sliding contact is placed at 2. To obtain the above results the switch *A* is placed in the up, or "normal," position. To secure very low voltage and high current switch *A* is thrown in the down or "low" position and the sliding contact placed at 1. By closing the switch *B* very low voltage and high current are obtained across *D* and *E*.

Another point of interest in this installation is the method of measuring the frequency. The frequency of the public utility company serving the district is kept at 60 cycles by means of a master clock so that it may be relied upon as accurate. By means of "synchronizing lamps" the speed of the test alternator can be adjusted till there is no flicker in the lamps, which shows that the alternator is operating at 60 cycles. The public utility 60-cycle, 220-volt lines were brought through a pair of 220/2,200-volt ½-kva. transformers, as shown.

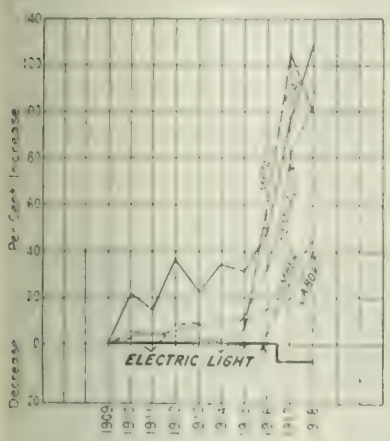
Ampere, N. J. EUSTACE C. SOARES.

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

How the Electric Dollar Has Increased in Value

HOW the electric dollar grew is shown graphically in the accompanying chart prepared by the Philadelphia Electric Company for the information of its customers. To the general shrinkage in the purchasing power of the dollar this chart is a striking contrast. But maintaining the low price of electricity in spite of the advancing cost of all materials and services entering into its manufacture has been difficult. It has been possible only because of the tremendous demand for power permitting the use of large generating units having very high efficiency. The increased demand has brought a higher load factor, making fuller use of investment and reducing overhead charges per unit. Greater density of customers has helped more economical use of distribution lines and commercial services. How long these factors will keep the cost of electric service ahead of rising costs cannot be foretold, but it seems certain that electricity will never reach the high level of other commodities.



COMPARISON OF DOLLAR VALUE

Diagram showing how the electric dollar has increased in value while the dollar for many essentials has steadily decreased.

Credit Deposits and the Rate of Interest Thereon

BY KASSANDRA

IT IS said that some men have brains divided into two or more compartments with different sets of ideas in each compartment. So long as the ideas are kept separate the man appears sane, but if the compartments in his brain allow the different ideas to mix there is an explosion. The same thing would seem to be true of the different departments of some central-station companies, as when the president appears before a commission and explains that he has to pay 8 or 10 per cent to attract money, while at the office the treasurer is explaining that he cannot possibly afford to pay more than 3 per cent on the credit deposits.

It is not only the companies that are inconsistent. Recently there was an account of a company that had adopted the policy of returning deposits after the customer had established a good credit standing by paying his bills regularly for a year. In spite of the fact that this company paid 6 per cent on the deposits, it was reported that the customers were pleased to have them returned, but what did they do with their deposits? Probably when they got them back they went and put them in their checking account to draw 2 per cent. On the other hand, where did the company get the money with which to return the deposits? Probably it was borrowed from the bank at 7 per cent.

Of course, if each set of accounts is kept absolutely separate, there is an excuse, though a poor one, for the companies paying a lower rate of interest on the credit deposits than on bank loans or to its stockholders, just as a bank pays a lower rate of interest on checking accounts than on time deposits, but why should not the president and treasurer sit down together and look at it in a broad way?

It is true that any individual credit deposits can be withdrawn on short notice, but only if a customer discontinues service. We cannot imagine a run on the credit deposits like a run on a bank. The total amount of credit deposits stays pretty steady. Again the small credit deposits require more clerical labor than a large bank loan, but is not this clerical labor really part of the credit division of the new-business department rather than a cost of hiring money? Still further, would not the number of interviews required to arrange for credit deposits be much less and would not the customers have a much more cordial feeling toward the company if they were allowed as interest on their deposits the same rate that the company was allowed to earn on its stock or its investment, as for instance 8 per cent?

Such a policy would make customers not only willing but even desirous to make deposits and would reduce the labor of the credit division to a considerable extent. Even if the increased rate of interest on the present deposits made an appreciable increase in the costs, this would be more than balanced by the increased good will of the customers. If, still further, the making of deposits became so popular that the total amount increased, this would do no harm. No customer would have the right to make more than a reasonable deposit, and he could not withdraw it before he discontinued service, except at the option of the company. Then, if the credit deposits increased, this certainly should reduce the net working capital which the company would need, since only a small cash balance is needed to provide for the number of deposits which would be returned in any one day or week.

The clerical work could be obviated by using the idea of the war saving stamps (not transferable). A customer making a deposit would receive in his name a non-transferable certificate, for which he would pay $10 on Jan. 1 and $10.01 on Jan. 5, and so on until on Dec. 31 the amount would be $10.80, and all customers whose

accounts showed they held certificates would on Jan. 1 receive a credit of the interest. When they discontinued and their accounts were closed they would receive a check for the proper amount, the check saying that it was for the certificate less the bills due on discontinuance.

The important part, however, is not the clerical labor, but paying a rate of interest on deposits such that there shall be no excuse for complaint on the part of depositors. The result should be greater good will on the part of the customers of the company at an expense very slight in comparison to the results that would be obtained.

A Complete Plan for Merchandising Electrical Goods Properly

FOR years the electrical industry has talked of better merchandising and the education of the electrical dealer in this field. Much that was constructive has been accomplished. Education, bit by bit, has been making its impression. Now come the Westinghouse Electric & Manufacturing Company, Westinghouse Lamp Company and affiliated interests with an entire and tangible working plan for the proper merchandising of electrical appliances to the public. These interests have joined in the formation of the Westinghouse Merchandising Bureau, which is "primarily to make special studies of the problems of marketing electrical merchandising and to suggest plans which should result in securing the maximum benefits for all distributers of electrical merchandise."

In order to stimulate sales there has been developed a traveling merchandising exhibit, known as "Better Merchandising Shows." There are two shows, with the same properties but different treatment, one for the jobber and his salespeople and one for the electrical dealer.

The bureau aims to have duplicates made for each of the company's districts. The shows contain some twenty wall charts, showing merchandising methods and containing ideas and statistics, and model store windows, showing also good and bad lighting and display tables. With each show goes an extensive merchandising program.

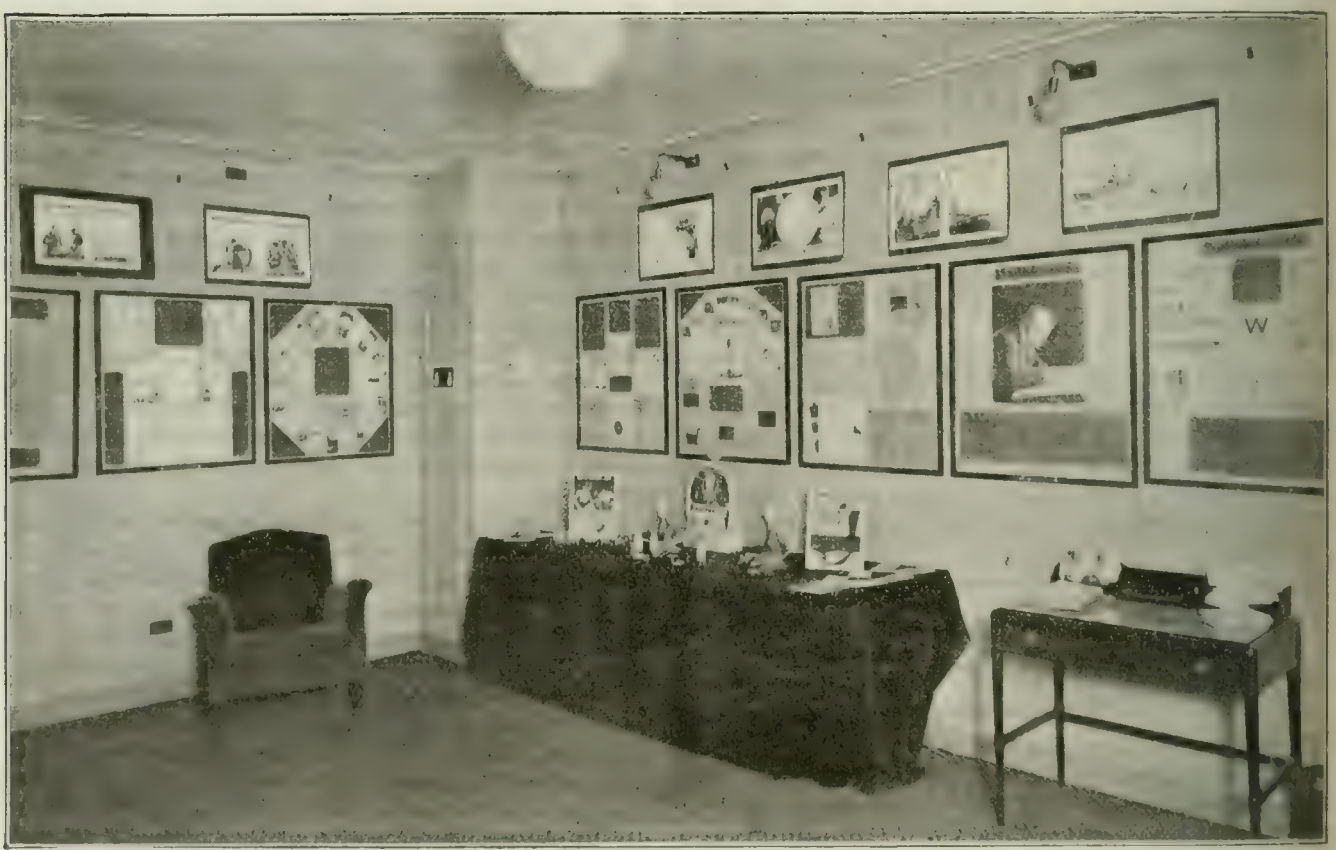
Before the dealers' show will be staged in any district the jobbers' show will be given, which will be attended by the jobber's salesmen, his merchandising manager, promotion men and the Westinghouse merchandising specialists who conduct the shows. The jobbers' show will cover two morning and two afternoon sessions of three hours each and one evening session of two hours on the same day, The program follows:

1. Introductory.—Object of meetings, plan of meetings, scope of work.

2. Merchandising.—What it is, to what lines applicable, why it must be done, how to do it.

3. Advertising.—Different kinds, object of each kind, how the merchandiser uses it.

4. Apparatus.—Talk on heating appliances, ranges, fan motors and sewing machines.



ONE CORNER OF THE "BETTER MERCHANDISING SHOW" WITH SOME TYPICAL POSTERS AND A TABLE DISPLAY

5. Stocks and Service.—Volume and diversity, inventories and reports, stocks of dealers and contractors, use of lamp service record, repair part stock, service plan on heating apparatus and ranges.

6. Value of a Lamp Contract.

7. The Westinghouse Industries.

8. Demonstrations.—Window illumination, window trimming, counter displays, shelf displays, demonstrations.

9. Jobbers' Follow Up "Show."—Getting new retail outlets, strengthening present dealers and contractors, how to run the "dealer show" and campaign, making permanent

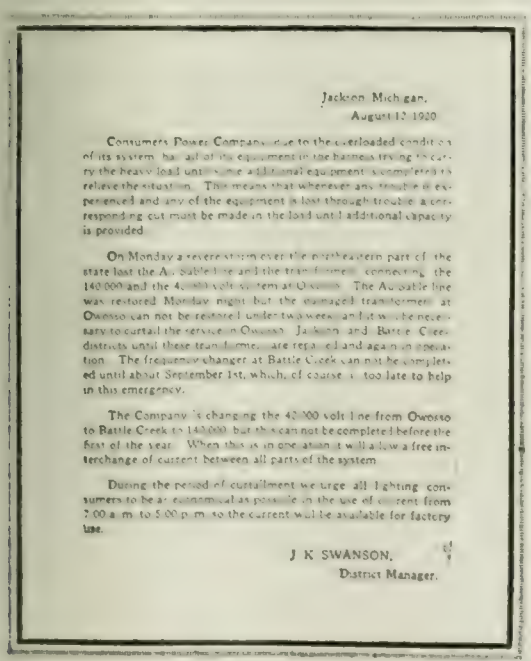
the "Better Merchant," exhibition of data showing past accomplishments.

Afterward the dealers' show will be ready for this territory, and will be given in each "dealer's center." This center will be chosen with respect to geographical location, train services, local buying tendencies, etc. In the East the centers will average about 50 miles apart and in the West about 100 miles. At these shows there will be in attendance the district office promotion men of the lamp and electric companies, the lamp and electric company salesmen and the agent jobbers' salesmen handling the customers who were invited to the show and the jobbers' merchandising manager. The program of this show is as follows:

1. OBJECT OF THE SHOW.
2. PLAN AND SCOPE OF WORK.
3. MERCHANDISING.
4. THE SHOW WINDOW.
5. THE COUNTER DISPLAY.
6. ARRANGEMENT OF APPLIANCES.
7. STORE DISPLAY OF RANGES.
8. STORE DISPLAY OF SEWING MACHINES.
9. STORE ARRANGEMENTS.
10. ARRANGEMENT AND SHOW OF MATERIAL ON SHELVES AND IN WALL SHOW CASES.
11. PUBLICATIONS AND BOOKS ON STORE MANAGEMENT.
12. STORE ACCOUNTING.
13. TIME PAYMENTS.
14. LOCAL ADVERTISING.
15. LOCAL CAMPAIGN.
16. MANUFACTURER'S ADVERTISING.
17. ADVERTISING HELPS SUPPLIED BY MANUFACTURERS.
18. THE WESTINGHOUSE COMPANIES.

How a Michigan Company Helps Customers to Understand System Troubles

THE Consumers' Power Company of Jackson, Mich., believes in letting its consumers know exactly what to expect from cases of system trouble. The advertisement reproduced illustrates the character of the publicity matter used in warning consumers what to expect in cases of severe trouble on the system.



Jackson, Michigan,
August 12, 1920

Consumers Power Company, due to the overloaded condition of its system, has all of its equipment in the harness trying to carry the heavy load until some additional equipment is completed to relieve the situation. This means that whenever any trouble is experienced and any of the equipment is lost through trouble a corresponding cut must be made in the load until additional capacity is provided.

On Monday a severe storm over the northeastern part of the state lost the Au Sable line and the transformers connecting the 140,000 and the 40,000 volt systems at Owosso. The Au Sable line was restored Monday night but the damaged transformers at Owosso can not be restored under two weeks and it will be necessary to curtail the service in Owosso, Jackson and Battle Creek districts until these transformers are repaired and again in operation. The frequency changer at Battle Creek can not be completed until about September 1st, which, of course is too late to help in this emergency.

The Company is changing the 40,000 volt line from Owosso to Battle Creek to 140,000, but this can not be completed before the first of the year. When this is in operation it will allow a free interchange of current between all parts of the system.

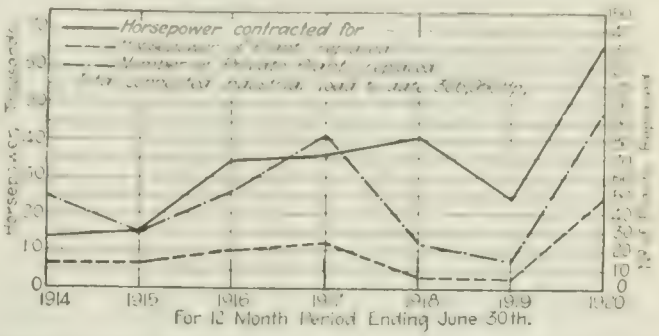
During the period of curtailment we urge all lighting consumers to be as economical as possible in the use of current from 7:00 a. m. to 5:00 p. m. so the current will be available for factory use.

J. K. SWANSON,
District Manager.

TELLING CONSUMERS WHAT SYSTEM TROUBLES MEAN HELPS THEM TO MAKE PLANS

Increased Use of Central-Station Power by Baltimore Industries

IT IS interesting to compare the new-business records of the Consolidated Gas, Electric Light & Power Company of Baltimore for the last seven years as graphically shown in the accompanying curves, giving the total horsepower contracted for, the horsepower and number of private plants replaced. As the curves represent the new business contracted for, a depression



THESE CURVES REPRESENT YEARLY ADDITIONS IN POWER FOR MANUFACTURING PURPOSES ONLY AND DO NOT INCLUDE DOMESTIC LOAD

means simply a slower increase. The general shape of all three curves reflects two elements of Baltimore's industrial life—the acquisition of new manufacturing activities and the desire on the part of the manufacturers to bring production to a maximum through the most efficient method of operation. The period of uncertainty and cautious expansion during the early part of 1919 has been more than counterbalanced since June of that year through expansions, new industries and replacement of isolated plants. During the twelve months ended June 30, 1920, the Baltimore company took over 50 per cent more industrial power contracts than for any similar period in its history. Ninety-six plants, aggregating 24,667 hp. have been replaced since June, 1919. This brings the total connected industrial load on the company's lines to 306,950 hp.

Helping the Utilities Commission to Expedite Its Work

AT A MEETING of the executive committee of the Ohio Electric Light Association held subsequent to the recent convention of that body a discussion took place concerning the way in which the association could assist the Public Utilities Commission of the State in facilitating the early hearing of cases brought before it. A resolution was passed to the effect that the members of the association having business before the commission be requested to co-operate with that body and others interested in an effort to facilitate hearings and that they consent that such hearings may be had before one member of the commission, when a record of such hearing is made and will be available to the other members for their inspection and study, and that they do such other things as may be reasonably necessary to enable the commission to dispose of matters before it without unnecessary delay.

Co-operation with the commission was declared to be in the interest both of the utilities and the public, and the secretary of the association was instructed to bring the matter to the attention of the member companies.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Lamps and Lighting

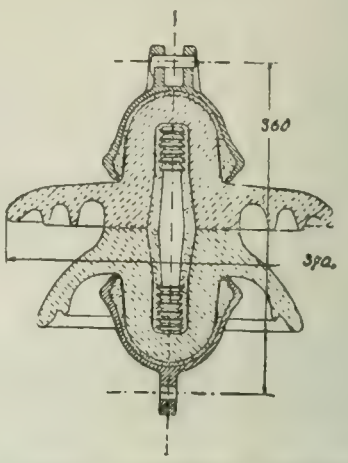
The Lighting of Show Windows and Showcases.—A L. POWELL.—Considerations which affect the planning of show-window lighting are taken up and include the intensity of illumination, the selection of lamp reflectors, color of light, direction of light, background, trimming, etc.—*Bulletin L. D. 103, Edison Lamp Works,* April, 1920.

Generation, Transmission and Distribution

Preparing Pittsburgh District Waters for Boilers.—Great difficulty is said to have been caused by the rapidly changing solution of several scale-forming substances with considerable free acid and undissolved organic matter in river waters of the Pittsburgh district. The Monongahela River water, for example, has changing characteristics which cannot be predicted. Water pumped from mines into the river is highly charged with sulphates, and the industrial pickling and by-product coke plants which line the river's banks for miles have a contaminating refuse water discharging at varying intervals and in varying quantities into the river. Acid waters from various plants dissolve the rocks of the river bed, thus increasing the scale-forming contents. The frequent testing and changing treatment required for this water are described.—*Power Plant Engineering,* Aug. 15, 1920.

Electrical Characteristics of Transmission Circuits.—XII.—WILIAM NESBIT.—In this number of the series the author takes up a comparison of various methods. The "localized capacitance" or "localized admittance" methods are discussed and a tabulation of the magnitude of the errors in the results as obtained by these approximate methods when applied to circuits of different lengths and frequencies is made. The graphical solution previously described in connection with the Wilkinson charts will be generally more accurate and shorter than these localized capacitance methods, it is said.—*Electric Journal,* August, 1920.

Characteristics and Tests of Suspension Insulators.—P. G. VENTURINI.—The conditions of working of porcelain high-tension suspension insulators are studied in detail in this article, and a new type of insulator devised by the author is described. The dimensions and form to be given to the different parts of the insulators in order to withstand without damage mechanical, thermal and electrical stresses and the tests to be made of such insulators are carefully discussed. The author considers that a good insulator to be employed for a line at the pressure V should present the following characteristics: Voltage of corona phenomenon, insulator dry, $2V$; voltage of the arc, insulator dry, $3V$; voltage of the arc, under rain, $1.5V$; voltage of perforation, in oil, $4.5V$. The new type of insulator devised by the author is shown in the figure. It is provided with double metallic cap, and the iron rod is embedded in cement and connects the two halves of the insulator. The iron rod consequently cannot assume a temperature different from that of the porcelain and cement and is therefore less liable to detach itself than in ordinary types, in which the iron, being in immediate contact with the air, immediately assumes its temperature,



NEW ITALIAN SUSPENSION INSULATOR

while the porcelain assumes it much later. The new insulator has a large capacity, which is useful when employing several of them in chain, in order to obtain a good distribution of the pressure along the chain.—*Science Abstracts, Section B,* July 30, 1920. (Abstracted from *Elettrotecnica,* April 15, 1920.)

Installations, Systems and Appliances

Evolution of the Coolidge X-Ray Tube.—A summary of a lecture delivered by Dr. W. D. Coolidge before the Röntgen Society in England. It was said that progress in the development of the X-ray bulb was possible only when the art of manufacturing and working tungsten had been mastered. Dr. Coolidge dwelt in considerable detail on the present method of purifying and reducing wolframite and the operations of sintering the powdered tungsten metal into blocks and plates from which disks could be prepared, when white hot, suitable for the targets of X-ray bulbs. The essential requirements of a target in an X-ray bulb were stated as follows: (1) A high melting point to permit sharp focusing of the cathode rays without fusing the target. (2) A high atomic number to secure a large yield of X-rays. (3) A high thermal conductivity to enable the heat to be got rid of. (4) A high heat capacity to withstand intense momentary discharges as in diagnostic work. (5) A low vapor pressure to prevent the metal being deposited on the walls of the bulb.—London *Electrician,* July 23, 1920.

Electron Power Tubes and Some of Their Applications.—WILLIAM C. WHITE.—In this article a substantial exposition is given of the factors of design and construction that determine the output of three-element

power tubes. A typical pliotron power tube is then taken up, and the properties of oscillating circuits for these tubes are discussed.—*General Electric Review*, June 1920.

The Selection of Oil Circuit Breakers.—W. A. COATES.—The writer discusses the rating of oil circuit breakers with reference to breaking capacity as defined by the British Engineering Standards Association. He also points out that there would be great advantage in having graphical methods of determining short-circuit current values in networks and shows a chart devised by himself which he says should be useful in this connection.—London *Electrician*, July 2, 1920.

Electrophysics and Magnetism

Fundamental Phenomena in Electron Tubes Having Tungsten Cathodes.—II.—IRVING LANGMUIR.—In the present and concluding installment the author treats of the fact that electrons impinging on solid surfaces frequently cause the emission of relatively large numbers of secondary electrons. He then tells how such phenomena may play a prominent part in the operation of vacuum tubes and describes striking experiments illustrating these effects. He also deals with the manner in which the various fundamental phenomena are co-ordinated to determine the operating characteristics of these electron tubes.—*General Electric Review*, July, 1920.

A New Galvano-Magnetic Effect.—LA ROSA and SELLERIO.—The resistance and thermo-electromotive force of certain metals change under the influence of a magnetic field. The authors have earlier investigated these magnetic effects and for their explanation advanced the hypothesis that the number of free electrons per unit volume is a function of the magnetic field strength. Working on the basis of this hypothesis, they further found that as a necessary consequence there must exist a longitudinal galvano-magnetic effect similar to the Hall effect, the latter, however, being of a tranversal nature. It now appears that experimental proofs have been given for the existence of such an effect. A short and wide cylinder of bismuth was placed coaxially between the pole pieces of a powerful electromagnet, and a current of 10 amp. was passed through the sample, between copper electrodes, along two diametrically opposite generatrices. At the center of each end surface of the cylinder electrodes were fixed, which were connected to a sensitive galvanometer. The magnetic lines of force, then, were parallel to the axis of the cylinder, and the two galvanometer contacts thus lay on the same magnetic line of force, while the current lines were perpendicular to the field. Upon reversal of the magnetic field a galvanometer deflection was observed which could not be fully accounted for by any known effect.—*Comptes Rendus*, June 14, 1920.

Electromagnetic Momentum.—H. A. WILSON.—The writer discusses fundamental relations involving electro-magnetic momentum, the relations of matter and ether to stresses and the transmission of energy and momentum in the field.—*Physical Review*, July, 1920.

Magnetic Properties of Iron Alloys.—The series of articles on the relation of magnetic properties and electric conductivity of iron to its percentage of carbon, aluminum, silicon and manganese, etc., published by Gumlish and Goerens in the *Elektrotochnische Zeitschrift*, June 26 to July 24, and referred to in these columns on Feb. 14, is reprinted almost in full in the *Revue Générale d'Electricité* of May 1, 1920.

Telegraphy, Telephony and Signals

Wireless Telephone Transmitter for Seaplanes.—The set described was designed primarily for the large flying boats of the United States Navy and has enabled transmission of speech over a distance of 150 miles (240 km.), it is said. The transmitter radiates at two wave lengths, 1,600 m. and 600 m. For the former wave length a trailing wire antenna of 0.0004 mfd. is employed, for the latter an emergency aerial of 0.00026 mfd. The transmitter is supplied with two three-electrode tubes of the pliotron type. One tube is employed as an oscillator for the production of radio-frequency currents and the other tube is employed as a modulator and as an amplifier of the voice currents that are communicated to it by the microphone.—London *Electrician*, July 30, 1920.

Adaptability of Aërial and Cabled Telephone Lines for Carrier Wave Multiplex.—FASSBENDER and HABANN.—Ordinary telephone lines are intended for use at rather low frequencies, of a few thousand cycles per second at most. In the new high-frequency multiplex telephony, where sometimes frequencies in the radio range are employed, phenomena of a somewhat different nature therefore come into play. The article gives a discussion of the transmission theory as applied to this particular problem. The ordinary theory cannot be directly applied, since at those high frequencies the so-called line constants vary appreciably with frequency. Some interesting tables are included showing the variation with frequency of the leakage per unit length of line and of the angle of loss of the dielectric. For 0.8-mm. paper-insulated cable the leakage was found to vary from 20 micromho/km. at 1.5×10^4 cycles to 3,390 micromho/km. at 30×10^4 cycles, corresponding to a variation in the angle of loss from 6×10^{-3} to 50×10^{-3}. Another table shows the difference between the wave length at given frequency in ether and when the wave is transmitted along a line. For the cable above the authors find that for a frequency corresponding to an ether-wave length of 7,000 m. the actual wave length is only 4,090, while at 1,000 m. the actual wave length is 716 m. On an aërial line of 4 mm. wire a 20,000-m. ether wave will set up waves of 19,490 m. length, and similarly an ether-wave length of 1,000 m. will correspond to a wave length of 975 m. along this aërial.—*Jahrbuch für drahtlose Tel. und Tel.*, May, 1920.

Miscellaneous

The German Incandescent Lamp Combination.—F. PINNER.—The Germans are getting together and preparing for industrial rehabilitation by combining interests so that internal competition will be avoided. The large aniline dye factories during the war pooled all interests and now are actually operated as one giant concern. Recently a similar combine was formed by the incandescent lamp manufacturers. The Auer company, controlling the "Osram" patents, and the A. E. G. and the Siemens-Halske, both licensees of certain General Electric Company patents, have discontinued their respective lamp departments and founded a new concern, the Osram-Werke G. m. b. H., which is taking over all incandescent-lamp business in Germany. The new company has a capital of only 10,000,000 marks, although the factories owned by the company represent physical properties which have a value of many hundred million marks.—*Teknish Tidskrift, Elektroteknik*, June 2, 1920.

WHILE GRANTING to the Potomac Electric Power Company an increase in rates, the Public Utilities Commission of the District of Columbia objected to the insertion of a coal clause on the grounds that there would then be no incentive to purchase coal advantageously.

HYDRO-ELECTRIC DEVELOPMENTS in eastern Iowa are contemplated in which twelve to fifteen small automatic plants eventually will be erected.

PLANS FOR SEATTLE'S Cedar Falls power house to develop an additional 20,000 hp. are now ready for approval, and as soon as this is secured the work will be rushed through.

THE SUPREME COURT OF CALIFORNIA has annulled an order of the State Railroad Commission requiring the city of Pasadena to file with it a schedule of rates.

B. E. MORROW, manager of the production and transmission department, and J. G. Hemstreet, superintendent of operation of the Consumers' Power Company of Jackson, Mich., are seriously investigating the possibility of using a slow speed aeroplane in combination with a system of wireless telegraphy in the patrol of its high-tension lines.

THE NEZ PERCE TELEPHONE COMPANY alleges that the Grangerville Electric Company has constructed 5 miles of electric lines parallel to the telephone company's line and in such proximity as to render the telephone company's lines worthless on account of inductive interference and has asked the commission to order the removal of the electric power line.

WORK OF CONSTRUCTING the Link River power dam, under order of the California-Oregon Power Company, has been ordered discontinued by the company, due, it is said, to the fact that construction of the dam would raise the level of Klamath Lake to flood 15,000 acres of land, which has been protested to the Interior Department.

HYDRO-ELECTRIC PLANTS on the Androscoggin and Kennebec Rivers have been interconnected by the Central Maine Power Company through the completion of a 45,000-volt tie line between the Augusta and Lewiston districts.

UTILITIES, in spite of priority orders, have been unable to obtain sufficient coal on their contracts and so are forced into the spot market, according to a prominent utility operator, although plenty of spot coal may be obtained in New York for a price.

FINAL PLANS are complete for the New England Geographic Division, N. E. L. A., convention at Kineo, Me., Sept. 13-17.

ELECTRIC RAILWAY LINES in northeastern Massachusetts are negotiating for the purchase of central-station energy, the existing scattered direct-current plants used in traction service having approached the limit of efficient expansion.

News in Brief

Summary of Market Conditions and of Recent and Approaching Happenings of Importance to the Industry

MICHIGAN HAS a coal committee which is making a study of the stocks of coal which utilities throughout the state have on hand.

A LIGHTING DEPARTMENT has been organized by the National Electric Light Association to teach, by means of demonstrations, manufacturers, merchants and the general public the most efficient use of electric light.

THE CARRYING OUT of the St. Lawrence River project, which would give a waterway direct from the Middle West to Europe, is offered as a solution of the nation's power and transportation problem by H. C. Gardner of Chicago in a survey which he has made for the American Society of Mechanical Engineers.

THE WESTERN SOCIETY OF ENGINEERS has gone on record as recommending the retention of the Public Utilities Commission, and instead of impairing the law which created it, urges the strengthening of that law.

STOCKS of electrical material are rapidly being built up under improving deliveries, with overstocking reported in instances.

COLLECTIONS are still far from being satisfactory, but improvements are seen in some sections.

IN ORDER to devote more time to technical matters the California Institute of Technology has eliminated modern languages from the required curricula.

AT THE Nebraska N. E. L. A. section meeting Mayor Smith of Omaha went on record as favoring valuation on present-day costs as a basis for rate making.

IN SPITE of a falling cotton market firm prices rule for loom because of the cotton purchased in advance to cover orders.

AN ACTIVE DEMAND for asbestos wire is reported, with factory stocks about cleaned out.

SAMUEL GOMPERS has urged Kansas labor unions to hold a conference to outline plans for a statewide campaign for the abolition of the Kansas Court of Industrial Relations.

AT ITS annual convention this week at Spokane the Northwest Electric Light & Power Association adopted the co-operative idea under the name of the Northwest Electric Service League.

THE COAL SITUATION of the Northwest is improving and if nothing is done to interfere with priority shipments to that section a sufficient supply will probably be received before winter conditions set in.

INCREASED RATES will restore confidence in public utility securities, it was pointed out on Wednesday by President W. R. Kenney at the annual convention of the Pennsylvania Electrical Association.

IN A REPORT to the North Carolina Chamber of Commerce, Thorndike Saville recommends, among other things, the passage of a water-power conservation bill retaining to the State authority over its water and forest resources.

A PLAN for the construction of a $20,000,000 reclamation and water-power dam in Boulder Canyon on the Colorado River with a capacity of 240,000,000 acre-ft. is being contemplated.

COMMERCIAL BODIES in the Northwest are much opposed to handling water-power permits for that region from San Francisco and are urging the establishment of a regional office of the Federal Power Commission in either Portland or Seattle.

THE FEDERAL POWER COMMISSION has completed its rules and regulations governing the application for and granting of water-power permits and licenses.

THE CONFERENCE CLUB is to meet at White Sulphur Springs, W. Va., Sept. 30, Oct. 1 and 2.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Federation Going Strong with Local Societies

SINCE last week the governing bodies of some six additional local technical and engineering societies have advised the Joint Conference Committee that they have made favorable recommendations to their respective organizations regarding the invitation to join the Federated American Engineering Societies. These societies have a combined membership of about 4,000, which, added to the 28,000 membership of the five societies which have already joined, makes a total of 32,000. A number of societies will give the matter consideration at the first fall meeting. The committee is very favorably impressed with the way the local societies are taking hold.

The Joint Conference Committee is expected to announce the date and place of the November meeting of the American Engineering Council together with the suggested program in about two weeks.

Regulations Governing Application for Water Power Permits Completed

THE rules and regulations governing the application for and granting of water power permits by the Federal Power Commission have just been completed. There are ten regulations as follows: (1) Definition of terms, (2) general requirements for applications, (3) applications for preliminary permits, (4) applications for licenses—major projects, (5) applications for licenses—minor projects, (6) applications for licenses—major projects already constructed, (7) declaration of intention, (8) priorities and preferences, (9) permits, (10) licenses. The first seven regulations deal more with routine detail, while the last three are of more general interest and consequently will be presented in full in next week's issue of the ELECTRICAL WORLD.

Northwest Men Want Regional Water Power Office

LIVELY bidding is going on among commercial bodies of the Pacific Coast for designation of their respective cities as regional or field offices of the Federal Water Power Commission, to receive applications on behalf of the commission, and perform other functions under the new water power law. The Seattle Chamber of Commerce has urged that Seattle be given the appointment, and urgently protests the tentative plan of locating the government offices in San Francisco to handle business for the Pacific Coast. It is urged that Seattle is the logical headquarters for Washington, Oregon and Idaho, which have 125, 68.4 and 60.4 horsepower per square mile respectively in contrast with 49.4 horsepower for the state of California, and no consideration is taken of the power possibilities of Alaska.

The city of Portland has also filed its claim with the commission, asserting that Portland is the center of the greatest potential hydro-electric energy of any known city in the world.

Western Society of Engineers for Retention of Illinois Commission

THE board of direction of the Western Society of Engineers has passed the following resolution:

"*Resolved*, That the board of direction approve the report of the public affairs committee and recommend to our members and to the public the retention of the Public Utilities Commission of Illinois, and instead of impairing the law which created it urge the strengthening of that law."

The results of poor service when rates are too low and extravagance and corruption when rates are too high met with under the old bargaining system that home rule brings about is pointed out in the report. That the old system is fundamentally unfair is asserted, since a third party is required to whom each side could present its arguments for an impartial decision. The committee believes the new system of state regulation and rates by a commission is the natural and logical outgrowth of the attempt to remedy the old and unbearable faults of the old system. The report of the committee deals principally with the controversy between the city of Chicago and the State Utilities Commission over the recent raise of street railway fares, in which the question of home rule is involved.

Northwest Division N. E. L. A. Indorses Co-operative Plan

THE Northwest Electric Light & Power Association, which is the Northwest Division of the N. E. L. A., adopted the co-operative campaign idea at the opening day's session of its annual convention at Spokane, Wash., on Sept. 8, 1920. The plan is similar to the California Co-operative Campaign and contemplates the formation of a permanent advisory committee. Funds are to be raised to put the Northwest Electric Service League in operation in Oregon and Washington. The other organizations in the Northwestern states will follow as the growth of business in those sections warrants.

President J. B. Fisken reported the labor and rate situation presented a more optimistic outlook. He pointed out, however, the need of special vigilance in meeting the tendency of municipalities and local authorities taking over utility commission functions. A number of subjects needing research work were laid out by the commercial committee, R. W. Clark, Puget Sound Power & Light Company, chairman, as follows: (1) Cost data on competitive and other service; (2) efficiency methods in all departments; (3) methods used in securing rate

increases; (4) elimination of gratuitous service; (5) educational campaigns; (6) customer ownership campaigns; (7) increase of demand; (8) policy on special transformers, and services; (9) demarkation between transmissions and distribution lines and fixing of voltage in rural districts; (10) rates; (11) classification of costs for more intelligent comparison.

Uniformity in accounts was urged by the accounting committee and the particular need of including those requirements peculiar to the West in forms which may be fixed for national use was discussed. The joint committee of engineers and accountants to discuss a uniform interpretation of accounting clauses by utility commissions may be appointed in view of the confusion now existing in the Northwest where some companies serve consumers in more than one state.

Franklin T. Griffith, president Portland Railway, Light & Power Company was elected president of the association for the coming year. The convention continued on Thursday and Friday, Sept. 9 and 10.

Coal Situation in Northwest Shows Signs of Improvement

THE coal situation in the northwest while not exactly reassuring shows signs of improvement. The receipts of coal at Lake Superior docks continues far below requirements and if no modification of the Interstate Commerce Commission's Service Order No. 10 (which provides for the shipment of coal to the northwest before the close of the lake season) is made, a sufficient supply will probably be received. Akron and Cleveland have petitioned for a modification of the order to enable them to obtain coal for lighting purposes. However, rather than modify the order the Interstate Commerce Commission advised a meeting of the Akron and Cleveland representatives with Daniel Willard of the railroad committee and President Wentz of the National Coal Association to arrange shipments of coal to those cities by some other plan. During August the Duluth-Superior docks handled 1,400,000 tons of bituminous coal as compared with 718,000 tons during July. The season's shipments on Sept. 1 were estimated to be more than 2,000,000 tons behind those of last year. Daily receipts at Duluth-Superior docks will have to average over 53,000 tons until Nov. 30 if last year's supply is to be equaled. During August the average was only 46,000 tons daily.

California Court Annuls Order on Municipality to File Rates

AS THE result of the application for certiorari to review an order of the Railroad Commission of the State of California requiring the city of Pasadena, a municipal corporation, to file a schedule of rates for electric service, the commission's order has recently been annulled by the Supreme Court of that State. The court found "no tenable ground upon which to base the conclusion that the rates charged by a municipality for its service in carrying on any public utility, either within its own limits or in outside territory, are under the control of the Railroad Commission."

The proceeding is an outcome of the order issued by the Railroad Commission of California on the city of Pasadena, which city supplies electric service also in the adjoining city of South Pasadena.

Conference Club to Meet at End of Month to Formulate Plans

THE Conference Club is to discuss and formulate plans for converting the club into a permanent conference at the meeting which is to be held at Greenbrier Inn, White Sulphur Springs, W. Va., Sept. 30, Oct. 1-2, 1920. Invitations are now being sent out to attend this meeting, which it is hoped will include a sufficient number of leading men as to make it representative of the several branches of the industry. No program has been laid out for the meeting.

Increased Rates Will Renew Confidence in Utility Securities

THE obvious part the central station is to play in improving the present disturbed economic condition is the providing of an adequate and dependable source of power supply for all needs, stated President W. R. Kenney at the thirteenth annual convention of the Pennsylvania Electrical Association, which opened at Bedford Springs, Pa., on Sept. 8.

"Lack of power and a tight money market," said Mr. Kenney, "have militated against effecting industrial improvements promptly. The essential factor for the time being is that of obtaining capital. The Interstate Commerce Commission has granted the railroads relief through increases in rates and thus renewed confidence in railroad securities. This is undoubtedly typical of the position of other utilities and they will produce an even more favorable showing regarding their values."

Colorado Association Convenes Next Week

NEXT week, Monday, Tuesday and Wednesday, there will be held at Glenwood Springs, Col., a combination convention of the Colorado Electric Light, Power & Railway Association and the Rocky Mountain Division of the National Electric Light Association, for which the following program was prepared:

MONDAY, SEPT. 13

Morning.—Welcoming address, C. W. Darrow, Mayor; address of the president, Norman Read, the Colorado Power Company, Denver. "The Present Financial Situation," by A. C. Foster, president Bankers' Trust Company, Denver; "Factors Controlling the Selection of Insulators," by L. C. Williams, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Afternoon.—"Present Day Trend of Utility Regulation," by G. E. Halderman, chairman Public Utilities Commission of Colorado; "Modern Illumination" (illustrated with lantern slides), by Otis L. Johnson, Illuminating Engineering Society.

TUESDAY, SEPT. 14

Morning.—"National Electric Light Association Activities," by Martin J. Insull, president N. E. L. A.; "Power Sales," by F. F. McCammon, Denver Gas & Electric Light Company, Denver; report of special committee on uniform power contracts, T. O. Kennedy, Denver Gas & Electric Light Company, Denver.

Afternoon.—"The American Plan," by E. A. West, Denver Tramway Company, Denver; "Central Station Merchandising Methods," by Thomas F. Kennedy, Western Light & Power Company, Boulder.

WEDNESDAY, SEPT. 15

Morning.—"Lighting Sales," by G. S. Merrill, National Lamp Works of General Electric Company, Cleveland, Ohio; "Public Policy," by J. F. Greenewalt, Mountain States Telephone & Telegraph Company, Denver.

Water Power League to Hold Convention Next Month

PRODUCERS of water power, users and prospective users of the same, state officials and others interested in the subject have been invited to attend the convention of the Water Power League of America, to be held in Washington, D. C., Oct. 7 and 8. The convention is called for the purpose of giving the representatives of the various states interested in this subject an opportunity to meet with the Federal Power Commission.

The Eastern super-power zone survey now under way will be discussed at the convention by William S. Murray, chief engineer of the survey. The federal water power act will be presented by O. C. Merrill, executive secretary of the Federal Power Commission. Related questions of drainage, forestation, etc., will be covered by state officials and others to whom these related questions mean almost as much as the development of hydro-electric power.

Such practical subjects as "Financing Under the Federal Power Act," "The Advantages of the Federal Power Act from the Standpoint of the Practical Developer and Operator" and "Co-operation Between the Power Producer and the Federal Power Commission" will also be presented. The farmers' side will be covered in "What the Farmer Expects from Water-Power Development" by a representative of the National Grange.

Michigan Governor Appoints Utility Men on Coal Committee

GOVERNOR ALBERT SLEEPER of Michigan has appointed a committee to handle the coal shortage situation now facing the domestic and industrial coal consumers of that state. Among those appointed are Charles B. Kelsey, utility engineer, Grand Rapids, Mich., and B. E. Morrow, manager of production and transportation of the Consumers' Power Company, Jackson, Mich. The committee is now engaged in securing a detailed report of the fuel stocks of the gas, electric and railway companies throughout the State. This report is to include full information as to contracts and orders for fuel as well as amount of coal being shipped at this time on orders and contracts. This information when compiled will enable the committee to take adequate steps to assist Michigan fuel users in securing coal in sufficient quantities to enable their continuing operations without interruptions.

Coal Clause Objected To as Offering No Incentive to Buy Advantageously

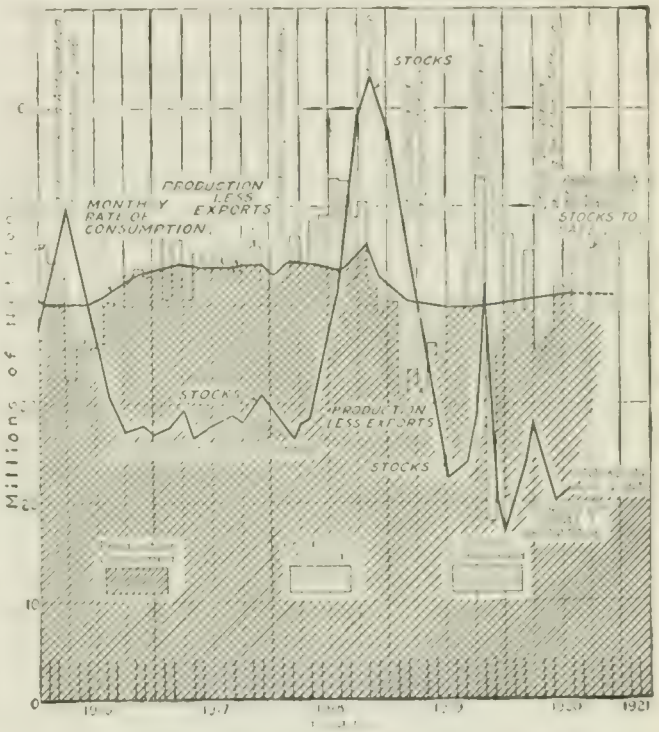
AN INCREASE of ½ cent per kilowatt-hour has been allowed the Potomac Electric Power Company by the Public Utilities Commission of the District of Columbia. The power company had asked 2 cents increase in the rate. In addition, certain concessions were made providing for increased pay for street lighting and the discontinuance of discounts. The ruling will increase the revenues of the company $400,000 yearly, the commission figures.

The increase was made necessary largely by the increase in the cost of coal. The power company had asked to insert a coal clause in its contracts with wholesale users of electricity. The commission objected to the coal clause, because "there is less incentive to secure coal at the most advantageous price when it is known that the cost is passed automatically to the consumer. As the increase in the cost of coal affects all consumers, such an increase should be borne as nearly as possible by each class in its proper proportion."

The Bituminous Coal Situation

THE accompanying diagrammatic representation of the existing bituminous-coal situation in the United States is reproduced from an article in *Coal Age* for Aug. 26 by C. E. Lesher, entitled "Is the Coal Shortage Real or Imaginary?"

The data from which this diagram was constructed were taken from official reports of the United States Geological Survey. The line of production less export is the monthly record of production of bituminous coal from which has been subtracted export less import.



COAL PRODUCTION, CONSUMPTION AND STORAGE FOR PAST FIVE YEARS

The result is production available for consumption or storage within the United States.

It will be noted that consumption increased nearly 10 per cent at the end of 1916 over the rate in the early part of that year, and that this rate of consumption was maintained until shortly before the armistice, when a sharp upward trend, culminating at the date of the armistice, took place. Immediately after the armistice consumption decreased, reaching its lowest level in several years in the months that followed. Its trend is now believed to be slightly upward. The small depression in the curve of consumption in the middle of the winter of 1917-1918 was due to the severe weather in those months and the extreme shortage of coal due to the inability of the railroads to make deliveries.

As the result of his investigation Mr. Lesher found that stocks are the lowest in five years, that the present rate of production is barely sufficient for consumption and exports, and that inequalities in production and distribution make necessary an output of 11,500,000 tons a week if a serious condition is to be forestalled this winter.

A. I. E. E. Meeting to Commemorate Ampere Centennial

THE hundredth anniversary of the important experiments of Ampere and his contemporaries will be commemorated at the October meeting of the American Institute of Electrical Engineers to be held at Philadelphia Oct. 8, 1920. Prof. Elihu Thomson and Prof. M. I. Pupin will address the meeting and demonstration will be made of some of the experiments originally performed by Ampère, Arago, Davy and Oersted. Other speakers are yet to be announced.

Two papers are to be presented at the afternoon session, as follows: "Economic Study of Secondary Distribution," by P. O. Reyneau and H. P. Seeyle, Detroit Edison Company, and "Electrical Demand Measurements," by P. A. Borden, Ontario Power Commission. Between the afternoon and evening session an informal subscription dinner is to be held.

N. E. L. A. to Educate Public Through Publicity

THROUGH its member companies the National Electric Light Association is beginning a publicity campaign to enlighten the public regarding the fundamentals of the electric light industry. This includes a comprehensive campaign of education in the commonly used electrical terms and some of the more interesting facts. To convey these messages a figure known as "Kilo Watt" has been adopted as the medium of contact.

The "Kilo Watt" pamphlets are written in a lighter vein and are so designed to accompany the monthly service bills. Once the point of contact has been established, "Kilo Watt" then will be used further to educate the public in some of the more specific problems of the electric light and power industry, such as financing, the building of extensions, the maintenance of equipment, etc. These pamphlets are not designed at present to popularize electricity nor to increase the use of electricity because so many companies are now giving service to the utmost limit of their capacity.

The department of publicity of the N. E. L. A. has also issued to member company executives a pamphlet designed to show the necessity for their participating actively in local civic and commercial activities and also their becoming acquainted with their local newspaper editors.

Other publicity plans are under way to bring to the attention of important groups the essential facts regarding the electric light and power industry.

Omaha Mayor Advocates Valuation on Present-Day Costs

THE need of public understanding of the problems confronting the utilities before City Councils can be expected to grant rate raises was the burden of the address of President Thomas H. Fritts of the Nebraska Section of the National Electric Light Association, which convened at the Hotel Fontenelle, Omaha, on Wednesday. The need of higher rates because of increased operating expense and the difficulty in financing utility requirements was also dealt with. Mayor Smith of Omaha in his address of welcome indicated his appreciation of the vital importance of the power company in the industrial life of the community and described the difficulty of finding a basis on which to determine rates. He stated as his belief that utilities are entitled to valuations of their property on present-day costs as a basis for rate making, though there is some difficulty in determining what these values are. He declared that it should be possible to settle them on a man-to-man business basis between the utilities and the city council without reference to political consideration.

Getting the facts of utility difficulties before the public in an understandable way, the importance of not underestimating depreciation and the need of better accounting methods were forcefully dealt with in J. A. C. Kennedy's discussion of the legal obligations of the central station.

Central station merchandising, in which the necessity of placing the business on its own foundation and making it stand alone, and a discussion of the rural distribution problem occupied the remainder of the Wednesday morning session. A luncheon at the Omaha Field Club, followed by sports, occupied Wednesday afternoon. The evening was devoted to the annual dinner and a discussion of public relations in Nebraska. The sessions closed Thursday after addresses by President Insull of the N. E. L. A. and the Hon. Thorne A. Browne of the Nebraska Railroad Commission and a disucussion of illuminating engineering and lighting development.

Electrical World Trade Service Increased

WITH the addition of weekly reports from St. Louis covering the Southwest, and from Salt Lake City and Denver covering the intermountain states the ELECTRICAL WORLD is now able to give a comprehensive picture each week of the electrical market conditions in each of the important trade centers. Besides the reports from the two newly added centers ELECTRICAL WORLD is regularly giving market reports from Boston for New England, New York for the Middle Atlantic States, Atlanta for the Southeast, Chicago for the Middle West, San Francisco for the Southern Pacific and Seattle-Portland for the Northwest.

Plan for a Large Irrigation and Power Project in Boulder Canyon Outlined

UPON his return from the League of the Southwest conference in Denver recently, Governor Bamberger of Utah told of a plan outlined by Arthur Powell Davis, director general of the United States Reclamation Service, which comprehends the building of a dam in Boulder Canyon to cost about $20,000,000 with a capacity of around 240,000,000 acre-ft. of water. It would take care of 10,000,000 acre-ft. of silt which is annually brought down the Colorado when the flood waters rush down.

Two areas of lands would come under the stored waters of Colorado tributaries in case this giant dam were built. On the South Myton bench 65,000 acres can be placed under irrigation with waters from the Duchesne basin, and 27 miles north from Green River 240,000 acres of adjacent lands would thereby be made fertile.

The storing of such immense quantities of water would develop considerable water power energy, that near Green River producing about 290,000 horsepower. This in a few years, according to Mr. Davis, would

become more important than the water impounded. It was estimated that the Colorado produces 2,666,000 hp., now unused.

The state engineer of Utah was much impressed with the plan as sketched at the Denver meeting, and said that the dam at the Boulder Canyon is a practical solution of the whole problem, as it would not waste valuable lands in impounding water upon them, and he was of the opinion that all the states concerned would back the plan strongly.

Coal Profiteering Charged by Prominent Utility Man

PLENTY of coal may be obtained in New York for immediate delivery providing the price is paid, a prominent electrical utility operator asserted to a representative of the ELECTRICAL WORLD this week. In spite of priority orders he stated utilities have been unable to obtain sufficient coal on their contracts, due to the shortage of cars, and so have been forced into the spot market.

"With contracts calling for coal at piers at a price of approximately $7 per ton," he said, "the spot market is $12 to $15. The difference is profiteering. Contracts are now being offered by large coal operators at prices ranging from $4 to $4.50 per ton at the mine, and as this figure leaves a reasonable profit, any charge over that represents undue profits and should be drastically curtailed. The apparent lethargy of government agencies who are charged with restricting profiteering; the low demurrage charges on coal cars which do not prevent speculative holding of coal in cars, and the serious plight of the railroads, are the fundamental reasons why the public utilities will either be forced to go into the winter without proper fuel storage or else pay double for coal which even now represents 65 per cent of the total operating expense."

N. E. L. A. to Conduct Lighting Demonstrations Through New Department

IN ORDER to promote the installation of lighting demonstrations for the purpose of educating the public, manufacturers, merchants and all others interested in illumination, the National Electric Light Association has instituted a lighting department. This department is not to engage in selling energy but is intended to teach the proper and most efficient use of illumination. The planning and carrying out of the work has been delegated to the lighting department, composed of the following committee: Charles L. Law, chairman; Oliver Hogue, G. Bertram Regar, W. A. Morton, Franklin Overbagh and Ward Harrison, industrial illumination expert, as field director.

An advisory executive committee has also been invited to serve as follows: Gen. George H. Harries, president-elect Illuminating Engineering Society, chairman; Frank W. Smith, vice-president N. E. L. A.; W. W. Freeman, president Society for Electrical Development; W. C. Peet, president National Association of Electrical Contractor-Dealers; F. S. Price, chairman lamp committee, Electrical Supply Jobbers' Association; M. S. Seelman, chairman of the N. E. L. A. commercial section; W. Rawson Collier, general sales manager Georgia Railway & Power Company; S. E. Doane, retiring president Illuminating Engineering Society.

It will be the purpose of the advisory executive committee to use its influence with various local central station companies, contractor-dealers and chambers of commerce to put on industrial illumination demonstrations in their respective cities. Expenses of these demonstrations are to be carried by the local companies, contractor-dealers and others interested, but will be under the auspices of the N. E. L. A.

The first industrial illumination demonstration to be made under the above arrangement will be in New York City. Similar demonstrations have been conducted recently in California by the California Electrical Co-operative Campaign and in Chicago by the Commonwealth Edison Company. Requests have also been received from Cincinnati and Boston for an installation of industrial illumination exhibits.

At this time Mr. Harrison is preparing an itinerary of prospective cities where these demonstrations could be held profitably. This itinerary will be submitted for approval by the committee at an early date.

Hydro-Electric Developments in Eastern Iowa Contemplated

THE development of 12,000 to 15,000 kw. of continuous power on the Cedar, Maquoketa and Wapsipinicon Rivers in eastern Iowa is contemplated by the Iowa Railway & Light Company and the Iowa Electric Company. S. C. Dows, manager of the Iowa Railway & Light Company, in commenting on the project in Iowa papers announced that sites at Shellsburg, the Palisades near Mount Vernon, Cedar Bluffs, Rochester and Cedar Valley on the Cedar and at Canton on the Maquoketa have been acquired and additional sites along the Wapsipinicon are to be acquired. Hydro plants are already in operation at Anamosa, Oxford Mills, Maquoketa and Cedar Rapids. When the project is completed there will probably be twelve to fifteen plants and the use of automatic and remote control equipment similar to that in use in the Cedar Rapids hydro plant will be resorted to in order to hold down operating costs. Central operating points to control groups of plants are contemplated. The two companies now operate transmission lines covering territory within a radius of 80 miles of Cedar Rapids. The new plants will all be tied into this system for use with existing steam and hydro-electric plants. Several years' time will be required to complete the work.

Plans Ready for City of Seattle's Cedar Falls Power House

THE completion by the city architect of Seattle, Wash., of plans and specifications for the new Cedar Falls power house, designed to accommodate the necessary machinery to develop 20,000 hp. additional power, marks the last step preparatory to beginning actual construction work of this unit, figured to cost $1,000,000. The new concrete and steel structure will adjoin the present power house below the falls and is to house a Pelton overhung turbine, driving a Westinghouse generator. Transformers will be used to step the voltage up to 60,000 volts for transmission. This is the first unit of large size to be installed under the new system designed by Superintendent J. D. Ross, by which the generating unit and the transformers are considered as an inseparable unit without intermediate switches and buses. This same system is to be used at the Lake Union steam plant.

Hogged Fuel Used to Save Coal in Albuquerque, N. M.

HOGGED fuel, which has always been burned in sawmills but never extensively in central stations, is to be substituted for coal in the plant of the Albuquerque (N. M.) Gas & Electric Company to reduce the cost of fuel. Wood refuse will be obtained from a near-by sawmill and "hogged" or ground up by the electric company at its plant. To use the hogged fuel two additional boilers and conveying apparatus will be installed at a cost of $50,000. Coal will still be burned where the supply of sawmill refuse is insufficient. The generating station in which this fuel will be burned is rated at 2,100 kva. and last year produced 3,800,000 kw.-hr., with a consumption of 11,000 tons of coal, the greater share of which will be saved by the changes. Arthur Prager is general manager of the company and C. H. Nichols, Federal Light & Traction Company, New York, is chief engineer.

Off-Peak Business to Be Most Sought For This Year

FOR the next year or two the majority of the central stations will be more interested in those classes of business which can be taken on without adding to peak loads than in any other class of sales, was the opinion expressed at the Sept. 2 meeting of the lighting sales bureau of the Commercial Section of the N. E. L. A. by Chairman O. R. Hogue. He felt that a large majority of central station companies would have an oversold condition on power during 1921. This being the case, he expressed the belief that such activities as those of M. Luckiesh on lighting effects in the home and those of W. D'A. Ryan on high intensity street lighting and those other activities on such things as sign lighting should be uppermost in the bureau's thoughts. Specifically, the problem of this year is selling something which will not increase the peak for the central stations.

The aims and scope of the lighting sales bureau were redefined at the meeting, in order to make them more specific, as follows:

1. To promote appreciation of the present and potential value of lighting to the electrical industry.
2. To collect, analyze and disseminate information concerning lighting practice.
3. To promote lighting sales.

Consumers' Power Company Securities Offered to Customers

SEVEN per cent cumulative preferred stock sales on either a cash or partial payment basis is a new plan that was put into operation Sept. 1 by the Consumers' Power Company of Jackson, Mich. The stock is offered on a cash basis at $95 per share and accrued dividends. The partial payment plan calls for $10 payment at time of purchase, $10 per month for seven months and $15 as a final payment. Interest at 7 per cent per annum on monthly installments will be credited the purchaser on the company books and dividends from the last dividend date prior to the final payment will be charged the purchaser and an adjustment made. Purchases under the partial payment plan are limited to twenty-five shares and the purchaser has the option of withdrawing all partial payments on ten days' notice at any time prior to the date of final payment for the stock. The company agrees to pay 3 per cent interest on the amounts paid in up to the date of notice of withdrawal. Payments may be made in full at any time.

Contract for Financing by State of Line Construction Upheld

THE attorney-general of Utah has rendered a written opinion to the effect that the state of Utah should pay for the construction of a power line, built about a year ago, by the Dixie Power Company, running between St. George and Cedar City, Utah. The power company will use the line, and has agreed to purchase it from the state within three years.

The line was constructed under a contract signed July 8, 1919, between the State Road Commission and the Dixie Power Company. At that time the state contemplated the building of a hard surface pavement on that portion of the state road between Salt Lake and St. George, and it was asserted by the engineers that electric power, if it could be obtained, would be much cheaper than any other power for the operation of the necessary road machinery. The Dixie Power Company offered to furnish the power at the regular rates, provided the state would build the line, which would later be taken over by the power company.

The state auditor at the time opposed the signing of the contract with the power company, and now expresses the belief that the contract might really be the loan of the state's credit to the power company in violation of the provisions of the state constitution. The attorney-general holds that there is no such violation.

"It is one of the unfortunate things," says the attorney-general, referring to the fact that it is now pretty certain that the hard surface road will not be built there for at least some time, "but the obligation of the State Road Commission remains the same." He holds that the State Road Commission is both morally and legally bound to pay.

Pacific Power & Light's New Station



PROGRESS on the Pacific Power & Light Company's new gas and steam electric generating station on Youngs Bay, Astoria, Ore., is shown here. The steam building will be of reinforced concrete, 90 ft. x 111 ft. and 50 ft. high. Three Stirling water-tube boiler units of 600 hp. each, with superheaters and equipped for burning oil, will be installed, with space for the installation of Dutch ovens for burning sawmill refuse. A 3,750-kva., 11,420-volt, three-phase, 60-cycle General Electric turbo-generator is to be installed with provision for an additional 6,250-kva. unit. It is expected to have the plant in operation by Oct. 1.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Engineering Education Opportunities.—Under the title of "Opportunities for the Study of Engineering at American Higher Institutions," the bureau of education of the Department of the Interior has issued circular No. 20, listing the institutions of the United States where an engineering education can be obtained, showing the various departments at each institution and the enrolment.

Telephone Progress in Sweden.—A long-distance telephone of the latest American type, equipped with Pupin loading coils and telephone repeaters, has been ordered from the International Western Electric Company by the Swedish government for installation between Stockholm and Gothenburg, a distance of 310 miles. This cable is the first of a large number to be installed by the government of Sweden, which has long ranked among the foremost European countries as regards the number of telephones and prevalence of their use.

Electrification of German Railways.—The scarcity of coal has led to a well-developed movement in Germany for the electrification of the state railroads in conjunction with the development of water power. A correspondent of the Manchester (England) *Guardian* says in this connection: "The aim of the electrification of railways is to unite the south German water powers of Bavaria, Württemburg and Baden (Prussia has no water power worth mentioning) with the brown-coal (lignite) district in the center. The object of this is the establishment of a railway network, starting in the Rheinfalz and stretching through Baden, Württemburg, southern Bavaria, the Oberpfalz and Saxony, thence through Silesia, Brandenburg, Hanover and Essen, and finally uniting the Rhenish provinces, Westphalia and the seacoast. Everywhere water power and coal fields are being united, and they will start at Munich."

Augmenting Italian Output.—Two Italian companies operating hydroelectric plants on Lakes Santa Croce and Morto, in the Adriatic section, and now capable of producing 20,000 hp. and 8,000 hp., respectively, find this output so inadequate for their customers' requirements that, according to an American Consular report, they intend to increase their plant to a capacity of approximately 280,000 hp., with a possible output of 700,000,000 kw.-hr. a year. This would mean a saving of nearly 1,000,000 tons of coal.

Commercial Talk With Airplane by Radio.—Recently a member of a London shipping firm, using an ordinary telephone, succeeded in sending instructions to a representative in process of flight across the British Channel to France. The London business man spoke to the Croydon airdrome, and his message was switched through to the wireless installation of the government. Two calls from the desk brought an answer from the pilot in the air, after which the conversation with London proceeded with little difficulty.

"No Accident Week" a Big Success.—The week of June 6-12, which was observed as "no accident week" by a number of utilities in New York State and Pennsylvania (not including steam railroads), was marked by a great decrease in casualties, according to G. R. Rinke, secretary of the 1920 Safety Committee. Only one fatality, from electrocution, took place in the week named and none in the succeeding two weeks. During the corresponding three weeks of 1919 there were five fatalities. Figures compiled by the Utilities Mutual Insurance Company show a total of 8,268 days' lost time in "no accident" week," as compared with 22,896 for the preceding week this year and with 39,381 in the corresponding week last year. Moreover, the insurance company covers 45 per cent more employees this year than last.

Electrification of Swedish Railways.—The Swedish Parliament has appropriated 23,000,000 crowns (more than $6,000,000 at the old rate of exchange) for the work of electrifying the state railroad between Stockholm and Gothenburg. The work is to be completed by 1925.

Bogus Electrical Sunrise Fools the Birds.—Sunrise and breakfast being indissolubly connected in the bird mind, the managers of the London Zoological Gardens have found it possible to expedite the breakfast hour of their feathered charges, where this is desirable, by the simple expedient of turning on electric lights so arranged as to simulate dawn. The same method is said to be practiced by dealers in quail who wish to fatten their product for the market, and the assertion is made that by switching the electric light on and off a bird can be induced to eat every hour of the twenty-four, afterward going contentedly to roost in the "twilight."

The Montefiore Prize of Belgium.—Next year the triennial award of a prize of 20,000 francs for the best work written in the three preceding years upon the scientific advancement and technical adaptation of electricity will be made by a jury of ten electrical engineers, five Belgians and five of other nations, under the presidency of the director of the Montefiore Electrotechnical Institute of Belgium. This prize was instituted by George Montefiore, the late honorary president of the institute, and the coming award will be in reality that for 1917, when the war made the competition impossible. Works may be submitted in either French or English, in printed form or in typed manuscript. A dozen copies of each must be furnished, April 30, 1921, being the last day for their reception. The recording secretary of the Foundation, George Montefiore, may be addressed at 31 rue Saint-Gilles, Liége, Belgium.

Electrical Treatment Proposed for the Liberty Bell.—At a recent meeting of the American Welding Society a proposal is said to have been seriously made to subject the famous Liberty Bell in Independence Hall, Philadelphia, to electrical treatment to obliterate the crack and restore its original tone. The welder would work with a needle made of metal of the identical consistency of that of which the bell is composed, and particle by particle the fissure would be filled up. It has also been contended that by heating the bell electrically and then allowing it to cool slowly the metal "fatigue" which is said to threaten the preservation of the relic can be eliminated, so that the bell should ring out as clearly as in 1776.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Coming Meetings of Electrical and Other Technical Societies

Association of Edison Illuminating Companies—New London, Conn., Sept. 13-15. (For program see issue of Aug. 14, page 308.)

New England Geographic Division, N. E. L. A.—Kineo, Me., Sept. 14-16. (For program see issue of Aug. 14, page 350.)

Indiana Electric Light Association—French Lick, Ind., Sept. 14-15. (For program see issue of Aug. 28, page 442.)

Association of Iron and Steel Electrical Engineers—New York City, Sept. 20-21. (For program see issue of Aug. 7, page 309.)

Atlantic Division, Electrical Supply Jobbers' Association—Philadelphia, Pa., Sept. 23.

Central Division, Electrical Jobbers' Association—Chicago, Sept. 24.

American Electrochemical Society—Cleveland, Sept. 30-Oct. 2.

Illuminating Engineering Society—Cleveland, Oct. 4-7. (For program see issue of Aug. 14, page 349.)

National Association of Electrical Contractors and Dealers—Baltimore, Oct. 4-9. (For program see issue of July 24, page 205.)

Electric Furnace Association—Columbus, Ohio, Oct. 6.

American Electric Railway Association—Atlantic City, N. J., Oct. 11-15.

National Association of Electrical Inspectors—Philadelphia, Pa., Oct. 12-13.

British Columbia Association of Electrical Contractors and Dealers—Vancouver, B. C., Oct. 19.

International Association of Municipal Electricians—New Orleans, Oct. 19-22.

Association of Railway Electrical Engineers—Chicago, Oct. 28-31.

Electric Power Club—Hot Springs, Va., Nov. 15-18.

Southeastern Geographic Division, N. E. L. A.—Miami, Fla., Nov. 17-19.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Courts Must Decide if Contract Is Violated by Shutdown.—Permission was granted the Chatham Electric Light, Heat & Power Company by the Public Service Commission of the Second District of New York to shut off current for three days from 7 a.m. to 4 p.m. from the line supplying the States Metals Company for the purpose of increasing the line insulation in order to increase the voltage, giving the manufacturer twenty-four hours' notice before shutting off the current. The States Metals Company claimed it was entitled to damages for shutting off the current, but this question, the commission held, is for the courts to determine. The commission held that it should confine itself solely to the public interests and that it is for the courts to determine whether any contract rights have been violated and if so to name the penalty.

Reparation for Charges Under Superseded Tariff.—By a former order the Public Service Commission of Pennsylvania canceled the tariff schedule of the Home Electric Light & Steam Heating Company and ordered a new tariff to be filed. It was found, however, that the electric utility was not receiving more revenue than it was entitled to, but that the rates were not equitably distributed among its customers. The Borough of Tyrone, however, claimed that its citizens should receive reparation for bills rendered under the tariff ordered canceled to the extent of the difference between the new rate and the old. The commission held, however, that the new rate could not be canceled until the later revision ordered by the commission had been filed, consequently the only tariff under which the company could charge was the one ordered canceled. Furthermore, since it was shown that the old rate yielded insufficient revenue the commission held that the company very properly refused to conduct its business on an unprofitable basis. The claim for reparation was consequently dismissed.

Commission Will Not Revoke Order Restoring Old Rates Because Certain Tariffs Are Missing.—Because its old rate schedule contained no municipal lighting tariff, the Susquehanna County Light & Power Company petitioned a modification of the order of the Pennsylvania Public Service Commission ordering the re-establishment of the old rates because it had failed to show the reasonableness of the increased rates. The commission stated that while it saw no reason to revoke or modify its order, still the company would be permitted to file any necessary new tariffs covering any particular rates and that the commission would permit the filing of such tariffs to become effective upon one day's notice to the public.

Rates to Meet Increased Costs.—The City Gas Company applied to the New Jersey Board of Public Utility Commission for increased gas rates not to yield a better return on the investment, but in order to meet increased operating costs. For this reason the commission did not consider the question of a return on the value of the property but undertook to determine what is a fair price to be charged for gas during the coming year, taking into account solely the increased expenses over those of the preceding year.

Stand-By Charge in Reclamation Service in California.—In connection with the schedule of rates for electricity sold to reclamation districts, an order was issued on Aug. 30 by the Railroad Commission of the State of California designed to cover variable conditions resultant from the use of energy by the different districts. Its effect will be to place all districts on an equal footing so far as rates are concerned, according to the commission, and to require them to pay a stand-by charge. The commission holds that reclamation service is primarily an insurance service, the average consumption per horsepower per year being very low.

Other Consumers Should Not Be Burdened with Cost of Special Service.—The Mountain Power Company in its application for increased rates for water service showed that on application it had installed for fire hydrant service larger mains than were necessary to deliver an adequate supply to its other customers. The California Railroad Commission stated that if any customer desires special facilities for the delivery of water, such as pipes of sufficient size so that a comparatively large quantity of water can be concentrated at one point at any time, that consumer must expect to pay the cost of rendering the service. It would be manifestly unfair, the commission held, to the other consumers of the company to burden them with the expenditure made for service such as is asked for by the municipality.

Increase Allowed, Bringing Rates Up to Those Charged in Surrounding Territory by Large Companies.—The Bay Point Light & Power Company was given an increase in rates for electric service approximating 25 per cent by the California Railroad Commission on Aug. 24. In its application for an increase in rates the company requested the commission to allow it to charge the same rates that the Great Western Power Company, from which it purchases energy, and the Pacific Gas & Electric Company charge in adjacent territory. The order of the commission brings the regular rates up to those charged by the larger companies besides adding a surcharge of 15 per cent.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Conclusiveness of Commission Orders.—The reasonableness of a rate established by the commission is the only justiciable question upon an appeal to the Oregon Supreme Court from a rate-fixing order of the commission, according to the finding of that court in Hammond Lumber Company vs. Public Service Commission, and the court will not assume the place of the commission or set its order aside on the court's conception of its wisdom. (189 Pac. 639.)

Establishment of Municipal Plants in Arkansas.—A question affecting city ownership of electric plants in Arkansas has been settled by the Supreme Court of that State in Walton vs. Commissioners of Light, Improvement District No. 1, City of Benton. This "improvement district" had been organized under the Arkansas statutes to purchase an electric light plant from a company which had allowed its franchise to be forfeited. To establish it a petition signed by a "majority in value" of property owners was necessary, and this the court declared had not been obtained, the value of railroad property not having been taken into account and officials of certain companies having signed the petition without proper authorization from boards of directors. (222 N. W. 1056.)

Electric Company Responsible for Line Over Which It Transmits Energy, Regardless of Ownership.—Finding, in Coleman vs. Iowa Railway, Light and Power Company, that the trial court was in error in directing a verdict for the defendant in a suit for damages because of the death from electric shock of the owner of a private line connected with the high-tension lines of the defendant, the plaintiff having erroneously charged that the company owned the subsidiary lines, the Supreme Court of Iowa held that this wrongful assertion did not invalidate the suit. The electric company, having contracted to supply the deceased with energy and having itself constructed the private line, was responsible for its safety, and it was the company's duty to insure that the low-tension wires did not come into direct contact with the high-voltage conductors through becoming loose. The contact between the high-tension wires and low-voltage conductors did occur, however, and this condition was found responsible for the fatal accident. (178 N. W. 364.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel and Position
Biographical Notes

Herbert A. Barre has recently been given the title of executive engineer with the Southern California Edison Company, Los Angeles, Cal., a position which corresponds with the character of responsibility which has rested upon him for some time. Mr. Barre is a Canadian, having been born in Nova Scotia in 1875. He moved to California when a child and was educated in the schools of San Francisco, graduating from the University of California in 1897, in the College of Electrical Engineering. After a short period of miscellaneous technical work in that locality he spent a short time in the operating department of the old Edison Electric Company and with the Los Angeles Railway in southern California. Following this he was assistant in electrical engineering with the Oakland (Cal.)



H. A. BARRE

Traction Company, and later was associated with Thomas Mirk in the construction of Station A for the Independent Electric Light & Power Company of San Francisco. In 1902 he became assistant to the consulting engineer for the Huntington properties in Los Angeles: the Los Angeles Railway, the Pacific Electric Railway and the San Joaquin Light & Power Company; during that period a number of the hydro-electric and steam plants and transmission lines of those companies were constructed. In 1906 Mr. Barre became associated with the Electric Bond & Share Company, New York, as engineer, gaining varied experiences in engineering, evaluation, and operation of many Eastern and Southeastern electric properties. In 1907 he built the Glenwood and the Bowlder plants for the Denver Gas & Electric Company. Shortly afterward he joined in the formation of the Electric Construction Company, which built the Fossil Creek power station for the Arizona Power Company. In 1911 he took a position with the Pacific Light & Power Company of Los Angeles, as electrical and mechanical engineer, retaining until recently this title with the Southern California Edison Company following the consolidation of the two companies in 1917. After his association with the Pacific Light & Power Company the famous Big Creek plants and 150,000-volt lines of that company were constructed. For several years Mr. Barre has been very active in affairs of the American Institute of Electrical Engineers and the National Electric Light Association. He is at this time first vice-chairman of the hydro-electric and technical committee of the National Electric Light Association.

H. P. Liversidge, assistant chief engineer of the Philadelphia (Pa.) Electric Company, has been appointed chairman of the power stations committee of the American Institute of Electrical Engineers. Mr. Liversidge succeeds Philip Torchio.

Graham Bright has been appointed chairman of the mine committee of the American Institute of Electrical Engineers, succeeding W. A. Chandler. Mr. Bright has for a number of years been engineer of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Philip Torchio has just received the appointment of chairman of the technical committee on economics of electric service of the American Institute of Electrical Engineers, succeeding C. S. Ruffner. Mr. Torchio has been electrical engineer of the New York Edison Company since 1895, and has been closely identified with the development of the extensive alternating-current system of the New York Edison Company. He is a member of many engineering societies and has presented before their meetings papers and discussions covering a wide range of electrical engineering subjects.

W. D. Alderson of St. Louis, who has been appointed director of industrial relations for the Union Electric Light & Power Company of that city, is the junior past-president of the company's Employment Managers' Association of the St. Louis industrial district. For some years he had charge of long-distance line construction for one of the Bell telephone companies, and for the last eleven years he has been with the Union Electric Light & Power Company and its subsidiaries as estimator, superintendent of construction and employment manager. Born in St. Louis in 1881, Mr. Alderson, after graduation from high school, completed a correspondence course in electrical engineering, took the employment managers' course at Washington University last year and is now devoting his spare time to study of law at the same institution.

C. S. McDowell, who was elected as one of the vice-presidents of the A. I. E. E. for 1920-1921 and took office on Aug. 1, was born in Millersburg, Ohio, in 1884, and graduated from the U. S. Naval Academy in 1904. From 1912 to 1915 he was in charge of the Navy's electrical laboratories at the New York Navy Yard and from 1915 to 1917 electrical officer of the U. S. submarine forces. For one year following he was secretary of the Navy Department's board on anti-submarine devices and in charge of naval experimental station, New London, Conn. During the latter part of the war Mr. McDowell was on the staff of Admiral Sims in connection with anti-submarine warfare. At present he is on duty at the General Electric Company, Schenectady, N. Y., as naval inspector of ma-



C. S. M'DOWELL

chinery and inspector of engineering material. Mr. McDowell was commissioned a commander of the U. S. Navy in 1918. He has been interested in A. I. E. E. matters for a number of years and was instrumental in forming the marine committee of the A. I. E. E., of which he was chairman from 1913 to 1916.

L. T. Robinson, who has been connected with the General Electric Company, Schenectady, N. Y., since 1904, in charge of their standardizing laboratories, has been appointed chairman of the board's committee on technical activities of the American Institute of Electrical Engineers. Mr. Robinson succeeds Wilfred Sykes.

W. R. Bell has resigned as commercial agent of the Baton Rouge (La.) Electric Company, to accept a similar position with the Haverhill (Mass.) Gas Light Company. Mr. Bell has been connected with the Baton Rouge Electric Company since November, 1913, and has served as commercial agent since September, 1917. He will be succeeded by J. C. Lamb of the commercial department of the Tampa (Fla.) Electric Company. All three of these companies are under the management of Stone & Webster, Inc.

Trade and Market Conditions

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

Prices for Loom Firm Despite Falling Cotton Market

CONTINUED firm prices, slight building up of stocks and some decrease in demand mark the non-metallic flexible conduit situation. No immediate price reductions are to be expected, according to manufacturers, notwithstanding the recent declines in the cotton market. These makers claim that they were obliged to buy cotton in advance in order to cover themselves on the large volume of orders which they accepted last spring. As a consequence loom is priced according to the spring price of cottom. In the New York markets current quotations are about $32.50 and $35 for 3/8-in. and 1/2-in. loom respectively.

Stocks are beginning to build up and some jobbers and manufacturers can ship immediately. Other manufacturers say that they have orders on hand for the next three months' production. Deliveries have been hampered by railroad trouble, but this trouble is diminishing. Labor conditions are satisfactory and production is reported to be normal.

As a general condition demand is falling to some extent, though it is still fairly strong. Collections are on the whole very good.

Increasing Supply of Friction Tape

FRICTION tape is being produced at a rate which is rapidly overcoming back orders, according to leading manufacturers. Cotton insulating tape on the other hand is in great demand, and production is falling behind orders. A leading maker of friction tape recently informed the ELECTRICAL WORLD that all production records were broken in his plant in a recent week, a total of 200,950 lb. being turned out. Tape manufacturers state that the raw material supply is now very satisfactory. Transportation conditions are improving, and a slackening of demand compared with a few weeks ago is facilitating the filling of back orders. Stocks are spotty, some makers having little tape on hand and others being prepared to make almost immediate shipment through agencies. Recent moderate reductions in the price of cotton have been insufficient to affect the price of friction tape to any extent. The latter quotes in representative cases from 60 to 70 cents per pound, according to quantity and quality involved. A representative jobbers' price last week on 3/4-in. black friction tape was 68 cents per pound on lots of less than 10 lb., 60 cents on 10 to 25-lb. lots and 57 cents on 25 to 100-lb. lots.

One prominent distributer has sold four times as much tape to date this year as last for the same period, and still can make immediate deliveries on fairly good-sized orders. Another producer reports 80 per cent more business this year, the month of July showing the largest production in the company's history. Foreign business is running about 15 per cent ahead of last year this manufacturer states. Deliveries can easily be made in two to three weeks in large quantities. Labor conditions are steady for the time being, and since the wage increase accorded about three months ago production has been coming along well. Black and gray tapes are being sponsored vigorously by some manufacturers at present for use instead of white friction tape.

High-quality woven tapes used in the insulation of electrical machinery coils are in great demand. Deliveries are being quoted on about three months' basis. Prices are firm, with extremely wide range according to weave, size and quality purchased. A representative tape of high-class finish used in field coil winding sells for about $3.50 per gross yard, and a good quality used in armature coil work runs around $2. The cost of labor is a primary factor in price advances that have been made in the past, as well as in the increases in the price of the high-grade cotton involved in manufacture. No less than four handlings are required in preparing the raw yarn for weaving in one of the leading makes, and after the weaving the finishing process or calendering to exact size calls for skilled work. The thinner tapes must be finished with extreme accuracy on account of the space limitations of slots. It is not feasible to predict future price movements, but so long as raw material and labor costs remain close to present levels it is hard to see any early downward movement. Factory stocks are practically cleaned out and orders are holding up well.

Active Demand for Asbestos Wire

LONG deliveries, nominal stocks and firm prices characterize the market for asbestos-insulated wire. Leading manufacturers are very busy trying to fill back orders, and factory stocks are practically cleaned out. The supply of asbestos is reported ample, but the smaller sizes of copper wire are not obtainable in the desired quantities, chiefly as a result of recent prolonged strikes in the wire mills. Interruptions to copper wire production lasting about six weeks in one case and about twelve weeks in another cost the purchaser dear as well as the wire drawer. With increasing production in the wire mills following the return of steadier labor conditions the outlook is much improved for the smaller sizes of wire.

Deliveries quoted by representative manufacturers of asbestos wire on heater cord were six to eight months, fixture wire, eight to ten weeks, on moving-picture cable, ten weeks, and on magnet wire, eight to twelve weeks. If the leading producers did not take another order before 1921 there would be little trouble in keeping the plants running. One manufacturer who had about fifty-six weeks' work on hand last June 1 now has orders enough on his books to keep his employees busy until about July 1 of next year, barring cancellations. A few of these have been received, but no general disposition to retrench is evident. The demand for domestic labor-saving appliances is too large to permit any marked curtailment in the production of heater and stove wire at present. Just now all makers of asbestos wire are not pushing sales at the normal rate, but more effort is being placed upon production and plans for the enlargement of manufacturing facilities than upon getting new business. This is of course not equally true of all competing houses, but until production begins to overtake demand, less "missionary work" will be seen in the trade. Users of asbestos-insulated wire for railway motor service would do well to order their anticipated winter requirements within the next few weeks, and it is generally held in manufacturing circles that the recent firm and steady price levels will be held for some time to come. Labor conditions are showing some improvement, and since the recent advance of wages registered last spring no great difficulty has been encountered in obtaining enough employees for this class of material.

Representative factory prices of asbestos-insulated magnet wire start from 45 cents base on lots of 200 pounds or over, from No. 0000 to No. 4 B & S gauge, inclusive, and

extras are added per pound for the finer sizes ranging from 1 cent per pound on No. 5 to $3.85 per pound on No. 28. A 250-pound order of No. 18 would be quoted in a typical case at 72 cents per pound. Lots less than 200 lb. carry 2 cents per pound additional. A leading Boston jobber quotes $10 per 100 ft. on No. 18 black heater cord in lots of under 250 ft., and $8 for orders exceeding 250 ft. No. 18 fixture wire is selling for about $7.86 net per hundred feet, with a reduction to $7.20 on $50 orders. The outlook is good for increased facilities for production of asbestos wire during the next year or two, and with improved labor conditions and good supplies of asbestos and wire, record outputs may be expected from manufacturers.

Germany Hopes to Regain World Electrical Trade

WITH production costs high in Germany and her electrical industry almost crippled by the war, American manufacturers now supply most of the electrical goods formerly made by Germany, whose output before the war amounted to 40 per cent of the world's production, according to Herr Henrich, manager of the Siemens-Schuckert works. However, the Germans are endeavoring to regain this trade, particularly in such lines as cables, small motors and incandescent lamps. On the latter item alone they had plants to make 70,000,000 lamps a year, exporting formerly 50 per cent of this number but now less than 25 per cent. The *Berliner Tageblatt* reports an address delivered to the members of the Workers' Association of the German Electrical Engineering Industry by Herr Henrich, in which he said:

"In 1913 the German electrical industry occupied a prominent position both within our own borders and in the world, and it was responsible for 40 per cent of the world's production. Today the world position of the industry is deeply shaken, on account of the foreign, and particularly the American, competition which has sprung up in the interval, and all the more so as our inland production prices, in the present state of exchange, are already above the market prices of the world, with the result that we are no longer capable of competing in foreign countries.

"Among the various branches of the industry, the position is worst in the cable business, while the installation and small-motor industry is in much the same state. In the incandescent-lamp industry provision had been made for an output of about 70,000,000 lamps. The export trade, taking before the war over 50 per cent of the total production, has fallen to below 25 per cent, and there is now lively competition abroad. Today there is no electrical engineering firm that is not in the gravest financial difficulties. Many firms have already had to think of curtailing their activities.

"Since the beginning of the war the production of the electrical engineering industry has declined heavily; during the war, because the factories were busy with war contracts which were mostly outside the ordinary scope of the electrical industry, and since the revolution because of the numerous strikes and the general unwillingness to work. According to a statistical return, there were eighty separate strikes in the Berlin metal industry during 1919, covering altogether 162 days. In one of the Siemens works—an example which is typical of the electrical engineering industry—only 63 per cent of the available working hours were worked. The work's tallies show for the current business year a production of 2,250 kg. per head, as against 4,400 kg. before the war. On the other hand, the wages paid per kilogram of finished goods rose from 43 pfennings to 2 marks in 1919 and are now to be reckoned at over 4 marks. Sharply rising prices led to the dissatisfaction of the workers, because their wages and salaries did not rise in the same proportion. The sales prices, however, are governed by the cost of materials, while the cost of necessary rubber, shellac, copper, etc., are absolutely dependent on the exchange."

Herr Henrich concluded by saying that the rebuilding of the industry would not be successful till the workers understood the realties of the economic position.

Metal Market Situation

STATISTICALLY the copper market shows little change. Quietness prevails, with producers nominally quoting from 18.75 to 19 cents delivered. A condition approaching a deadlock is present, as consumers are apparently trying to force down prices by holding off buying, while large producers for the most part are obstinately sticking to their 19-cent quotation. The situation seems to favor the seller, however, as buyers have apparently safeguarded their needs no further ahead than November, and it is only a question of time until they must come into the market.

The outside market has grown weaker and lower prices have brought out orders in considerable quantity. Second hands are selling as low as 18.12½ cents for September delivery and up to 18.50 cents for November. Standard copper at London remains dull but firm.

The zinc market is inactive under the influence of domestic dullness and the arrival of further reconsignments of the metal from abroad. This inactivity is reflected in a further slight decline in price for spot. Lead continues to be featured by the offer of foreign shipments at about 8.50 duty paid, though little interest is being taken at present.

NEW YORK METAL MARKET PRICES

	August 31	September 7
Copper	£ s d	£ s d
London, standard spot	95 0 0	95 0 0
	Cents per Pound	Cents per Pound
Prime Lake	18 50 18 75	18 25 18 50
Electrolytic	18 75 19 00	18 25
Casting	18 00	17 75
Wire bars	22 50 23 00	22 50 23 00
Lead, trust price	9 00	9 00
Antimony	7 00	7 12
Nickel, ingot	43 00	43 00
Sheet zinc, f.o.b. smelter	12 50	12 50
Zinc, spot	8 30 8 40	8 25
Tin	46 00	45 25
Aluminum, 98 to 99 per cent	35 10	35 10

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	15 50 to 16 00	15 50 to 16 00
Brass, heavy	9 25 to 9 50	9 00 to 9 25
Brass, light	7 25 to 7 75	7 25 to 7 50
Lead, heavy	7 50 to 7 75	7 25 to 7 50
Zinc, old scrap	5 25 to 5 50	5 25 to 5 50

THE WEEK
IN TRADE

Quiet prevails in the electrical industry in the Middle West, in the East and in the Intermountain section. In the latter district the public seems to be expecting lower prices. Sales in New England are proceeding at a brisk rate, and a good volume of business is also reported from St. Louis, but on the Pacific Coast conditions are uneven. An increase in demand seems to be expected more or less generally.

A shortage of water for power purposes in California has led to the curtailment of power there similar to wartime restrictions. Many cancellations in the lumber industry are being received in the Northwest and this is affecting sales. The price of lumber has dropped about 25 per cent in Chicago. New prices on some lines of electrical goods are also being quoted from Atlanta and Boston. Stocks are building up in good shape throughout the country to meet the anticipated fall trade. Deliveries are materially improved. In New England some overstocking is even reported.

Money seems to be slightly more plentiful in some sections, though collections are far from satisfactory. In St. Louis and in Portland territory credit is tight and bills are collected with difficulty. In other parts of the Northwest the credit situation has improved, and in the Intermountain section money is more plentiful as crops are being harvested. Collections in New England are also improving. A general scarcity of motors and porcelain is reported

except that the situation in the latter item is relieved in the Northwest, and demand for motors has fallen off in some quarters. Back orders prevent the accumulation of stocks, however.

NEW YORK

With the exception of occasional jobbers who say they have been having a good volume of business all along, distributors are finding trade very slow. No further reports have been received that the expected fall wave of buying has set in; in fact, jobbers state that sales are proceeding along the same quiet level of the past few weeks.

A happy result of this condition, however, is that stocks are building up fast and, with the better transportation facilities which most firms are finding, supplies of nearly all lines of goods should be in good condition to meet the heavier demand which is expected soon. Rigid conduit and porcelain are about the only items on which there is a decided shortage and demand for the latter material is slackening. A few specialities of various companies are in poor supply, but most of these delayed lines are now beginning to come in. Electric irons, dry cells, tape, lead and rubber-covered wire and sockets are more or less plentiful.

Residence construction remains as badly lacking as ever and electrical sales have suffered accordingly. Opinions on collections differ. Some jobbers say their bills are being paid fairly promptly, while others are finding collections slower and more difficult than earlier this summer.

Electric Irons.—Demand is rather light and consequently good stocks have accumulated. No trouble in obtaining supplies is reported.

Rubber Covered Wire.—Demand is fairly good and medium stocks are on hand. Shipments are coming along in good shape. No. 14 is quoted at from $11.50 to $13 per 1,000 ft.

Tape.—Good stocks of both friction and rubber are generally reported, though some jobbers have less of the latter type on hand. Demand is about normal. Most quotations range from 56 to 70 cents a pound on friction tape and from 52 to 68 cents on rubber.

Porcelain.—A representative jobber's prices on 3-in. tubes are $10.80 per 1,000; on knobs, $24 per 1,000; and on 2-wire unglazed cleats, $21 per 1,000, all in barrel lots. In some cases the shortage is so severe that prices are merely nominal, however, as stocks are spotty and badly broken. Shipments are irregular and demand slightly less.

Dry Cells.—Although some manufacturers are finding a good demand, jobbers say sales are light. Plentiful supplies are on hand, with No. 6 cells quoted at 32 cents in barrel lots and 45 cents for quantities less than a dozen.

Bells and Buzzers.—Demand is only average but the shortage of magnet wire is slowing up supplies and in some cases stocks are low while others have plenty. The dearth of residence construction is keeping down sales.

Lead Covered Wire.—Shipments are received in good shape and jobbers are well supplied. Demand is about normal. No. 14 duplex is quoted at about 8 cents a foot or from $57 to $60 per 1,000 ft. in large quantities.

Lamp Cord.—Some shortage is prevalent, particularly in the reinforced cotton cord. Large quantities are difficult to obtain and shipments are quoted at from two to three months. Some jobbers are having a heavy call while others say demand is not especially strong. Stocks are fairly good. Silk cord is quoted at $9 per 100 ft.; heavy reinforced cotton ranges from about $6 to $8 per 100 ft., and light from $5.25 to $6, depending upon the quantity.

Controlling Devices.—The Cutler-Hammer Manufacturing Company has increased its prices on this goods. The new discount sheet No. 5-A-1222 dated August, 1920, states that net prices are now obtained by adding 15 per cent to list prices. This applies only to bulletins dated March, 1916, or later.

Insulated Wire.—Price decreases averaging in general about 5 per cent on weatherproof and rubber-covered wire are announced by one manufacturer. Inquiries instituted among other producers, however, revealed no price changes. Factory stocks are either very low or else depleted, while demand continues strong. Deliveries are slow, ranging from about one to four months and even longer on some sizes.

Sockets.—Most jobbers are finding only a fair demand and have average stocks, but a few are behind on filling orders and are short on supplies, particularly the key type. Keys are quoted at 33 cents, keyless 30 cents and pulls 60 cents in standard packages, less 15 per cent.

Rigid Conduit.—Demand is holding up strongly and stocks are spotty with many sizes missing in the supplies on hand. One jobber just received seven or eight cars but shipments are slow and irregular. The price for ½ in. black ranges from $90 to $103 per 1,000 ft.

Fans.—Few if any price cuts have been made here, and although most jobbers have large stocks unsold, they prefer carrying them over to next year to reducing prices.

CHICAGO

Quiet continues to prevail. A great let-up in all lines of business is being felt, and this extends to the electrical industry particularly in retail trade. Sales of household appliances and all classes of material coming under the general classification of luxuries have been very light throughout the summer.

Adverse building conditions, so far as costs are concerned, have halted industrial development as well as housing construction. The price of lumber has consequently dropped close to 25 per cent and many cancellations have been received by machinery builders on orders intended for the equipment of new plants. This condition is helping one line of the electrical trade, however, for since new construction has stopped a vast amount of reconstruction and improvement is going forward in industrial plants and residence property. This is keeping the electrical contractor and contractor-dealer busy on rewiring jobs.

The current week's building permits total $520,000, of which $120,000 was for alteration jobs.

Motors.—While manufacturers are still unable to make prompt deliveries, the former pressure of back orders has materially lessened. No complaint is heard in regard to cancellations and recent price increases have had no evident effect on new business. It is said certain small factories are in a position to book additional orders.

Transformers.—Central station transformers still require from two to three months for delivery. Demand during the early summer was heavy and raw material difficulties delayed manufacturers. Small let-up is seen in the flow of new business.

Insulating Material.—Some jobbers have finally succeeded in building up nearly normal stocks. Tape and mica products are under steady demand, motor rebuilding absorbing a good share of the supply.

Porcelain.—Some quantity shipments have been received, but the volume has not been sufficient to supply requirements. Tubes are particularly in demand, with knobs and cleats in only slightly better supply. Most jobbers are unable to promise definite delivery dates.

Lock Nuts and Bushings.—A similar unfavorable condition exists in these items, as all incoming shipments are absorbed on arrival. Prices in this class of material are firm and stocks seriously depleted.

Magnet Wire.—The long-standing shortage continues. Certain makers, uncertain of the future, have withdrawn quotations and will make no definite promises of delivery. Labor troubles in the mills are partially to blame.

Heaters.—With but one or two exceptions, dealers and jobbers are buying very cautiously. The retail trade is uncertain as to how free trade is going to be this winter. There is also some question as to the price and supply of fuel. Manufacturers report the total volume of orders to date as less than at the same time last year.

BOSTON

Trade shows an excellent volume, although some jobbers report quieter conditions. An early revival of business is expected to follow the close of the holiday season, and fall orders are already being placed by retailers looking toward seasonal trade expansion. Prices have advanced slightly on rigid conduit. Stocks are believed to be above normal in many lines. One jobber stated recently that his stock, valued at more than $1,000,000, is about $350,000 too large, and consequently he is doing his utmost to reduce supplies before ordering extensively from manufacturers. An effort is being made to obtain larger profits on slow-moving supplies, through concessions by the manufacturer.

Collections are responding to vigorous efforts to improve them, but they are far from satisfactory. Many of the larger customers plead shortage of funds when pressed for payments. Deliveries are somewhat better, barring shortages in rigid conduit, motors and porcelain. Building contracts in New England for August, 1920, total $23,670,000 against $27,409,000 for August, 1919.

Rigid Conduit.—Prices have been advanced on some makes about 5 per cent. Stocks are low and spotty. The outlook for fall deliveries is not encouraging, especially in view of possible strikes in the steel industry.

Motors.—Increased factory facilities are slowly beginning to tell on the production record, but little improvement can be expected in deliveries until more back orders are filled.

Washing Machines.—By strenuous efforts, jobbers are able to keep up with the demand fairly well, but local stocks have little chance to accumulate. Twenty-five per cent off list being quoted on leading makes.

Sockets.—Orders are slowing down somewhat. Prices are steady, pulls quoting 50 cents net, keys 28 cents, and keyless sockets 26 cents in case lots. Good local stocks are in hand.

Wire.—Rubber-covered wire is reasonably plentiful, with steady prices. No. 14 quotes at $11.75 per 1,000 feet. Weatherproof and bare bases are running around 27 and 23 cents respectively. Magnet wire is still very scarce.

Heaters.—Stocks are being rapidly accumulated for the fall trade, which is expected to increase rapidly from now on. Recent coal price increases will undoubtedly help sales.

Tape.—Good stocks of black friction tape are reported. The ¾-in. size, in 25-pound lots, quotes 65 to 68 cents per pound in the better grades, and 70 cents for smaller lots.

Lamp Cord.—Silk cord is reported very short. Cotton-covered cord is in fair supply, No. 18 twisted pair quoting $43.70 per 1000 ft. list, with discounts up to 30 per cent on 5000-ft. lots.

Flexible Armored Conductor.—Prices are steady, with good supplies available.

ATLANTA

With the exception of a very few lines on which jobbers have as yet not obtained full data regarding the increase in freight, new prices are being quoted. Within the next few days quotations for the entire field of electrical material will have settled to the new level of prices without having encountered any noticeable resistance on the part of the public. The Sixth Federal Reserve District report of building permits for July shows a total number of 668 permits, valued at $3,804,535, this being a decrease of $1,309,736 over July of 1919. A better supply of labor is now available and conditions are more settled.

Schedule Material.—With the exception of items requiring porcelain there are very fair stocks on hand. A price increase of 10 per cent is to be noted in the more popular lines, such as rosettes, cutouts, fuses and so forth. Porcelain continues to be very short with poor shipments, there being practically no stocks of knobs and cleats available. Prices, rosettes, combination one piece, 12 cents; nail-it knobs, lots of from 500 to 4,000, $5.50 per 100; cleats, 1,850 and over, unglazed, 2 wire, $2.70 per 100.

Vacuum Cleaners.—The demand for this article continues to hold up satisfactorily with promises of even better business in the near future. Local stocks are reported in fair shape and shipments are coming through in a reasonable time.

Rigid Conduit.—No relief is being experienced in the galvanized line but stocks of black continue in fair shape, several large shipments having been received in the past week. The demand continues to hold up well and prices are quoted in lots of less than 2,500 pounds: Black, ½ in., $9.21 per 100 lb.; ¾ in., $12.24 per 100 lb.; 1 in., $18.79; 2 in., $39.39. Galvanized, ½ in., $9.72; ¾ in., $12.93; 1 in., $19.10; 2 in., $41.59.

Conduit Fittings.—The supply continues to hold up unusually well in the face of a strong demand, manufacturers apparently being in better shape than is the case in other lines.

Industrial Motors.—Little or no let up in demand is reported. Local stocks of the popular sizes, namely 220, 550 and 2,300-volt, three-phase type, are entirely exhausted and shipments range from eighteen to fifty weeks. Second-hand motors are being quoted on practically the same basis as new equipment. Special types of textile motors in the 550-volt type are on hand, however, in fair quantities.

ST. LOUIS

A normal easing off of general business was experienced in this territory during August, but nevertheless St. Louis electrical jobbers did more business than in August of last year. Large stocks of general merchandise in this territory are being reduced, but the stocks of electrical jobbers are increasing.

Building is practically at a standstill because of differences between the supply dealers and unions. Permits for new buildings during August represented only about one-third the investment of the same month in 1919. The lack of construction means that there has been little new house wiring for contractors, but there is a considerable amount of industrial installation work under way.

Jobbers' stocks are ample in most lines outside of small sizes of conduit, meters, transformers and linemen's tools. Shortages are being overcome as the improvement in transportation facilities continues. Dealers have full shelves as a result of early orders and sales are being fairly well maintained by intensive selling efforts. Credits are watched closely and collections from utility and industrial customers are very slow. The tendency has been for collections to become more difficult.

Wire.—Good stocks of both rubber-covered and weatherproof wire are in jobbers' hands. The demand for weatherproof is the greater. No. 14 rubber-covered is selling for $11.50 per 1,000 ft. in 5,000-ft. lots, and $12.25 in lots from 1,000 to 5,000 ft. No. 6 weather-proof is quoted at $32.35 per 100 lb. in lots of 1,000 lb. or more.

Rigid Conduit.—Very little of the ½-in. and ¾-in. sizes is available but there are good stocks of the larger sizes. Demand is fair. The price was increased last week and card No. 46 is now effective. The price for 1-in. conduit is $148 per 1,000 ft. in lots of 5,000 ft.

Transformers.—There has been a steady demand from industrials for power transformers of from 200 kva. to 500 kva., for use in connection with the purchase of primary central station power service. Deliveries of six or seven months are now being promised on these units.

Linemen's Tools.—Local stocks are generally depleted and it is so difficult to obtain supplies even on orders placed last winter, that at least one jobber is considering the advisability of giving up the line entirely.

Guy Wire.—Stocks have been reduced almost to the vanishing point and it cannot be said with any certainty as to when they will be replenished. A local manufacturer says the shortage is due to inability to get the galvanized steel wire used in making up the strand. The price of quarter-inch galvanized stranded steel wire is $1.75 per 100 lb. with a discount of 25 per cent in quantities of from 1,000 to 5,000 lb., and 35 per cent off for orders of 5,000 lb. or more.

Cross Arms.—Both stocks and demand are good. Jocelyn of Chicago has issued a new price list, F 25, effective Sept. 1 for Washington fir and yellow pine cross arms. The new list represents an advance in price to cover the increased freight rates.

Meters.—House type meters of the 5-amp. size are in demand by central stations which did not order their year's requirements early in the spring. There are practically no stocks and it is almost impossible to get any quantity under three months.

SAN FRANCISCO

Business in northern California is slowing appreciably, while in the southern part of the state it is very brisk. This is evidenced by the value of the building permits issued during August, 1920. For the principal cities these figures were as follows: San Francisco, $1,456,000; Oakland, $672,000; Los Angeles, $6,870,000; San Diego, $483,000. This compares with figures of $2,788,000, $921,000, $2,403,000 and $130,000, respectively, in the same cities for August, 1919.

Three dry winters and the need of water for irrigation have resulted in strict orders for power conservation similar to war-time restrictions. Electric signs are banned and street lighting has been cut to a minimum. During this inforced inactivity, however, plans are being pushed to care for the future. The Great Western Power Company, now distributing 86,000 hp., will have 140,000 hp. available shortly after the first of the year in one of the most compact plants in the state. The cable is on the ground, nearly all the steel towers have been placed, and the wire is being rapidly strung. The Pacific Gas & Electric Company through its Pitt River project will shortly be able to deliver 220,000 volts current. The development of the San Joaquin valley, which has been hampered during the past year by lack of power, will be mightily assisted by the completion of the new San Joaquin Light & Power Company project. Efforts are being made to interest the electrical trade in the purchase and holding of valuable power securities, as census estimators state that an electrical pumping installation on a farm increases its yield per acre from three to ten fold.

Household Appliances—Shipments are being received in better quantities from the factory, and nearly all jobbers and dealers now have fair stocks. Buyers expect a considerable price increase in the near future.

Lamps.—Deliveries as a whole are excellent, and business is showing signs of the fall rush.

SEATTLE—PORTLAND

From present indications fall business in the electrical industry will be good, as already sales in certain lines, such as heating appliances, household equipment, lighting fixtures and lamps have begun to show a healthy movement. Contractor-dealers report a considerable amount of new work, and sales of both jobbers and retailers for the past week show improvement. Bankers who last spring were predicting a strained credit situation during the crop-moving period now adhere to the belief that no unusual disturbance will be witnessed.

Orders for lumber in the Northwest have slumped heavily as a result of the application of freight rate increases and cancellations of old business are being made. New business seems destined to continue at low ebb until transcontinental carriers inaugurate their contemplated modifications of the new rates.

Portland jobbers report business as running along on about an even keel. Prospects are not particularly bright. The credit situation continues to tighten and collections are slow. This as usual reflects itself in the amount of business transacted. Contractors say business is good at present, with considerable work in prospect for the future. Many of the larger contractors have enough work ahead to keep them busy for the next two or three months. Competition is keen on larger contracts but many of the standard firms depend upon regular customers where competition is not felt. The business of retail stores varies from fair to good, several report that August sales mark the month as the banner one of the year thus far. Cash sales are good, but collections on accounts are slow. The credit situation is being watched carefully.

Motors.—In Portland territory manufacturers report stocks of motors, transformers and meters are low and difficult to replenish. The call for motors and transformers is very light. In Seattle like conditions exist, except in fractional size motors. However, in both districts the demand is far in excess of available stocks.

Flashlights.—Demand the past two weeks has been steadily increasing. Sales campaigns did not bring the results anticipated. Seattle jobbers particularly report no difficulty in securing supplies.

Insulating Material.—Demand is picking up and tapes, mica material and fibre are showing a good movement. Prices are steady and stocks in excess of demand.

Wire.—A fairly satisfactory stock of rubber covered is on hand in assorted sizes, but some jobbers report weather proof continues scarce. Prices show no recent change.

Lock Nuts and Bushings.—The shortage of these fittings has been overcome, because of the decreasing demand and an improvement in shipping. No price changes are reported recently.

Porcelain.—Recent shipments have built up jobbers' stocks in a satisfactory manner and the shortage is over. Demand is now light.

SALT LAKE CITY-DENVER

Jobbers express the belief that the purchasing power of the public is substantial and that it is not altogether the lack of money that accounts for the present widespread wave of conservatism in buying. The public seems to be waiting for prices to fall, and the recent downward tendency in some lines of merchandise has given some warrant for this attitude.

The vacation period is nearly over and business is generally settling down to a normal level. This is already being reflected in improved retail sales. The electrical market is picking up, especially in all kinds of household appliances. Sales for August in nearly all electrical lines show an increase over July. Dealers attribute this to the fact that more money is circulating as the crops are being harvested and marketed. From all indications September will be a better month than August.

Jobbers in some quarters say they could sell more merchandise to dealers if they wished to be more lenient in the matter of credit. They are refusing to sell extensively on a credit basis, however, and are admonishing retailers to establish their own business on the same stable foundation. The last two or three weeks show a decided improvement in collections. Deliveries are gradually returning to normal. Especially is there a gratifying improvement in the delivery of all kinds of domestic appliances.

Washing Machines.—With the approaching end of the vacation season a greater demand is becoming noticeable. Most factories are in a position to make satisfactory deliveries.

Vacuum Cleaners.—There is a decided increase in sales. This is attributable in part to the need of equipment for fall house cleaning. Dealers are showing a tendency to concentrate on cleaners in their advertising.

Conduit.—There is still a serious shortage of conduit for construction work. Manufacturers are not able to meet the orders as demand is unusually large just at present.

Wiring Devices—There has been a recent advance in prices due mainly to the increased freight rate schedule. Porcelain factories in many cases are unable to keep their jobbers sufficiently stocked.

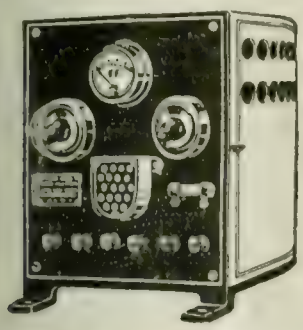
Street Lighting Equipment.—Cities and municipalities show little interest in new lighting equipment for streets. In several cases orders for new installations have been cancelled. It is found impossible to finance civic improvements involving any large outlay of money.

NEW APPARATUS & APPLIANCES

A Record of Latest Developments
and Improvements in Manufacturers' Products
Used in the Electrical Field

Rotary Rectifier for Battery Stations

A rotary rectifier for charging batteries from a 115-volt, 60-cycle line has been developed by the France Manufacturing Company, Berea Road and West



CHARGES ONE TO TWENTY-EIGHT 6-VOLT BATTERIES FROM A.-C. LINE

104th Street, Cleveland, Ohio. This rectifier, which gives from 7½ volts to 105 volts direct current, is made in three types of 1,000, 1,500 and 2,000 watts rating. From three to forty-two cells may be charged on the two smaller outfits and from three to eighty-four on the larger outfits. The outfits weigh 75, 100 and 125 lb. respectively. The operation is entirely automatic. The voltage and current is readily adjustable for different numbers of batteries.

Combination Fan and Household Heater

A combined fan and heater has been announced by the Thermo Fan Electric Company of New York City and its distributers, the S. O. S. Electric Sales Company of 2 Columbus Circle, New



FAN DISTRIBUTES HEATED AIR

York City. This "Triplex" heater consists of a standard fan to the guard of which is attached a nichrome heater, through which the air from the fan passes. Fan and heater have independent connections, attaching to any socket, and combined, in the domestic size, require 660 watts. The fan-heater is made in larger sizes for industrial purposes. The fan may be used alone for cooling purposes.

Portable Power Stand

The Delco-Light power stand, manufactured by the Delco-Light Company, Dayton, Ohio, is built to permit of driving household and farm appliances from the same motor. The ½-hp. motor is mounted on a tripod and drives through a 5-step pulley. Weight is 50 lb.

Plug Bushing Which Grips Cord

For taking strain off the binding screws of plugs a new bushing has been developed by the Bryant Electric Company, Bridgeport, Conn. The hole in the bushing has a number of inwardly projecting bosses which serve to securely grip the outer surface of the wire



BUSHING GRIPS WIRE, TAKING STRAIN OFF BINDING SCREWS

around its entire circumference. Thus the strain on the wire is taken by the bushing and not by the binding screws. The threading is standard ⅜-in. iron pipe size. It is therefore possible to attach the cap to socket handles, etc.

Notes on Recent Appliances

Electric Dishwasher

The Tupper Manufacturing Company, 1122 West Forty-seventh Street, Seattle, Wash., has placed on the market a motor-driven dishwasher of large capacity.

Storage Battery

An automobile-type storage battery with hard separators has been developed by the Duplex Storage Battery Company, Edison and Market Streets, Milwaukee, Wis.

Electric Stove

An electric stove for factory use has been placed on the market by the S. U. E. Company, 89 Beach Street, Boston, Mass.

Oil-Engine-Driven Farm-Lighting Plant

For operation on thin crude oil, kerosene and low-grade fuel oil down to 28 deg. Baumé, a farm-lighting plant has been designed by the Petroleum En

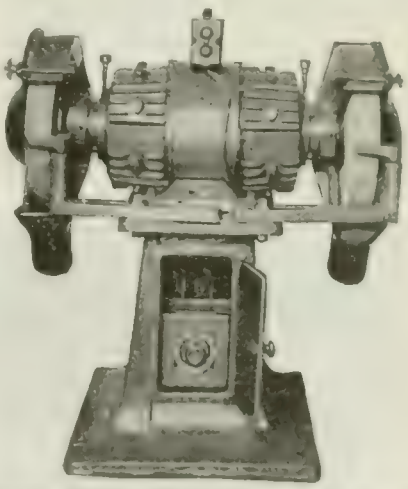


RUNS ON LOW GRADE OILS

gine & Manufacturing Company, Insurance Exchange Building, Chicago. The outfit consists of a 3-hp. vertical engine, a Westinghouse Electric 1.5-kw. generator and control panel and a storage battery.

Self-Contained Motor-Driven Tool Grinder

A push button on top of the motor frame actuates a starter with a speed-adjusting rheostat, all of which are located in the bottom of the machine frame of the tool grinder just placed upon the market by the U. S. Tool



MOTOR AND CONTROL APPARATUS TOTALLY ENCLOSED

Company of Cincinnati, Ohio. The grinder shown is equipped with a 5-hp. direct-current shunt-wound adjustable speed (1,120 to 1,600 r.p.m.) 230-volt Westinghouse motor.

MANUFACTURERS' ACTIVITIES

Record of Changes Affecting Sales and Distribution Together with Trade Personals and Notes on Foreign Trade, Jobbers' News and New Trade Literature

THE GEORGE CUTTER WORKS of the Westinghouse Electric & Manufacturing Company, South Bend, Ind., is making extensions which will double its manufacturing capacity and will include new foundry space of 64 x 112 ft. and a second floor, measuring 66 ft. x 250 ft., for assembling and storage rooms. In addition outdoor storage space has been acquired which will increase the facilities greatly.

THE WALKER & PRATT COMPANY, 31 Union Street, Boston, manufacturer of stoves, etc., has awarded contract for an addition to its plant. The increased space will be used for the manufacture of electric stoves and to increase the output of gas stoves.

THE ARROW ELECTRIC COMPANY, Hartford, Conn., manufacturer of switches and other electrical equipment, has awarded contract for construction of an addition to its plant, 33 ft. x 40 ft.

THE NATIONAL LAMP WORKS of the General Electric Company, with main offices in New York City, will build two factories in Indianapolis to manufacture incandescent lamps representing an investment of about $2,000,000 on a site at East Washington and Gray Streets. It is proposed to build a finishing plant of three stories and a basement 111 x 240 ft., to cost about $1,000,000, and a glass works of two stories and a basement 80 x 200 ft., at a cost of about $750,000. About 1,200 persons will be employed in the finishing plant and 500 at the glass works. The proposed plant will manufacture miniature incandescent and automobile lamps, and will have a capacity of 160,000,000 lamps a year.

CARL G. BARTH & SON, consulting engineers, announce that they have opened an office in the Fuller Building, 10 South Eighteenth Street, Philadelphia, where they will continue their specialization in production and costing methods, etc., based on the Taylor system of scientific management.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, East Pittsburgh, Pa., held its thirty-fourth annual outing and basket picnic at Kennywood Park, Pittsburgh, on Aug. 14, which was attended by more than 40,000 employees of the company and their families. Among the companies represented at the outing were: the electric, machine and meter works, East Pittsburgh; Trafford City (Pa.) works, Linhart plant and copper mill at Turtle Creek, Homewood service station and Pittsburgh office, and Pittsburgh & Braddock foundry, Braddock, Pa.

THE SOUTHWESTERN BATTERY COMPANY, 1707 Jackson Street, Dallas, Tex., recently organized, is contemplating the construction of a new plant, 50 ft. x 125 ft., to cost about $20,000. The company proposes to manufacture electric battery equipment.

THE KINGSBURG-SAMUEL ELECTRIC COMPANY, 213 North Calvert Street, Baltimore, Md., has acquired a three-story building at 530-32 North Calvert Street, where it will establish a new plant for the manufacture of electrical apparatus.

THE UNITED STATES LIGHT & HEAT CORPORATION.—Interests connected with the Willys-Overland Company, Toledo, Ohio, and affiliated concerns have obtained a substantial interest in the United States Light & Heat Corporation, Niagara Falls, manufacturer of storage batteries, electric lighting systems for railroads, etc. The following officers have been elected: John N. Willys, chairman of the board; J. Allen Smith, president; E. H. Gold, vice-president of the board; C. L. Lane, vice-president and general manager; H. H. Knapp, treasurer, and H. H. Van Nest, vice-president and secretary.

THE DUPLEX STORAGE BATTERY COMPANY, 537 Edison Street, Milwaukee, Wis., has purchased the plant of the former Beaver Dam (Wis.) Manufacturing Company which it will remodel and equip for the manufacture of storage batteries. The company is making arrangements to increase its capital stock from $60,000 to $500,000.

THE FORT WAYNE ELECTRIC WORKS of the General Electric Company, Fort Wayne, Ind., has filed plans for the erection of a building at Wall Street and Broadway, to cost about $25,000.

THE INTERNATIONAL RADIO TELEGRAPH COMPANY, Pittsburgh, Pa., manufacturer of radio apparatus, has filed notice of change of name to the International Devices Company.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., has filed plans for the construction of a one-story building at its plant at Columbia Avenue and Putnam Street, Baltimore, Md., recently acquired from the government. The factory will be used for the manufacture of electric switches and other specialties.

METROPOLITAN ELECTRICAL SUPPLY COMPANY, Philadelphia, Pa., has leased the property at 45 North Seventh Street, in that city, where it will operate a branch establishment.

THE APEX ELECTRICAL DISTRIBUTING COMPANY, Cleveland, Ohio, held a convention at the Hollenden Hotel, Cleveland, July 13, 14 and 15, which was attended by sixty-eight Apex district sales managers, their assistants and distributers, and Apex department managers. With Apex cleaner sales increasing rapidly, new sales policies were outlined and progressive business methods unfolded by which the company plans to make even greater progress during the next year.

THE BLUE BIRD MANUFACTURING COMPANY, St. Louis, Mo., manufacturer of the Blue Bird electric clothes washer, has sold its property and good will to the Davis Sewing Machine Company, Toledo, Ohio. The latter company will continue the manufacture of the Blue Bird clothes washer and will operate the business on a large scale. As far as possible the old distributers will be retained.

THE SAFETY CAR HEATING & LIGHTING COMPANY has awarded contract for alterations in the former plant of the Marlin-Rockwell Company, New Haven, Conn., recently taken over by the company.

THE OHIO GENERATOR COMPANY, Wheeling, W. Va., manufacturer of generator equipment, etc., has been reorganized and several new directors have been elected. Plans are being considered for extensions. Henry Miller of Miller & Stein, is chairman of the board.

Supply Jobbers' Notes

JAMES W. POOLE, Inc., electrical supply jobbers since 1887 at Boston, will be established after Sept. 1 at 197-203 Congress Street, Boston. The former wholesale and retail quarters of the company, at 16 Columbia Street and 64 Kingston Street respectively, will be given up, and the business of the establishment henceforth will be chiefly wholesale. About 12,000 sq.-ft. of floor space is available at the company's new home.

THE CARTER ELECTRIC COMPANY, Atlanta, Ga., is erecting a new warehouse on Haynes Street, to cost about $250,000. The new building will give the company about 55,000 ft. of floor space. Arrangements have been made for recreational devices for the employees.

Foreign Trade Notes

LARGE INCREASE IN CAPITALIZATION OF ELECTRICAL WORKS IN GERMANY.—The Westphalian United Electric Works has increased its capital from 3,000,000 marks to 12,000,000 marks. It is also announced that the Allegemeine Elektricitats-Gesellschaft (the A. E. G.) of Germany has decided upon an issue of 250,000,000 marks in preferred stock, to provide the company with an enlarged capital corresponding to the generally higher level of prices.

DEMAND FOR ELECTRICAL EQUIPMENT AND MACHINERY IN SPAIN.—At the present time the demand for electrical equipment and machinery is very brisk and will probably develop considerably during the coming year. There are now some 2,800 electric plants in the country, producing annually 54,800,000 kw.-hr. of electricity. Hydro-electric plants are in the lead and plans are being considered and prepared for still greater use of electricity for the rapidly multiplying industries.



SALES CONVENTION OF THE APEX ELECTRICAL DISTRIBUTING COMPANY

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A mercantile company in India (No. 33,569) desires to purchase and secure an agency for the sale of electrical goods, etc.

A commercial agent in Brazil (No. 33,573) desires to represent firms for the sale of electrical supplies, etc., in that country.

A mercantile firm in Turkey (No. 33,576) desires to purhase copper wire, plain and silvered.

A commercial agency firm in Brazil (No. 33,583) desires to secure the representation of firms for the sale of electrical goods, etc.

A miner in Spain (No. 33,591) desires to secure an agency for the sale of complete electrical installations for mines and mining industry.

A co-operative mercantile company in Australia (No. 33,598) desires to purchase and secure an agency for the sale of electric-lighting plants, driven by gasoline engine, etc.

Trade Publications

SYNCHRONOUS CONDENSERS.—The General Electric Company, Schenectady, N. Y., has issued bulletin No. 41,311, superseding bulletin No. 4859, covering its synchronous condensers.

INSULATING FABRICS AND LINK INSULATORS.—The General Electric Company, Schenectady, N. Y., has published bulletins Nos. 18, 15 and 16, describing respectively the G-E insulating fabrics and the Dewhirst link insulator.

COPPER WIRE, CABLES, ETC.—The Copper Clad Steel Company, Braddock, Pa., Braddock post office, has issued a 16-page leaflet covering its Copperweld bond wires for ordinary open-wire service, low-voltage power distribution and for power connection and insulation.

FUEL SAVING DEVICES.—Bulletin 111 issued by the Uehling Instrument Company, 71 Broadway, New York City, describes and illustrates the standard Uehling CO$_2$ meters, both single and multiple units.

INSULATING COMPOUNDS.—"Insulating Compounds" is the title of bulletin No. 48,704A, published by the General Electric Company, Schenectady, N. Y., covering its insulating compounds, including insulating varnishes, japan oils, etc.

WATER SOFTENERS, FILTERS, ETC.—The Permutit Company, 440 Fourth Avenue, New York City, has issued bulletin No. 101, entitled "Permutit Water Rectification Systems," in which it describes and illustrates its products, including water softeners, filters, manganese removal equipment, etc.

ELECTRIC DRILLS.—The Independent Pneumatic Tool Company, 600 West Jackson Boulevard, Chicago, is distributing circular No. 33, describing its "Thor" universal electric drills, grinders, etc.

STEEL BUILDINGS.—"Prudential Steel Buildings" is the title of catalog No. 21 issued by the Blaw-Knox Company, Pittsburgh, Pa., covering its line of galvanized sheet-steel buildings.

COUNTERS.—"Veeder Counters Checking Up Production" is the title of catalog No. 1901 issued by the Veeder Manufacturing Company, Hartford, Conn., describing its products, including cyclometers, odometers, counters, tachometers, fine die castings, etc.

New Incorporations

THE HOME LIGHT & POWER COMPANY, Columbia, S. C., has been incorporated by S. O. and M. G. Lindeman. The company is capitalized at $20,000 and proposes to engage in the manufacture of domestic lighting apparatus, heating appliances, etc.

THE JAMESTOWN ELECTRICAL ENGINEERING CORPORATION, Jamestown, N. Y., has been incorporated with a capital stock of $50,000 to manufacture electrical equipment and appliances. The incorporators are [illegible] Westburgh.

THE CANADIAN EDISON APPLIANCE COMPANY, Ltd., Toronto, Can., has been chartered with a capital stock of $1,000,000 to manufacture electric specialties, machinery, etc. The incorporators are: William A. J. Case, 94 Leuty Avenue; James B. Taylor, 801 Dominion Bank Building; George F. Wessel, real estate, all of Toronto.

THE OCEANIC POWER COMPANY, Charleston, S. C., has been chartered with a capital stock of $10,000. The officers of the company are: William Gregersen, president; J. E. Martin, Jr., vice-president, and William P. Tillinghast, secretary and treasurer.

THE BURNSVILLE WATER & LIGHT COMPANY, Burnsville, W. Va., has been incorporated with a capital stock of $75,000 by W. E. Marple, John I. Bender and J. L. Coberly.

THE HODGSON ELECTRIC APPLIANCE COMPANY, Glens Falls, N. Y., has been incorporated by E. J. West, W. D. Hodgson, and D. F. Imus. The company is capitalized at $100,000 and proposes to engage in the manufacture of electrical apparatus.

New England States

SKOWHEGAN, ME.—The Central Maine Power Company, 40 Water Street, Augusta, contemplates the erection of a hydro-electric plant to develop 12,000 kw. The cost is estimated at about $1,350,000. Frank H. Mason is chief engineer.

NORWOOD, MASS.—The Hollister Mills, Lenox Avenue, will soon award the contract for the construction of a mill to cost about $300,000. Electric light and power equipment will be installed. J. W. Beal, 62 Summer Street, Boston, is architect.

Middle Atlantic States

BROOKLYN, N. Y.—Bids have been received by the Board of Education, Room 2800, Municipal Building, Manhattan, for the installation of electric light systems in Brooklyn Public Schools Nos. 10, 23, 35, 48, 53, 77, as follows: T. F. Jackson, $8,179; $10,647; $10,186; $2,728; $3,840; $9,484. Jandous Electric Company, $9,100; $10,240; $9,325; $1,927; $3,580; $9,285. Croker National Engineering Company, $8,827; $10,497; $9,780; $1,966; $3,814; $9,095.

CLIFTON PARK, N. Y.—The Adirondack Power & Light Corporation, Schenectady, has petitioned the State Public Service Commission for permission to erect an electric plant in Clifton Park and in certain towns in Montgomery and Fulton Counties. D. E. Peck is secretary.

MINEOLA, L. I., N. Y.—The Nassau & Suffolk Lighting Company has been authorized by the Public Service Commission of the Second District to issue $1,000,000 in bonds, the proceeds to be used for extensions and improvements to its plant and distribution system.

ROME, N. Y.—The Rome Wire Company has filed plans for the construction of a power house at the junction of Kensington Avenue and the Delaware, Lackawanna & Western Railroad tracks, to cost about $15,000.

ALLENTOWN, PA.—The Allen Tire & Rubber Company, 510 Hamilton Street, has awarded the contract to the Allentown Construction Company, Fifth and Hamilton Streets, for the erection of a factory for the manufacture of tires and tubes, to cost about $2,500,000. Electrical equipment will be installed.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

WATSONTOWN, PA.—An issue of $50,000 in bonds has been authorized by the citizens for improvements to the municipal power plant.

BALTIMORE, MD.—The Whitaker Paper Company, 415 Guilford Avenue, received bid from B. F. Bennett Building Company, 123 South Howard Street, for the erection of a warehouse building to cost about $1,000,000. Wiring and fixtures for electric lights will be installed.

PORTSMOUTH, VA.—Bids will be received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Sept. 14, for 1,000 ft. single conductor cable for Portsmouth. (Specification 6271.)

WASHINGTON, D. C.—Bids will be received at the office of the Chief Signal Officer, U. S. A., War Department, Washington, D. C., until Sept. 14, under PR 4402—1CP, for furnishing two telephone switchboards, 100-line, local battery, jacks and signals, one position to be serially numbered, and 15 cord circuits with single supervision.

North Central States

AKRON, OHIO.—A [illegible] system for Storer Avenue has been approved by the City Council.

AKRON, OHIO.—The Portage Lakes Improvement Association has been assured by the Northern Ohio Traction & Light Company of Akron that a high-tension light line will be erected to the Lake [illegible] year.

CLEVELAND, OHIO.—It has been reported that the Wheeling & Lake Erie Railroad, Leader-News Building, Cleveland, contemplates electrification of its lines including the erection of a power house near Conesville and high-tension transmission lines to Akron and Canton.

CLEVELAND, OHIO.—Contracts have been awarded by the city officials as follows: for turbo-generator, to the Allis-Chalmers Mfg. Company, Cleveland, at $188,000; switchboard to the Westinghouse Electric & Manufacturing Company, 6905 Susquehanna Street, Pittsburgh, Pa., at $12,707; condenser and auxiliaries to the Wheeler Condenser Company, Indianapolis, Ind., at $65,000.

ELYRIA, OHIO.—The Reliance Crane Company has plans under way for the construction of a factory and power house to cost about $125,000. Watson Engineering Company, Hippodrome Building, Cleveland, are engineers.

COLUMBIA CITY, IND.—The City Council has filed petition with the Public Service Commission for approval of an issue of $75,000 in bonds for the installation [illegible] Columbia City Light, Power and Water Plant.

BEAVER DAM, WIS.—The Wisconsin Power, Light & Heat Company contemplates the erection of a power house at Beaver Dam. Hutter Construction Company, 128 Western Avenue, Fond du Lac, [illegible]

HUDSON, WIS.—The Burkhardt Milling & Power Company will soon award the contract for the erection of a power house to cost about $40,000. Holland, Ackerman & Holland, 122 North Fourth Avenue, Ann Arbor, Mich., are engineers.

MILWAUKEE, WIS.—The Sewerage Commission contemplates the erection of a [illegible] sewage system.

CRYSTAL LAKE, IOWA.—Plans will be received by F. A. Gabrielson, secretary, until Sept. 30, for electrical work, heating and plumbing for the Consolidated Independent School District of Crystal Lake.

HOPKINTON, IOWA.—The Hopkinton Electric Light & Power Company has plans under way for the erection of a power house to cost about $35,000. Holland, Ackerman & Holland, 122 North Fourth Avenue, Ann Arbor, Mich., are engineers.

STOCKPORT, IOWA.—The Van Buren Light & Power Company of Stockport has applied to the State Railroad Commission for permission to erect electric transmission lines to Farmington, Bonaparte, Keosauqua, Cantril and Milton.

BURLINGTON, KAN.—A charter for the organization of a local corporation capitalized at $25,000 has been granted for the installation of an electric lighting plant.

OSAWATOMIE, KAN.—Bonds to the amount of $85,000 have been voted for extensions and improvements to the municipal light and water plant.

OTTAWA, KAN.—The proposal to issue $195,000 more in bonds will be submitted the voters at a special election soon, of which $165,000 will be used for improvements to the light and water plant.

TOPEKA, KAN.—The Security Benefit Association has preliminary plans under way for the construction of a hospital and detention building including a power house to cost about $300,000. Schmidt, Garden & Martin, 104 South Michigan Avenue, Chicago, Ill., are engineers.

Southern States

WINNSBORO, S. C.—The Winnsboro Mills contemplates the installation of 3,000 kva. bank of transformers in a new mill now under construction.

TOCCOA, GA.—The Toccoa Falls Light & Power Company has work under way on the construction of a hydro-electric plant on Toccoa Mountain. Plans include the erection of a dam.

DELRAY, FLA.—Bids will be received until Sept. 25 for the installation of an engine and equipment for electric light unit. W. A. Brennan is town clerk.

GREENSBORO, ALA.—The city officials contemplate the establishment of an electric light and water plant to cost about $12,000.

JUDSONIA, ARK.—The Arkansas Hydro-Electric Development Company, Little Rock, contemplates the erection, by day labor, of the first unit of a hydro-electric plant on the Little Red River, about eighteen miles from this place, to include a 10,500-hp. power plant and a dam, at a cost of about $1,208,000. Dickinson & Watkins, Little Rock, are resident engineers.

Pacific and Mountain States

EVERETT, WASH.—The development of a power project on the Sultan River and Olney Creek in Snohomish County is being planned by the Sound Power Company. H. O. Pond, 25 Broad Street, New York, N. Y., is president.

SEATTLE, WASH.—Contract has been awarded to Thomas D. MacNeil, of Mt. Vernon, by Washington Dairymen's Association for the erection of a main building, power house, etc. Cost is estimated at about $88,000. P. W. Shubert, Railway Exchange Building, is engineer.

PORTLAND, ORE.—The Columbia Valley Power Company, organized under the laws of Delaware, has applied for permission to operate in Oregon. N. D. Simon, Board of Trade Building, Portland, is the Oregon representative of the company.

ROUNDUP, MONT.—The installation of an ornamental street-lighting system will be made on certain streets of the city, to cost about $25,000.

PUEBLO, COL.—The Colorado Fuel & Iron Company contemplates the erection of a power house and the electrification of some mills

Canada

ST. JOHN, N. B.—The Federal Department of Marine and Fisheries has appropriated $25,000 for the installation of radio stations in St. John Harbor.

WINDSOR, N. S.—A local company is being organized for the development of a project to consist of a pulp mill, 3,000-hp. power plant, etc., to cost about $250,000. T. B. Atkins, of Windsor, and Wright & Jodrey, of Wolfville, are interested.

FENELON FALLS, ONT.—Plans are under way for the construction of a new waterworks and fire protection plant. Electrically driven centrifugal pumps will be installed. Oliver Smith, of Lindsay, is engineer.

KAPUSKASING, ONT.—The Government has decided to aid in the development of water power and the establishment of a townsite at this place.

TORONTO, ONT.—The Marconi Wireless Company of Canada, Ltd., contemplates the erection of an experimental station for wireless communication between Canada and England.

COATICOOK, QUE.—A by-law has been passed authorizing borrowing $60,000 for the construction of a new dam and power house.

Miscellaneous

VILLA ACUNA, COAHUILA, MEXICO.—The Mexican Government has granted a concession to Antonio Guijosa for the construction of an electric light and power plant at this place. The plant will be of sufficient size to furnish power for the operation of pumping plant for irrigation purposes on the American and Mexican sides of the Rio Grande River.

Record of Electrical Patents

Notes on United States Patents

(Issued Aug. 24, 1920)

1,350,925. INSULATION: Giuseppe Faccioli, Pittsfield, Mass. App. filed March 20, 1917. Oil filled bushing.

1,350,933. ALTERNATED TIME-CONTROLLED MECHANISM FOR IRONS; Jose A. Oca-Balda, New York, N. Y. App. filed Aug. 1, 1919. Clock controls current.

1,350,936. INSULATOR; Frank W. Peek, Jr., Pittsfield, Mass. App. filed March 15, 1917. Combination of conducting shapes for stress distribution in bushing.

1,350,937. CONTROLLER FOR ELECTRIC MOTORS; Charles I. Perry, Schenectady, N. Y. App. filed Dec. 6, 1918. Manual controller operates motor controller to give definite speeds.

1,350,954. OPTOPHONE; Archibald Barr and William Stroud, Anniesland, Glasgow, Scotland. App. filed Nov. 26, 1919. Produces musical notes for blind to read printing.

1,350,956. ALKALINE ACCUMULATOR; Antoine Marius Cave, St. Etienne, France. App. filed Nov. 7, 1918. Metallic cloth wrapped around electrodes.

(Issued Aug. 31, 1920)

1,351,019. ELECTRIC REGULATING RHEOSTAT; Lawrence Boothman, Manchester, England. App. filed March 4, 1915. Two elements.

1,351,023. CONTROLLER FOR SMALL MOTORS; Joseph L. Chantemerle, Turtle Creek, Pa. App. filed Jan. 14, 1918. For foot operation.

1,351,027. RELAY; David C. Davis, Wilkinsburg, Pa. App. filed June 17, 1918. Frequency actuated.

1,351,030. ARC-WELDING SYSTEM; Hans Fahnoe, Pittsburgh, Pa. App. filed Sept. 3, 1919. Improved starting characteristics.

1,351,033. SYSTEM OF DISTRIBUTION; Charles Le Geyt Fortescue, Pittsburgh, Pa. App. filed Dec. 4, 1915. Regulation of voltage.

1,351,035. DYNAMO-ELECTRIC MACHINE; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed Dec. 14, 1915. Dynamotor voltage ratio varied.

1,351,036. DYNAMO-ELECTRIC MACHINE; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed May 8, 1916. Dynamotor voltage ratio varied.

1,351,042. SYSTEM OF VENTILATION FOR TRANSFORMERS; Carl G. Jones, Wilkinsburg, Pa. App. filed Aug. 3, 1917. Aspirator draws air from above oil.

1,351,054. ELECTRIC SADIRON; Edwin Miller, Hartford, Conn. App. filed Jan. 19, 1920. Cool support.

1,351,055. ELECTRIC REGULATION; George G. Milne, Rye, N. Y. App. filed Feb. 17, 1917. Self-regulating dynamo.

1,351,059. SHUNT ATTACHMENT FOR BRUSHES; Frank D. Newbury, Pittsburgh, Pa. App. filed July 6, 1917. Detachable brush.

1,351,061. TRANSFORMER; John F. Peters, Pittsburgh, Pa. App. filed April 6, 1917. Eliminates distortions in three-phase transformers star connected.



1,351,059 Shunt Attachment for Brushes

1,351,074. CONDENSER; Phillips Thomas, Edgewood Park, Pa. App. filed June 15, 1917. High dielectric strength.

1,351,114. PROCESS OF ELECTRICALLY DEPOSITING ALUMINUM; Glen L. Williams, New York, N. Y. App. filed March 12, 1918. Producing aluminum from compound dissolved in liquid anhydrous vehicle.

1,351,150. DEVICE FOR ATTACHING ELECTRIC LIGHT FIXTURES TO OUTLET BOXES; Richard Battle, Okmulgee, Okla. App. filed April 11, 1919. For fans or the like.

1,351,191. ELECTRICAL CONNECTING DEVICE; Maximilian Sidon, Bridgeport, Conn. App. filed Nov. 24, 1916. Contact blades interchangeable with receptacles.

1,351,203. PLUG CUT-OUT BASE; Robert C. Cole, Hartford, Conn. App. filed Feb. 27, 1919. Rapidly assembled.

1,351,214. ELECTRIC SWITCH; Norman W. Nutt, Trenton, N. J. App. filed Jan. 29, 1919. Lamp socket.

1,351,254. AUDIPHONE; Charles Larrick, Los Angeles, Cal. App. filed March 26 1919. Improved type.

1,351,255. LIGHTING FIXTURE; Abraham Lazerson, Chicago, Ill. App. filed Jan. 26, 1920. Directs large part of light down.

1,351,270. SQUIRREL CAGE WINDING CONSTRUCTION; Nathan Wilkinson, Milwaukee, Wis. App. filed Aug. 27, 1914. An improved method of welding end members.

1,351,271. METHOD OF AND APPARATUS FOR ELECTRIC WELDING; Nathan Wilkinson, Wauwatosa, Wis. App. filed Aug. 27, 1914. For welding end bars.

1,351,294. ELECTRIC MOTOR; Nils D. Levin, Columbus, Ohio. App. filed April 7, 1916. For use in mines.

1,351,350. INTERPOSED FABRIC MACHINE; William S. Southwick, Clinton, Mass. App. filed April 22, 1918. Improved machine.

1,351,356. SOUND-DETECTING DEVICE; William S. Tucker, Thames Ditton, England. App. filed Jan. 6, 1919. For determining position of gun.

1,351,396. IGNITION SYSTEM FOR INTERNAL COMBUSTION ENGINES; Albert H. Midgley, Acton Vale, Eng. App. filed Feb. 6, 1919. Reduces wiring.

1,351,422. ELECTRIC SIGNALING SYSTEM; Simon B. Hess, Jamaica, N. Y. App. filed Sept. 19, 1916. Fire alarm.

1,351,432. MUSIC RECORDER; Philip J. Meahl, Summit, N. J. App. filed March 27, 1919. Records on paper rolls.

1,351,443. CONTROL SWITCH FOR CINEMATOGRAPHIC TARGETS; William P. Robertson, New York, N. Y. App. filed June 7, 1919. Improved housing.

1,351,445. MEANS FOR HOLDING FORMED METAL PIECES WHILE THEY ARE BEING ELECTRICALLY WELDED; Herbert M. Smith, Great Barrington, Mass. App. filed Sept. 30, 1918. Holds parts exactly to size.

1,351,446. COMBINATION WELDING-MACHINE; Herbert M. Smith, Great Barrington, Mass. App. filed Sept. 30, 1918. Work held on a rotating arbor.

1,351,458. TREATMENT OF PETROLEUM AND LIKE OILS; Edward W. Wynne, Liverpool, Eng. App. filed Aug. 28, 1918. Improved apparatus.

1,351,478. ELECTRIC GLUE HEATER; Harry Kain, Con L. Miles and Glen A. Wilkinson, Wabash, Ind. App. filed Jan. 8, 1920. Simple structure.

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Rural Service Controversies Unnecessary

IN SOME quarters there is a tendency toward controversy between the contractor-dealer, the small private-plant manufacturer and the central station over the rural service situation. This is as unfortunate as it is unnecessary, and it is to be hoped that the leaders of these three branches of the electrical industry will be far-sighted enough to squelch the tendency promptly wherever it appears. The field is so big that the private plant and the central station both have more than they can comfortably handle for years to come without coveting each other's field. Each will give service in its own field so long as the cost and reliability combined are better than the other can give, and no amount of controversy can change the fact. The contractor-dealer and the central station can ill afford to argue their respective rights. Both are factors in a vital service in the field and by a little careful planning co-operative schemes can be worked out that will benefit all.

Reliable Service First

RELIABILITY of service has been the glory of the central-station industry for many years. The time and money which have been expended to maintain a reputation for continuous energy supply are utterly unrealized by the public. All human institutions have their limitations, however, and there is food for thought in the recent loss of a large power contract by a central station which offered to furnish energy at a cost about 5 mills less per kilowatt-hour than the industrial plant concerned was attaining. The mill owners refused to sign because of irregularities in the operation of the local urban distribution system, contending that the annual saving in energy cost would count but little against the cost of a shutdown several times a year. Such experiences are not pleasant reading for central-station managers; but if they lead to the establishment of ring feeders for important industrial districts, or to the provision of emergency inter-substation tie lines or reserve capacity underground or overhead, they at least point the way toward the logical development of reliable service. The old adage against putting too many eggs in one basket applies also to industrial power feeders.

Distribution Losses and Fuel Scarcity

ONE compensation for high fuel costs to public utilities is the justification they accord to tests and investigations formerly restricted in scope because of operating exigencies, lack of time to canvass areas remote from headquarters and the expense of thorough analyses of elusive phenomena. Distribution system efficiency with a given investment in lines and transformers now "ties in" so closely with fuel supply and expense that it is no longer excusable to let such losses "run wild." If a kilowatt-hour at the consumer's meter requires 1.5 kw.-hr. at the station switchboard, the loss easily represents an extra pound of coal on a system enjoying high plant efficiency, and the present reward of reduced line and transformer losses is greater in dollars and cents than ever before in the history of central-station operation. Besides this, the conservation of fuel is sufficient incentive to set in motion keen-edged analyses of lost and unaccounted-for energy, even if the prices of heat units delivered to the turbo-generating sets were still at pre-war levels.

The High Cost of Money

IF THERE are still those who cannot understand that the public utilities must pay high rates of interest for the money required for expansion and for the maintenance of service on the high level that the people demand, then the loan that the French Republic has floated within the past few days in the United States should be a convincing eye opener. When the government of a great victorious nation, with its world-famous record for thrift and recuperative power, is in the market to sell bonds at 8 per cent, how can public utilities, with their restricted earnings, obtain money at a lower price? Yet until a higher rate of return is granted to them, as a matter both of elementary justice and public expediency, only the strongest among them can pay this price, and as a necessary consequence development is everywhere retarded or indefinitely postponed.

Co-operation of Electrical Interests

"CO-OPERACTION," rather than the more passive form, "co-operation," would be a good name for the spreading movement in the Far West which is intended to "promote the growth of the electrical industry in all its branches through the co-ordination of effort in the rendering of better electrical service to the public." Originating in California in 1917, the movement was composed of the four branches of the industry—manufacturers, contractor-dealers, jobbers, and central stations—united under the name of the California Electrical Co-operative Campaign. Following an unknown trail, the advisory committee, which is the executive and directing body, proceeded slowly and with the greatest caution to avoid missteps. One whole year was spent in procuring the adoption of the idea by the industry; next followed the employment of field men who visited the dealers and stimulated them to render better service, and after this an advertising representative and an architectural representative were employed who have been exceedingly active. The result of all this activity has been that far more is known by Californians about electricity, its uses and the possi-

bilities of its future application than in most other states. Moreover, the people have been most receptive to the plan and have actively assisted and been sympathetic in the solution of the local problems of the industry.

With the California example in mind the Northwest Electric Light & Power Association has formed the Northwest Electrical Service League, similar in purpose, organization and scope to the California plan. In British Columbia and in Ohio the plan is to be tried. With this rapid growth of a movement which has proved its value beyond doubt the question arises as to its ultimate expansion, which already has taken the form of a national program. The experience of the California committee favors isolated group control without many set rules of conduct. Because of its purposes the plan requires intimate dealing with a wide variety of local subjects; so that while national in scope its control must take into consideration first and last its direct local appeal.

The Emergency Plant at Niagara

ONE of the greatest feats of war-time effort, the building of the new 100,000-hp. plant at Niagara Falls, is described in our columns this week by the vice-president and chief engineer of the Niagara Falls Power Company, John L. Harper, and his right-hand men. To build a station of this capacity is a distinguished task under any circumstances; to carry it through with equipment ordered from various sources without detailed and homogeneous specifications and at top speed is an achievement that reflects particular credit on both the company engineers and the manufacturers who put their best talent and energy into meeting the emergency. The immediate work at hand was to put on duty as speedily and efficiently as possible all the remaining water available at Niagara under the treaty with Great Britain. The War Department called for plans and finally adopted one of those presented by the Hydraulic Power Company of Niagara, one of the three large companies then utilizing the power of the great cataract. The first step toward unified action was the actual consolidation of these three, and early in May, 1918, orders were given to proceed.

The work carried out involved the deepening of the intake from the Niagara River, improved protection from ice, deepening the hydraulic canal through the city, the excavation of three slope tunnels from the forebay to the brink of the river, and finally the building of the hydro-electric plant itself as an extension of Station No. 3 of the Hydraulic Power Company system. Three hydro-electric units of uniform size, aggregating 100,000 hp., were ordered—one complete from the Allis-Chalmers, one generator each from the General Electric Company and the Westinghouse company, and the two corresponding turbines from the I. P. Morris Company. To the hearty co-operation of these great works the prompt success of the enterprise is due. Without specific guarantees of efficiency and with a free hand in design, all co-operated in providing similarity of exterior appearance and inherent characteristics and turned out a machine representing the highest developments of the art. Each unit has proved capable of continuous operation at 40,000 hp., at present the record rating for a single hydro-electric unit. For the several wheels it appears that the hydraulic efficiency will reach fully 93 per cent, while the efficiency reckoned from headwater to switchboard will be more than 90 per cent. Rush work though it was, the results have been of the most distinguished character. The first unit was actually put into service in nineteen months and this time could have been shortened by about five months had the work not been slowed down after the armistice was signed.

The greatest opportunity for improvement in efficiency has in late years been in the turbines and their accessories. Electrical generator design long ago reached a point where in large units to operate under given conditions variations in efficiency are likely to be measured only in tenths of 1 per cent. The whole increase of the last decade is almost exclusively due to betterment of the hydraulic end of the unit, chiefly in the reduction of frictional and eddy losses. In the Niagara work great care was taken to keep down the velocities of flow in the path to and from the wheels. The former portion of the task was carried out along lines somewhat familiar. The latter rested upon the improvements in draft-tube practice, to which are in no small measure due the remarkable results attained. Careful design and finished execution of the wheels themselves did the rest.

The net result has been an efficiency to the switchboard not likely to be raised materially. The setting of the units involved structural problems on account of the great weights dealt with, but the conditions appear to have been most successfully met in every particular. In the general plan of hydraulic work the matter of winter water supply in defiance of ice came to the front, but fortunately more than a score of years' experience with local conditions furnished the requisite data for the solution. A wide and deep channel was cut outward to the normal limit of ice in the stream and then extended upstream. Shoreward a screen of concrete piers and booms was built in double rank, keeping the float ice out of the intake channel. Our heartiest congratulations are due on the energy and skill which have so promptly made available this great increase in the practical usefulness of the cataract.

Construction Accounting Needs Attention

ANALYSIS of property accounts that reveals serious errors is an all too common experience when it is necessary to dig into past records. It is not uncommon in an attempt to ascertain the cost of a specific property unit to find general property accounts disregarded entirely and an engineer's estimate of what the unit should have cost substituted. Such a situation is due to inexcusable carelessness in the building up of accounting systems, in that those responsible have specified the ultimate result without proper consideration of the means for attaining that result. Elsewhere in this issue will be found a discussion of construction accounting and its relation to the general property accounts of the utility. An accounting system that does not provide proper methods of securing ultimate results by a carefully planned construction accounting system is a source of weakness, particularly when dealings with commissions must be had. A clear, indisputable record of the actual cost of property units may be the subject of differences in opinion as to whether costs have been kept to the lowest possible limit, but as compared to an

estimate in which opinions as to what costs should be are the guiding factor the actual cost record is a tower of strength. Actual investments are a vital factor in determining rates, and utilities cannot afford to handicap themselves by carelessness and short cuts in construction accounting methods that cast doubt on the accuracy of their general property records.

Elements of Sound Power Developments

PUBLIC utilities, for their own salvation if for no other reason, should take it upon themselves to instruct the public regarding the elements of sound water-power development. They should point out to the layman that it is not sufficient merely to have potential water power. It must be technically feasible to develop the power economically, and there must be a market available within reasonable distance. Consideration must be given to variations in water flow during the year. The minimum flow limits the power which can be developed unless storage or a reserve steam plant is provided. The cost of these must logically be charged against the water-power development. In addition it should be emphasized that subsoil formation must have careful attention because otherwise the water in storage may leak through or the dam may be washed out, while if the site is in rugged country, away from transportation, the construction may be impracticable or prohibitively expensive.

Last but not least, attention should be called to the necessity of a market within economical transmission distance. To have a possible market is not enough. One must exist. It is not good engineering to pay fixed charges on the whole development and have a demand for only a part of the power. Furthermore, there is little economy, if any, in developing a water power for only part of the ultimate output, since the first investment is the heaviest.

Arithmetic and Rate Fixing

A DISINCLINATION to prepare in brief form a thorough computation demonstrating the estimated possibilities and justice of questioned rates is natural to a central-station manager who realizes that judgment plays a leading part in the determination of rates by the regulating commission. In trying to ascertain the cost of a particular service certain operating expenses can be set down with fair accuracy, and sometimes initial plant and development costs are available to enable the rate base to be found to a substantial percentage of its total. Beyond the zone of definite figures, however, lies a sort of No Man's Land of uncertainty across which the way must be picked according to the wisdom and judgment of those who are attacking the problem of conquering the combined tangibles and intangibles of rate determination. It is because of the latitude involved in passing upon cost exhibits and estimates of rate equity that it often seems not worth the effort to set down the arithmetic of rate making. Such an attitude overlooks the value of computations from the standpoints of suggestion and of open-handed publicity. The commission may modify the computations and it may make sweeping changes in the assumptions and allocations in the company's efforts to vindicate a particular schedule; but the possibility of this ought not to deter as complete a demonstration as possible of how the rate base is attained and the charges thereon are supported. Rate fixing is far more than an arithmetical problem; but it demands arithmetical computations in order that the conclusions of both experience and assumption may be properly attained. Assumptions as to the rate of depreciation, period of cost during which investment should be computed, the future price of money and other things cannot be picked off an adding machine like the items of a grocery bill; but these must fall into line in the grand assault upon the factors involved in a reasonable rate, and if the company omits them, the opposition and the commission must make their own. A consistent, straightforward setting forth of the reasons why rates in particular cases are just to a company and its customers is as useful in the establishment of a rate in the face of opposition or ignorance of the facts as is the supporting artillery fire in an infantry advance. Failure to set forth in arithmetical form the asserted equity of a stated rate under critical or searching fire puts the operating company at a decided disadvantage in proceedings where the best judgment of all concerned is needed to reach a sound decision.

Electromagnetism One Hundred Years Ago

BY A FORTUNATE coincidence of dates, the ELECTRICAL WORLD is enabled this week to celebrate with its readers a memorable day, the one hundredth anniversary of the discovery of electromagnetism. It might be said that the electromagnetic theory had its inception in the announcement of his discoveries by Oersted on July 21, 1820, and that it was fully formulated and launched by Ampère on Sept. 18, 1820, exactly one hundred years before the date of this issue of the ELECTRICAL WORLD. On another page may be found a series of letters recalling to mind the wonderful genius of the men who worked out electromagnetic relations in the face of every obstacle. These early scientists had practically no facts upon which to build, and there existed no little misconception, prejudice and confusion which they had to overcome; but the facts established by Oersted and formulated by Ampère have become the underlying law of electrical science.

It is interesting to note that Oersted and Ampère were both college professors, as were many of the others whose contributions added materially to the work of these two. And in looking over the names of the men who have contributed letters to this centennial celebration, men distinguished in electrical science in our day, it may be observed that most of them also are, or at least were, college professors. The occasion should not be allowed to pass, therefore, without calling attention to the great importance of the work of purely scientific investigation even now going on in our university laboratories as well as in many progressive industries. By all means let this work be directed along useful lines where possible; yet there is still the necessity for the exploration of new ground which may not now offer promise of fertility but which may some day bring forth a tremendous harvest, as in the case of the work of Oersted and Ampère.

Appreciation of the achievements of these pioneers should induce a healthy respect for the work of our own investigators and result in increased encouragement of their efforts.



John Lyell Harper

The engineering genius back of the power developments at Niagara Falls whose resourcefulness has made it possible to use Niagara's waters without marring its beauty

THE most famous power development in this country, from the standpoint both of the engineering it represents and the service it renders to industry, is situated at Niagara Falls. This work stands as a monument to the genius of John Lyell Harper, whose name is as inseparably linked with it as is the wealth of the well-known Schoellkopf family that has made that development possible. It is due wholly to Mr. Harper's vision and engineering judgment that there stands today on the American side a mammoth station of 250,000 hp. where in 1902 there was a total rating of only 14,000 hp. The recent addition of 100,000 hp. which is described in this issue, built as a war need in record time and at a remarkably low cost, is the latest product of his engineering ability. In developing Niagara Falls Mr. Harper has devoted much study to ways and means to preserve the scenic beauty of the great cataract.

Besides his responsibilities as vice-president and chief engineer of the Niagara Falls Power Company, Mr. Harper has made scientific investigations of the applications of electric service in the electrochemical and electrometallurgical industries at Niagara Falls and has developed and patented several electric furnaces. In all his work he has maintained high engineering standards and ideals and has done much to stimulate manufacturers to turn out the highest grade of product rather than simply to meet specifications. One outstanding accomplishment was increasing the over-all plant efficiency from 65 to 90 per cent.

Mr. Harper was born at Harpersfield, N. Y., in 1873 and was graduated from Cornell University with the class of 1897. He first took up practical work with the Union Electric Company at Seattle, Wash. A year later he became associated with the Twin City Rapid Transit Company and the St. Croix Power Company of Wisconsin and spent three years in central-station design and operation. In 1902 he joined the engineering staff of the Hydraulic Power & Manufacturing Company at Niagara Falls, becoming its chief engineer two years later. Under the stress of war needs, the federal authorities brought about the merger of the power companies at Niagara Falls, and it is a fitting tribute to Mr. Harper's vision and ability that the developments of the consolidated companies were placed in his hands and that in 1919 the responsibility of vice-president was added. Mr. Harper works with his head, his heart and his hands, and, great as his past achievements have been, it is safe to say that his labors at Niagara Falls have only begun

Niagara Falls 100,000-Hp. Development*

Although Built Under the Stress of War-time Conditions, the Niagara Falls Power Company's New 100,000-Hp. Extension Embodies the Latest Word in Hydraulic and Electrical Development — Reliability of Operation and Maximum Efficiency Given Chief Consideration

By JOHN L. HARPER
Vice-president and Chief Engineer Niagara Falls Power Company



WHEN the war came and shells and guns and ships and motor trucks and phosphorus and gas were found vital to the existence of the nation and its allies, our government functioned through representatives whose minds appreciated values at Niagara other than in thundering vibrations and clouds of spray, wonderful as both may be in times of peace. There was no hesitation on the part of the directors of the war in first restricting Niagara power to the manufacture of basic materials and then demanding further development of power so that the production of these materials might be increased. All parties interested in power development at Niagara Falls were asked to submit plans and propositions for a "rush" development of the remaining water available for diversion under the treaty with Great Britain. From these competitive plans one of those presented by the Hydraulic Power Company of Niagara Falls was approved by the War Department as that which would produce the largest amount of power in the shortest time and at the same time be a proper and efficient power development after the stress of war had passed.

The plan approved by the War Department required the use of all the water to which the various operating companies at Niagara Falls had proprietary rights. To unify these rights it was obviously the easiest way to consolidate all the power companies, and upon suggestion of the War Department such consolidation was undertaken. The Niagara Falls Power Company, Hydraulic Power Company of Niagara Falls and Cliff Electrical Distributing Company were consolidated under the name of the Niagara Falls Power Company, the control and management of the consolidated company resting in the former owners of the Hydraulic Power Company.

Scope of Development

In the early part of May, 1918, authority was received from the Secretary of War with orders to proceed with the development in accordance with the approved plan under the supervision of an officer of the Corps of Engineers. The scope of the work carried out under this plan included the deepening of the intake from the Niagara River, the development and installation of improved ice-deflecting booms, the deepening of the Hydraulic Canal through the city of Niagara Falls, the construction of a new forebay, and three slope tunnels for taking the water from the forebay to the edge of the river in the middle basin, where the power plant was constructed as an extension to Station No. 3, the former Hydraulic company's plant, now known as the Hydraulic plant.

Three hydro-electric units were designed, to be equal in size and to have a combined output at the highest efficiency of 100,000 hp. In view of the peculiar conditions that existed on account of the war, and in order to secure quick delivery, the contracts for the manufacture of the waterwheels and generators were distributed as follows: One complete hydro-electric

*First installment of a symposium on the 100,000-hp. extension to Station No. 3 of the Niagara Falls Power Company.

unit to the Allis-Chalmers Manufacturing Company, two waterwheels to the I. P. Morris department of the William Cramp & Sons Ship & Engine Building Company, one generator to the General Electric Company and one generator to the Westinghouse Electric & Manufacturing Company.

On account of the urgent need of this work by the War Department, A-1 priority orders were given by it to the builders for the obtaining of materials necessary for manufacture and construction, and sympathetic and effective assistance was rendered by all government departments in carrying out this work.

The contracts for the building of these waterwheels and generators were not placed on a basis of competitive prices, nor were specific guarantees of efficiencies exacted. As all of the power companies on the American side were to become one, it was deemed advisable to allow all of the larger manufacturers of this class of apparatus to have an opportunity to show what they could do in the production of these new units, which were expected to be the last word in hydro-electric design. All of the manufacturing companies approached their tasks with enthusiasm and patriotic endeavor to produce the best, and now, when all three of these units are in operation, it is impossible to say that any better apparatus could have been constructed under the most minute specifications and inspection. All of these companies not only co-operated fully with the War Department and the power company in meeting with dispatch the emergency requirements of rush production, but at the same time gave such careful and efficient attention to the whole design and manufacture that the resulting machinery was of the highest class known to the art. Although the machines are of different manufacture, the builders co-operated to produce similarity in their exteriors, thus giving a uniform and pleasing appearance to the station.

Although the official efficiency tests have not as yet been completed, it is apparent from those already made that the hydraulic efficiency will equal or slightly exceed 93 per cent, and that the efficiency from forebay to the switchboard will be over 90 per cent. The units have each demonstrated their ability to operate continuously at 40,000 hp., although the combined operating station output is considered as 100,000 hp.

These are at present the largest hydro-electric units in the world, and it is a subject for pride in our American manufacturers that these four companies, as well as those manufacturing valves, bearings, etc, have mutually taken this step in advance without failure in any particular.

The construction work was carried out in the face of unusual obstacles in procuring both labor and materials, yet in all cases the manufacturers of the principal parts of the apparatus lived up to their agreements as to time of completion. If the construction and installation had been pushed with the same vigor after the armistice was signed as it was before, it is probable that the first unit would have been put in operation in fourteen months after the word was given by the Secretary of War, but, under the reduced schedule as to progress, the first unit was not put in operation until nineteen months after authority was received to proceed.

The writer wishes to express his appreciation of the loyalty and efficiency of the engineering and construction staffs of the Niagara Falls Power Company, which were obliged to make the plans at the same time that the work was in progress, and whose ability and efficiency may be measured by the fact that in spending about $8,000,000 less than $1,000 was wasted in changes

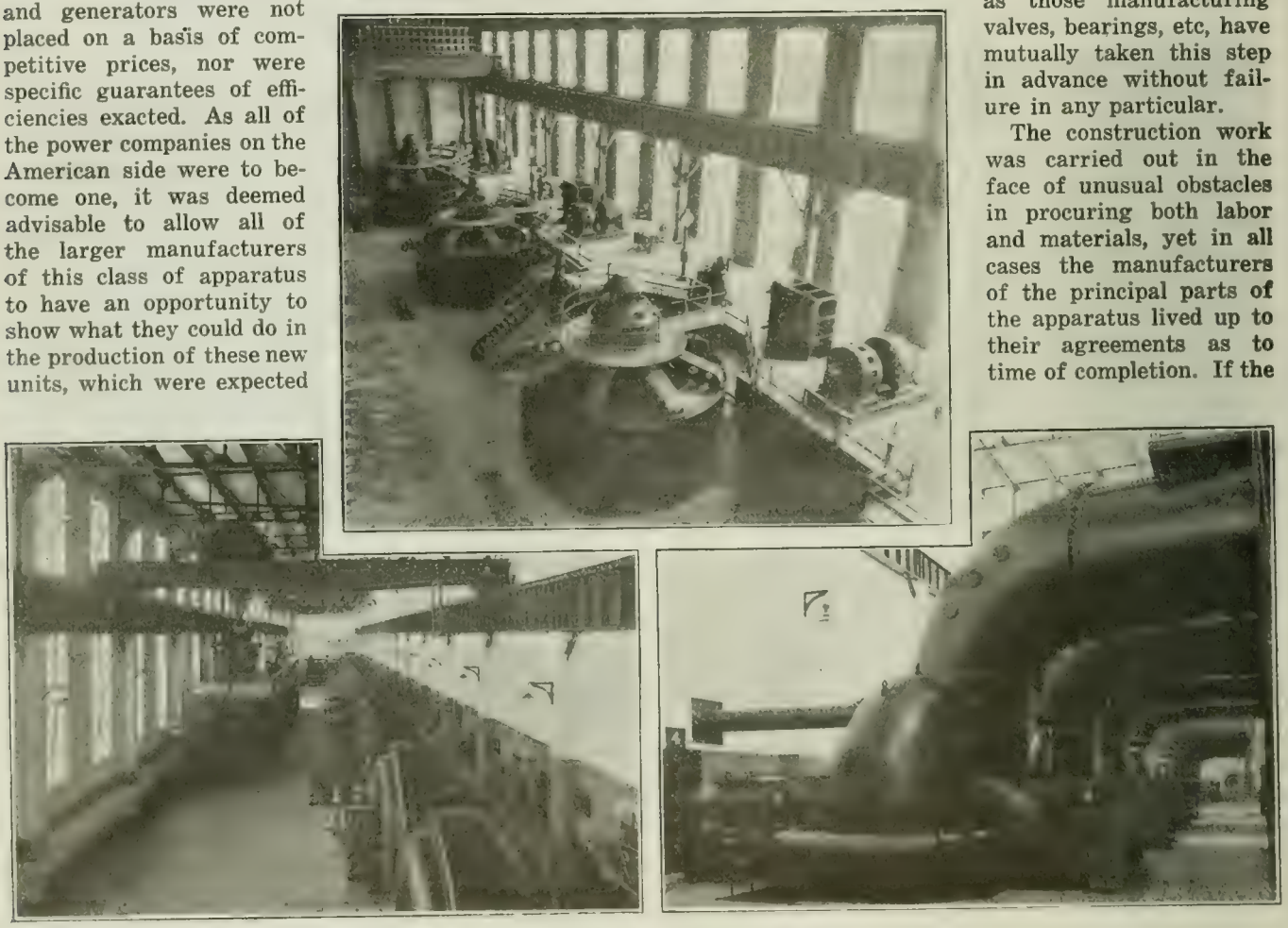


FIG. 1—THE NEW AND OLD AT NIAGARA NO. 3

At the top are the three new generators rated at 35,000 kw. but capable of developing 40,000 kw. Their magnitude is indicated by comparing them with the desk appearing just above the top of the nearby unit. In the lower left-hand view is a long hall of horizontal shaft generators driven by waterwheels on the opposite side of the wall. These wheels are shown in the right-hand view. All of these units are in the Hydraulic Plant No. 3, which is shown in Fig. 5.

of plans. In addition to those engineers who have contributed to this symposium and installments which are to follow it is desired to express appreciation of the efficiency and co-operation of Ross R. Coddington, general superintendent, whose aggressive and efficient personal direction of the construction work made possible the balance and speed with which the various parts of the work were completed in proper co-ordination without sacrifice of quality or perfection in workmanship. Also Benjamin F. Lee, operating superintendent, whose resourcefulness and experience overcame all obstacles in operating the older plants of the system during the interference of both mechanical and electrical construction by the building of this extension.

General Engineering Problems Involved in the Development

Steps Taken to Assure Ample Water in Winter—Vertical Units Allow for Large Fluctuations in Tailwater Elevation—Study of Draft Tube Requirements

BY GEORGE R. SHEPARD

Assistant chief engineer Niagara Falls Power Company

AT THE time of the United States' entry into the war the Niagara Falls Power Company was entitled to draw from the Niagara River not to exceed 8,600 cubic-foot-seconds (240.8 cu.m. per second) and the Hydraulic Power Company was entitled to 6,500 cubic-foot-seconds (182 cu.m. per second). Very soon thereafter the need for power for war industries became so great that the War Department issued additional permits to both companies to cover the maximum output of the apparatus

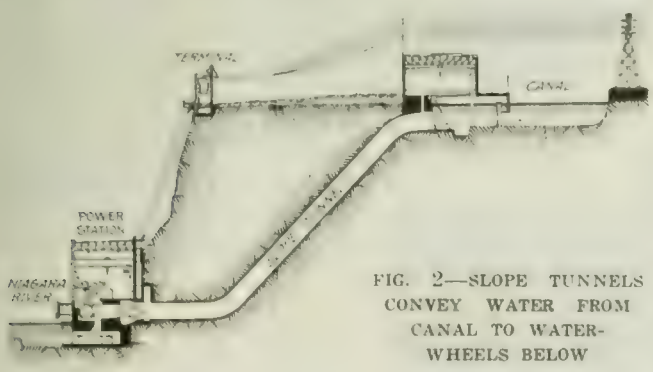


FIG. 2—SLOPE TUNNELS CONVEY WATER FROM CANAL TO WATER-WHEELS BELOW

then installed. After the merger of the two companies and the agreement of the consolidated company to proceed immediately with a new development, a permit was issued for the entire amount of water available at Niagara Falls under the treaty, or 19,500 cubic-foot-seconds (546 cu.m. per second). Fifteen thousand one hundred second-feet (422.8 cu.m. per second) of this could be utilized by the normal capacity of the existing plants, leaving a balance of 4,400 cubic-foot-seconds (123 cu.m. per second) for the new development.

The total diversion can be obtained continuously because the Niagara River is the natural outlet of a drainage area of about 300,000 square miles (750,000 sq.km.), making the variation of the river flow from normal comparatively small, although there is a small seasonal variation. Variations of greater amount are caused by winds and occasionally by ice jams but last only for a short period of time. Therefore, except for severe ice conditions, the river fluctuations are not an operating problem, nor will they be until there is considerably more diversion.

The combination of extremely uniform flow and a fixed maximum diversion limit placed the company in a position where load factor was, as it still is, the controlling economic element. Unless the company maintains continuously its maximum diversion, there is a certain

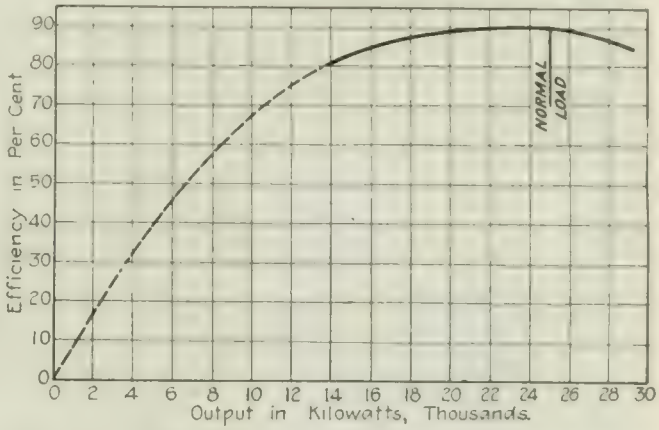


FIG. 3—AVERAGE OVER-ALL HYDRAULIC PLANT EFFICIENCY AT DIFFERENT OUTPUTS

amount of energy absolutely lost not only to the company but to the country in general. If the Niagara load were combined with a steam plant, economy would require a reversal of the usual custom and a supply of the base load by the hydraulic plants and the peak by the steam plant. It seems therefore that Niagara power is economically suited for industries requiring a continuous twenty-four-hour load and that any service with an inherently low load factor represents an economic waste.

The dire necessity for extreme speed in the development of power to meet the war demand for electrochemical products decided the power company in utilizing as far as possible its existing development to facilitate the new development.

The existing development consisted of a surface canal 100 ft. wide and 15 ft. deep, passing from the upper

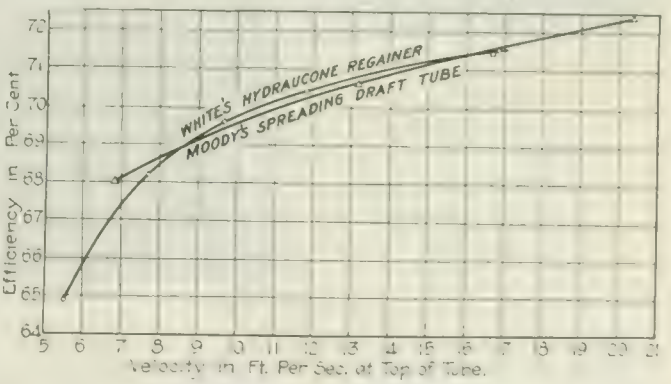


FIG. 4—EFFICIENCIES OF TWO TYPES OF DRAFT TUBES USED AT DIFFERENT RATES OF DISCHARGE

river through the city about 5,000 ft. to a forebay overlooking the high bank of the lower Niagara River. At this point is Station No. 3, which took water from the canal through thirteen steel penstocks built outside of the cliff, though now concealed from view by a face wall.

The water was delivered under a 212-ft. head to thirteen horizontal turbines of 10,000 hp. each.

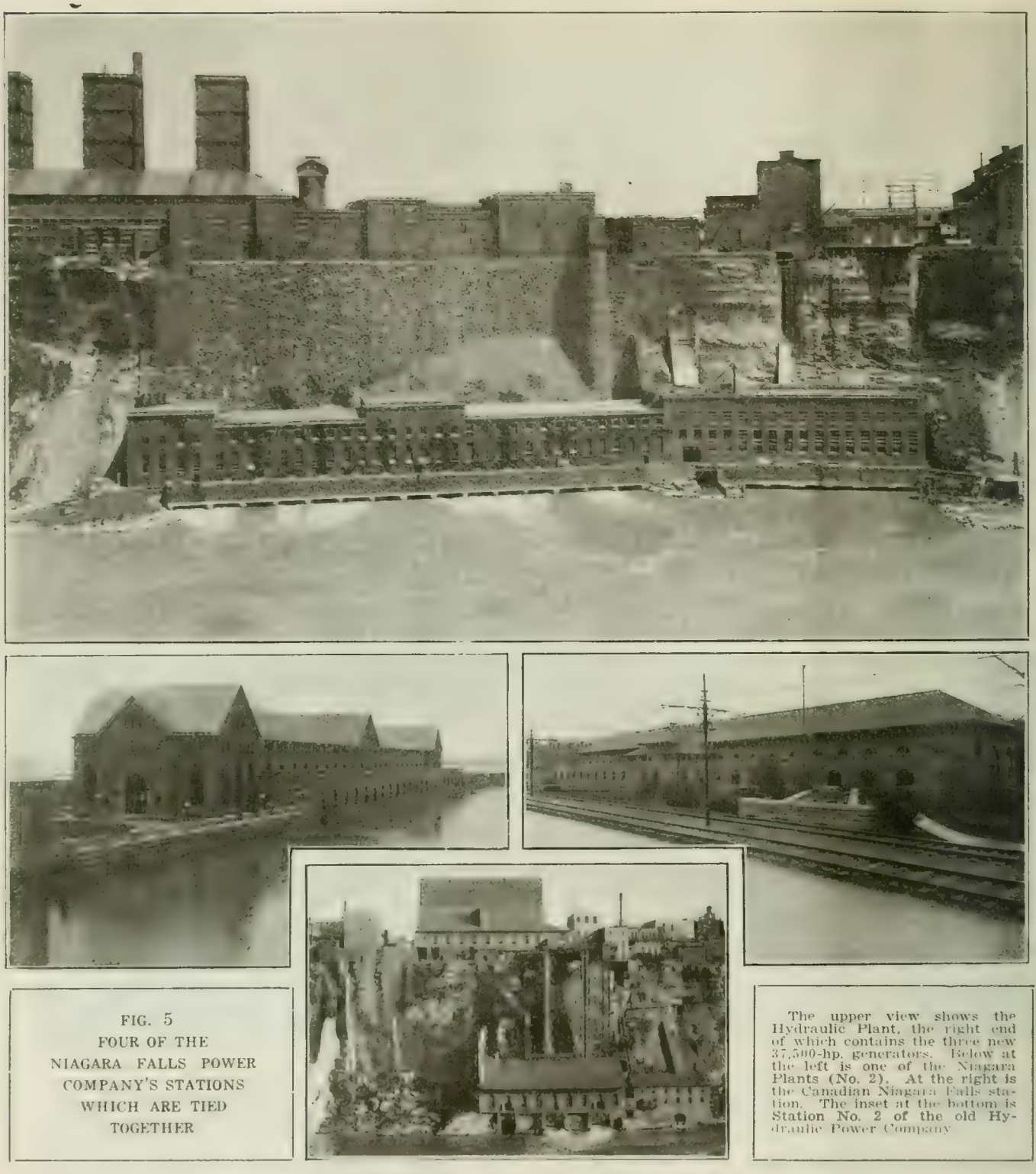


FIG. 5
FOUR OF THE
NIAGARA FALLS POWER
COMPANY'S STATIONS
WHICH ARE TIED
TOGETHER

The upper view shows the Hydraulic Plant, the right end of which contains the three new 37,500-hp. generators. Below at the left is one of the Niagara Plants (No. 2). At the right is the Canadian Niagara Falls station. The inset at the bottom is Station No. 2 of the old Hydraulic Power Company

The new extension to Station No. 3 was built immediately upstream from the existing plant. It consists of three 15½ ft. penstocks opening directly from the canal through a new forebay and passing through the limestone rock at a general slope of 45 deg. to the power house built as an extension of the old power house just above the lower river level. Here are installed three vertical units of 37,500 hp. each. Along the river side of the building at the level of the thrust bearing deck of the generators is the operating gallery.

At the point where the power company takes its water, the Niagara River is a broad stream, and the main channel is near the Canadian side. Between the main channel and the company's intakes there is a broad stretch of water intersected with submerged reefs and ridges and having a depth of from 4 ft. to 14 ft. (1.2 m. to 4.2 m.) at the mean stage of water elevation.

The stream never freezes solidly over its entire width, and the outer line of the solid shore ice remains in approximately the same place from year to year.

One engineering problem involved in the new development was to obtain the normal supply of water for the power plants during the winter period of low temperatures and severe ice conditions. The company's engineers had studied this problem for twenty years and were prepared with the proper solution. A deep chan-

nel about 200 ft. (60 m.) in width was dug from the company's inlet outward to the edge of the ice line. Commencing at the intersection of this channel with the ice line, a series of piers were built, running upstream in the general direction of the ice line but gradually working in toward the shore. Floating booms were placed from pier to pier. About half way between this row of piers and the shore another row was placed, extending in the same direction and supporting floating booms in the same manner as the outer row. See Fig. 10.

This system has been in operation through one exceptionally severe winter and has proved entirely satisfactory. The booms have kept out the ice floating down the river, and what small amounts actually formed inside the booms have been broken up from time to time in small quantities by the company's ice-breaking tugs and allowed to flow down the canal, where they were disposed of through the spillway gates.

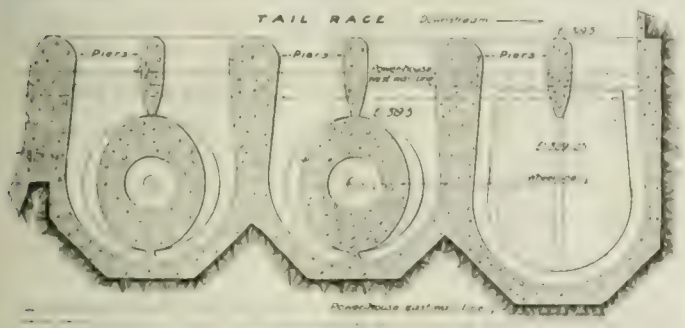


FIG. 6—HORIZONTAL CROSS SECTION THROUGH THE TWO TYPES OF DRAFT TUBES EMPLOYED

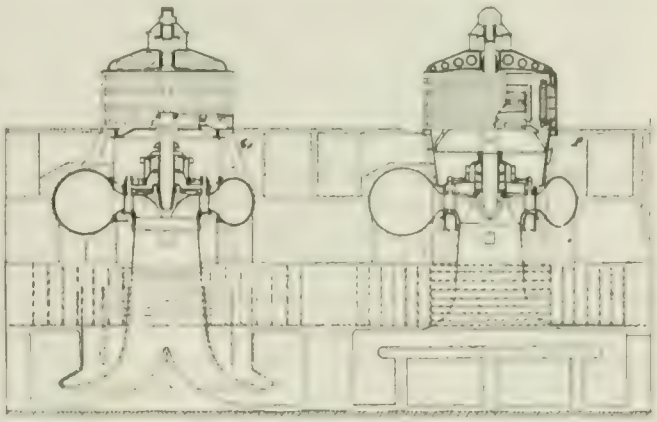


FIG. 7—CROSS SECTIONS THROUGH TWO TYPES OF WATER-WHEELS USED SHOW DIFFERENCES IN DRAFT TUBES

Prior to this extension the canal was 100 ft. (30 m.) in width and varied in depth at the high-water period of the year from 15 ft. to 22 ft. (4.5 m. to 6.6 m.). In order to get sufficient water through the canal to run the added equipment it was necessary to enlarge the cross section. The canal runs through the most thickly settled portion of the city, and it was impossible to acquire property rights to widen the canal, so that the only possible thing to do was to deepen it. Drilling, blasting and dredging seemed to be the only practical method, although the proximity of large buildings introduced an element of risk which made extreme caution necessary.

The canal is spanned by eight bridges, having a clearance above the water surface of from 6 ft. to 15 ft. (1.8 m. to 4.5 m.), which prohibited the use of the ordinary type of dredge, but the long experience of the company's general superintendent with this class of work had evolved a dredge model that accomplished the work without any undue difficulty.

SELECTION OF WHEELS

The experience of the power company in former developments led to the adoption in 1906 of the horizontal-shaft units for the plant then being designed. However, in 1916, when most of the preliminary engineering on the present extension was undertaken, the Kingsbury and General Electric thrust bearings had reached a stage of perfection that eliminated the engineering problem in connection with the supporting of the weight of the rotating parts of the unit. These mechanical difficulties having been eliminated, the efficiency of the unit became the deciding factor, and the vertical units were used as offering the best opportunity for the development of a high efficiency. This type also made possible a vertical discharge and eliminated one 90 deg. bend in the draft tube.

Furthermore the surface elevation of the water in the lower river fluctuates through a vertical range of about 30 ft. (9 m.), so that the vertical design of unit offered the only means of getting the waterwheel runner low enough to get the full benefit of the low-water stages and at the same time have the electrical machinery high enough to be safe from damage during high-water stages. The available head obtained by this arrangement varied from 210 ft. to 220 ft. (64 m. to 64.6 m.), the mean being 215 ft. (64.3 m.).

Having determined the head, the maximum safe specific speed for the Francis type of runner was at

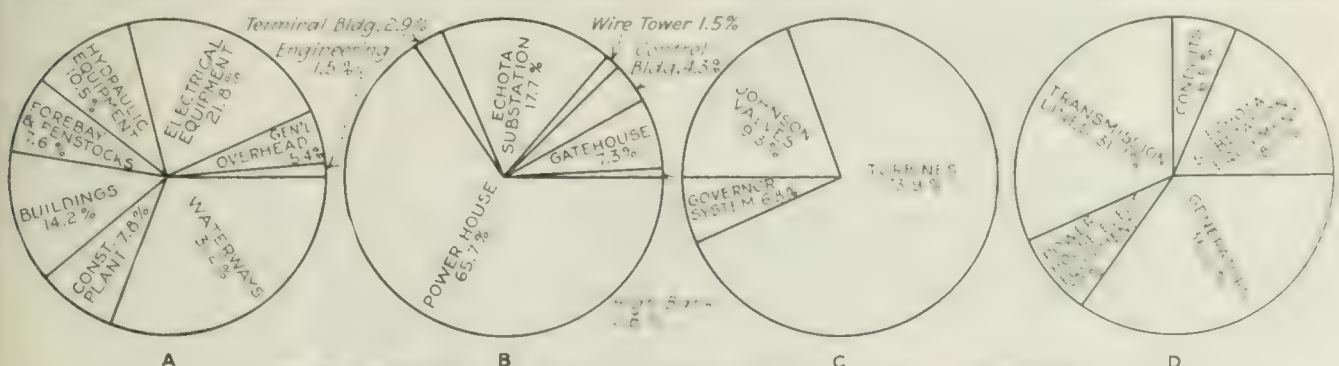


FIG. 8—SUBDIVISION OF CAPITAL INVESTMENT IN NIAGARA FALLS EXTENSION

A and B—Subdivision of expenses for entire extension including power plant, substation and transmission lines in different ways. C—Subdivision of investment in hydraulic equipment. D—Subdivision of investment in electrical equipment for entire extension. The low engineering expense was due to employing men who were thoroughly familiar with existing conditions and who were thoroughly experienced along lines for which they were responsible. Note that the waterways constituted over 31 per cent of total investment.

once known and gave a rough idea of the limitations of speed and load for each unit. There was available for development 4,400 cubic foot-seconds (123 cu.m. per second), and the problem was to determine the number and size of units which would most efficiently develop that amount of water. Consideration of this feature and the rough limitations set by the specific speed led to the selection of three units as the proper number to use. The number of units being fixed, the next thing was the point of maximum efficiency for each single unit, which was set at the point of use of 1,500 cubic foot-seconds (42 cu.m. per second). The experience of the waterwheel builders was that in order to arrive at this result it would be necessary to design the wheels for a maximum output of from 10 to 12 per cent in excess of the point of maximum efficiency. The builders further agreed that with the hydraulic efficiency naturally to be expected this maximum output would be 37,500 hp. The combination of this maximum output with the specific speed and periodicity of the current to be

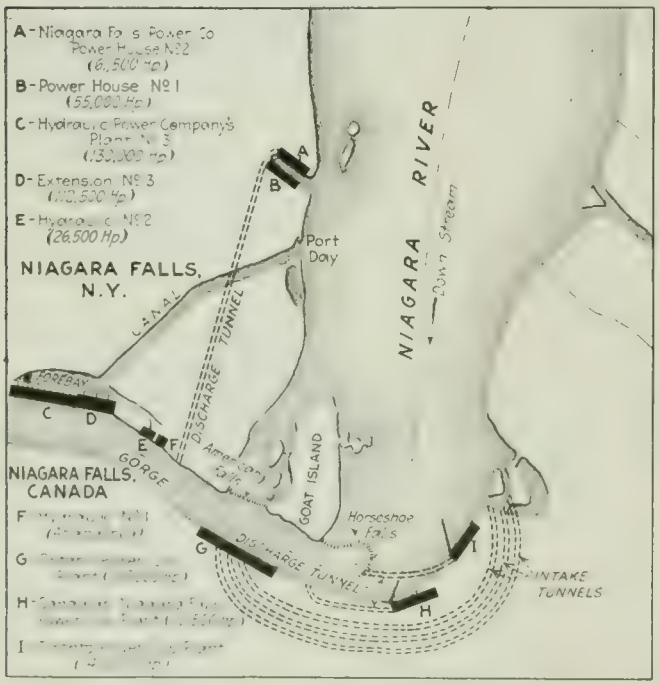


FIG. 9—LOCATION OF STATION NO. 3 EXTENSION WITH RESPECT TO OTHER PLANTS IN THE NIAGARA FALLS SYSTEM

generated fixed the speed of the unit at 150 r.p.m. per minute.

Having determined the over-all characteristics of the installation, the first minor problem to obtain consideration was that of the proper shape of the draft tube.

The ideal draft tube would, of course, be a straight tube of uniformly enlarging cross-sections, the expansion angle being in the neighborhood of 4 deg. This ideal shape of draft tube is impracticable in most installations on account of the prohibitive cost of the excavation required. It was necessary, therefore, to determine some form of tube which would accomplish the same purpose in a much shorter vertical distance.

The company's engineers designed and developed an apparatus for testing the regain efficiency of a series of model tubes, and, after a long series of experiments on many different models, decided on the White hydraucone and a somewhat similar form of tube designed by the I. P. Morris department of the William Cramp & Sons Ship & Engine Building Company as offering the best practical solution of the problem.

Hydraulic Design and Efficiency of Units and Plant

Large and Easy Waterways Provided—Two Types of Draft Tubes Selected—New Method of Testing Wheels

BY N. R. GIBSON
Hydraulic Engineer Niagara Falls Power Company

EFFICIENCY was the underlying principle upon which the design of Station No. 3 extension was based, and to this end hydraulic losses were reduced to a minimum by providing large and easy waterways and by special attention to the design of some details which frequently are not so carefully considered. For the nominal velocities in the various waterways, the following were chosen:

	Ft. Per Second
Canal	4.5
Forebay	1.5
Through racks	1.8
Penstock entrances	3.0
Penstocks	8.0
Entrances to turbine gates	17.3
Top of draft tube	20.0
Exist from draft tube	5.0
Tailrace	3.5 to 4.5

With these velocities the resulting hydraulic losses from forebay to tailwater, exclusive of turbine efficiency, has been found to be approximately 2 ft. at normal load, less than 1 per cent total average head available.

In collaboration with the designers of hydraulic turbines, considerable attention was given to the designs of draft tubes, and after experimenting with about twenty-five draft tube models of various designs two types were finally adopted and constructed in the powerhouse foundations. The right hand view of Fig. 7 shows the hydraucone regainer patented by W. M. White of Milwaukee; the left view shows the spreading draft tube patented by Lewis F. Moody of Philadelphia. The efficiencies of these two tubes, as shown by Fig. 4, were practically the same, and both gave results which were far in excess of the efficiency of any other model of equal dimensions.

The effect of these draft tubes is to maintain flow parallel to or radially from a central axis, with a gradual diminution of velocity until the velocity of discharge is finally reached. Such designs allow free play for the whirls in the water as it leaves the runner until the velocity of whirl has been greatly reduced. Large losses are thus prevented which occur when the direction of flow is changed, as in a bent tube, before the velocity of the whirl has been reduced. The passages are also designed so that the hydraulic friction losses throughout the tube are reduced to a minimum.

So far as can be ascertained, the adoption of these draft tubes has been fully justified by the results attained, such as the direct gain in efficiency and the freedom from excessive vibration of the machinery.

The efficiencies of the hydraulic turbines received particular consideration, but no guarantees were exacted from the manufacturers. Instead, each manufacturer agreed that "In lieu of any guarantees of efficiency the contractor will use its best engineering talent and skill in the design and construction of the turbine, to the end that the highest attainable efficiency may be secured. It is expected, but not guaranteed, that the combined efficiency of the turbine and generator will be as high as 90 per cent."

With this ideal constantly in mind each contractor has put into the work the best design, material and workmanship of which he was capable, and more than the expected efficiency has been attained.

Provision for testing the wheels in place was made by building a testing chamber around the base of the slope tunnels so that Pitot tubes or other equipment might be readily installed. While tests of the wheels may be made by using Pitot tubes and chemical gagings, it has not been possible to have such tests carried out up to the present time. However, complete efficiency tests have been made by a new indirect method of water measurement recently invented by the writer. This method, sometimes called the "pressure-time process,"* utilizes the relation between velocity change and rise of pressure, and by means of specially designed apparatus* there is produced a diagram, called the pressure-time diagram, from which the mean velocity in the conduit may be calculated. The apparatus, which is attached to a small piezometer tube tapped into the wall of the penstock at any convenient point, records on a sensitized film or paper the changes of pressure that occur in the penstock with respect to time. The changes of pressure are produced by the simple process of closing the turbine gates, or in some cases the Johnson valve.

The procedure for a test by this method may be briefly described as follows: The turbine gates are put on hand control, and steady conditions of load on the unit are maintained for several minutes until the flow in the penstock has become as uniform as possible. Readings of headwater and tailwater elevations are taken in the usual manner, and the pressure head at the entrance to the turbine casing is observed by gage or piezometer, so that allowance may be made for the loss of head in the penstock. Measurements of the generator output are taken by calibrated wattmeter and auxiliary instruments, and, if the unit is separately excited, ammeter and voltmeter readings of the exciting current are also obtained. When conditions have been steady for several minutes the turbine gates are closed gradually by operating the hand-control of the governor. During the closure the load thrown off the generator is taken up by the other units operating in synchronism with it. At the same time the Gibson apparatus makes its record of the changes of pressure that occur in the penstock. From this record may be calculated the mean velocity of the water in the penstock prior to the shutdown. Having determined the velocity, the discharge is readily computed, and after allowing for the known efficiency of the generator the turbine efficiency is calculated in the usual manner.

*Patents applied for by N. R. Gibson

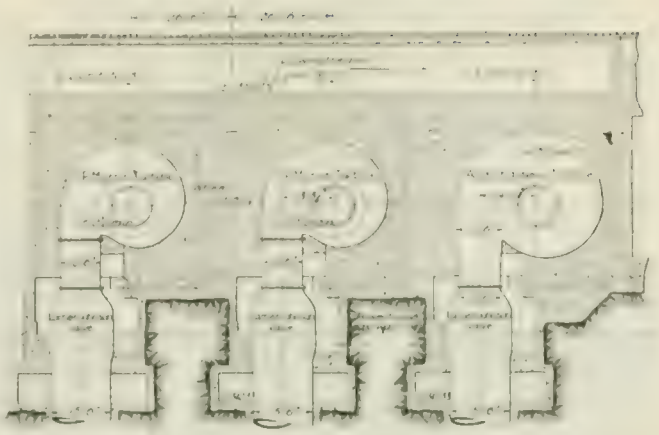


FIG. 11—HORIZONTAL CROSS SECTION THROUGH THE THREE NEW WATERWHEEL FOUNDATIONS

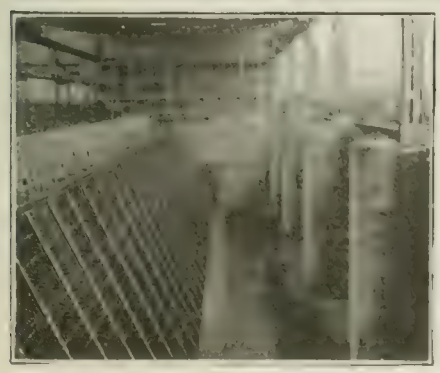
From these tests it has been determined that the turbine efficiencies are in excess of 90 per cent from half gate to full load, reaching in each case a maximum of 93 per cent.

The average combined efficiency curve, including losses in penstock, Johnson valve, turbine and generator, is shown in Fig. 3. It will be noted that at normal load the efficiency from forebay to switchboard is 90 per cent.

FIG. 10 PROVISIONS FOR HANDLING LARGE VOLUMES OF WATER USED BY STATION NO. 3 WHICH, WITH EXTENSION, HAS RATING OF 250,000 HP.



At the top are ice diverters which have been anchored near canal intake to keep the waterway free of ice. Below, at the left, are the intake racks for the new units. The racks are removed when slush ice is flowing. The flaring draft tube of one unit shown in the middle view looms up like a cavern back of the man shown. At the right is a view from the draft tube looking up toward the outlet of one wheel







Effect of Loading on Construction of Substructures

Large Water Discharge Areas Required Special Construction—Eleven-Foot Foundation Slabs Were Specially Reinforced

By L. S. Bernstein
Designing Engineer Niagara Falls Power Company

IN PLANTS where the combination of a moderate discharge and the bent-tube type of draft tube exists the problem of supporting the turbine and generator is comparatively simple, as the loading is usually small and the natural arch of the bent tube acts as the support on one side and the concrete mass foundation as the support on the other side. As the unit becomes larger and both the clear span of the tailrace and the load to be supported become greater, however, the arch type of construction is not feasible, so the problem of supporting the unit becomes more complicated.

Where the turbines and generators are of extreme size and weight, as was the case at Niagara Falls, special provision must be made to take care of the vibration of the machine as well as the superimposed loads.

In the Niagara Falls development two types of waterwheels and draft tubes were used, so the substructures differed in some details. The draft tube of the Allis-Chalmers unit consists of a horizontal reinforced-concrete plate supported by three reinforced-concrete walls, the entire structure being centered in the tailrace directly under the discharge of the turbine. The draft tube of the I. P. Morris unit consists of heavy flared reinforced-concrete wings suspended from the foundation slab of the unit and a center cone extending up between and centering these wings. The foundations for the units outside of the draft tube are practically the same.

Condition of Loading

In the Allis-Chalmers unit the generator is supported by a heavy cast-iron frame called the "pit liner," which in turn is carried by the speed ring. The latter is supported by another circular casting called the "discharge ring," which rests on the foundation slab. The concrete inside of this casting is cut out and formed to the shape of the draft tube.

The generator in the I. P. Morris unit is supported by massive concrete piers which rest directly on the heavy cast-iron wheel case. The load is transferred from the wheel case to the foundation slab and the distribution is more favorable than in the other unit. The flared wings of the draft tube are attached to the bottom of the main foundation slab with three rings or reinforcing bars. The opening in the main slab is similar to that of the Allis-Chalmers unit.

The main foundation slab is 11 ft. (3.3 m.) thick and has a clear span of 45 ft. (13.5 m.). The reinforcing consists of eight bands of steel bars, each band containing twenty-five 1½-in. (3.75-cm.) square bars. In addition to this there are about 450 vertical 1-in. square bars, spaced on about 2 ft. (0.6-m.) centers over the entire area, acting like stirrups. For construction reasons it was decided to pour this slab in two layers. In addition to these vertical bars, limestone plums were placed so that about one-half of the stones projected above the neat line of the first pour to serve as an additional horizontal tie. The entire surface was picked, roughened and thoroughly cleaned before the final pour was made.

In the design of the main foundation slab each band was considered acting as a beam and assumed to carry one-eighth of the total load inside the neat line of the foundation piers, the load being considered as uniformly distributed. The foundation slab is carried by the main power house piers, which are spaced on 53-ft. (15.9-m.) centers, and one smaller center pier. The main piers taper from the river face of the power house to the center line of the unit and are joined together next to the bedrock by concrete to give a horseshoe-shaped tailrace.

[In later issues will appear contributions on the waterwheels, generators, electrical layout of the generating station, transmission line and substation.—Editor.]

Regulations Governing Water Power Permits and Licenses

REGULATIONS governing the application for and the granting of water power permits and licenses under the recently passed water power bill have been completed by the Federal Power Commission. There are ten regulations, as follows: (1) Definition of terms, (2) applications—general requirements, (3) applications for preliminary permits, (4) applications for licenses—major projects, (5) applications for licenses—minor projects, (6) applications for licenses—major projects already constructed, (7) declaration of intention, (8) priorities and preferences, (9) permits, (10) licenses. The last three are considered to be of such general interest that they are here printed in full.

Regulation 8. Priorities and Preferences

A. Priority of application for a license may be initiated either by the filing of such application under the provisions of Regulations 2 and 4 or 2 and 5, or by the filing of an application for preliminary permit under the provisions of Regulations 2 and 5, and will be established either by the issuance of a preliminary permit, or, if no preliminary permit has been issued or applied for, by the approval of the application for license. When two or more applications are filed for the same site the commission will give full consideration to all pertinent matters, including the relative dates of filing of application, before taking final action upon such applications.

B. Priority established by preliminary permit may be lost if there is failure to fulfill the requirements of the permit; if the permit is canceled by order of the commission upon failure of the permittee to comply with the conditions thereof; or if in the course of consideration by the commission of an application by the permittee for license, such permittee shall not before the expiration of the term of the preliminary permit or such later date as may be fixed by the commission,

(a) File data required by the commission in addition to that contained in, or furnished with, the application, or,

(b) Present satisfactory evidence of ability to carry out the plan set forth in the application, or,

(c) Accept the conditions of a proposed license, or,

(d) Modify its plans as required by the commission, if the project adopted by the applicant as disclosed in the plan set forth in the application is not such as in the judgment of the commission will be best adapted to a comprehensive scheme of improvement and utilization for the purposes of navigation, or water power development, and of other beneficial public uses.

C. Priority established by approval of application for license may be lost if the conditions of the proposed license are not accepted within a time fixed by the commission.

D. In issuing preliminary permits, or licenses where no preliminary permits have been issued, and in issuing licenses

to new licensees under section 15 of the act, the commission will give preference to applications therefor by states and municipalities, provided the plans of the same are deemed by the commission equally well adapted, or shall within a reasonable time to be fixed by the commission be made equally well adapted, to conserve and utilize in the public interest the navigation and water resources of the region; and as between other applicants, the commission may give preference to the applicant the plans of which it finds and determines are best adapted to develop, conserve, and utilize in the public interest the navigation and water resources of the region, if it be satisfied as to the ability of the applicant to carry out such plans; but such preferences will not be deemed to apply to the issuance of license under the provisions of the first paragraph of section 23 of the act.

Regulation 9. Permits

A. Except as hereinafter provided, preliminary permits may be issued on the application of citizens, associations, corporations, states or municipalities desirous of obtaining licenses for the construction, maintenance or operation of dams, water conduits, reservoirs, power houses, transmission lines, or other project works necessary or convenient for the development and improvement of navigation, and for the development, transmission and utilization of power across, along, from or in any of the navigable waters of the United States, or upon any part of the public lands and reservations of the United States (including the territories), or for the purpose of utilizing the surplus water or water power from any government dam.

B. Permits will be issued only for the purpose of enabling applicants to maintain their priorities while securing the data required for an application for license and will be for such periods, not exceeding a total of three years, as in the judgment of the commission will be necessary for studying the proper location and design of the project; for making examinations, surveys, maps, plans, specifications and estimates; for conducting stream measurements; for sinking test pits or making borings to determine foundations for dams or other structures; for securing a market for the power to be developed; for making financial arrangements; or for any other purpose necessary or desirable in the preparation of application for license.

C. Permits will not be issued for projects already constructed; for transmission lines alone; for projects of a power capacity of less than 100 horsepower; for projects which, in the judgment of the commission, do not come within the scope of its authority under the act, or should be undertaken by the United States itself, or do not propose adequate scheme of development, or would unreasonably interfere with projects under permit, license or other authority theretofore granted; or for projects for which data sufficient for filing application for license are already available. Permits affecting any reservation will be issued only after a finding by the commission that the proposed use will not interfere or be inconsistent with the purpose for which such reservation was created or acquired. Permits will not be issued until after the expiration of the publication period prescribed by the act.

D. In acting upon applications for preliminary permits, and in determining preferences therefor, the commission may in its discretion, upon the request of any applicant or upon its own motion, hold hearings, order testimony to be taken by deposition, summon witnesses, or require the production of documentary evidence.

E. No charges will be made for permits, but permittees will be required, as a condition of maintenance of priority, to perform such work and to make such studies and investigations, and such reports thereon, as in the judgment of the commission may be necessary or desirable to enable both the applicant and the commission to determine the feasibility, and the character and extent of development, which is proposed or which should be undertaken, which requirements will be expressed in the permit.

F. Upon a satisfactory showing of reasons therefor the commission may authorize permittees to perform such construction work as may be necessary to maintain water rights under state law, or as may be desirable in preparation for the construction of project works; but the granting of such authority shall not be deemed to have created any equities or to have established any rights beyond what would have been created or established had such authority not been given.

G. Permits will not be transferable and may be canceled by order of the commission for failure to comply with the conditions thereof.

H. Each preliminary permit shall set forth the conditions under which priority shall be maintained and a license issued, and shall also set forth the essential terms and conditions of such license.

Regulation 10. Licenses

A. Except as hereinafter provided, licenses may be issued either in accordance with the provisions of preliminary permits or upon direct application therefor by citizens, associations, corporations, states or municipalities, for the purpose of constructing, operating, and maintaining dams, water conduits, reservoirs, power houses, transmission lines, or other project works necessary or convenient for the development and improvement of navigation, and for the development, transmission, and utilization of power across, along, from or in any of the navigable waters of the United States, or upon any part of the public lands and reservations of the United States (including the territories), or for the purpose of utilizing the surplus water or water power from any government dam.

B. Licenses will be issued for such periods, not exceeding fifty (50) years, as in the judgment of the commission will, in each individual case, allow for the satisfactory development and operation of the project and protect the public interest, and shall remain in full force and effect for such periods unless surrendered or terminated as provided in these regulations or revoked as provided in the act.

C. Licenses will not be issued for projects which, in the judgment of the commission, do not come within the scope of its authority under the act, or should be undertaken by the United States itself, or do not propose adequate schemes of development, or lack satisfactory showing of financial ability, or would unreasonably interfere with projects under permit, license, or other authority theretofore granted, or would be opposed to the public interest. No license affecting the navigable capacity of any navigable waters of the United States will be issued until the plans of the dam or other structures affecting navigation have been approved by the Chief of Engineers and the Secretary of War. Licenses within any reservation will be issued only after a finding by the commission that the license will not interfere or be inconsistent with the purposes for which such reservation was created or acquired. Licenses will not be issued until after the expiration of the publication period prescribed by the act.

D. Licenses may be altered only upon mutual agreement between the licensee and the commission. Any such alteration shall be made a part of the license and a substitute for the provision altered, but no such alteration shall operate to alter or amend or in any way whatsoever be a waiver of any other part, condition, or provision of the license.

E. Licenses may be surrendered only upon mutual agreement between the licensee and the commission, and upon the fulfillment by the licensee of all obligations under the license, with respect to payment or otherwise, existing at the time of such agreement, and, if the project works authorized under the license are constructed in whole or in part, upon such conditions with respect to the disposition of such works as may be determined by the commission.

F. Licenses may be terminated by written order of the commission after such reasonable notice, not exceeding ninety (90) days, as the commission may grant, if there is failure to commence actual construction of the project works within the time prescribed in the license, or as extended by the commission. Under similar conditions and upon like notice the authority granted under a license may be terminated with respect to any project works or separable part thereof covered by the license, if there is failure to begin construction of such project works or parts thereof within the time prescribed in the license or as extended by the commission; but no part of the project works shall be deemed separable for the purposes of this regulation unless so specified in the license.

G. Licenses may be revoked only through proceedings in equity instituted in a district court of the United States for a district in which some part of the project is situated, and in the manner provided in the act,

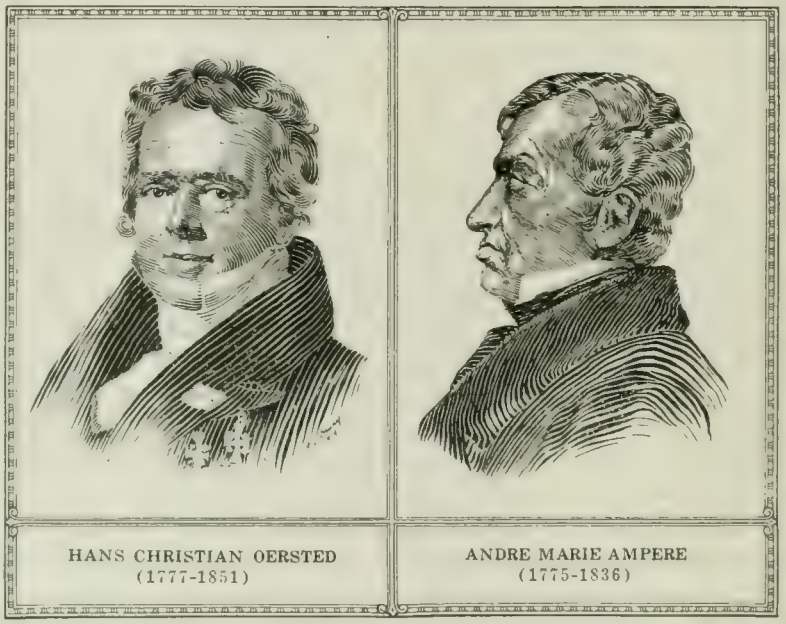
(a) In case construction of the project works covered by the license, or of any specified part thereof, has been begun but not completed within the time prescribed in the license, or as extended by the commission; or

(b) In case the terms of the license are violated by the licensee.

One Hundred Years Ago Today

Ampère Stated the Fundamental Electromagnetic Laws on Sept. 18, 1820, Based Upon the Discovery by Oersted That a Magnetic Field Is Set Up About a Conductor Carrying a Current

THERE are probably no more interesting pages in history than those into which are written the achievements of the early experimenters in electrical science. The present generation has seen a remarkable engineering development; the rise of radio communication, electric lighting and transportation and even the telephone have been witnessed by many who read these pages. No less remarkable, however, were the accomplishments of those who laid the foundation for electrical engineering a century ago, and it is particularly fitting, in this issue of ELECTRICAL WORLD, to call attention to the events leading up to the announcement by Ampère, on Sept. 18, 1820, of the laws governing the effect of a wire carrying a current upon a magnet and also on Sept. 25 of the same year, the force action of one wire carrying a current upon another. The paper by Ampère was frankly based upon the earlier work of Oersted, who discovered the effect of an electric current upon a compass needle and who explained the concentric nature of the magnetic field set up about a conductor carrying an electric current.



HANS CHRISTIAN OERSTED (1777-1851)

ANDRE MARIE AMPERE (1775-1836)

Volta in Italy had already produced the voltaic pile, made of layers of copper and zinc separated by a wet cloth, in 1799, when Hans Christian Oersted, a professor of natural philosophy in the University of Copenhagen, took up his study of electricity. It is said that he first noticed the effect of an electric current upon a compass needle when he brought a compass near a voltaic pile from which current was flowing, thus accidentally making a great discovery. There is evidence, however, that he had some conception of a relationship between electricity and magnetism as early as 1813, although he did not actually establish this relationship until 1820. But on July 21 of that year his famous paper "Experiments on the Effect of a Current of Electricity on the Magnetic Needle" was published and from that beginning progress in electrical science was rapid.

It is interesting to recall the words of Oersted, who gave his conclusions regarding the magnetic field set up about an electric current as follows: "It is sufficiently evident that the electric conflict is not confined to the conductor, but is dispersed pretty widely in the circumjacent space. We may likewise conclude that this conflict performs circles round the wire, for without this condition it seems impossible that one part of the wire when placed below the nagnetic needle should drive its pole to the east, and when placed above it should drive its pole to the west." This statement also offers a viewpoint from which one may appreciate the fact that Oersted and others of his time worked upon phenomena which could not yet be defined, for which there was yet no language with which to express the facts, and with only the voltaic pile and the compass for laboratory equipment.

Several weeks after the announcement by Oersted, his experiments were repeated before the Academy of Sciences at Paris on Sept. 11 and witnessed by the eminent French professor André Marie Ampère. Ampère's ability as a philosopher and scientist may be appreciated when it is recalled that his famous paper appeared on Sept. 18, a week later, in which he gave a complete explanation of the phenomena observed by Oersted. Ampère's analysis still remains a classic in electrical literature. Not only did Ampère show the force action between a magnet and an electric wire but he quickly analyzed that between two currents, and he also followed this up by showing that coils of wire carrying current developed magnetic poles and which were subject to calculation based upon his paper of Sept. 18.

With the establishment of the facts concerning electromagnetism and electrodynamics by Oersted and Ampère electrical developments followed in rapid succession. Ohm, in Germany, established the relation between electrical pressure, current and resistance which made possible a better understanding of the electric current and its control. A powerful electromagnet was also devised by William Sturgeon in 1825 by winding a spiral conductor upon a horseshoe magnet of soft iron.

In this period of important electrical development America was ably represented by Joseph Henry, who shares with Faraday the honor of discovering that induced currents are set up in a conductor by varying the magnetic field with which the conductor is linked. Henry also was first to conceive the notion of inductance or electrical inertia, and the unit inductance was quite appropriately given his name. The Yankee genius of making practical use of the progress in science was also demonstrated in the setting up and working of the first electromagnetic telegraph by Henry in 1831.

With this foreword to give some idea of the period in which Oersted and Ampère worked, a series of letters from prominent men in electrical science of this day has been arranged to express the debt of our own generation to these brilliant scientists of a century ago.

Ampère Gave Generous Credit to Oersted

A LETTER on this subject by the writer was published in the ELECTRICAL WORLD of June 19, 1920, also an editorial commenting on the same. That letter gives briefly the facts in the case as to the discovery of electromagnetism by Oersted and the complete working out of its theory, also the phenomenon and theory of electrodynamics, by Ampère. Particular attention was called to the fact that Ampère was able in one week to work out and formulate the theory of these two branches of science, also performing considerable experimental work on which his theory was based.

A book in the possession of the writer has the name "A. M. Ampère"



Francis B. Crocker

in his own writing on the title page. This book is particularly valuable in giving a detailed—in fact, almost daily—account in diary form of Ampère's work, both experimental and analytical. The book was written by Ampère himself and it is very significant, also characteristic, of his generous nature that the name "Oersted" usually appears several times on every page. Indeed, more than full credit is given to Oersted by Ampère for the discovery of the phenomenon.

Of course, the discovery was a very great event in the history of science and Oersted is entitled to much credit for making the discovery. Nevertheless, it was Ampère who carried the experimental work much farther in a more definite and quantitative manner and to him the principles and theories are almost entirely due. Moreover, the discovery, based on his own experimental facts, as well as the theory of electrodynamics, is all entirely due to Ampère.

It is all the more striking and all the more admirable in Ampère that he gave Oersted such full credit. The former was in Paris and presented papers to the Academy of Sciences nearly every week. He was in close touch with and in many cases actually had the ear of many of the most prominent scientists of Europe. Oersted was in Copenhagen, in those days far away from Paris. It would have been very easy for Ampère to have more or less ignored or gradually eliminated Oersted. In all of his published statements, however, for many months, if not years, he never failed to be more than magnanimous.

FRANCIS B. CROCKER,
Crocker Wheeler Company
Ampere, N. J.

Electromagnetism One Hundred Years Old

WHILE even in the days of Franklin's investigation of the electricity of friction—later called static electricity—there was present a suggestion of some relation existing between electricity and magnetism, it was not until two-thirds of a century later that this relation was established by Oersted's simple experiment of the deflection of a compass needle by a wire conveying a battery current.

It is on record, however, that Romagnosi of Trent about 1802 observed in a rather indefinite way that a voltaic pile affected a compass needle. It is probable that the current flowing was too small and too variable in his case to give results so definite as to command investigation, and it must be remembered that even in Davy's experiments in the early years of the last century the internal resistance of the batteries used was so high that in spite of the coupling of thousands of cells in series the current in a wire in the circuit must have been small. The coiling of the wire to increase its effects came much later. Oersted of Copenhagen made the real discovery. He found that a magnetic needle tends to set itself at right angles to a wire carrying a voltaic-battery current and investigated the law of turning to right or left according to the direction of the current in the wire and the position of the wire itself in relation to the free needle. The announcement of this great but simple discovery was received with much enthusiasm among the scientific men of the time, and experiment and discovery followed one another rapidly in the hands of Davy, Ampère, Arago and others.

Schweigger's so-called multiplier was the forerunner of galvanometer coils of many turns surrounding a poised magnetic needle and incidentally laid the foundation for the needle telegraph developed by Wheatstone. Sturgeon's early electric magnet, with its iron coil of horseshoe form surrounding a layer of wire, was perfected by Henry, who showed the need of many turns in layers to produce strong electromagnets. One may readily trace the advances through the years following 1820 and include Faraday's discovery in 1831 of the generation of current in magnetic fields—a discovery no less fundamental than that of Oersted.

The present year marks without doubt the centenary of electromagnetism, the development of which gave us in succession a wonderful series of splendid discoveries and the application of whose laws gave



Elihu Thomson

rise, to the telegraph on land and sea. The telephone came later, along with the dynamo and the electric motor, as applied to driving machinery, to locomotion and to the multitude of affairs now so important in our lives.

The coiled wire, the iron coil—what wonders they have brought about!

ELIHU THOMSON,
Consulting Engineer, General Electric Company, Swampscott, Mass.

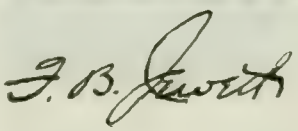
Hundred Years in Electrical Research

THE fact that a hundred years comprises the entire span of electrical science as it exists today is a matter difficult of appreciation, even by those of us who pride ourselves on a reasonable familiarity with the history of our art. To be sure we are familiar with Faraday, Joseph Henry, Maxwell, Helmholtz, Heaviside and Kelvin and what they did in the way of building a solid foundation for our present superstructure. How many of us, however, appreciate that the real birth of modern electrical science took place a hundred years ago today, when Am-

père presented his historic paper based on the work which he did and Arago had done following the then recent discovery of Oersted, that electricity and magnetism were definitely related one to the other?

No single year in the entire history of electrical development has been more pregnant with discoveries of a revolutionary character than was the year 1820. Prior to that time all that the world knew of the present science were a few discreet and unrelated fragments of knowledge concerning voltaic electricity and the magnetism of lodestones. While many had dreamed and specu-





lated on a possible relation among these fragments, it remained for Oersted, university professor of Copenhagen, to discover the true relationship and unlock the gates to the flood of discovery and invention which has tended so much to the happiness and good of mankind.

While we consider and marvel at the debt which the present day world owes to these workers of a hundred years ago, there is one fact in connection with their work which we should not lose sight of. It is a fact which had then and still has an intense and vital bearing on the progress of science. At the time of these epoch-making discoveries, and for nearly three-quarters of a century afterward, the term "industrial research" was unknown. The discoveries which these men made were in the course of a search for the abstract truths of nature.

In our present-day quest to build up the efficient industrial research laboratory we must still look to the university laboratories for our supply of trained investigators and, in large part, for those far reaching scientific discoveries which will later prove so revolutionary in the conduct of human affairs. F. B. JEWETT,

Ryerson Physical Laboratory, University of Chicago

Growth from First Discoveries Like Huge Tree

WHEN one begins to make a careful study of the tree of modern industrial civilization, following back any particular leaf or flower through twig, stem, branch, and trunk to top root, he can scarcely fail, no matter with what particular modern development he starts, to trace the line of causes back through either Faraday, Oersted and Ampère to Volta, or else through Joule, Carnot and Rumford to Watt. For surely *the top root of modern civilization is to be found in the principle of energy* and its thermal and electrical application. The latter all go back to Oersted and to Ampère, for are they not the scientific ancestors of Faraday?

I have below taken at random four fields of very recent development, two of them, the second and fourth, of immense scientific and philosophic interest; the other two, the first and third, of great practical importance, the one in a physical, the other in a biological sense, and have merely sketched in this manner their scientific genealogy, not including all the names which might properly find a place, but merely inserting a series of appropriate "key names."

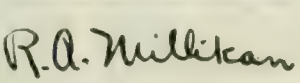
1. *Electronic Amplification.* De Forest, Richardson, Thomson, Roentgen, Lenard, Hertz, Maxwell, Faraday, Ampère, Oersted.

2. *Relativity.* Einstein, Lorenz, Becquerel, Roentgen, Lenard, Hertz, Maxwell, Faraday, Ampère, Oersted.

3. *Radio Therapy.* Rutherford, Crivic, Roentgen, Lenard, Hertz, Maxwell, Faraday, Ampère, Oersted.

4. *Subatomic Structure.* Sommerfeld, Bohr, Rutherford, Thomson,





Roentgen, Lenard, Hertz, Maxwell, Faraday, Ampère, Oersted.

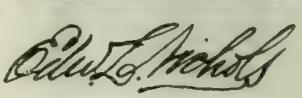
These are merely illustrative of what might be done presumably in scores of other fields. They illustrate also the immeasurable value to mankind of the work of the pure scientist and the imperative necessity of stimulating and supporting him. With one single exception all of the foregoing names belong to men who devoted their whole lives to pure science. R. A. MILLIKAN,

Ryerson Physical Laboratory, University of Chicago.

Laws of Oersted and Ampère Still Stand

IT IS FITTING to couple together the names of Oersted and Ampère in commemorating the centennial of the discovery of the magnetic relations of the electric cur-





rent. Taken together, their investigations laid the foundations of modern electrical engineering and the great subsequent advances by Faraday and Henry followed almost as an inevitable consequence.

Oersted's discovery of the movement of a compass needle when brought near an electric circuit is often classed as an accident, wrongly, I think, for, although the fact was quite different from what had been expected, Oersted had long sought a relation between electricity and magnetism. His experiment, beautifully and clearly described in his paper of July 21, 1820, was an essential forerunner to the work of Ampère; for there is no reason to think that any one in France had been considering possible electromagnetic relations up to the time when the news reached Paris.

Arago brought it with him on Sept. 11 from Geneva, where he had witnessed de la Rive's repetition of Oersted's experiment, and that same evening he showed the effect at the Institut de France.

Ampère was doubtless present at that meeting and *just one week later*, on Sept. 18, he gave before the Academy of Sciences his complete demonstration of the laws of the in-

teraction between electric circuits. The work was so well done, in spite of the extraordinary speed of production, that it has needed no restating or modification from that day to this.

I know of no achievement to match this of Ampère unless it be that of Fresnel, who wrote to a friend: "I do not know what is meant by the polarization of light" and who a few weeks later had completed his epoch-making first memoir on that subject. Incidentally he furnished the final and decisive proof of the wave theory of light.

Ampère's reaction to the stimulus of a new idea was, however, even more rapid and amazing, and his discovery has obviously had a much more direct influence upon the development of applied electricity.

EDWARD L. NICHOLS,
Professor Emeritus,
Department of Physics,
Cornell University.

Many Devices Are Repetitions of Early Work

FOR MANY YEARS attempts had been made, without success, to find a connection between magnetism and electricity. One of the most diligent searchers after





this relation was Oersted, professor of natural philosophy and secretary of the Royal Society of Copenhagen, at Copenhagen. In 1820 he discovered that if a wire be placed parallel to a magnetic needle and an electric current be passed through it, the needle is deflected and tends to place itself perpendicularly to the current. Conversely, he showed that if the magnet be fixed and the current movable, the latter is deflected.

Oersted's discovery was reported to the French Academy on Sept. 11, 1820. One week later, at a meeting of the same body on Sept. 18, Ampère presented a paper confirming these results and pointing out the possibility of long distance signaling by such means. At a subsequent meeting on Sept. 25, he showed that parallel currents in the same direction attract each other, and in the opposite direction repel, and that a wire carrying a current attracts iron filings to itself as a magnet would do.

During the next few years he continued his investigations, devising ingenious and beautiful experiments to demonstrate the quantitative laws of electrodynamics.

Maxwell speaks of the experimental investigation by which Ampère established the laws of the mechanical action between electric currents as one of the most brilliant achievements of science. "The whole, theory and experiment, seems as if it had leaped, full grown and full armed, from the brain of the Newton of electricity. It is perfect in form and unassailable in accuracy, and it is summed up in a formula from which all the phenomena may be deduced, and which must always remain the cardinal formula of electrodynamics."

It is remarkable that at so early a date and so soon after Oersted's discovery of the action of a current upon a magnet Ampère should have worked out so completely and so perfectly the theory of such action.

The practical applications of these discoveries have been many, and they have been of tremendous importance. In electrical instruments, in electrical communications, and in deriving mechanical from electrical energy, the action of a magnetic field upon a magnetic needle or upon an electric current have been essentially a repetition of those pioneer experiments of 1820; and we do well to pause a moment at the centennial of these epoch-making achievements to recall and to honor the names of Oersted and Ampère.

E. B. ROSA,
Chief Physicist, Bureau of Standards,
Washington, D. C.

Oersted and Ampère Built a Solid Foundation

IN BUILDING a great structure it is of the first and utmost importance to have an absolutely reliable foundation for it to rest upon, especially when the ultimate weight of the structure is unknown and may grow much greater than was originally expected; it should therefore be built on solid rock. It is in the laying of this solid and reliable foundation on which the theory and application of electricity was built that Oersted and Ampère contributed such a valuable part by the discovery of some of nature's laws; and their work was all the more creditable because in those early days there existed not only very little knowledge on the subject, but worse than that, the competing hypotheses were even inclined to lead one off the track.

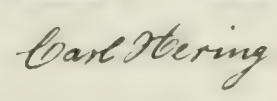
We, who now benefit so greatly in the building of a superstructure on this foundation, and to whom the results of the work of these pioneers is now the A, B, C of our science, often forget or fail to appreciate the great difficulties they labored under, and the lack of prior knowledge available to them at that time.

Sometimes a foundation can later be extended or improved, but this does not detract from the pioneering work; Ampère, for instance, studied the mechanical forces of currents upon each other, but not the internal forces upon its own conductor, to crush or stretch it, as in the pinch effect.

Sometimes even the best of foundations will sag a little here and there in the course of time and require a little repairing, which then makes them better than they were before. But slight flaws found later are to be expected and do not reflect on the original workers.

Sometimes a violent earthquake shatters even the supposedly solid rock foundation on which a magnifi-



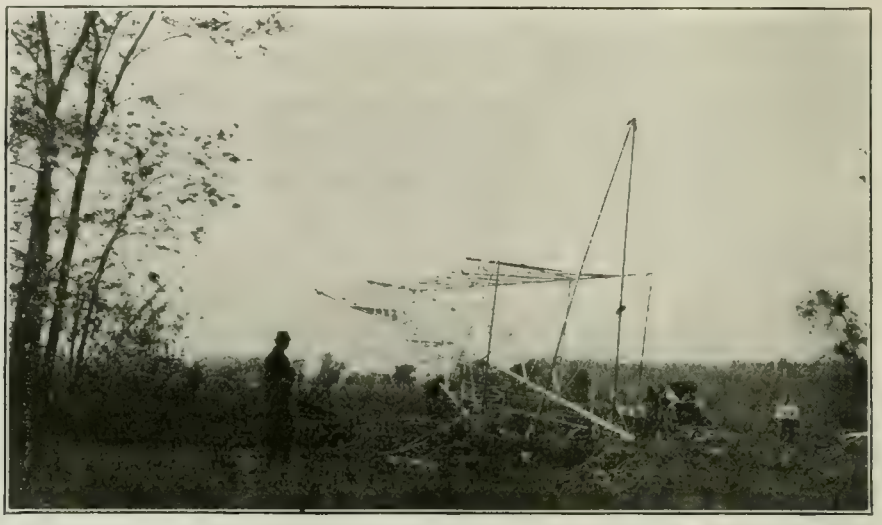


cent superstructure had been resting securely for many years, and compels us to start rebuilding on a new and still firmer foundation; such an earthquake is illustrated in the recent revelations of Einstein; but for many years the former superstructure had served a useful purpose, as it was not built on sand. And if, as seems to be boldly predicted by the disciples of Einstein, even the science of mechanics is to rest on electrodynamics as a subfoundation, the researches of Oersted and Ampère will be even more fundamental than they themselves had supposed.

CARL HERING,
Consulting Electrical Engineer,
[illegible]

Utility Construction Accounting

This Vital Factor Should Be a Part of General Accounting Records—Systems Must Be Devised to Fit Viewpoints of Construction and Accounting Departments—Property Addition and Depreciation Factors Demand Consideration



On as big a job as constructing a generating station a cost accounting system is almost certain to be used, but on smaller undertakings, like building transmission and distribution lines, the accounting is often neglected. Still, because of the greater recurrence of such jobs, proper accounting is most important.

CONSTRUCTION accounting has not as yet received the broad meaning that it should and must have if the best interests of public utility accounting are to be served. It has ordinarily been treated in its relation to the job without adequate consideration of its relation to the general accounting system, company history and the dealings that the company must have with regulatory bodies in the establishment of service rates.

Broadly construction accounting may be treated as follows:

1. As a historical cost record of a specific job.
2. Its record of a specific job as an integral part of the general property accounts to be maintained so long as the property it deals with remains in existence.
3. An ideal situation would be one in which the physical property accounts of a corporation were backed by construction records whose accuracy was unquestioned. The original cost value of the property could therefore not be successfully attacked.

Historical Record

The importance of the historical cost record of a specific job is usually called into question on the ground that few if any utility construction jobs are ever actually duplicated and it is impossible to judge fairly as to the cost of succeeding jobs by the records of those preceding. The fallacy of such an argument lies in the assumption that there is no relation between the fundamental operations in jobs of the same general type because they bear no surface similarity. The fundamental operations in the construction of a line, power plant or substation are the same as those for any other job of the same type. A construction cost record that reveals abnormal costs and forces an explanation has a decided influence in causing avoidance of the same type of errors in future work. Such a record also tells construction men the normal costs and sets them to devising more economical ways of doing work, exercising a decided influence in eliminating carelessness in planning and supervising the work of construction forces.

In the second phase the most valuable feature of proper construction accounting appears. It, however, is the one most often entirely ignored. It is not an unusual thing to find the cost of specific jobs so distributed in a general accounting record that the assembly of the total costs is an impossibility, and even when they can be assembled they are found so full of errors due to improper distribution on original vouchers that the figures are valueless. The general property accounts are a vital part of the record upon which the business is founded, and a condition of this sort means that in a controversy the business may be attacked at a vital point, viz., whether the investment shown in the general property accounts is actually there, a very pertinent question in any controversy, as on its answer may depend the determination of the good faith and business ability of the company.

To meet the ideal situation the first and most important step is the establishment of a construction accounting system that will cover all the factors that must enter into the final general property accounts. These factors may be defined as follows:

New Construction.—Comprising the cost of all construction that has not previously been in existence.

Replacements.—These are ordinarily understood to represent replacements in kind, though, practically, such a thing seldom or never occurs. To simplify, this term is therefore combined with betterments.

Betterments.—This term represents the replacement of a property unit by a unit that increases the general property value.

Depreciation.—Representing the property units that are removed during the installation of units that constitute betterments. Some criticism may be offered

of the use of this term in this manner, but for the simplification of the discussion it will be understood as including not only physical depreciation due to natural wear and tear but depreciation of property due to the growth of service demands and development of the art.

In building up a construction accounting system two factors representing working conditions to be contended with must be considered, the first being that the accountant ordinarily has no conception of the practical working out of an accounting system on a construction job, and the second being that the best construction men have an equally small knowledge of the accountant's habits of thought and methods of work. Any attempt to talk debits and credits, betterments or depreciation in technical terms to the average construction man is as hopeless as an attempt to talk of engineering problems in technical terms to a first-class accountant. The problem therefore resolves itself into one of reducing the system to terms that both can translate readily into their own terms. This cannot be done by making the general accounting classification the basis of the construction classification. General property classifications are naturally so broad in scope that even the most competent of accountants will differ as to the items that belong in any given group. The field construction accountant cannot be expected intelligently and consistently to interpret and apply such a classification to his work. To maintain a consistent record the interpretation and application of the general accounting classification should be confined to one source, which should be a construction accounting department, the primary responsibility of which includes not only construction accounting but the proper interpretation of the relation between contruction and general property accounts. Such a department is the point of contact between the general accounting department and the construction forces and must learn to think in the terms of both. For successful results the only form of classification that can be applied to construction work for field use is one based solely on labor and material items. These the construction man understands, and with a classification properly constructed training will reduce the errors to a mimimum.

Distinguishing Between Accounts

To maintain the proper distribution between new construction, betterments and depreciation two forms of designation, one of which must be used with every charge against the construction classification, are suggested. These are new construction, abreviated "Ncn," and reconstruction, abbreviated "Rcn." The designation "Ncn" is used to cover all new material and labor installation charges regardless of whether they cover an absolutely new property unit or replace an old one. "Rcn" designates all charges for labor, handling and hauling, etc., incurred in (a) moving and reinstalling old equipment, (b) removing old equipment from service and placing it in storage, (c) any new construction material that may be necessary for temporary use in handling or removing old equipment.

With the foregoing designations properly used the charges against a job readily segregate into two groups, one of which is the cost of all new equipment installed and the other the cost of wrecking and removing or changing location of existing equipment. The general accounting department will be able to dispose of these charges between property and depreciation maintenance or operating accounts without difficulty, but will find itself without an adjustment in property accounts that may be made necessary by the removal of operating property from service. The adjustment is easily made by writing off either the actual original cost of the apparatus if available or the estimated original cost. While this operation should be connected with the construction accounting for the job it should be done through the construction accounting department and without any knowledge on the part of the field accounting force, except that it is responsible for reporting a physical inventory of the material removed from service. Beyond this its knowledge of operations should cease.

Principal Accounting Operations

As a summary in brief of the various main operations involved in construction accounting the following are illustrative, it being assumed that an individual accounting record of the job with an adequate classification is kept and transferred to property accounts when the work is complete.

NEW CONSTRUCTION (Ncn)

DEBIT	CREDIT
Charge with the cost of all new material, labor of erection, handling and hauling and all other costs of new installations.	Credit with all new unused materials returned to stock from the job. Close by transferring the balance to general property accounts.

The debit balance transferred to property accounts represents (a) the total cost of the job where only new work is involved and (b) the portion of the cost representing property additions where the work represents betterments. The figures in either case represent increased property values created by the work.

RECONSTRUCTION (Rcn)

DEBIT	CREDIT
Charge with the cost of labor and new material (for temporary use only) required in the wrecking and removal of old equipment, and also the cost of tearing down and re-erecting old equipment on the same job.	Credit with the salvage value of all material charged to Rcn. for temporary use in removing old equipment. Close by transferring the balance to depreciation or maintenance accounts.

The debit balance represents the costs of handling, removing and re-erecting old material that do not increase property values. The only material legitimately chargeable to Rcn. is temporary construction material required in the wrecking process.

PROPERTY ACCOUNTS

DEBIT	CREDIT
Charge with the debit balance credited to New Construction	Credit with the original or estimated original installed value of all old equipment removed from service.

The difference between the debits and credits here represents the net increase or decrease of property values.

STORES ACCOUNTS

DEBIT	CREDIT
Charge with the salvage value of all equipment removed from active service Charge with all material originally charged to "Ncn" or "Rcn" and returned unused or salvaged	Credit with the value of all material charged to "Ncn" and "Rcn" for use on the job

DEPRECIATION OR MAINTENANCE ACCOUNTS

DEBIT	CREDIT
Charge with the debit balance from "Rcn" and the difference between credits to "Property" and the salvage value of equipment charged against stores	

The above grouping represents the main operations that any construction accounting system must be concerned with. Of these groups "Ncn" and "Rcn" are the only ones the field accountants need be concerned with, the remainder coming solely under the province of the office end of the construction accounting department.

Readers' Views and Comments

Honolulu More Progressive than Many Cities in the United States

To the Editor of the ELECTRICAL WORLD:

SIR: People who have the idea that the Hawaiian Islands are covered with palm trees and tropical foliage climbing the sides of volcanic peaks, among which the Hawaiians live in simplicity, with nothing much more to do than play ukeleles, should see the electrical pages running every week in the Honolulu *Star-Bulletin*. The pages are right up to the minute, the advertising cuts and copy are as good as any used in a New York or San Francisco paper and the reading matter is supplied by the Society for Electrical Development, thus insuring its accuracy and its interest for the readers.

What the Hawaiian Electric Company, an active member of the Society for Electrical Development, says:

> We received your letter of July 13 with material for our electrical page inclosed. We were very much pleased at your promptness in complying with our request for this material.
>
> Inclosed herewith you will find several issues of our electrical page. We will endeavor to see that a copy of each issue is forwarded to you for your perusal and files.
>
> Thanking you for the interest and co-operation which you have shown in our behalf and for the interesting reading matter, which is very adaptable to our local requirements.

Last year there was a big Territorial Fair held in Honolulu. The Hawaiian Electric Company had a building of its own as a part of the fair. It asked the Society for Electrical Development for suggestions, and a six-page "special service" was sent, of which it made excellent use. Betwen 140,000 and 150,000 people visited the fair during the week. The electrical exhibits and displays proved one of the great attractions.

There are many communities in this country where the electrical interests could show a great deal more energy in their development work and the Society for Electrical Development would be glad to help them do it.

J. M. WAKEMAN, General Manager.
The Society for Electrical Development,
New York, N. Y.

Early Electric Stoves and Irons

To the Editor of the ELECTRICAL WORLD:

SIR: We thank you for forwarding a copy of the letter from W. F. Boggs, Port Angeles, Wash., which was published on page 528 of the Sept. 11, 1920, issue of the ELECTRICAL WORLD, referring to the small stove made by the American Electric Heating Corporation that he has used for twenty years.

Our customer feels that his is about the oldest hot plate in existence, which is not quite correct, as we sold thousands of small hot plates like his before 1899. Probably the greater part of them are still in everyday use, but we do not often run across one which has had more constant daily service than Mr. Boggs'.

In this connection the writer is tempted to relate an incident which happened when he was on the road, about 1908. When calling on the United Electric Illuminating Company of New Haven, Conn., the manager there said that his wife used an enamel heating-type iron which was very nearly twenty years old. It was called a St. Paul iron, and he thought that we might like to have it to put in our museum of early electric irons. I told him that we should be glad to and would give him one of our new irons, which we at that time made with enamel elements, if he would return the old St. Paul iron to us. He did send it, but instead of coming to the office it took the natural course of returned goods and was sent up to our repair department, where it was tested and returned to the United Electric Illuminating Company, with a no-charge bill and a notation that it was O. K. with no repairs necessary. The point of this story is that the St. Paul line was made by a concern which we bought out when first going into the business, and the enamel process which it used for making heating elements was superior to all others at that time and was adopted by us.

Simplex Electric Heating Co. R. P. INGALLS,
Cambridge, Mass. Sales Manager.

Radio-Telephone Concerts

To the Editor of the ELECTRICAL WORLD:

SIR: In a recent issue of the ELECTRICAL WORLD, under the heading "Another Step Toward Transoceanic Radio-Telephony," you mention the radio-telephone service to the Catalina Islands and the fact that phonograph music played on shipboard had been heard 600 miles away at St. Johns, Newfoundland.

I am sure it will be of interest to your readers to have some information regarding the permanent installation of a radio-telephone concert service which has been in operation for three months in the California Theater building at San Francisco. Here for the first time a serious attempt has been made to convey real orchestral music (not phonographic) from a fifty-piece orchestra which plays twice daily at the theater. Special microphonic instruments are placed in the pit and in the balcony of the theater, and the microphonic currents are carried to the radio-telephone room near by, whence an antenna rises to the tower of the Humboldt Bank building, about 200 ft. (60 m.) above the sidewalk. These radio concerts have been heard great distances. They are frequently picked up by ships at sea, on one occasion as far out as 1,200 miles (1,920 km.)

As a matter of record, perhaps the first radio-telephone transmission in this country was of music, in the spring of 1907, from the old building at the corner of Thirty-ninth Street and Broadway, New York, which housed the "Telharmonium" apparatus. The radio music there transmitted was first "picked up" at the Brooklyn Navy Yard by George Davis, then chief electrician in charge of radio. In 1909 radio music was sent out from my laboratory at 103 Park Avenue, New York, Mme. Mazarin of the Manhattan Opera Company singing on one occasion to an audience in Newark. A little later a temporary installation was made on the roof of the Metropolitan Opera House and music picked up by microphones on the stage was sent out.

During the summer and fall of 1916 regular nightly "concerts" of phonograph music were maintained at the High Bridge radio laboratory, this music being heard at that time as far as Buffalo. Parties in New Jersey danced to this music played 35 miles (56 km.) away.

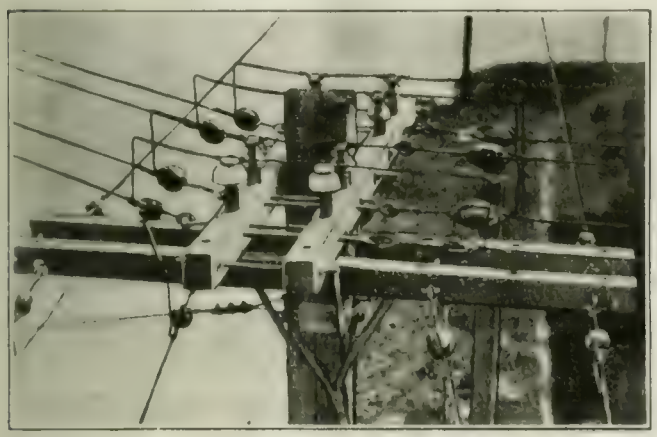
LEE DE FOREST,
President De Forest Radio Telephone & Telegraph Co.
New York City.

Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Egg-Shaped Insulators Prove Serviceable on Distribution Lines

EGG-SHAPED insulators such as are commonly used for guy wires are becoming popular in the West for use on distribution lines with voltages as high as 33,000. These insulators are used on the strain positions as shown in the accompanying photograph, only one insulator being used for low-voltages, while for the higher voltages several are connected in series. In these insulators the porcelain under strain is in compression, and deterioration due to tension and to temperature changes is not present as it is in cap and stud insulators. It is reported that these insulators have long life in the dead-end position.



EGG-SHAPED INSULATORS USED ON DEAD-END POSITIONS GIVE VERY LITTLE TROUBLE

Combustion Engineers Increase Plant Economy 20 per Cent

FOUR combustion engineers supervising the operation of the twenty-eight heating plants operated by the Union Electric Light & Power Company in St. Louis have during the past two years increased the quantity of steam generated per pound of fuel burned more than 20 per cent. One combustion engineer is assigned to seven plants, three of which are high-pressure generating plants and four low-pressure plants generating steam for heating purposes. A combustion engineer's duty is to keep in continuous touch with all of the important features of plant operation and control and rectify any irregular conditions. He keeps a daily check on coal used and amount of water evaporated per pound of coal; he keeps records of all operating conditions, such as draft, temperatures and CO_2 of fuel gases, and personally sees to properly sampling for analysis the coal received and the ash sent out.

The functions of the combustion engineers are independent somewhat of the general plant supervision and routine, although these engineers co-operate with the two plant supervisors, the watch engineers who are responsible for the operation of the plants as well as the firemen. The best results from the efforts of the combustion engineers were obtained from the assistance given to engineers and firemen in the form of suggestions, and it has been found that these are readily accepted if tactfully made.

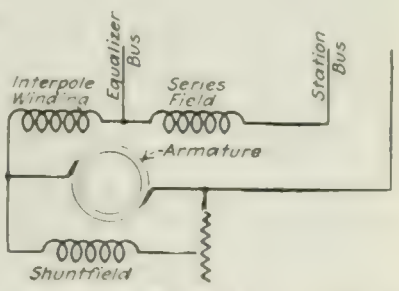
The form of the daily reports of these combustion engineers and their organization follows quite closely the duties and organization of the combustion engineers in the company's main generating station.

E. H. TENNEY,
Chief Engineer Power Plant.
Union Electric Light & Power Company,
St. Louis, Mo.

Operating Interpole Generators in Parallel

TO OPERATE an interpole generator in parallel with other machines the same arrangements must be provided as for non-interpole generators, and certain additional points must be given attention. The interpole winding must be considered as part of the armature and not as part of the series field. It must therefore not have any effect on the field strength and must neither boost nor buck the main series. This condition will be met if the brushes are set at the correct neutral position.

The equalizer connection must be made between the main series winding and the interpole winding and never to the brush bus ring direct. If the equalizer is connected to the armature terminal the equalizing current, if there be any, will flow not only through the series coils where it is wanted but through the interpole coils also. This current will make the interpoles either too strong or too weak. Usually the resistance of the interpole circuit and the series circuit is greater in proportion to the output than the resistance of the series circuit of a non-interpole machine. Consequently, when the equalizer is connected directly to the armature of the interpole machine, part of the current which should go to the interpole will flow to the non-interpole machine over the equalizer. This weakens the interpole and it does not then properly compensate for the armature reaction. Usually a machine so



PROPER CONNECTIONS FOR PARALLELING AN INTERPOLE GENERATOR

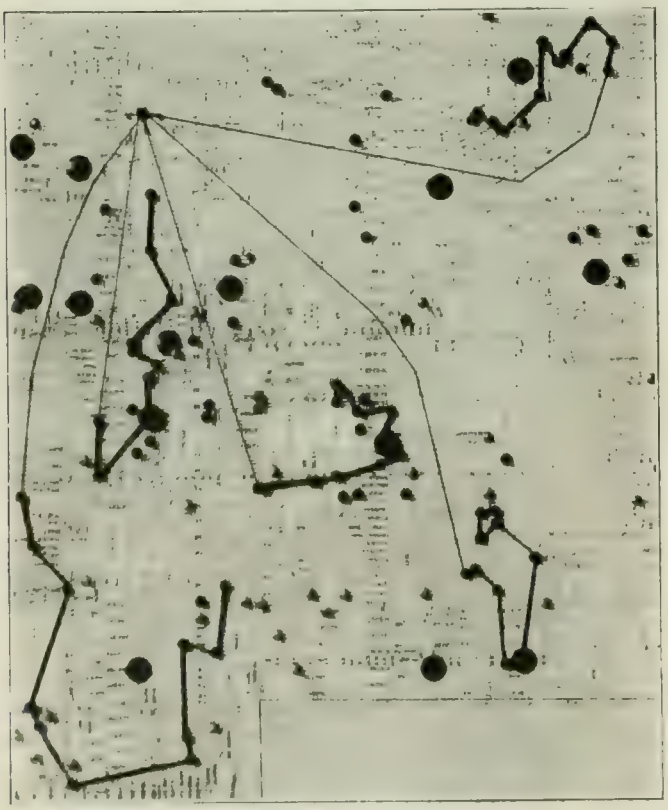
connected will not compound properly and will begin to spark at about half load owing to the weak interpole strength.

JAMES DIXON.

Cleveland, Ohio.

Map Used to Route Work of City Maintenance Crews

TO HELP the service work dispatcher lay out work for the maintenance gangs the map shown in the accompanying photograph is employed in the efficient system of the Commonwealth Edison Company, Chicago, which was described in the ELECTRICAL WORLD for Aug. 7. This particular map is for the central district of this company, similar maps being used for other districts. Service orders are indicated on the map by tacks with colored heads, a different color being used for each day in the week. Large round paper tags suspended from the tacks indicate transformer installations or changes. Minor repairs that can be done by the same gang are indicated with other kinds of tacks. These routing tacks are standard stock in map stores, and about forty varieties of heads are available. Each afternoon the service work dispatcher makes up a route for each gang on the following day by running a string around each of the tacks indicating work to be done by this gang. Service orders are given preference, and enough other repair work conveniently located is added to fill out the day's work. After work has been determined and indicated by the string, the work dispatcher arranges the service installation orders in their proper sequence and



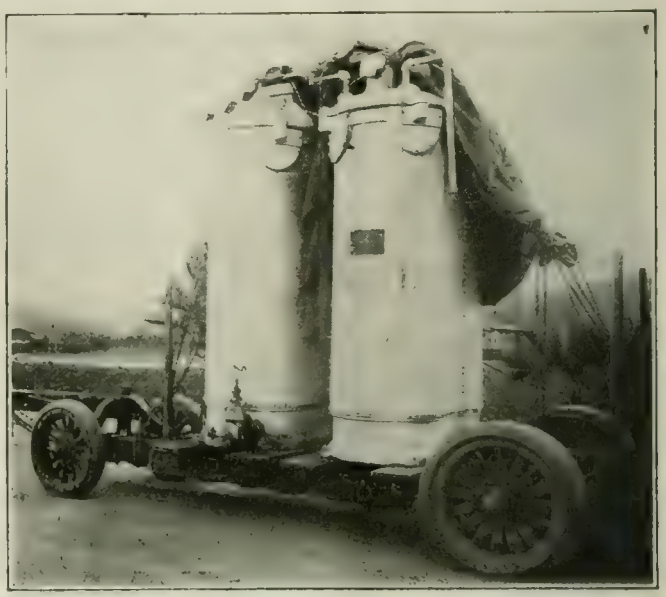
TACKS ON MAP INDICATE TRANSFORMERS TO BE CHANGED AND OTHER WORK

hands them to a typist, who prepares the daily list of orders for each of the service gangs.

D. W. ROPER,
Superintendent Street Department,
Commonwealth Edison Company,
Chicago, Ill.

A 28-Ton Auto-Trailer Hastens Transformers to Stations

IN ORDER to move heavy transformers for supplying emergency demands the Southern California Edison Company of Los Angeles designed and built an automobile trailer suitable for carrying 28 tons. This was done when it was found that shipping transformers by rail often required a week or more and left unsolved the



RAILROAD DELAYS AVOIDED BY SHIPPING TRANSFORMERS ON THIS 28-TON TRAILER

problem of getting the heavy equipment from the railroad siding to the exact location desired. Having the equipment out of service even for such a period was a serious loss during times of limited power supply.

The company, therefore, built a trailer, shown in the accompanying illustration, which has successfully handled 28-ton loads. Since it has been used there has seldom been a delay of more than twenty-four hours in moving heavy equipment over distances up to 100 miles wherever the destination could be reached over good roads, such being the case in most of the communities served by the company.

Two features of the trailer design are that it is without springs and that the forward axle is arched so that the bed is suspended by king pin and links. The bed is 18 ft. (5.4 m.) long and the over-all width is 8 ft. 3 in. (2.5 m.). The diameter of the front wheels is 36 in. (0.9 m.) and of the rear wheels 42 in. (1 m.). Wheels are equipped with solid rubber tires, the rear tires being 14 in. (35 cm.) wide. The lift to the top of the bed is 25 in. (63 cm.) and the clearance is 15 in. (37.5 cm.). When handling capacity loads the trailer is usually drawn by a 6-ton truck with 5 tons of ballast.

The first truck built by the company, at a cost of about $2,300, was in constant demand and was found to be so useful that a second one was constructed, the only change in design in the second trailer being the addition of hand brakes operated by an 8-ft. (2.4-m.) lever to which a rope from the driver's feet was attached. The design has been copied by three other trucking companies.

P. H. Ducker is superintendent of transportation for the Southern California Edison Company.

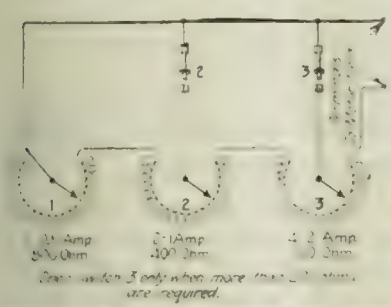
Industrial Applications

The Economical Utilization of Electrical Energy
in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

Connection of Rheostats for Testing

IN THE electrical testing department of a large motor manufacturer the burning out of plate rheostats used in field circuits due to overloading has been prevented by connecting them up as shown in the sketch.

As will be seen, the lowest-resistance rheostat, No. 3, which also has the largest capacity, must be all cut in the circuit first and switch No. 3 opened before No. 2 can be used. This reduces the current to a safe value for rheostat No. 2. Similarly No. 2 rheostat must be all cut in the circuit and switch No. 2 opened before rheostat No. 1 can be used. The rheostats used are the ordinary field-regulating rheostats of the plate type manufactured by the Cutler-Hammer Manufacturing Company. They are mounted on a board supported on a small platform with wheels so that they can conveniently be moved from place to place.



RHEOSTATS ARE PROTECTED BY THIS WIRING AGAINST IMPROPER OPERATION

EUSTACE C. SOARES.

Ampere, N. J.

Inserting Magnetic Slot Bridges to Improve Operation of A.-C. Machines

MAGNETIC SLOT bridges improve the operating characteristics of alternating-current generators and motors by making the density of the magnetism in the air gap and the iron nearly uniform. The advantages in operating gained by using magnetic wedges in induction motors are: Better power factor especially at light loads, less core loss, better efficiency, less exciting current and better starting ability. In generators and synchronous motors the magnetic bridge by giving uniform flux permits the use of a liberal air gap, reduces core loss, and therefore improves efficiency and allows the use of solid poles and pole shoes.

The magnetic wedge is a piece of iron or steel which fits in grooves in the sides of the stator teeth and allows the magnetism to spread out so that the density over a slot is nearly the same as over a tooth. The wedges are thin in the middle so that the iron is saturated at this point.

The bridges must be well and permanently insulated from the laminations. If "grounded" on one side only, the laminations are short-circuited and eddy currents will cause local core heating. If grounded on both sides, the bridge and laminations form a short-circuited turn interlinked with the winding, and by transformer action current will flow and heat the bridges and core. In a heavily loaded machine grounded bridges may run red hot. It is fairly easy to insulate the bridges by using a fiberoid trough and plenty of varnish to keep out moisture and oil. The grooves in the teeth of stator must be clear of all old insulation, burns and bumps. A thickness of insulating trough (bridge paper) which gives a good driving fit dry must be used. Before inserting the paper the slot grooves are varnished with the best baking varnish. The bridge paper is then placed in the slot and worked into the grooves with a blunt-nosed tool. A coat of varnish is applied to the trough, and after dipping the tip of the bridge in varnish it is started in the groove and driven to its place. After setting, the bridge is tested for grounds with at least 110 volts (220 volts if available). If a grounded bridge is found, it must be taken out and the cause must be removed.

When all the bridges are in and test clear, excess paper is trimmed off and the face of the stator is varnished, working the varnish into the slots and between the ends of bridges. The varnish should dry before running the machine. If possible, the machine should be baked in an oven.

Where there are several bridges per slot, short bridge papers can be used. On most large stators a fiber stick is placed while wet with varnish under the bridge to wedge the coil down. Bridges should not stick out endwise beyond the core as they are liable to shake loose if not held throughout their whole length. Split stators must have a fiber bridge at the split slot on each side. There is always some "working" at the splits, and it is impossible to keep metal bridges insulated there. When there are several bridges per slot they should be set about ⅛ in. (1.5 mm.) apart. Where slot grooves are badly mangled fiber or wood bridges should always be used.

JAMES DIXON.

Cleveland, Ohio.

Synchronous Motor Advantages Compared with Induction Motors

DETERMINATION to change the phase-wound-rotor type induction motors to the synchronous type in a Southern plant was made for the following reasons:

1. No sacrifice in original rated capacity of the motor. The use of increased field current would, of course, permit a certain amount of overload.
2. A combination of good starting torque of the induction motor with the constant-speed characteristics of the synchronous motor.
3. Adequate stability of operation with change of load.
4. Improved system power factor, with motor in question having inherent leading-power-factor characteristics.

Standard Pulley Sizes for Motors Recommended by Power Club

STANDARD pulley sizes for fractional-horsepower and large power motors have been adopted as recommended practice by sub-committees of the Electric Power Club, the sizes being as shown in the accompanying tables.

TABLE I—PULLEY DIMENSIONS FOR FRACTIONAL HORSEPOWER MOTORS

Flat-faced pulleys: Diameter, In.	Face, In	Bore, In.
3	2½	⅝
3	2¼	½
2	1¼	½
Grooved Pulleys:		
Pitch Diameter, In.	Belt Diameter, In.	Bore, In.
2	⅝	½
1½	⅜	½
1½	⅜	⅜

NOTE.—The 1½-in. ⅝-in. pulley when used with a ½-in. belt, gives pulley dimensions of 1½-in. by ½-in. Grooved pulleys should be arranged for mounting upon the shaft provided with a flat and secured by a set screw.

For the fractional-horsepower motors standard shaft diameters, keyways and set-screws have also been adopted.

TABLE II—SHAFT, KEYWAY AND SET-SCREW DIMENSIONS FOR FRACTIONAL-HORSEPOWER MOTORS

For flat or crowned-faced pulleys: Shaft Diameter, In	Key
⅝	⅛ sq.
½	⅛ sq.
Flat and set screws for grooved pulleys:	
Shaft Diameter, In	**Set Screw Dimensions**
⅝	¼-in.—24-thread set screw
½	¼-in.—24-thread set screw

The pulley sizes shown for large motors are for open and semi-inclosed alternating-current single-phase and polyphase and direct-current, constant-speed, continuous-duty motors.

The tables for fractional-horsepower motors are for continuous duty, constant-speed motors, irrespective of ratings.

TABLE III PULLEY SIZES FOR POWER MOTORS

For open and semi inclosed, alternating-current, single-phase and polyphase, and direct current, constant-speed and continuous-duty motors. (Dimensions are in inches.)

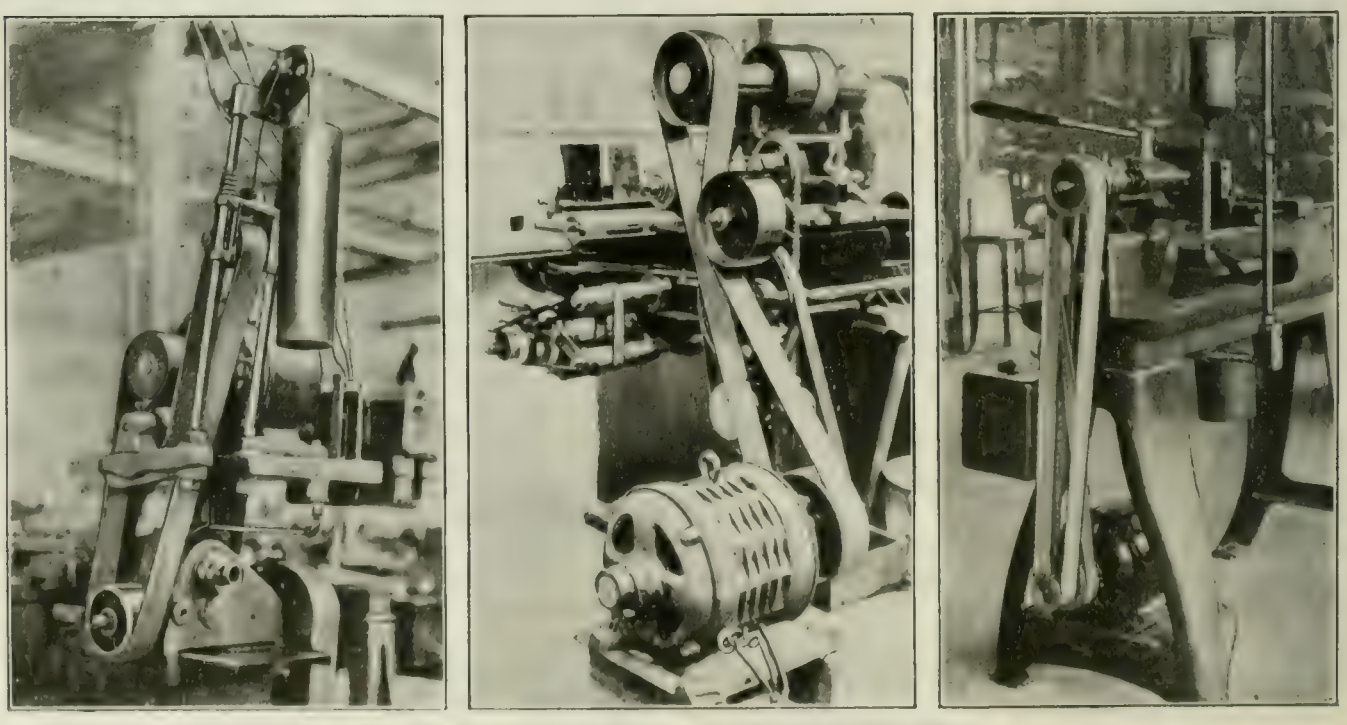
Hp. at 1750 1800 R.p.m.	Hp. at 1150 1200 R.p.m.	Hp. at 850 900 R.p.m.	Pulley Belt, Diam., In.	Width, In	Bore, In
1	¾		3	2	⅝
1½	1		4	3	⅝
2	1½		4	3	1
5	3		5	4	1¼
7½	5	3	5	4	1¼
10	7½	5	6	5	1¼
15	10	7½	7	6	1½
20	15	10	8	6	1½
25			9	7	1½
30	20	15	9	7	1¾
40	25 30	20 25	10	7	2¼
	40	30	11	10	2¼
	50		12	11	2¼
	60	40	12	11	2¼
	75	50	13	12	2¾
		60	13	12	2¾
	100	75	15	14	3¼

NOTE.—These pulley sizes are based on the use of paper pulleys and are applicable to either 40 deg. or 50 deg. motors.

Removing Slack from Short Belt Drives by Means of Weights

BY MEANS of weights, the two very short belts shown in the accompanying photographs are kept always tight. In the photograph to the left the motor is mounted on the frame of the machine close to the pulley to be driven. By means of a stationary idler pulley and the idler pulley which travels on the two slide rails the belt is arranged to give a large contact area, and the weight keeps sufficient pressure on the belt to prevent slipping.

In the center there are two belt drives, the main one of which is kept tight by means of the idler pulley, which is held down by a weight hanging over the chain just to the right of the pulley. At the right is an example of compact mounting of motor and control. These machines are in the Westinghouse Electric & Manufacturing Company's factory, East Springfield, Mass.



WEIGHTS ON IDLER PULLEY KEEP SHORT BELT DRIVES TIGHT

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

Denver Company Sells $40,000 Worth of Washing Machines in Thirty Days

A THIRTY-DAY washing-machine campaign was conducted by the Denver (Col.) Gas & Electric Company during June and 300 machines were sold. Sixteen salesmen were used, assigned to thirteen residential and three business districts. In addition, about $5,000 was spent in newspaper advertising. Clare N. Stannard, secretary and commercial agent of the company, believes that the plan of intensive personal solicitation combined with judicious advertising is the most effective for special campaigns. He has demonstrated this theory successfully in the execution of the vacuum-cleaner campaigns which he has conducted with marked success during the last few years. His semi-annual campaigns have resulted in the sale of about 12,000 cleaners in the city of Denver.

New Angle from Which to Look at Rate Theories

BY KASSANDRA

THERE are two main theories of rates. One is based on the old-fashioned law of supply and demand and maintains that the rate for each quantity and class of service should be fixed by competition. If such rates lead to a greater than a fair return on the total investment then again the law of supply and demand leads to an increase in the investment and service and a general lowering of rates until an equality between supply and demand is again reached.

The other theory of rates maintains that the cost of each quantity and class of service can be computed by some formula, as, for instance, by assigning to each class some proportion of the fixed costs, some proportion of the customers' costs, some proportion of the energy costs, some proportion (usually an average) of the distance costs, etc.

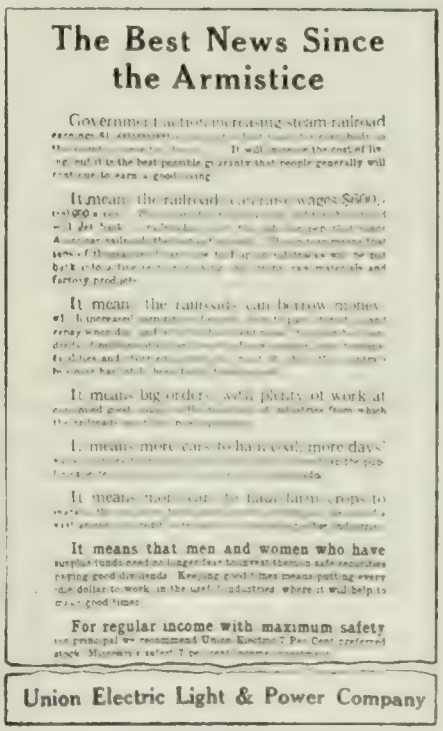
If the two theories lead to the same rates, as they often do, then there is no test as to which theory is right or best. But suppose the competitive or supply and demand theory gives a rate of say 3 cents for a definite case (which under this theory would be only just under what that class could pay) while the so-called cost theory leads to another rate, say 5 cents or 2 cents. If the cost theory leads to a rate of 5 cents or higher than the competitive theory, of course the customers will not take service, but will secure it elsewhere, and the central station will lose the economy it might get from the greater output.

If, on the other hand, the formula used in applying the cost theory leads to a rate of 2 cents the customer will take the service rather than supply himself otherwise, but is not this profiteering on the part of the customer? The customer would pay the equivalent of 3 cents if he got the service elsewhere, and this presumably would enable the customer to make just a fair profit in his own business. For the central station to supply at 2 cents would then enable the customer to make more than a fair profit in his own business, and he is apt to become a profiteer.

If the customer is another public utility it may refuse to take the unfair profit and pass it on to its customers, but even then why should these customers of the other utility get the profit rather than the customers of the central station? Is it not better that, to prevent profiteering, the central station should keep the rates at (or just below) the competitive level, and should use its profits not for its stockholders but in extending the service so as to serve more of the public with the maximum of service at a fair price, rather than to serve a selected class of consumers at lower than a fair price?

The latter plan results in the selected class becoming profiteers and injures the rest of the public, while the application of the competitive theory results in the greatest good for all.

Increased Freight Rate as Argument for Sale of Stock


The Best News Since the Armistice

Government action increasing steam railroad ... It will increase the cost of living but it is the best possible guaranty that people generally will receive value to earn a good living.

It means the railroads can increase wages $600,000,000 a year ... and get back into a line to buy more raw materials and factory products.

It means the railroads can borrow money at ... increased earnings ... and repay when due ... for duties and ... be issued ...

It means big orders ... with plenty of work at ... good wages ... industries from which the railroads ... now buy.

It means more cars to haul coal, more days' ... to the pay ...

It means ... cars for farm crops to ... the ... and ...

It means that men and women who have surplus funds need no longer fear to invest them in safe securities paying good dividends. Keeping good times means putting every idle dollar to work in the useful industries where it will help to create good times.

For regular income with maximum safety we recommend Union Electric 7 Per Cent preferred stock. Monthly ... 7 per cent income ...

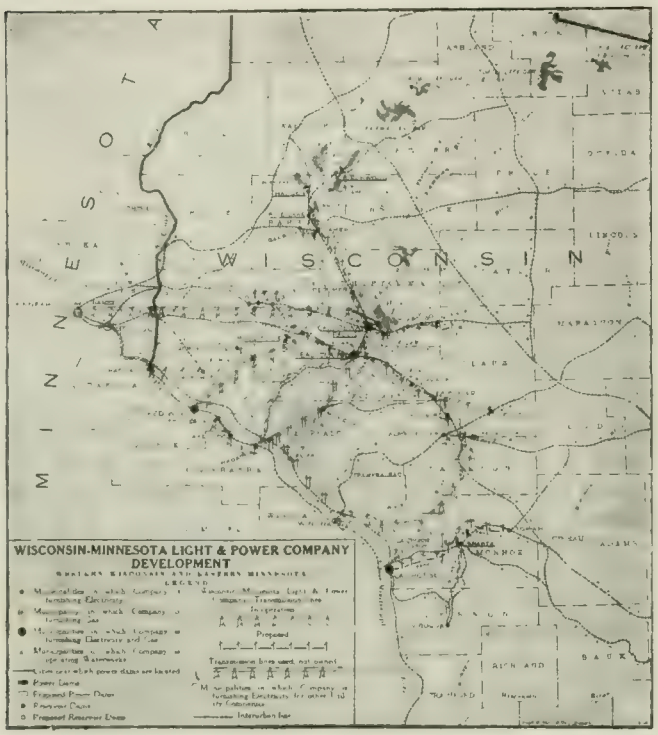
Union Electric Light & Power Company

AN example of broad-gaged public policy advertising is shown in the accompanying advertisement of the Union Electric Light & Power Company of St. Louis, which appeared in the daily papers of that city. The advertisement ostensibly uses the news of the increased railroad freight rates as an argument to sell the company's stock, but in reality tells the people that they are the ones who profit when public utilities are allowed to charge rates which are high enough to pay for the quality of service which the public expects.

Showing the Public Extent of Territory Served

A DIAGRAM of a transmission system framed and hung in a conspicuous place in hotel lobbies is a method of central station publicity that the Wisconsin-Minnesota Light & Power Company is employing in its advertising.

The system diagram used is shown herewith. On



THE WISCONSIN-MINNESOTA LIGHT & POWER COMPANY PLACES IN HOTEL LOBBIES FRAMED COPIES OF THIS MAP SHOWING THE TERRITORY SERVED

the original the circuits owned by the company are shown in red while those forming a part of connecting systems owned by other companies are shown in black. The placing of these diagrams in hotel lobbies frequented by business men has been valuable in familiarizing the public with the extent of an important system and is a decided help to the stranger who is interested in knowing the central station service in a territory new to him.

Three-Phase Extension for Residential Elevator Declared Burdensome

AN ATTEMPT by wealthy interests in Newton, Mass., to force the Edison Electric Illuminating Company of Boston to spend about $2,200 to extend a three-phase feeder 0.6 mile (1 km.) to supply a single electric elevator met defeat, on petition to that effect to the Massachusetts Department of Public Utilities recently.

The district in question is served by single-phase circuits, and the petitioners contended that the company should rearrange its lines to enable the operation of a three-phase elevator installation in a new residence, bearing all of the expense of the construction.

The company offered to build the line on a basis by which its cost would be rebated from the bills of the petitioner from year to year until paid for, but an agreement could not be reached. In its finding the commission declared that there was no evidence that any other customer required this type of service and that the cost would have to be borne by the small users of service if put upon the company. The use of a motor-generator set was suggested as a means of obtaining the desired elevator service.

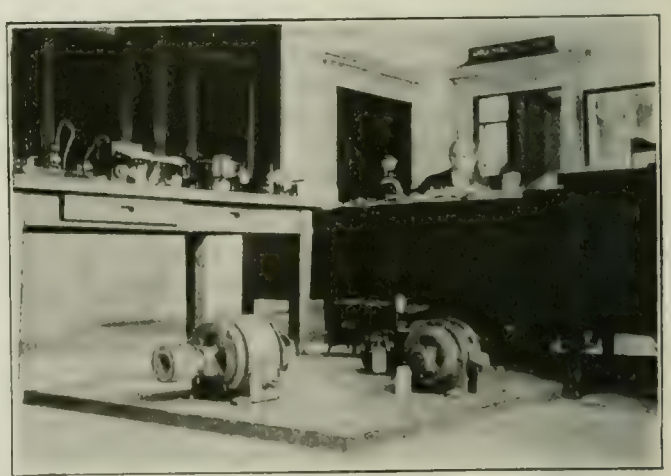
Employers Warned to Carry Compensation Insurance

EMPLOYERS who come under the workmen's compensation law of New York State are being warned by Bernard L. Shientag, chief counsel to the State Industrial Commission, to carry compensation insurance to cover their employees. Failure to do so, Mr. Shientag points out, is a misdemeanor punishable by a fine up to $1,000, by imprisonment up to one year, or by both such fine and imprisonment. The Industrial Commission through its counsel will proceed vigorously against any employer who continues to disregard this law.

Any employer who is in doubt as to his duties under the workmen's compensation law should apply to the Industrial Commission, at its office, 124 East Twenty-eighth Street, New York City. "If an employer continues to violate this law, he may expect very little consideration from the commission and from the courts," said Mr. Shientag. In the last year the Court of Special Sessions imposed fines ranging from $50 to $250 on 122 employers failing to carry compensation insurance, and one uninsured employer in whose plant a worker was seriously injured was sent to jail for thirty days.

Composition Platforms for Motor Displays

CLEANLINESS and quiet in handling small motors in the office of the Hartford (Conn.) Electric Light Company are assured by using a platform of composition floor material, illustrated herewith, upon which motors



PLATFORM, FOR DISPLAYING MOTORS, COVERED WITH COMPOSITION MATERIAL

may be moved about freely. The platform is 2 in. (5 cm.) high, 72 in. (1.83 m.) long and is 56 in. (1.42 m.) in width.

The convenience of displaying small motors in this way instead of on a granolithic or other hard flooring serves both neatness and flexibility.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Rating of Motors for Intermittent Work.—ADLER AND SCHIEBELER.—The rating of a machine is usually determined by the temperature rise during load tests. Motors are often tested for temperature rise on a one-hour run. When the motor is intended for intermittent service, however, it may safely be loaded far beyond the continuous one-hour rating. The authors discuss the factors which affect the performance and heating of motors for intermittent work and suggest that methods be standardized for intermittent testing. A modification of the standardization rules of the V. D. I. is drafted, three types of loading being defined: Continuous loading, occasional, or brief loading, and intermittent loading, and tentative rules for the testing of motors for these three types of service are laid down. For intermittent-load motors the authors suggest a test cycle of three minutes full (intermittent) rated load, followed by a nine-minute total test, this cycle to be repeated during any such length of time as the parts may stipulate, and the tested motor not being permitted to heat up over a certain temperature. According to the authors such a machine should also have on its numberplate a short-time rating, based on a thirty, forty-five, sixty or on a ninety minute continuous-load run.—*Elektrotechnische Zeitschrift*, June 24 and 30, 1920.

Induction Type Frequency Changer.— HARRY S. SMITH.—The author describes a two-machine induction type frequency changer in which one is commonly a standard wound-rotor polyphase induction motor and the other a direct-current machine, used to drive the rotor of the induction machine at the proper speed for any frequency. The underlying theory of this type of frequency changer is discussed.— *Electric Journal*, August, 1920.

Lamps and Lighting

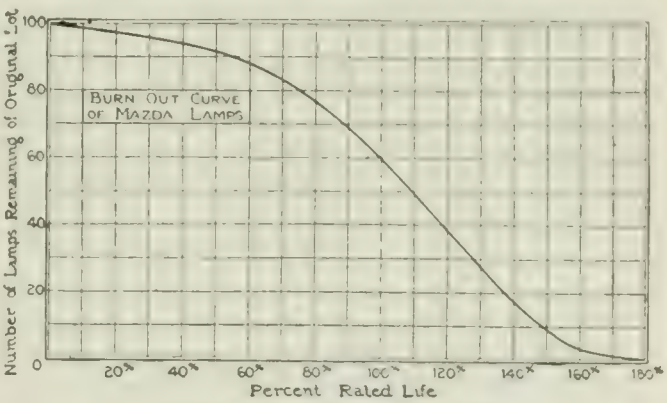
Maintenance of Electric Lighting Equipment on the Lincoln Park System.—C. H. SHEPHERD.—On a system which consists principally of 400-watt gas-filled lamps enclosed in 20-in. (50-cm.) globes, the author states that the life of the gas-filled lamp varies from 1,000 to 12,000 hours. Three types of continuity equipment in use are the film cutout, the compensator and the series-multiple transformer systems. The lamp record, which consists of a card for each particular standard throughout the system, is kept showing the location of the standard, type of filament, make of lamp, date of installation, date of burnout or breakage, and other necessary information on the face of the card, while on the back of the card is given the electrical characteristics of the transformer, compensator or film cutout which serves the lamp. It is said that the cash cost of operating this system is about 50 per cent below the cost of the original arc lamp system which was in service about five years ago. Difficulty due to the accumulation of dirt and insects is taken care of by means of an air tank operating from an initial pressure of 105 lb. (7 kg. per square centimeter).—*Transactions Illuminating Engineering Society*, July 20, 1920.

Theory and Characteristics of Incandescent Lamps.—HENRY SCHROEDER.—An interesting summary of the chief characteristics of modern incandescent lamps. The table gives the temperature data of various filaments:

Lamp Filament		Approximate Operating Temperature	Approximate Melting Temperature
Carbon	60 watts, 220 volts (untreated)	1870 deg. C	4000 deg. C
	50 watts, 110 volts (treated)	1930 deg. C	
Tungsten	25 watts, 110 volts (vacuum)	2150 deg. C	3300 deg. C
	500 watts, 110 volts (gas-filled)	2560 deg. C	
	30 volts, 30 amperes (gas-filled)*	3000 deg. C.	

*Motion picture lamp

The curve indicates typical results of life tests of tungsten lamps showing that, of the number tested,



LIFE TESTS OF TUNGSTEN LAMPS

60 per cent burned for the full rated life.—*Bulletin L. D.* 114, *Edison Lamp Works*, June, 1920.

Generation, Transmission and Distribution

Recent Tendencies in Cable Manufacture.—H. SAVAGE.—It is stated by the writer that the British have led in the development of satisfactory cables for underground transmission, for the reason that underground transmission is so commonly adopted in England. It is said that impregnated paper has proved its value by being used to an enormous extent for all pressures and conditions, and that it is the only really reliable and satisfactory dielectric for extra high pressures. The only serious competitor is vulcanized bitumen, which has lately emerged into an article of general manufacture and use. Its rise is mainly due to the extension of electricity in the mining industry. Being neutral to the peculiar moist conditions in mines, independent of a heavy sheath, semi-flexible, and not requiring the skilled care of a hydroscopic dielectric, it has found acceptance among colliery managers. It is also held that the steady rise in working pressures from 3,000 volts to 30,000 volts has not produced any drastic change in cable

materials, but has been met by a certain increase in thickness, greater care founded on experience in manufacture and a reduction in the ratio of test to working pressure. Grading of the dielectric to minimize the potential gradient in the dielectric has not yet fulfilled the anticipation of its authors, it is said. The author points out the gradual disappearance of the large single-core cables with hollow centers which were prominent some years ago when single-phase alternating current was in the ascendant and which were designed to minimize the so-called "skin effect."—London *Electrician*, July 2, 1920.

Traction

Overhead Construction for Electric Railroads.—Reishaus.—The article is profusely illustrated and gives a rather complete account of all more representative systems for overhead construction which have been employed by the Siemen-Schuckert-Werke in various European electrifications. Particular attention is given to problems of multi-track roads and yards, and to different systems for keeping the contact wire automatically under proper tension at all times.—*Elektrische Kraftbetriebe und Bahnen*, June 24 and July 4, 1920.

Installations, Systems and Appliances

Energy in the Magnetic Circuit of a Magneto.—N. W. McLachlan.—This paper deals solely with the magnetic energy associated with the primary circuit and is said to be merely an introduction to the subject. The treatment is very approximate, but is suggested to serve as a guide for more exact study. On account of the complex nature of the magnetic circuit the mathematical work does not check very closely with experiments, but, according to the author, it should, nevertheless, be useful in a qualitative way.—London *Electrician*, July 30 and Aug. 6, 1920.

Bonding in Special Locations.—G. H. McKelway.—Cross bonding and special connections to structures, bridges and poles constitute a class of bonding very generally used and requiring care in installation. This type of bonding is discussed by the author.—*Electric Railway Journal*, Aug. 21, 1920.

Electrically Deposited Thermocouples.—A method of constructing thermocouples in which one of the elements is deposited electrically on a core, which constitutes the other element of the couple, is described. In particular the couples investigated are those in which constantan is used with either silver or copper. The process is ascribed to W. Hamilton Wilson and T. D. Epps.—*London Engineer*, Aug. 6, 1920.

Electrophysics and Magnetism

Quantum Emission Phenomena in Radiation.—David L. Webster.—A comparison of X-rays and light are given covering the best known cases of excitation of line spectra by electron impact and the form of the Bohr theory that is required by them. These phenomena are compared with corresponding absorption phenomena with especial reference to the accumulation of energy for photoelectrons by absorption. It is said that theories of the type of Bohr's appear inconsistent with these facts. The phenomena suggest that the law of the conservation of energy as applied to atomic oscillators holds only statistically. A set of postulates to replace it for individual oscillators is outlined.—*Physical Review*, July, 1920.

Units, Measurements and Instruments

Note on Radio Frequency Measurements.—Carl Englund.—After discussing the need for a radio-frequency bridge of general utility, the bridge method is critically compared with indicating, null and potentiometer methods. Certain precautions in the shielding and coil construction of such bridges are considered, and the specific form of bridge used by the author is described in detail. Beat note with amplification and telephone indicator of balance point are used. Some applications of the bridge are then given.—*Proceedings Institute of Radio Engineers*, August, 1920.

A Potentiometric Control Rheostat.—J. Damien.—It is sometimes essential in current-adjusting resistances—for instance, field rheostats—that the current shall increase by just the same amount for every step on the rheostat. Such characteristics are easily obtained in a rheostat built on the drop-wire principle. The author shows how the successive resistance steps must be graded in order to give the desired straight-line relation, and gives a method for computing the separate steps. In a certain numerical example, which is dealt with in detail, it is found that while the first few steps must be rather small, the number of ohms per step reaches a peaked maximum at about one-third of the range and then decreases to even lower values than those of the first steps. On the other hand, if a drop-wire rheostat with equal resistance steps is used, the current increments will be found to pass through a rather flat minimum around the mid point of the range.—*Revue Générale d'Electricité*, June 26, 1920.

Telegraphy, Telephony and Signals

Measurements of the Electromagnetic Field of Waves Received During Transoceanic Radio Transmission.—Giancarlo Vallauri.—A series of recent experiments is described on the determination of the electric and magnetic field intensities of the waves received at Leghorn, Italy, from the Annapolis transmitting station. A pair of large loops, respectively practically parallel and perpendicular to the incoming wave, are used. The incoming signals are received by heterodyne oscillator and amplified. A substitution method is used for the measurements, whereby the incoming signal is compared to an artificial signal produced in the non-receptive loop by a local oscillator. A thermocouple and galvanometer in the oscillator circuit, together with a calibrated mutual inductance for coupling to the non-receptive antenna, permit quantitative results. Numerical results are also given and it is shown that the field strengths of the incoming waves are much greater than those calculated by the usual transmission formulas.—*Proceedings of the Institute of Radio Engineers*, August, 1920.

Miscellaneous

Coal and Water in the United States Compared as Sources of Power.—R. S. McBride.—Data are given concerning the water power resources of various states of the union and the distribution of coal deposits by districts.—*Coal Age*, Aug. 12, 1920.

Organization of the Electrical Industry.—C. H. Wordingham.—The author points out the desirability that engineers shall have some body which will represent their interests when questions of both external and internal policy have to be decided. He outlines the possible usefulness and organization of such a senate.—London *Electrician*, April 30, 1920.

Scientific and Industrial Research

(PRINTED IN THE THIRD ISSUE OF EACH MONTH)

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available, and Suggestions for Co-operative Work.

Conducted by PROF. VLADIMIR KARAPETOFF
Cornell University, Ithaca, N. Y.

Research in Progress and Completed

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

CONCRETE MIXTURES, PROPORTIONING OF.

A method of proportioning concrete mixtures is being developed based on the theory that the quantity both of cement and water required to give concrete of a workable plasticity depends upon the surface area of the aggregate used. By this method it is possible to fix the portions of the constituent materials of a concrete mixture, namely, cement aggregate and water, so that a concrete of definite strength will result while at the same time the mixture will have a predetermined degree of plasticity. Results to date have been very encouraging and this method is now being given a practical tryout on several works of large size.—*R. B. Young, Hydro-Electric Power Commission Laboratories, Toronto, Canada.*

FREQUENCY BRIDGE.

An arrangement of capacity, mutual inductance and resistances, consisting essentially of a Heaviside bridge, has been developed for the accurate determination of frequency in the audible range. A telephone may be used as a balance indicator, or better a vibration galvanometer, and the frequency is obtained by the usual formula, $\omega^2LC = 1$. In this expression the value of the mutual inductance multiplied by the ratio of the two resistances must be added to that of the primary inductance. The resistance ratio may be taken large, say 30:1, and thus low frequencies measured without prohibitively large condensers and inductances. Losses in the condensers do not affect the result, nor does the inductance in the resistances, but adjustment of an auxiliary small variometer is necessary for a sharp balance. Using a vacuum-tube oscillator, giving about 1,000 cycles, results which check to five significant figures have been repeatedly obtained with this bridge, incidentally showing the great constancy of conditions obtainable with such an oscillator. The bridge has also shown that rather small changes in the secondary load of the oscillator cause considerable changes in the frequency. An investigation regarding its adaptability to commercial frequencies is in progress.—*Edy Velander, Harvard University, Cambridge, Mass.*

LAMPS, INCANDESCENT, FOR SIGNAL FLASHING.

In a study of incandescent lamps for use in daylight signaling by the United States Signal Corps the following results have been obtained: (1) The time required for a filament to heat to approximately its maximum brightness exceeds greatly the time required in cooling to effectively zero brightness; (2) the higher the maximum temperature of a flash, the greater is the speed of the flash; (3) the smaller the filament, the greater is the speed of the flash; (4) the less the resistance in a circuit external to the flashing lamp, the greater is the speed of the flash; the speed of flashing for a given filament at a given temperature in various atmospheres—including in vacuo—is the greater the greater the gas loss; (6) for lamps of the same open-filament construction in various atmospheres, such that they possess the same luminous flux and the same average life at the same fixed voltage, the speed of flashing is the greater the greater the gas loss.—*A. G. Worthing, Nela Research Laboratory, Cleveland, Ohio.*

LAMPS, LUMINOUS-ARC.

Luminous-arc lamp efficiencies have been increased by the compounding under high pressure of the ingredients of the electrodes. It is reported that by this means 30 to 40 per cent more light is produced than with the previous standard electrodes, with at least equal life. For the same light as formerly increased life of the electrodes is expected.—*A. I. E. E. Committee on Lighting and Illumination.*

PAINTS, INDICATING TEMPERATURE.

An examination is being carried out into the characteristics of indicator paints; that is, paints which change their color with the temperature. This investigation covers their critical temperature, the permanency of characteristics, the number of reversals, the commercial availability and the possible advantage of using these paints on bearings of electrical apparatus, oil coolers, etc.—*H. Logan, New York City.*

PROTECTIVE DEVICES, BEHAVIOR OF, DURING DISTURBANCES.

An unusually large percentage of the larger operating companies have experienced severe system disturbances, and in some cases the behavior of the protective devices was an important factor in the disturbances. A sub-committee is now endeavoring to formulate some standard method of reporting on such matters, so that the reports can be properly condensed, summarized and made available for further study.—*Protective Device Committee of the A. I. E. E.*

STANDARD CELL, CADMIUM, IMPROVEMENTS IN.

Instead of the soft glass ordinarily used for the container a hard Corning glass G702P was used, which is much less soluble than ordinary soft glass. Further, this glass seals directly to tungsten and ordinary porcelain. Tungsten is substituted for platinum leading-in wires, and of the seventy or more cells made up and tested there has been no case of cracking of the terminals, while the mortality with platinum in ordinary glass would have been several per cent. The emfs of the cells tend to run very uniform, possibly a little high. Some other new designs are being developed so as to give a greater portability and more compact form. A disk of porous porcelain is sealed into the glass permanently to separate anode and cathode salts. In one form one electrode is an annular ring surrounding the other.—*I. Spooner and C. J. Kottman, East Pittsburgh, Pa.*

SYNCHRONOUS MOTOR, PROPERTIES OF V-CURVES.

The locus of all points on the V-curves of the synchronous motor, where the tangents to the curves are vertical, is a hyperbola which is conjugate to the hyperbola which is the locus of all points at which the tangents to the curves are horizontal. The hyperbola first mentioned divides the figure into two parts, in one of which, below the hyperbola the operating conditions are stable, and in the other, above the hyperbola the operating conditions are unstable.—*A. S. Langsdorf, Washington University, St. Louis, Mo.*

Suggestions for Research

ALTERNATORS, FIRES IN.

A number of destructive fires have occurred of late years in large turbo-alternators, with resultant losses and interruption in service. The modern inclosed construction of the alternator, the forced air draft and the high operating temperature seem to be particularly conducive to such fires. Systematic research is needed (a) into the undesirable elements of construction, (b) into dangerous operating practices, (c) into the best means for minimizing the possibility of a fire and checking its speed. —*Editorial Suggestion.*

CUT-OUTS, PRIMARY, FOR LINE TRANSFORMERS.

One of the largest operating companies some years ago abandoned the use of all types of cut-outs or lightning arresters which were inclosed in an iron case. This was found necessary on account of the troubles with these devices during rainstorms and wet snowstorms. The difficulty increased with the size of the generating or transforming units which supplied the current to the lines on which these devices were installed. In the past year another large operating company has taken exactly the same action and for the same reason. It is recommended that operating companies take note of this situation, because with the increase in the size of their generating and transforming units they will ultimately be called upon to take similar action and they should therefore investigate types of such devices without the metal inclosing case with a view to its adoption for their future work.—*Committee on Protective Devices of the A. I. E. E.*

ELECTRON EMISSION, PREVENTION OF.

During the last few years an intensive study has been made of the surface conditions of wires necessary to produce the emission of electrons, and this study has resulted in the high state of efficiency of the present electron tube. Nothing short of a similar study of the surface conditions of wires necessary for preventing the emission of electrons, instead of producing them, will finally give us the wire conductor of the future, for use with high-frequency carrier oscillations.—*G. O. Squier, War Department, Washington, D. C.*

IGNITION, HIGH-TENSION LEADS FOR.

Some trouble has been experienced with the ignition of gas engines when the high-tension leads from the spark coil to the distributer are placed in the same metal conduit with the leads from the distributer to the spark plugs. Apparently the electrostatic capacity of the lead to the ground draws an appreciable charging current from the coil and causes an excessive drop of voltage, thus leaving an insufficient voltage for the spark. Whatever the explanation may be, a careful experimental and theoretical investigation is desired, with recommendations as to the best arrangement of the leads.—*Editorial Suggestion.*

PORCELAIN, POROSITY TEST OF.

Tests to determine porosity in insulator units at the factory are needed, and the man who develops a method whereby we can detect porous insulators at the factory without destroying them will be a true benefactor of the transmission engineers and porcelain manufacturers.*—*W. D. A. Peaslee, Huntington, W. Va.*

*A.I.E.E. *Journal*, 1920, page 445.

TELEPHONE RECEIVER, INCREASE IN SENSITIVENESS.

As a result of some experiments, W. Kunze believes that the static sensitiveness with direct current of a telephone receiver may be increased many times by using a separately excited and laminated iron core in place of the permanent magnet.—*Archiv für Elektrotechnik*, 2, page 195 (1914).

Further experiments with alternating-current excitation are desired to confirm or to disprove the practicability of this suggestion.—*Editorial Suggestion.*

WOOD AS INSULATOR.

Dry wood is a good insulator, but in order to keep the wood dry its pores must be filled with some non-hydroscopic insulating compound. The proposed research would fall under several heads: First, methods for abstracting all moisture from the wood; second, the best method of forcing a suitable compound into the pores of the wood; third, determination of the best insulating compound for the purpose.—*H. H. Cochrane, Butte, Mont.*

ASSIGNED coal cars for public utilities are expected to be continued by order of the Interstate Commerce Commission. The New England priority order, however, will, it is thought, not be extended.

OF A DAILY average of 4,100 cars loaded with coal in the central region of the Pennsylvania system in a recent week, 2,200 were assigned cars, and of these more than 800 were assigned to public utilities.

MATERIAL improvement is reported in the coal situation in Ohio so far as the supply to public utilities is concerned.

SIX HUNDRED coal cars with a carrying capacity of 55 tons each have been ordered by the Public Service Electric Company of New Jersey in order to insure a continuous supply of fuel at its plants.

DIFFICULTY in obtaining coal supply for utilities may be expected to persist for several years in the opinion of Vice-President Morrow of the National Coal Association, as expressed before the Pennsylvania Electric Association.

UNWILLING to purchase coal at prevailing high rates, the Ohio Utilities Company recently closed down its plant at Delaware, Ohio, without warning its consumers, forcing a temporary suspension of many of the industries of the place.

INTERRUPTIONS to the service of the Rockford (Ill.) Electric Company were occasioned one morning recently by the poor quality of coal available and continued until a better grade could be obtained.

VALUATIONS made in 1919 and based on the average prices for the five years preceding Jan. 1, 1916, have been found by the Supreme Court of New Jersey to be unfair to the public utilities affected, and the cases have been remanded to the Public Utilities Commission for an increase in rates based on present-day costs.

THE FIRST applications for licenses to be advertised by the Federal Power Commission were made by the Ford Motor Company, Troy, N. Y., and the State of Illinois.

DEVELOPMENT of Alaskan water power in the timber area in order to make available 40,000,000,000 ft. of paper-pulp material is urged by the United States Forestry Bureau.

THE TOTAL production of electrical energy for the first six months of 1920 is put by the Geological Survey at 8,274,295,000 kw.-hr. These figures are based on reports from 3,000 power plants.

BUSINESS is reported as quiet in all sections of the country except the district around Portland, Ore., where sales are good. A heavier volume of buying is, however, looked for everywhere in the near future. Rain is thought to have injured the cotton crop, and this has caused some pessimism in the South, despite general prosperity there. Slower collections except in the Intermountain States are reported. Few price changes are noted. Transportation is better, and stocks in most lines are growing in volume.

News in Brief

Summary of Market Conditions and of Recent and Approaching Happenings of Importance to the Industry

REGULATORY commissions, declared Vice-President Young of the General Electric Company to the ELECTICAL WORLD, should show clearly to utilities and consumers what they will gain by increasing the efficiency of operation and what will be the increased cost of service if various public demands are met.

AN INCREASE in rates to large power users is to be made by the Dallas Power & Light Company in the interest of the smaller consumers.

DECLARING that the electric railways of the country need between them $300,000,000 and $400,000,000 for betterments and rehabilitation and $200,000,000 a year income, John H. Pardee, president of the American Electric Railway Association, asserts that credit can best be restored by regulatory bodies permitting flexible rates.

MARKED improvement in labor conditions throughout the country is revealed by a comprehensive survey in all sections. More workmen, fewer strikes and an improvement in individual efficiency are reported. Release of workmen by other industries makes it less difficult for electrical manufacturers to keep a full force together.

AT THE second session of the Northwest Electric Light and Power Association's convention at Spokane, Wash., the new Technical Section presented a comprehensive report, and many operating and other central-station problems were discussed.

THERE is a tendency for utilities to engage in long rather than short-term financing, according to D. C. Johnson, utility expert of the National City Company, who points out that long-term financing is the less costly.

CHANGES have been brought about which are expected to prevent large turbine unit troubles, it was brought out at the convention of the Association of Edison Illuminating Companies held this week at New London, Conn.

DETAILS of a contract for joint use of poles by power, telephone and telegraph companies where the voltage is above 5,000 were outlined at the convention of the Pennsylvania Electric Association.

A THREE-DAY practical demonstration of industrial electric lighting was staged at Nela Park, Cleveland, for electric supply jobbers.

CONVERTIBLE securities are finding public favor, according to O. B. Wilcox, chairman of the public utility committee of the Investment Bankers' Association.

A SPECIAL election upon a constitutional amendment placing all public utilities within the state under commission regulation will be held in Nebraska next week.

EDUCATION of the public both by the utilities and by the state commissions is necessary to dispel the long-existing popular suspicion, according to statements made by members of state regulatory commissions at the Nebraska Section, N. E. L. A., convention.

A SLIDING scale of rates involving bonus and forfeiture in proportion with increase or decrease in efficiency was advocated at the convention of the Indiana Electric Light Association.

AT LEAST 60,000 members of engineering societies are expected to be represented at the November meeting of the American Engineering Council.

FINANCE and regulation were the main topics at the joint convention of the Colorado Electric Light, Power and Railway Association and the Rocky Mountain Geographic Division of the N. E. L. A.

MANY technical and commercial topics were discussed by the 400 delegates who attended the convention of the New England Geographic Division, N. E. L. A.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Interest in Federated Societies Growing

THREE more local societies and one national society have indicated that they will send delegates to the November meeting of the American Engineering Council. The joint conference committee sent invitations to join the Federated Engineering Societies to associations with an aggregate membership of around 120,000. The committee is of the opinion that at the November meeting at least 60,000 of this membership will be represented by delegates. Already membership has been applied for or favorable replies received from societies with a combined membership considerably in excess of 30,000.

Representatives have been appointed by the American Society of Mechanical Engineers to the American Engineering Council to serve until Jan. 1, 1923. In addition to President Fred J. Miller and President-elect E. S. Carman, the following were chosen, representing virtually every section of the country: L. P. Alford, R. H. Fernald, A. M. Greene, Jr., W. B. Gregory, W. A. Hanley, D. S. Kimball, Charles T. Main, L. C. Nordmeyer, V. M. Palmer, H. P. Porter, A. L. Rice and Paul Wright.

Ford Water-Power Application First to Be Advertised

THE first applications for licenses to be advertised by the Federal Power Commission are those of the Ford Motor Company at Troy, N. Y., and of the State of Illinois for the use of the waters of the Des Plaines and Illinois Rivers.

Public Utility Securities to Become as Stable as Municipals

PUBLIC utility securities, because of the permanent public necessity for utility service and, in addition, because of the regulation which is consequently put upon the utilities, will eventually become in the nature of quasi-municipal securities, enjoying somewhat the same degree of stability as municipal issues themselves, was the statement of H. M. Addinsell of Harris, Forbes & Company, a member of the public utility committee of the Investment Bankers' Association, Wednesday night before the Association of Edison Illuminating Companies.

"We may just as well face frankly the fact," said Mr. Addinsell, "that the day of possible large speculative profit in public utility securities is passed.

"With the regulation that exists and the incontrovertible fact that these industries are an indispensable and permanent part of the economic structure of the communities they serve, they are becoming, and I think will become, increasingly of the nature of quasi-municipal securities. I look forward to the day when the public utility practice and financing will be so standardized and stabilized that the securities of these companies, at first in the larger communities and eventually everywhere, will command a market closely approximating—both as to level and real marketability—that enjoyed by the obligations of the municipalities themselves.

"I think that eventually some combination of the indeterminate permit and service-at-cost franchise will be universal. I perhaps should mention, however, that in view of recent experience, to be satisfactory, such franchises should contain no maximum rate and should provide a cushion in the form of a reserve fund to take up slack pending the readjustment of rates and thus insure continuously the companies the fair rate of return on their investment that is contemplated by such a franchise. So the broad solution lies in frankly putting the cards on the table and letting the light of publicity shine on the problems and purposes."

Utility Coal-Car Order Preference Expected to Be Continued

OWING to the absence of two of the members of the Interstate Commerce Commission, no conclusion as to the action to be taken on extending priority orders was expected to be reached before Friday of this week. It was very generally expected that the New England priority would not be extended, but G. W. Elliott of the National Committee on Gas and Electric Service, who is the point of contact between the public utilities and the Interstate Commerce Commission, was hopeful early in the week that assigned cars for public utilities would be continued. The committee is urging that the commission interpret "current use" as not less than twenty days' supply. Mr. Elliott made it clear that he is not interested one way or the other in the New England order, but he believes that assigned cars must be continued to insure daily supplies for public utilities.

New Jersey Utility Orders Own Cars to Insure Coal Supply

IN ORDER to insure a continuous supply of coal for its power plants the Public Service Electric Company of New Jersey has taken steps to overcome the disadvantages of a car shortage, so far as it is concerned, by providing its own coal cars. An order has been placed with the Standard Steel Car Company of New York for 600 all-steel coal cars with a carrying capacity of 55 tons each. Deliveries are promised for November, and the company expects to be carrying much of its contract coal from the Clearfield district of Pennsylvania in its own rolling stock before the end of the year.

"For those who have had to use large supplies of

coal," Thomas N. McCarter, president of the company, said, "conditions have been much worse during the greater part of the last year than at any time during the war, and as our electric company burns more than 3,000 tons of coal a day to supply light and power to domestic, commercial and industrial consumers in 191 municipalities, and to provide energy for the street cars, our problem has been a tremendous one.

"This time last year the company had a reserve coal supply of more than 200,000 tons; at present the reserve is less than 60,000 tons, due largely to a shortage of cars. There were days during the last six months when no cars were available for the company's contract coal and the only fuel it received was that bought in the open market. For weeks at a time the company failed to get normal shipments and was able to keep its plants going only by paying exorbitant prices for whatever coal it could buy. This 'free coal,' so called, cost double the contract figures, or more, but the company had to submit or run short of fuel. The purchase of the cars will, it is believed, prevent a repetition of such conditions.

"With the approval of the Interstate Commerce Commission, already granted, the cars will be used exclusively for the Public Service Electric Company, and they are of a capacity to handle three-fifths of the total supply required, provided that transportation conditions permit cars to make two round trips a month between the mines and the central stations. To handle the remaining two-fifths of its coal needs the company will depend upon cars regularly allotted under a priority order of the Interstate Commerce Commission."

Large Proportion of Assigned Cars Going to Utilities

DURING a hearing before the Interstate Commerce Commission on its wagon mine order J. B. Fisher, the general superintendent of transportation of the central region of the Pennsylvania system, selected a typical week for the territory under his jurisdiction to show the proportion of coal traffic moving under priority orders. During that week an average of 4,100 cars were loaded daily. Of that number 2,200 were assigned cars. He testified that more than 800 of the 2,200 were cars assigned for public utilities. The Great Lakes and tidewater took 900 cars, and there were 500 privately owned cars loaded.

Ohio Utilities Experience Better Coal Conditions

THE coal situation so far as Ohio utilities are concerned has materially improved. Coal shipments from the mines are increasing as a result of the coal-car preference order of the Interstate Commerce Commission. In fact, it is reported from a reliable source that mines are putting salesmen on the road soliciting orders from utilities in order to keep the mines running.

Prices for coal in Ohio are weakening, and there are some there who believe that if utilities and others refrain from storing coal at present prices for a while more nearly normal prices can be expected.

The car supply from the West Virginia fields is greatly improved owing, it is reported, both to the I. C. C. priority order and the quick unloading by utilities.

Nebraska Electric Utility Rates May Be Regulated by Commission

NEBRASKA electric utility rates are not now subject to commission regulation. Among the constitutional amendments that will be submitted to the voters on Sept. 21, 1920, at a special election is one that will make it possible for the Legislature to place every utility or common carrier under the jurisdiction of the Railway Commission, a thing that is not now possible.

Federal Power Commission Accepts Engineering Council's Offer

OFFICIALS of the Federal Power Commission have accepted the offer of the water conservation committee of Engineering Council to act in an advisory capacity on technical matters coming before the commission. At a conference between the two organizations on Sept. 10 various phases of the financial aspects of the regulations were discussed, and the committee of Engineering Council will prepare and submit recommendations thereon. O. C. Merrill, the executive secretary of the Federal Power Commission, expressed the belief that the committee will be very helpful to the power commission.

Poor Coal Causes Interruption of Service

ELECTRIC service in Rockford, Ill., was interrupted for brief periods throughout the morning of Sept. 9 owing to the inferior quality of the coal available at the power plant of the Rockford Electric Company. The interruptions began about 7 o'clock and continued until 11:15, when a better grade of fuel was obtained and normal service resumed.

In a statement to the local newspapers Adam Guchwindt, vice-president and general manager of the company, is reported as saying:

"The electric company is experiencing the greatest difficulty at the present time in obtaining the proper quality of coal for operation of the plant. We cannot buy it; it is sold to us. That is, we have to take any kind of fuel we can get without any selection as to quality on our part. The company's plant has sufficient capacity to produce the necessary amount of power, and there were no breakdowns today to warrant the curtailments in the flow of current. The whole trouble is in the poor grade of coal available for use."

Continued Coal Shortage and High Prices Predicted

OWING to the shortage of transportation, for which the solution can be worked out only gradually, public utilities may expect difficulty in obtaining their coal supplies for several years, asserted J. D. A. Morrow, vice-president of the National Coal Association, before the Pennsylvania Electric Association last week. This condition, together with increases in wages, freight rates and all other charges entering into its cost, will make cheap coal impossible in the future.

That the utility needs a preference in its coal supply in order to maintain service and prevent a public calamity was pointed out by Mr. Morrow. But because the utility is a preference customer it must pay a premium on the price of coal for the privilege.

Utility Commissions Should Recognize Efficiency, Says O. D. Young

WHILE state regulatory commissions maintain that they believe in the principle of rewarding efficiency in public utilities, they do not get right down to rock bottom by setting up formulas which will definitely show the companies and the consumers what both will gain in dollars and cents by increasing the efficiency of operation or the skill of management, or what will be the increased cost of service if the various demands of the consumers or the public are met. This was the opinion expressed this week by O. D. Young, vice-president of the General Electric Company, to a representative of the ELECTRICAL WORLD.

"It is not necessary for a commission to set up a formula that must be applied generally throughout the state," said Mr. Young, "or which is not to be altered when severe changes in general conditions come up. If, however, a basis of return which is fair at the time is definitely put down, together with the conditions under which increased economy will react on these returns, then commission regulation will be a servant instead of a master.

"A public utility has the right to know beforehand what proportion of a given increase in net revenue will remain as an increased return on the property value and how much of it will revert to the public. The public and the utility should be able to find out exactly what the increased cost of service will be if demands such as making line extensions or the placing of overhead distribution circuits underground are to be met without the insecurity of waiting for the commission to decide at the time according to its judgment or political expediency."

Many Technical and Commercial Topics Discussed by New England Men

FOUR hundred delegates registered at the twelfth annual convention of the New England Geographic Division of the National Electric Light Association at Mount Kineo, Me., on Tuesday. The sessions were enthusiastic and a splendid response to the new organization development of the parent body was evident. The features of Tuesday's meeting were a stimulating and informing address by W. S. Murray on the progress of the super-power zone survey, an able outline of national association work by Executive Manager Aylesworth and a fine technical session planned by I. E. Moultrop and conducted by W. H. Cole, E. B. Ricketts, W. K. Vanderpoel and D. S. Boyden. Great interest was taken in the discussion of the technical reports made at the Pasadena convention of the N. E. L. A.

An emphatic telegram urging the Interstate Commerce Commission to extend priority order No. 9 was sent.

The intensive use of paper-insulated cable was favored in the technical session discussions, as well as the use of motor-driven auxiliaries supplied from the house turbine to secure a heat balance. A record of 8.6 kw. per boiler-horsepower was obtained at a recent Boston Edison company test where equipment was forced beyond desirable operating conditions. The automatic station is coming into larger use for all classes of service. Speakers urged the need of specification for farm-line construction.

At the public policy session on Wednesday night addresses were made by M. R. Bump, W. E. Stanwood of Boston and M. H. Aylesworth.

Problems of Large Systems Discussed by Edison Association

ABOUT 150 executives and engineers of the central-station companies operating in the metropolitan centers of the East and Middle West attended the thirty-ninth convention of the Association of Edison Illuminating Companies at New London, Conn., Monday to Thursday of this week. President Walter H. Johnson of Philadelphia at the opening session briefly commented on the work of committees during the year, calling attention to the creation of the new committee on steam turbines and generators. That committee, headed by H. P. Liveridge of Philadelphia, and the committee on troubles in generation on direct-current distribution systems, headed by Philip Torchio of New York, presented very comprehensive reports covering all phases of large-system operation. Through co-operation between the operators and manufacturers it was pointed out that certain changes have been brought about which are expected to prevent the troubles that have been experienced with large turbine units.

In the symposium of the committee on troubles in generating stations and distribution systems details of special disturbances were outlined and their effects on operation. Those special troubles included short circuits, cable failures, control failures and the like. These troubles were largely caused by the strain on all systems due to the growth of load and abnormal operating conditions. It was pointed out that reliability of control circuits through special storage-battery installation, the proper use of reactors to maintain stable synchronizing conditions where several units are operated together in separate stations and to protect switches and circuit breakers by limiting momentary short circuit currents are among the operating problems of first importance.

Dr. C. P. Steinmetz in a very interesting paper took up the problem of synchronous operation arising from the use of power-limiting reactors, discussing them from the standpoints of reliability and economy. Another particularly interesting paper was presented by E. W. Rice, Jr., president of the General Electric Company, on turbine characteristics, in which he reviewed briefly the troubles experienced during the war period with large turbines and the research methods that have been employed to determine the causes and apply corrections. By lantern-slide illustrations he showed the studies which have been conducted to detect flaws in metals and character of vibrations that are liable to occur.

Commercial problems were discussed, with particular attention to power factor, rates, special loads such as electric welding and electric furnaces, and the financing of future requirements in plants and lines. A feature of this convention was the discussions by those who have been associated with the electrical industry since its early days. Among these were Alex Dow, Detroit Edison Company; John W. Lieb, New York Edison Company; L. A. Ferguson, Commonwealth Edison Company; Dr. C. P. Steinmetz, General Electric Company; Dr. A. E. Kennelly, Harvard University and Massachusetts Institute of Technology; S. F. Mitchell, Electric Bond & Share Company; C. L. Edgar, Edison Electric Illuminating Company of Boston, and E. W. Rice.

Northwest Utility Men Discuss Technical Problems

ABROAD general survey of the technical problems of the Northwest was taken at the second session of the Spokane convention of the Northwest Electric Light & Power Association. This was the first year of the Technical Section, and a most comprehensive report was presented by George E. Quinan, Puget Sound Power & Light Company, chairman. That particular attention be given to the education of meter readers was urged in the discussion of the meter report, presented by J. C. Henkle, Portland Railway, Light & Power Company, as well as the necessity for all members of a company understanding and conveying to the public the idea of the accuracy of meters. H. J. Gille, Puget Sound Power & Light Company, appealed for further study of power-factor recording devices, which are now becoming an important Western problem. Survey of Western practice in the use of hydro-electric apparatus was made in the apparatus report by F. D. Nims, Washington Coast Utilities Company, who pointed out the responsibility of the West in hydraulic research.

The need for a special study of the oil-switch problem was brought out in the discussion, as Western plants will soon reach the limit of rupturing capacity of switches now manufactured. That attention should also be given to non-electrical apparatus and performance records kept for the guidance of manufacturers was brought out by S. C. Lindsay, Puget Sound Power & Light Company. Steam prime movers, being more especially an Eastern problem, were not emphasized in the report. The acuteness of the inductive interference problem was outlined by Mr. Quinan, who cited many requests for aid in interference cases and sketched the general principles as outlined by the national committee as important. The co-operation of the communication interests in the scientific study of this problem was pledged by D. I. Cone, Pacific Telephone & Telegraph Company, who urged a joint consideration of the difficulties before construction rather than an adjustment afterward. A paper on pole treatment was presented by W. M. Leavitt, Western Red Cedar Association, who told of the success of the new puncturing treatment which guarantees half-inch penetration even with unseasoned wood.

F. T. Griffith, Portland Railway, Light & Power Company, presented a survey of N. E. L. A. work in its relation to Western needs and urged concerted action in carrying out a national public policy program of education. The importance of protecting poles from fires was brought out in the discussion of the report on overhead construction presented by R. M. Boykin, North Coast Power Company.

Active discussion brought out by the range report reflected the extreme interest in this subject in the Northwest. It was apparent that, although the range business had been allowed to lapse somewhat, owing to high construction costs, it was in a healthy state at present and on the way to large increases. Transformer and installation costs had not proved so much of a burden as had been anticipated, and also the diversity factor of this load was more attractive than had been expected. The use of a two-way switch between a water heater and a range was supported by the experience of several companies. W. R. Putnam, Idaho Power Company, concluded the discussion by pointing out the justification for an increase in cooking rates to meet increases in cost of other fuel.

W. M. Hamilton, Portland Railway, Light & Power Company, concluded the meeting with an able analysis of management problems, which he held might be summed up as the necessity for maintaining cordial relations between employer and employed and company and public.

The election of officers resulted in the choice of Franklin T. Griffith, Portland Railway, Light & Power Company, as president; R. M. Boykin, North Coast Power Company, Portland, member of the executive committee at large, and the following vice-presidents: Montana—O. W. McConnell, Helena; Idaho—W. R. Putnam, Boise; Utah—S. R. Inch, Salt Lake City; Oregon—George L. Myers, Portland; Washington—N. W. Brockett, Seattle.

Telephone and Telegraph Lines to Operate on Poles Carrying Over 5,000 Volts

DRAWING up and executing a contract for the use by telephone and telegraph companies and electric power companies of joint-pole lines where the transmission voltage is above 5,000 volts was the principal feature of the report of the engineering committee, Paul Spencer chairman, at the convention of the Pennsylvania Electric Association at Bedford Springs, Pa., Sept. 8 to 11. This contract, which is the result of nearly a year's negotiations between the engineering committee and representatives of the telephone and telegraph company, provides that where it cannot be reasonably avoided circuits above 5,000 volts may be put on a joint-pole line.

In an address on "Coal Storage" O. P. Hood, chief mechanical engineer, United States Bureau of Mines, pointed out that one of the troubles causing spontaneous combustion has been that undue attention has been given to minor factors such as sulphur, height of pile, volatile matter, etc., while the main factors, such as initial temperature, breakage in handling, freshness of coal and coal screening before storage have been overlooked.

In a paper on "Power Service—Where Do We Go from Here?" G. M. Gadsby called attention to the rapid development of new fields for electric service.

As the result of the large sales of household energy-consuming devices a greatly increased residential load has been built up and some central stations estimate that 50 per cent of their total residence load is due directly to this source, said Thomas W. Berger in a paper discussing electrical merchandising.

Data were presented by Joseph McKinley in a paper discussing the advantage of purchased power, showing the increasing use of central-station power by manufacturers who have found it more profitable to invest their money in expansion of their business rather than in non-productive isolated power plants.

Determination of the capacity and location of pole-line distributing transformers with reference to the investment required and efficiency of operation was discussed in a paper on the economical arrangement of pole-line transformers of George S. Humphrey.

At the close of the convention the following officers were elected for the ensuing year: President, Henry Harris, Wilmerding, Pa.; first vice-president, A. H. S. Cantlin; second vice-president, E. H. Davis, Williamsport, Pa.; treasurer, H. H. Ganser, Norristown, Pa.; secretary, Henry M. Stine, Harrisburg, Pa.

Public Must Be Educated if Suspicion Is to Be Dispelled

THE public cannot shift the burden of increased costs in such a way as to bring financial distress to the utilities, declared Thorne A. Brown of the Nebraska Railroad Commission in his address before the Nebraska Section of the National Electric Light Association at Omaha on Thursday, Sept. 9. The utilities are facing an unfavorable past history that has aroused suspicion in the public mind, and it is entirely up to them to dispel this suspicion by careful and tactful education, Mr. Brown added. The utilities cannot expect a fair-minded attitude on the part of the public unless a fair-minded attitude toward the public is maintained, it was argued. The address also pointed out the impossibility of municipalities properly handling regulatory problems because of a lack of facilities and organization and the pressure of purely local business and political conditions. Regulatory bodies reflect the public attitude, and while utilities are legally protected as to earnings, regulatory bodies have in many cases been responsible for improper rates due to excess caution because of public suspicion and political conditions.

The merchandising problem is being studied from the engineering standpoint, according to H. D. Sanborn, who led in the discussion of T. E. Roach's paper on "Central-Station Merchandising."

F. H. Brooks presented a clear outline of present rural-line distribution financing practices, the Wisconsin and Iowa methods being largely dealt with. R. J. Andrus, A. J. Colè and J. C. Martin discussed the paper, pointing out mistakes made in financing and rates due to insufficient consideration of the problem as to its probable development.

The discussion on "Public Relations in Nebraska" Wednesday evening was participated in by W. B. Roberts, Horace M. Davis and Frank Mays. The necessity of getting a thorough understanding of utility matters before the public and city councils was discussed by all the speakers. The activities of the Nebraska Committee on Public Utility Information were described by Mr. Davis. President Martin J. Insull of the National Electric Light Association told of the new activities of that body and urged the importance of commission regulation. The Nebraska commission has no jurisdiction over electric utility rates.

The following officers were elected: President, James B. Harvey, Omaha; vice-president, W. B. Boberts, Omaha; executive committee, J. E. Harsh of Lincoln, W. B. Roberts of Omaha, O. J. Shaw of Lincoln, C. H. Cornell of Valentine, J. E. Davidson of Omaha, and J. B. Harvey of Omaha.

West Wants 1921 A. I. E. E. Convention at Salt Lake City

WESTERN members of the American Institute of Electrical Engineers are anxious to secure the 1921 annual convention at Salt Lake City in conjunction with the annual Pacific Coast convention. F. L. Hutchinson, secretary of the Institute, who has just returned from an extensive tour of the West, reports that, since the Portland convention, at which a resolution to the above effect was adopted, from conversation had with members the plan seems to have the general approval of the Far West. It is also known that influential members further east are in sympathy with the proposal. Except for the Milwaukee convention in 1906 and the San Francisco convention in 1915 no annual convention of the Institute has been held in the West since 1898, when it was held at Omaha.



DELEGATES TO THE NEBRASKA N. E. L. A. SECTION CONVENTION GROUPED IN FRONT OF HOTEL FONTENELLE, OMAHA

Society for Electrical Development Launching Christmas Campaign

THE Society for Electrical Development is launching its annual electrical Christmas campaign. The outstanding feature of the dealer helps to be supplied during this year's drive will be an attractive eight-color window display cutout featuring the slogan, "Say 'Merry Christmas' electrically." Poster stamps, attractively printed letters, advertising cuts and other selling helps will be supplied. Full particulars of the drive will be mailed to the industry about the middle of October. The plans were laid before the executive committee at its Sept. 10 meeting and were approved.

Many Public Utility Hazards to Be Considered by National Safety Council

MEETING at Milwaukee, Wis., from Sept. 27 to Oct. 1, the National Safety Council will have a five-day program packed full of reports and papers bearing on the avoidance of industrial accidents. The program for the meetings of the public utilities section, two in number, is as follows:

TUESDAY, SEPT. 28

Reports. Addresses: "Hazards in Line Construction—Handling Poles, Erecting Poles, and Reconstruction of Old and Antiquated Lines," by F. W. Fisher, Rochester (N. Y.) Railway & Light Company; "Accident Hazards in Laying Conduit Underground," by H. W. Lueck, Commonwealth Edison Company, Chicago; "Accident Hazards in Laying Gas Mains," by R. S. Carter, Malden, Melrose Gas Light Company, Malden, Mass.; "Utility Accidents to the Public Prevented Through School Safety Education," by Dr. E. George Payne, principal Harris Teachers' College, St. Louis.

WEDNESDAY, SEPT. 29

Report of nominating committee. Addresses: "Medical Service in Public Utilities," by Dr. C. H. Lemon, Milwaukee Electric Light & Railway Company; "Hazards in Building Additions to Power Plants—Protecting Operators and Equipment," by W. H. Mulligan, Hydro-Electric Power Commission of Ontario; "Accidents to Meter Readers and Other Employees on Equipment Outside of the Company's Premises," by George Opp, Detroit Edison Company, and F. A. Tewksbury, Denver Gas & Electric Light Company; "Fixing the Responsibility and Penalizing Those Responsible for Accidents and Awarding Those Showing Meritorious Action in Time of Accident," by H. C. Lucas, Philadelphia Electric Company.

On Tuesday, Sept. 28, there will be a "get-together" luncheon of the public utilities section, with addresses by A. W. Berresford, president of the American Institute of Electrical Engineers, and Martin J. Insull, president of the National Electric Light Association.

Sliding Scale of Bonus and Forfeiture Advocated at Indiana Convention

THE keynote of the twelfth annual convention of the Indiana Electric Light Association, held at French Lick Springs this week, was struck by President P. H. Palmer when he said in his opening address: "The utilities of the state are kept alive by the allowable fixed rate of return, but this creates no incentive for better service and more efficient operation. The public and the investors will both be better off when public utilities are operated on a sliding scale of bonus and forfeiture in proportion with the increase or decrease in efficiency.

Martin J. Insull, president of the National Electric Light Association, and E. I. Lewis, chairman of the Public Service Commission of Indiana, were on the program for the first day, but neither could be present.

The contention of many central-station managers that no unavoidable investment should be made until prices drop was declared to be untenable in an address by G. S. Neal of Michigan City. He said that any improvement should be made if it reduced annual operating expenses by one-third of its cost.

"I do not believe that in the whole State of Indiana there is a single public utility operating today that is earning or has been allowed to earn by the commission what the laws of the State of Indiana says that the commission should allow it to earn," said Charles C. Perry, president of the Indianapolis Light & Heat Company, in an address on "The Public and Public Utilities." "Every public utility of whatsoever character should help to educate the people with reference to the provisions of the public utility law." This paper brought out an extended discussion led by Harry Reid of Louisville, Ky., on central-station credit, financial and public policy matters.

The report of the last two days of the convention will appear in an early issue.

Finance and Regulation Main Topics at Colorado Convention

THE Colorado Electric Light, Power and Railway Association met in its seventeenth annual convention at Glenwood Springs, Col., on Monday, Tuesday and Wednesday of this week, joining with the Rocky Mountain Geographic Division of the National Electric Light Association, which held its first convention at this time.

A. C. Foster, president of the Bankers' Trust Company, Denver, spoke optimistically of the future of utility securities, which, while at present difficult to sell, are being taken up more freely than heretofore. Norman Read, Colorado Power Company, and president of the association, made the feature of his address the lack of understanding of the problems of the utilities by the general public and the necessity of an educational campaign to foster a spirit of respect for the utilities and the commissions which will make the marketing of their securities easier and lead to a better public appreciation of the service.

Mr. Dwight, engineer of the Public Utilities Commission of Colorado, pleaded for a better understanding between the utilities and the commissions. His point was that the commissions now have a better appreciation born of knowledge of the public utility business, but that there are forces at work to bring regulation to naught. In combating these forces it is necessary for the utilities and the commissions to work together for the common good.

The necessity of uniformity in power contracts throughout the state was emphasized by T. O. Kennedy of the Denver Gas & Electric Light Company. There appears to be a wide divergence of practice in charging for extensions and in apportioning the costs among the various users of the lines.

A feature of the convention was the address of Martin Insull, president of the National Electric Light Association, who dwelt on the newer and broader activities at the headquarters of the association.

W. H. Onken, Jr., editor of the ELECTRICAL WORLD, discussed regulation from a public policy viewpoint and the obligations that utilities are under, not only rendering maximum service but also in working in close cooperation with public service commissions. He elaborated on a higher phase of municipal ownership through customer ownership of securities and told why preferred stocks and bonds were being taken rather than common stock. The advantages of large scale production were discussed and the disadvantages under which water-power companies are laboring financially was touched on.

Officers were elected as follows: President, C. A. Semrad, Boulder, general manager Western Light & Power Company; first vice-president, T. O. Kennedy, Denver, general superintendent Denver Gas & Electric Light Company; second vice-president, F. Norcross Greeley.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Newton, Iowa, Sells Light Plant.—At a special election held recently the voters of Newton, Iowa, indorsed by more than two to one a proposition to sell the city's electric light plant for $41,500 and granted a franchise to A. H. Rich of Des Moines.

Exposition of Chemical Industries.—The sixth National Exposition of Chemical Industries will be held in the Grand Central Palace, New York City, in the week beginning next Monday, Sept. 20. Among many motion pictures showing progress in the chemical art will be two series illustrating the United States ammonium nitrate plant No. 2 at Muscle Shoals, Ala.

Naval Radio Service Now Accepts Private Messages.—The United States Navy Department is now accepting private and press radio messages to France, which are transmitted by way of the big power radio station at Lyons. Commercial messages to Colombia, Ecuador and Venezuela are sent through the radio station at Porto Colombia. The navy will also accept messages to Belgium and the Netherlands, Italy, Luxemburg, Switzerland, Czechoslovakia and Jugoslavia.

Western Electric Employees Buy Bonds.—Among the subscribers to the recent issue of five-year 7 per cent convertible gold bonds issued by the Western Electric Company were 4,574 employees, representing investors in each of the forty-two branches of the concern. They have applied for securities aggregating approximately $2,000,000 par value. The sale to the employees was made under an installment basis, payment being made on a schedule similar to that used during the Liberty Loan drives.

Achievements of Naval Consulting Board.—Many of the most interesting inventions of the war are set forth, with illustrations, in "The Naval Consulting Board of the United States," a book just issued under the auspices of the Navy Department. The work of Thomas A. Edison, who is president of the board, is described, and the development of the listening devices employed successfully in the war for the detection of submarines is recounted in detail. Lloyd N. Scott is the author of the volume, of which a sales edition will be issued by the Government Printing Office should the demand for copies warrant it.

Electrification of Italian Railroads.—The general plan for the electrification of the railroads of Italy drawn up by the government includes four groups of roads. The first of these groups, which is to be electrified at once by the Administration of the Railways, has a total length of 826 miles; the second group, also to be electrified by the administration but at a later date, has 695 miles; the third group, on which experiments with new systems of traction are to be made, has 157 miles, and the fourth group, to be left to private enterprise, has 1,080 miles. The new systems of traction which are to be experimentally installed are described as including a three-phase system with industrial frequency, a system of direct current at high tension, and a system of direct current with ordinary voltage and accumulation.

Hydro-Electric Project at the Falls of the Ohio.—The utilization of waste water power at the Falls of the Ohio, Louisville, Ky., has been recommended in an official report to General Lansing H. Beach, Chief of Engineers, U. S. A. Hitherto it has been thought that the low stage of these rapids for two months of the year, necessitating a supplementary steam plant, rendered their development uneconomical; but the increased price of coal has operated to change this opinion. It is reported that 100,000 hp. could be developed with an outlay of $9,500,000, and that from 20,000 hp. to 50,000 hp. could be produced very cheaply. It is also contended that by the construction of a canal connecting the two branches of the U-shaped river and affording a 24-ft. drop in a distance of two or three miles the difficulty caused by the varying stages of the stream would be eliminated.

Increased Rates for Electricity in Many Sections.—The City Council of Springfield, Ill., has abolished the discount of 10 per cent formerly allowed on electric light bills paid before the tenth of the month, this amounting to an increase of 12.2 per cent for energy furnished by the municipal plant. The Minneapolis General Electric Company has imposed a surcharge of 10 per cent on all bills for electric lighting and power as a coal emergency measure. The Public Service Commission of Oregon has permitted the Bandon Power Company to raise its rates, the former ones being found non-compensatory. In Lenoir, N. C., the Corporation Commission has allowed the Citizens' Light & Power Company a temporary increase in rates. Twenty per cent has been added to the rates of the Dublin (Ga.) municipal plant and 60 per cent to those of the Kentucky Light & Power Company at Hickman, Ky. Martin's Ferry, Ohio, has raised the price of energy furnished by the municipal plant. The Clinton (Mass.) Gas Light Company has put up its electric rates 1 cent a kilowatt-hour, and the Cambridge (Mass.) Electric Light Company has adopted a fuel charge of 1¼ mills per kilowatt-hour for each dollar's cost per ton of coal in excess of $5, no charge for electricity, however, to exceed 9 cents per kilowatt-hour. In Arizona the Deseret Power & Water Company, operating in Mohave County, has been permitted by the Corporation Commission to advance its rates.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Power Club Convention at Hot Springs, Va.—The convention of the Electric Power Club will be held at the Homestead Hotel, Hot Springs, Va., Nov. 15-18, 1920.

E. S. J. A., Atlantic Division.—The next regular quarterly meeting of the Atlantic Division of the Electric Supply Jobbers' Association will be held Sept. 23 at the Bellevue-Stratford, Philadelphia.

Duluth Engineers' Club.—Graham Bright, general engineer of the Westinghouse Electric & Manufacturing Company, will give talks on "Electric Mine Equipment" before the Duluth (Minn.) Engineers' Club and the Engineers' Club of Northern Minnesota at Virginia, Minn., on Sept. 20 and 25, respectively.

Montana State Contractor-Dealer Association.—The second convention of this association was held recently at Great Falls, the organizing convention having been held at Butte only last April. A movement is under way to affiliate with the National Association of Electrical Contractors and Dealers. The jobbers and the central-station men of Montana have become affiliated with the Contractor-Dealer Association, and a co-operative campaign on the lines followed in California is being planned. The president of the Montana body is J. P. Currah of Helena, and the secretary is E. Downing of Butte.

Coming Meetings of Electrical and Other Technical Societies

Association of Iron and Steel Electrical Engineers—New York City, Sept. 20-24. (For program see issue of Sept. 4, page 492.)

Atlantic Division Electrical Supply Jobbers' Association — Philadelphia, Pa., Sept. 23.

Central Division Electrical Supply Jobbers Association—Chicago, Sept. 24.

American Electrochemical Society—Cleveland, Sept. 30-Oct. 2.

Illuminating Engineering Society—Cleveland, Oct. 4-7. (For program see issue of Aug. 14, page 349.)

National Association of Electrical Contractors and Dealers—Baltimore, Oct. 4-9. (For program see issue of July 24, page 205.)

Electric Furnace Association — Columbus, Ohio, Oct. 6.

American Electric Railway Association—Atlantic City, N. J., Oct. 11-15.

National Association of Electrical Inspectors—Philadelphia, Pa., Oct. 12-13.

British Columbia Association of Electrical Contractors and Dealers—Vancouver, B. C., Oct. 19.

International Association of Municipal Electricians—New Orleans, Oct. 19-22.

Association of Railway Electrical Engineers—Chicago, Oct. 28-31.

Electric Power Club—Hot Springs, Va., Nov. 15-18.

Southeastern Geographic Division N. E. L. A.—Nov. 17-20.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

What Constitutes Negligence.—The St. Louis (Mo.) Court of Appeals in a suit for damages (Gilbert vs. Hilliard) has declared that "negligence" is properly defined in an instruction to the jury as failure to use ordinary care, which is the care that reasonably prudent men would use under the same and similar circumstances. (222 S. W. 1027.)*

Unjust Rates Cannot Be Approved by Commission.—In Borough of Greensburg vs. Public Service Commission of Pennsylvania, the Supreme Court of Pennsylvania asserted that the commission was unable to order or approve the collection of rates which it had found to be unjust and unreasonable. (110 At. 750.)*

City Estopped from Denying that Rights Were Conferred on Company.—Where a city has charged a power company yearly sums, designated as rent, for granting the right to lay and operate its conduits on a bridge, it is precluded from taking the position that the power company already had the right to cross the bridge under its general franchises and powers, and that therefore no rights were conferred or consideration given for the payments which were exacted, according to a decision of the Court of Appeals of New York in a proceeding by the New York & Queens Electric Light & Power Company against the Public Service Commission to have such sums credited on assessments made on special franchises granted to the company. (128 N. E. 131.)

Negligence Under California Workmen's Compensation Act.—The failure of a master to comply with a general safety order of the Industrial Accident Commission of which he had no notice would not of itself constitute "gross negligence" within the meaning of the workmen's compensation, insurance and safety act of California, according to a decision of the District Court of Appeals of that state in Schmidt vs. Pursell. It is incumbent upon a servant suing for personal injuries caused by gross negligence to prove that injury resulted both from gross negligence and from willful disregard of life, limb or bodily safety, the term "to willfully disregard" meaning to intentionally do or fail to do something which contributes to the injury, having actual knowledge of the perils incident thereto or having what in law is equivalent to such actual knowledge. (190 Pac. 846.)

Moral Debt by Company Where Excessive Rates Have Been Paid.—If a consumer, pending a decision by the Public Service Commission, pays to a public service company sums which are subsequently found to be excessive, such excess payments are, according to a judgment of the Pennsylvania Supreme Court in Borough of Greensburg vs. Public Service Commission of Pennsylvania, debts morally due by the company, even though the statute of limitations prevents a recovery by suit; and it may recognize and pay them at any time. Customers of a public service company are, however, legally interested only in being charged nothing beyond just and reasonable rates, and hence if this is secured to them they have no just ground of complaint. (110 At. 750.)

Burden of Proof.—Where complaint is filed against a schedule of rates of a public utility within the thirty days before schedule becomes effective under the public service act, the burden of proving the rates reasonable, the Pennsylvania Supreme Court has declared, in Suburban Water Company vs. Borough of Oakmont, is on the utility; but if complaint is made after the schedule becomes effective the burden is on the complainant. (110 At. 778.)

Rehearing from Commission Need Not Be Asked Before Court Action.—The Supreme Court of Indiana has determined, in Greensburg Water Company vs. Public Service Commission, that as the public utilities commission act contains no provision requiring a party dissatisfied to apply first for a rehearing by the commission one dissatisfied with a commission order need not make such application. The act limits the time for bringing an action in the courts to sixty days after the decision or thirty days after an order of the commission has been set aside. (128 N. E. 103.)

Death from 120 Volts Held Not to Warrant Damages — Negligence Must Be Proximate to Be Actionable.—Two points of interest were decided by the Supreme Court of Alabama in Lawson vs. Mobile Electric Company. In this case damages were sought because of the death of a negro ship worker who while standing on a wet plank received an electric shock through an imperfectly insulated lamp cord. It was held to be clearly proved that the voltage could not have exceeded 120, and the court held that, this not being a fatal voltage, the doctrine of *res ipsa loquitur* (the thing speaks for itself) did not apply. The company was charged with negligence in failing properly to inspect its transformers, but the court held that this would not justify recovery for the death of the man, since an examination after the accident showed that in this instance the transformer was working properly and no excessive current was carried. Negligence, it held, must be proximate to be actionable. (85 So. 257.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Basis of Valuation on War Values Denied.—In the Chesapeake & Potomac Telephone Company rate increase case the Virginia Corporation Commission held that a fair and reasonable basis for valuation is the reproduction value as of normal times at pre-war prices, plus the actual sums necessarily expended during the period of inflation less depreciation deductions.

Heating Plants of Electric Utilities.—In denying an application from the Southern Illinois Light & Power Company to discontinue in part its heating service, the Illinois Public Utilities Commission, while asserting that a heating plant receiving its heat for the most part from the exhaust steam of an electric plant should not be required to extend its lines beyond a reasonable distance from the plant or into the residential districts where the amount of business served per unit of distribution main is relatively small, declared that a utility furnishing such heat could not be permitted to serve a portion of its consumers and abandon others which it had taken on while operating under a franchise obtained from the city government.

Definition of "Demand Charge."—The Idaho Public Utilities Commission, in fixing the amount of demand charge to be made to a certain irrigation district by the Idaho Power Company, said: "Demand charge is simply a readiness-to-serve charge. In other words, it is an amount paid to the power company by the customer for the privilege of having a certain portion of the company's capacity reserved for the use of the particular customer whenever he may call for it. Whether he calls for the service or not, the demand charge must be paid because the service is held for him. However, a readiness to serve means an ability to serve. The customer pays for, and the company must receive its payment through, service rendered. When a utility holds part of its capacity for the service of a company it performs a very real service for which it is entitled to payment; but this service is of full value only when the energy to meet the customer's full demand is available when made." The commission went on to assert that the demand charge of an electric company should not reflect an amount of horsepower greater than the company is able to deliver with a reasonable degree of certainty and continuity when the demand for this service is made by the consumer.

Franklin T. Griffith, president of the Portland Railway, Light & Power Company, who was elected president of the Northwest Electric Light & Power Association at the Spokane convention on Sept. 9, 1920, is a native of Minnesota, where he received his early education in the Oakland Academy. In 1894 he was admitted to the bar in Oregon, and he was for a number of years connected with the legal department of the Portland General Electric Company. He has been employed by the Portland Railway, Light & Power Company since 1904 and early in 1913



F. T. GRIFFITH

was elected vice-president. On July 1, 1913, he succeeded B. F. Josselyn as president. Mr. Griffith was chairman of the water-power development committee of the National Electric Light Association during the year 1919-1920 and has been re-elected for the year 1920-1921. At the Pasadena convention in May, 1920, he was elected fourth vice-president of that association.

Obituary

Dr. Samuel Sheldon, who for the last thirty-one years had been professor of physics and electrical engineering at the Polytechnic Institute of Brooklyn, died Sept. 5 at Middlebury, Vt., while on his vacation. As an experimental physicist, electrical engineer, scientific writer and author Dr. Sheldon was well known in this and other countries. As professor of physics and electrical engineering at the Polytechnic Institute Dr. Sheldon organized the latter department and under his supervision the mechanical engineering, physical and electrical engineering laboratories were installed. During his administration he also carried on an extensive consulting engineering practice. His reports of experimental investigations to the Electro-Therapeutic Association constitute a valuable contribution to science and to the art relating to electrostatic machines. Dr. Sheldon was born at Middlebury, Vt., fifty-eight

Men of the Industry

Changes in Personnel and Position—Biographical Notes

years ago. He was graduated in 1883 from Middlebury College with the degree of A.B. and remained there two years as instructor in mathematics. In 1887 he received the degree of A.M. In the fall of 1885 he entered the University of Würzburg, Germany. During his first year there he was selected by Professor Kohlrausch to assist in special investigations, among which was the classic determination of the ohm for the Bavarian government. At that time he held the position of assistant in laboratory physics. He was graduated in 1888 with the degree of doctor of philosophy. He then returned to America and was appointed first assistant in physics under Prof. John Trowbridge at Harvard University, where he conducted many original investigations in magnetism, the results of which were embodied in papers presented before the American Academy of Arts and Sciences. In 1899 Dr. Sheldon was appointed to the chair of physics and electrical engineering at the Polytechnic Institute of Brooklyn. Dr. Sheldon was a member of many engineering organizations, including the American Institute of Electrical Engineers, American Association for the Advancement of Science, Brooklyn



SAMUEL SHELDON

Institute of Arts and Sciences, American Electro-Therapeutic Association, New York Electrical Society, American Physical Society, Society for the Promotion of Engineering Education, American Electrochemical Society and the American Electric Railway Association. Professor Sheldon was the author of the following technical books: "Dynamo-Electric Machinery." "Alternating-Current Machines," "Electric Traction and Transmission Engineering" and "Physics Laboratory Experiments."

Prof. John Perry, well-known scientist and engineer, who died at his home in London on Aug. 4 at the age of seventy, was widely known as an inventor, teacher and author. Among the books published by him are "The Calculus for Engineers," "Applied Mechanics" and "Steam, Gas and Oil Engines." Many of his lectures and addresses before the British engineering societies and technical colleges have been published in book or pamphlet



JOHN PERRY

form. Many honorary degrees were conferred upon him, and he was a past-president of the Institution of Electrical Engineers and of the Physical Society and treasurer of the British Association. In conjunction with Professor Ayrton, he brought out many inventions, including multipolar dynamos in 1882. These two men were also pioneers in electrical instrument development, and credit is accorded to them for having invented the first motor meter put on the market in Great Britain. Professor Perry had a long career as a teacher, beginning in 1870 at Clifton and later being honorary assistant to Sir William Thomson (Lord Kelvin) in Glasgow. He was joint professor of engineering with Professor Ayrton from 1875 to 1879 at the Imperial College of Engineering in Japan. In 1882 he became instructor in mechanical engineering and applied mechanics at Finsbury Technical College and later was made professor of mechanics and mathematics at the Royal College of Science in 1896, retaining that post until 1913, when he was retired under the age-limit rule. Upon his retirement from the Royal College of Science in 1913 he was chosen by the government to investigate the conditions of education in South Africa, and he was largely instrumental in drawing up a scheme for the foundation of the South African University. During the last few years he gave scientific advice on military matters and pursued studies in gyroscopic temperatures.

Trade and Market Conditions

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

South African Dealers Complain of American Manufacturers

DEALERS in American electrical goods in South Africa are complaining because they are unable to get long-standing orders filled in the United States, the American Trade Commissioner at Johannesburg reports. Some of these customers say that they have had goods on order for twelve months and still have no definite promise of delivery.

Lack of consideration for foreign customers is one of the old standing complaints against American methods. It has been "harped" on time and again. The South African dealers seem to be of the opinion that American manufacturers are devoting all of their attention to the domestic market and that they have tied up their output for long periods without giving a thought to agents and customers thousands of miles away who may be entirely out of goods.

Dr. R. S. MacElwee, Director of the United States Bureau of Foreign and Domestic Commerce, urges manufacturers of electrical goods to make a special effort to fill foreign orders: "If they do not," said the director, "much harm will result to American business, not only in the electrical trade but to other lines as well. Indifference to the needs of foreign customers in one line of goods readily affects the sale of other American products in the same section. I do not believe our manufacturers are willfully neglecting their foreign patrons. Some of them simply do not appreciate the importance of the subject and do not seem to realize the national harm which may result."

American manufacturers will soon have to face keen competition in foreign markets. It is not likely that our competitors will overlook "American indifference" as a selling argument, especially if they find foreign business men in a receptive mood for such propaganda. To eliminate legitimate cause for complaint and keep the factories going is the director's final advice.

Decided Improvement Seen in the Labor Situation

A SURVEY of labor conditions throughout the country reveals marked improvement in the situation. A greater supply of available workmen, less labor trouble, fewer strikes, and in many cases an improvement in the unit efficiency of labor, are the features which mark the situation.

While no material reduction in the amount of labor employed by the electrical industry is noticed, except where the inefficient workman has been released, still the release of labor by other industries makes it less difficult for the electrical manufacturer to keep a full force together. It also acts as a stabilizer to labor by discouraging to a degree job-changing and strikes on the slightest provocation. An analysis of the labor situation from this angle therefore is interesting.

The gradual development of non-employment in many parts of the country has apparently been caused by three factors. Delays in receiving fuel and raw material have compelled plants to curtail operation. In other districts canceling of orders and lack of demand have caused the shutting down of factories. In the third place, inability to obtain needed capital has quite often resulted in the abandonment or suspension of contemplated undertakings. The results of this non-employment, it is reported, have been an increase in the efficiency of the individual and less insistent demands on the part of labor.

In a recent report of the United States Department of Labor in which employment statistics were presented for thirteen manufacturing industries and for coal mining the figures for July, 1920, when compared with the previous month, show a decrease of about 6 per cent in the number of workers employed and a decrease of about 11 per cent in the amount of the total payroll.

In the New York district there has been a distinct though not large increase in non-employment. The report of the New York State Industrial Commission shows that the decrease in the number of factory workers employed in July over June in the State was one-half of 1 per cent. General labor conditions in that section are more stable than a few months ago

Better Conditions in New England

Labor conditions in the New England electrical industry are improving materially. While in some establishments unrest continues to interfere with production, a decided turn for the better is apparent. There is little question that recent shutdowns in the textile and leather fields have had a sobering effect upon employees in other industries. This has begun to temper the attitude of many workers toward their daily duties, and consequently an increase in production per employee is to be found in many branches of the electrical manufacturing industry.

Inquiry by a representative of the Electrical World among representative electrical manufacturing plants develops the conclusion that the employer is beginning to come into his own once more. In two-thirds of the establishments with which the Electrical World is in touch new employees are still being hired, but applications for employment are increasing in 80 per cent of the plants. In about 60 per cent of the plants orders are either holding up as well as during the spring or increasing, and in 87.5 per cent of the establishments labor is producing better. Eighty-five per cent of the firms report a tendency among employees to stay longer at their jobs. In about half the factories which reported inefficient employees have been laid off during the last few weeks. General wage increases are becoming less frequent. The large amount of business on the books and the continued shortage of many jobbers' stocks have led to the employment of additional labor in many establishments, but the employment departments are now better able to pick and choose than they were a few months ago.

Little complaint is heard as to labor shortage among the contractor-dealers, and relations are at present unmarred by serious disagreements. Jobbers and central stations are well provided with help. Some unrest has cropped up recently in the telephone field owing to the competition of rival union organizations for members, but no threats of a strike are heard. In the electric railway field the arbitration of demands for wage increases rules in most communities, and the great majority of employees are working regularly.

Plentiful Labor Supply in Other Sections

Electrical contractors in the South report a larger labor supply than has been the case for some time past. Wages remain very high, and the help is not particularly skilled or efficient. Railway employees in New Orleans have returned to work, together with the metal trade workers. The strike

in the coal fields in the Birmingham district is playing havoc with the shipment of coal, but, all in all, labor conditions in the South are reported somewhat more settled.

Reports from the Middle West indicate a distinctly better labor supply. In Chicago territory there is a gradual increase each week in the number of men out of employment. In Detroit there has been a decrease of slightly less than 7 per cent since April 1 in the working forces of seventy-eight firms employing 200,000 people, according to a statement of the Employers' Association of Detroit, the latter part of August.

In the Intermountain section of the West labor is plentiful in building lines. A more settled tone is evident since the settlement of recent disputes there. In Salt Lake City the strike of the International Brotherhood of Electrical Workers is over, and union labor in other cities has also settled its disagreements.

Less complaint is heard of labor conditions on the Pacific Coast, as few strikes or disturbances of any importance have recently taken place there. More men are being employed in electrical installation work this month than last in the Northwest. The supply of labor on the West Coast about equals the demand.

Prospects of a Shortage in Heating Appliances

ACCORDING to leading manufacturers of domestic heating appliances throughout the country, indications seem to point to a widespread shortage this fall. Demand in some cases is reported slightly less than two or three months ago, but it is still extremely active, especially on the part of consumers. Some manufacturers are finding demand from jobbers, dealers and central stations slightly off. This is thought to result from financial reasons and because there seems to be some feeling in the trade that lower prices will prevail late in the fall. Regarding the outlook for the autumn and holiday trade, producers are extremely optimistic. Excellent sales are generally anticipated. Factories are making every effort to prepare for the expected spurt in buying. Thus far, however, the volume of demand has kept well ahead of production in spite of all efforts.

As a rule, factory stocks are entirely depleted and large quantities of back orders have piled up. Manufacturers report that their distributers are also poorly supplied, with the exception perhaps of 6-lb. irons, which seem to be in a little better supply. The demand for flatirons for immediate shipment is quite heavy.

Difficulty in securing raw material has been one of the biggest adverse factors in coping with the demand. A decided improvement during the past month is reported, however, though the shortage in some lines, such as switches, heater cords and special wire, still continues. Deliveries range all the way from two to eight months and even as long as ten months on some devices.

Very heavy back orders have piled up in most cases, in spite of the fact that factories are shipping goods as fast as they can be manufactured. One of the largest appliance makers is finding the situation so serious that a quota has been placed on each district sales office and jobber, and shipments are allotted to them on the basis of a certain number of pieces each month.

Prices, it is stated, have ranged steadily upward, commensurate with increased costs of labor, raw material and overhead expenses. During the past two months price advances varying from 6 to 20 per cent on the whole line of heating devices have gone into effect. Opinions on the probable future trend of prices vary. Some manufacturers hold that the peak of prices has probably been reached, or at least that the present level will hold for some time. Several producers think the increase in freight rates may make another advance necessary. It seems likely that there may be a change in policy regarding transportation charges in some sections of the country. The cost of transportation now averages 25 to 40 per cent higher in certain zones. It is stated that there is nothing tangible upon which to base hopes of any price reductions. Almost no labor troubles are being experienced at present, and the supply of labor is also reported better.

Production in some instances ranges from 40 to 100 per cent ahead of last year, while other manufacturers say it is about normal and a few who have been hampered in obtaining necessary material report that they have not as yet been able to reach their capacity output. Collections in this line are said to be fairly prompt, averaging from thirty to sixty days in most cases.

Jobbers' Stocks Are Low

Regarding the domestic appliance situation as it affects jobbers throughout the country, conditions are little better than with manufacturers in so far as ability to meet the expected demand is concerned. In New England territory flatirons are plentiful in jobbers' hands, but the supply of toasters, percolators, small grills, etc., is none too good. Buying of bowl-type heaters has begun, and in spite of high prices a large volume of business is being done. In the South jobbers report that they are unable to accumulate sufficient stocks for the heavy fall trade that is anticipated. Shipments have not come through so promptly as was expected, and the brisk demand absorbs a major portion of all supplies received. The general estimate is that there is sure to be a shortage on the most popular lines this fall, with the exception of flatirons. In the East jobbers' stocks of appliances are badly broken, with the exception of 6-lb. irons, and considerable scarcity is expected to confront the fall trade. Deliveries are uncertain, and the supplies coming through are generally on orders months old. In the Middle West it is stated that at the rate new business is coming along it will require some months to catch up with orders.

On the other hand, in the Intermountain section trade in appliances is not up to the standard of other years and very high prices prevail. Jobbers' stocks are pretty well filled up except on the hollow-ware items, where there is some shortage. Distributers' stocks in the Northwest are reported to be in poor shape, but on the Pacific Coast, where there has been a dearth of hollow ware ever since last Christmas, percolators, etc., can now be obtained for the first time in many months.

Metal Market Situation

THE domestic market for copper continues quiet, but a slightly better tone is evident as consumers seem to be taking more interest. This is because current contracts are now running out and producers are confident that within the next two or three weeks a heavier buying movement must result to cover consumers' needs for November and December. Most producers have now made a concession to the dull market to the extent of shading prices ¼ cent for nearby delivery, and a few small producers have even quoted 18.50 cents on attractive orders. Future shipments are still held at 19 cents.

The outside market is less active as the cheap lots of copper at 18.12½ and 18.25 cents have been sold and the lowest price in the East is about 18.37½ cents delivered.

NEW YORK METAL MARKET PRICES

	September 7	September 14
Copper	£ s d	£ s d
London, standard spot	95 0 0	99 15 0
	Cents per Pound	Cents per Pound
Prime Lake	18.52 18.50	18.50–18.62½
Electrolytic	18.75	18.75
Casting	17.75	17.87½
Wire-bars	22.50 23.00	22.50 23.00
Lead, trust price	9.00	8.50
Antimony	7.12½	7.12
Nickel, ingot	43.00	43.00
Sheet zinc, f.o.b. smelter	12.50	12.50
Zinc, spot	8.25	8.00-8.25
Tin	45.25	45.00
Aluminum, 98 to 99 per cent	35.00	35.00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	15.50 to 16.00	15.50 to 16.00
Brass, heavy	8.00 to 9.25	9.00 to 9.25
Brass, light	7.25 to 7.50	7.00 to 7.25
Lead, heavy	7.25 to 7.50	7.00 to 7.25
Zinc, old scrap	5.25 to 5.50	5.25 to 5.50

THE WEEK
IN TRADE

REPORTS from all districts with the exception of Portland territory in the Northwest indicate a quiet volume of business. Though a heavier wave of buying is expected soon, it has not yet made its appearance. In the one exception noted sales are good and business is increasing. In the South pessimism is expressed as the result of rains that have injured the cotton crop. The general prosperity of the section is encouraging, however. In the Intermountain section of the West a slightly better buying tone on the part of the public is noticed, but conservatism is still the order of the day.

Slower collections are reported throughout the country except in the Intermountain district, where they are improving. This is probably a result of the third-quarter federal income taxes which were due on the fifteenth of this month. In many sections labor conditions are improved and a more plentiful supply is available. A few price changes on items such as conduit, bells and dry cells are reported. Stocks seem to be accumulating in good shape in most lines. Transportation conditions are better, especially in the Northwest, where a shortage of cars has long been felt.

NEW YORK

Some jobbers report that the volume of trade is slightly picking up, but on the whole the situation locally is still characterized as quiet. The spurt in sales as a result of the expected fall demand has not as yet made its appearance. Collections appear to be pretty tight in this district, and for the past few weeks customers have been slowing up in paying their bills.

Stocks are building up in good shape, and plentiful supplies in most lines are reported. There is still more or less shortage on some items such as outlet boxes, but the noticeable improvement in shipping conditions is slowly having its effect.

A few price changes have occurred in the past week. Dry cells have taken a jump, and the price of bells has been advanced about 25 per cent.

Rigid Conduit.—Export sales are increasing, but domestic demand in some quarters is said to be slightly less. Irregular shipments and badly broken stocks are the rule. Only one or two fortunate distributers report a good supply. The price for ½-in. black ranges from $85 to $93 per 1,000 ft., and for ¾-in. from $114 to $125. Some reports are received of increased prices to cover the new freight rates.

Non-Metallic Flexible Conduit.—Jobbers seem to be short on many sizes. Shipments are slow and demand holds up well. The price quoted for ⅜-in. is $32 and for ½-in. $35 to $36 per 1,000 ft., in coil lots or more.

Flexible Armored Conductor.—The current quotation for No. 14, two-wire, ranges from $100 to $104 per 1,000 ft. on large quantities. Small lots are quoted as high as $110 per 1,000 ft. Plentiful supplies are available and demand is decidedly off.

Bells.—A representative manufacturer has just announced price increases amounting to 25 per cent over the list that has been in effect since last spring.

Dry Cells.—New prices have just been announced. No. 6 is now quoted at 36 cents in barrel lots. In quantities under 125, the quotation is now 39 cents; in lots less than 50 the price is 45 cents, and under a dozen 50 cents. Conditions are the same as reported last week.

Fuses.—Demand is rather quiet. Good stocks of both renewable and non-renewable types are reported. Sales are expected to increase soon. The price of N. E. C. standard 250-volt non-renewable fuses, 3-amp. to 30-amp., ranges from 10 cents to 13 cents in the inclosed and about 5 cents to 5¼ cents in the plug type in standard-package lots.

Conduit Fittings.—Demand for fittings as condulets, etc. is said to be rather quiet. Stocks are in good shape and no trouble with shipments is experienced. The current discount on standard packages is 15 per cent, on one-fifth of a standard package 5 per cent, and on quantities less than that the quotation is list net.

Flashlights.—Some jobbers have been meeting a good demand, while others say sales have been not up to standard. Plentiful supplies and good shipments are the rule.

Flashlamp Batteries.—A somewhat heavier demand is reported than for flashlight cases. Stocks are well built up and supplies are easily obtained. A representative jobber's price for a three-cell, 8½-in. tubular battery is 27 cents in lots of 100, and for a two-cell, 3½-in. flat battery about 21 cents net in lots of 100.

CHICAGO

Electrical jobbers are as one in stating that the volume of new orders and the number of inquiries received have fallen off materially in the past few weeks. The situation is not alarming, the only surprise being that the lull did not come sooner. Jobbers' stocks as a whole are improving, although on many items shelves are still bare. The worst shortages are found in guy wire and on linemen's tools. On both these items factories are behind on orders, and on linemen's tools they have withdrawn prices.

Freight-rate revisions have occasioned new quotations in many lines. No changes are recorded on wire, as the decrease in the cost of cotton and rubber are offsetting the freight raise on insulated stock, while the makers of bare copper see fit to absorb the difference. Many reductions are being made in the forces of industrial plants.

Motors.—Inquiries as well as actual orders are reported less in sizes up to 200 hp. Deliveries are mostly very slow, but a few 40-hp. and 50-hp. motors are available for immediate shipment from factory. Makers are still working at top speed with no indications of a reduction in output.

Transformers.—New price sheets on General Electric transformers were issued this week, showing an advance approximating 10 per cent. Demand is heavy, particularly for farm lines. Deliveries on light transformers range from four to six weeks and on heavy power work from twelve to sixteen weeks.

Power Control and Protection Apparatus.—Conditions are practically unchanged. Deliveries of large-sized oil switches require about four months. Small sizes are in some cases available from badly broken stocks. Shipments of motor starters are still slow. Many motors are shipped with starters to follow. Lightning arresters are in fair supply, small quantities of most types being available from stock. Demand for circuit breakers is very slow.

Northern White Cedar Poles.—Producers report a satisfactory output in the woods. Car supply is now occasioning no great trouble, though little improvement in the time required for transit of goods is noted. No new lists have been issued, the actual increase in freight expense being added to the old quoted price. This increase in the Chicago district amounts to from about 25 cents on a 6-in., 30-ft. pole to $1.25 on a 7-in., 55-ft. pole.

Line Hardware.—New price lists have been issued amounting to an increase of about 5 per cent. Supply is erratic. The current price on galvanized pole steps, ⅝ in. x 9 in. is $92.51 per 1,000 in quantities of from 500 to 1,500, and $104.10 per 1,000 in lesser quanities. Galvanized machine bolts, ⅝ in. x 10 in. are $13.99 per 100 in large quantities and $15.74 per 100 in small lots. No advance was recorded on cross-arm braces.

Electric Heaters.—Brisk trade has been the rule all season. Householders are buying to forestall the coal shortage. Manufacturers have been able to fill the demand of the trade in all sizes. The most popular variety is a single unit retailing for about $12.

Curling Irons.—Dealers report that trade so far this season is heavier than ever before. The "Hotpoint" list is $7.50 each, complete with comb.

BOSTON

A sustained recession in trade continued although a good volume of business is being handled from week to week. Building operations are falling off somewhat. Manufacturers are beginning to catch up on deliveries and jobbers are finding less difficulty in replacing stocks. Rigid conduit is still scarce, transportation conditions being unsatisfactory.

Collections are being pushed closely. Appliance sales are not so large as was expected, and holiday stocks are accumulating in some quarters. Flexible armored conductor and pull sockets are in better supply. "Nail-it" knobs are firmer in price. Porcelain and small motors are slightly improving in deliveries. Labor conditions continue steady and quiet. The larger woolen mills of New England were scheduled to resume production this week.

Wire.—With the exception of magnet wire, fair stocks are in hand. Demand is excellent. Rubber-covered wire No. 14 is selling for about $11 per 1,000 ft. in 1,000-ft. lots. Bare copper wire quotes on 24 cents base and weatherproof on 29 cents. So far the lower price of cotton has not had much effect on wire prices.

Flexible Armored Conductor.—Single-strip No. 14 sells for about $100 in 1,000-ft. lots, reflecting easier conditions. Demand is good, and current requirements are being well handled.

Non-Metallic Flexible Conduit.—Owing to moderate demand and improved deliveries, stocks are not being reduced to any serious extent. Prices are steady, ½-in. loom being quoted at $33.50 per 1,000 ft. in 5,000-ft. lots and ¼-in. loom at $36.50.

Dry Cells.—Stocks show considerable improvement over conditions earlier in the year. A good staple demand exists, with a tendency toward larger replacement orders. The No. 6 cell brings $32.95 per 100 in barrel lots, $33.95 being quoted on ignition cells in the same quantity.

"Nail-it" Knobs.—A better supply is coming through, but no overstocks are reported. Prices are firmer, a going quotation being $36.75 per 1,000 in barrel lots.

Sockets.—Pulls are easier in price, 50 cents net each being asked in case lots. Keys and keyless sockets are selling at 28 cents and 26 cents respectively. A fair demand exists, with excellent supply.

Tape.—Friction tape is plentiful, black ¾-in. being priced at about 65 cents per pound in 25-lb. lots. Current requirements are being served with ease.

Heaters.—Stocks are being built up against the fall demand. Good sales in the Northeastern coast resorts are reported for the season now closing. Owners of large cottages in the mountain resort district have bought well in response to a 3.5-cent energy rate established in the spring. Jobbers are quoting 25 per cent off list in lots of six.

Rigid Conduit.—Slow deliveries are causing jobbers to husband their incoming shipments for distribution to regular customers. Back orders absorb new supplies soon after their receipt. Prices are firm after the recent increase, typical quotations being as follows on 1,000 ft., in lots less than 2,500 lb.: 1-in. black, $188; 1-in. galvanized, $198; ¾-in. black, $97; ¾-in. galvanized, $103.

ATLANTA

Continued rains throughout the section have probably damaged and materially retarded the cotton crop. The report of cotton ginned to Sept. 1 for this section was only about 20 per cent of the amount ginned prior to Sept. 1 last year. The lack of optimism is reflected in slower collections of electrical interests. Jobbers are endeavoring to tighten up slightly on credits in order to reduce overextensions and offset slow collections.

In contrast with the feeling of depression resulting from the unsettled weather conditions, it is interesting to note the general prosperity of the section during the past year as evidenced by the amount of internal revenue taxes paid. These figures indicate that the average amount paid by the six great agricultural states of the South was approximately 40 per cent more than the average amount paid per state by the six great agricultural states of the Central West.

Building permits in Atlanta for the last half of August show a slight increase over the first half of the month.

Schedule Material.—In spite of reduced residential construction demand is active, probably owing to some extent to renovating and small mill work. Prices are steady and shipments as good as can be expected under prevailing conditions.

Lamps.—Sales show continued gains and supplies are apparently holding up well.

Fuses.—Demand is excellent and jobbers and contractor-dealers report considerable activity. The renewable fuse has evidently come into popularity as evidenced by the number of orders received for parts.

Electric Ironers.—Campaigns by jobbers are stimulating business. The field has been worked only slightly in this section and manufacturers and jobbers are beginning to realize the possibilities in this line.

Washing Machines.—Sales have slowed up somewhat in the past two weeks and jobbers have accumulated considerable stocks. Jobbers anticipate more active sales in the next thirty days. Shipments are coming through very satisfactorily.

Annunciators and Fire-Alarm Equipment.—Jobbers have been advised this week of an increase in price on this equipment. Demand holds up, but the increase in price apparently is not the reflection of demand.

Poles.—The call for poles continues brisk. The lack of transportation facilities is seriously hampering deliveries in this section. Prices remain stable, though a slight advance is anticipated as a result of the recent increase in freight rates.

Distributing Transformers.—The shortage in this line continues acute, with little relief in sight. Local stocks are exhausted and long deliveries are quoted. Demand, however, continues strong.

Wire and Cable.—Demand continues on about the same level except for heavy cable, which has been somewhat stimulated by the recent placing of contracts for large mill jobs. Some local jobbers report good recent receipts of rubber-covered.

ST. LOUIS

Jobbers report a fair movement of electrical supplies and material during the past week, though fall buying has not made itself very manifest so far. Stocks are more nearly normal in all but a few lines than for some time.

Building work which had been stopped when the teamsters' strike held up needed material has been resumed. East St. Louis building permits for August show a large increase over August of last year. The big majority of the work is for industrial plants. Further progress in the clearing-up of freight accumulations and blockades at many points is being made in this section. As a result deliveries are much improved.

Collections are becoming more difficult. One manufacturer is offering a discount of 5 per cent for cash, a policy never before followed by that firm.

Transformers.—Single-phase, 2,300-volt distributing transformers up to 100 kva. and even 150 kva. are in great demand by central stations. Very small stocks are available in the hands of jobbers or local manufacturers. Three months' delivery is the average.

Conduit Fittings.—Adequate stocks are in jobbers' warehouses to meet the present steady demand. No price change has been made corresponding to the increase in the price of conduit.

Line Hardware.—Demand from central stations is very good and practically all orders are being shipped from jobbers' stocks. There is no change in price.

Hollow Ware.—Dealers are fairly well stocked and jobbers are beginning to get their reserve stocks in shape to handle the Christmas business. "Loving-cup" percolators are still somewhat scarce. Dealers report a fairly good demand with little dissatisfaction over present high prices.

Irons.—Stocks are in good shape and shipments from factories are sufficient to offset the extensive sales of local retailers.

Washing Machines.—Business has fallen off all along the line. Plentiful stocks are available. Prices are steady.

Fractional Motors.—Cancellations have now reached the larger manufacturers, and as a result large orders for certain types and sizes can now be delivered from stock.

Ranges.—Good stocks of various sizes and types are available for prompt delivery, but orders are very slow.

Lamps.—Business has been good. Complete stocks are in most instances available except for the large sizes. Lamps of 75 watts to 200 watts, type C, are more difficult to obtain, and it may be three months before reserve stocks of these have been built up by all jobbers. Stocks of series lamps for street-lighting purposes are spotty and demand is growing.

Porcelain Insulators.—There is a steady demand for insulators around 33,000 volts. Stocks are very incomplete. Some factories do not promise delivery before January or February, 1921. There are plenty of 6,600-volt insulators available.

SAN FRANCISCO

Business is quieter. Building permits are running considerably below last year's rate, except in southern California. Labor is growing more plentiful and many contractors are working only a small proportion of their regular force. Collections are rather slow and credit is being extended very sparingly.

On the other hand, the completion of new power projects will cause a much-needed expansion and distribution of current into new territories. Serious efforts are being made to interest the electrical trade more in the sale of power securities, for money is needed badly to finance the new work.

Poles.—The market is in a disturbed state, though prices have not greatly advanced despite increased freight rates. Stocks are very poor because of the lack of cars to bring supplies from the mills. The higher wages of lumbermen are also an indirect factor in this poor distribution, because mill owners cannot count on the services of their men for as long a time as they used to be able to do.

Cross-Arms.—The supply is affected by the same causes that cover the inability of jobbers and dealers to accumulate well-balanced pole stocks.

Washing Machines.—Several of the standard cylinder makes have advanced in price. The average swinging wringer machine now sells for $180 f.o.b. Pacific Coast. Stocks are good.

Electric Ranges.—This has been a most exceptional year in the sale of hotel ranges, bake ovens and other heavy-duty appliances. Good sales have been made to summer resorts. Good business from the United States government is also reported. Even better sales are expected to result from the success of present installations in various army posts.

Household Appliances.—Considerable discussion is current over the proper discounts to be allowed dealers. It is felt that further investigation is needed into the especial overhead required.

SEATTLE—PORTLAND

Jobbers in Seattle and Puget Sound cities report that fall trade as a whole is dull. An exception is noted in the increasing movement of household appliances, particularly ranges, washing machines, heating devices, vacuum cleaners, etc. Seattle jobbers are obtaining all of this class of material that they need, but there is a decided shortage on ranges and hollow ware. Conduit also remains scarce but call is light. Weather conditions in the Pacific Northwest for the past week were very favorable for harvesting crops. The transportation situation has materially improved as transcontinental railroads serving the Puget Sound district are now filling at least 50 per cent of all car orders.

Bids will shortly be called in Portland on equipment for a 15,000-ton drydock, including four electrically operated capstans, floodgates, sluicegates, valve stems, and ten 100-hp., 440-volt motors. Jobbers in the Portland district report good business the last week or two, with a decided upward tendency. Demand is especially good for pole-line material, lamps, conduit and wire. Stocks are in about the same condition as reported for several weeks past. Conduit is very short, however, particularly in the small sizes. Previous to the advance in freight rates there was an unusual volume of goods shipped, and the resulting freight congestion has served to slow down deliveries.

Credit and collections remain unchanged. It is not expected that much improvement will be shown until after crops are marketed and the Presidential election is over. Portland dealers report good business. There has been a perceptible improvement in sales the past week. Demand for lamps and washing machines is picking up and this improvement is about three weeks earlier than the usual fall demand starts. The price on No. 14 rubber-covered wire in less than 500-ft. lots is $19.20 per 1,000 ft.; 500 to 5,000 ft., $16, and in lots of 5,000 ft. and over, $15.20. Weatherproof solid-conductor, triple-braid, No. 0 to No. 4/0, less than 500 lb., $39 per 100 lb.; 500 lb. to 1,000 lb., $34, and 1,000 lb. and over, $33.

SALT LAKE CITY—DENVER

Electrical dealers observe a slight increase in the demand for domestic appliances. They regard it as a hopeful sign, an indication that people are ready to spend money when they have it.

The buying attitude of the public is much improved. Buyers seem less suspicious that prevailing prices are exorbitant. They are more willing to concede that there is an economic condition that largely controls prices instead of their being fixed in an arbitrary way. Marked conservatism in buying is still evident, however. High-priced merchandise is not in demand. Shoppers are demanding goods of second-rate. Hasty buying seems a thing of the past. Collections are improving month by month. Dealers in some quarters believe that prices on electrical cooking appliances are higher than the cost of manufacture and haulage warrants. They would welcome substantial reductions as a stimulant to retail buying.

Shipments are greatly improved. Neither dealers nor jobbers experience much difficulty in getting adequate stocks.

Heating Appliances.—Demand is anything but brisk. High prices discourage retail buying. One representative dealer believes that prices on this line of merchandise are 20 per cent too high.

Motors.—Supplies are plentiful. Dealers report a steady demand for all sizes and kinds.

Electric Ironers.—Thus far this year sales have been light. Interest seems to be awakening in this line, however. Dealers believe the time is near when ironers will be regarded as an indispensable feature of the household equipment.

Sewing Machines.—Not so many are being sold this year as last, some dealers report. The retrenchment in wearing apparel is held responsible for the falling off in demand.

Washing Machines.—Some jobbers and dealers are overstocked. Manufacturers seem unduly eager to unload on their jobbers.

Vacuum Cleaners.—Demand is satisfactory. Intensive advertising is given much credit for activity in this field. The need of equipment for fall housecleaning is also a contributory cause.

NEW APPARATUS & APPLIANCES

A Record of Lates' Developments
and Improvements in Manufacturers' Products
Used in the Electrical Field

Oil and Water Strainer

The Griscom-Russell Company, 90 West Street, New York, has placed on the market a "G-R" strainer which may



STRAINER TO PURIFY OIL OR WATER

be installed either as a single unit or as a set of two. The strainer is made in sizes for 1-in. to 6-in. pipe.

Electric Sign Color Hoods

For gaining color effects in electric displays, the Reynolds Electric Company, 2650 West Congress Street, Chicago, has brought out colored glass hoods designed to slip over a lamp to do away with dipping. The hood is held in place by a spring fastener and is made in five colors, ruby, opal, amber, blue and green. Facility in attaching the hood, economy and lasting color qualities are the advantages claimed.

Mine Locomotive Headlight with Spring-Suspended Case

In the mine locomotive headlights placed upon the market by the Westinghouse Electric & Manufacturing



LAMP CASE SUSPENDED BY SPRINGS

Company the incandescent lamp case is carried on a spring suspension to protect the filament from breakage due to vibration. The frame, case and cover of this headlight are made of high-grade cast iron. The lens holder is fitted to the case with a threaded joint and rubber gasket.

Alternating or Direct-Current Bell

A new type of bell, the A. D., operating, according to the manufacturer, equally well on alternating and on direct current of the proper voltage, from 4 to 110, is being put out by the Holtzer-Cabot Electric Company, Roxbury, Boston, Mass. The bell is designed so that the speed of the hammer is independent of the frequency of the current. A new principle in bell construction is used, consisting of a buckled steel spring coupled to the armature so that each stroke is very positive in action. The coil is wound on a laminated core and the hammer is under the gong.

Plug Adapter

For connecting Edison screw plugs into Spartan receptacles an adapter made of substantial molded insulation has been brought out by the Bryant Electric Company of Bridgeport, Conn.



CONNECTS SCREW PLUG TO SLOTTED RECEPTACLE

It consists of a combination Spartan standard parallel-blade plug and an Edison base receptacle. The catalogue number is KL; the same device in porcelain is No. KF. When polarity connection is desired the numbers are ML and MF, respectively.

Notes on Recent Appliances

Bushings for Rigid-Steel Conduit

Walker Brothers & Haviland, Otis Building, Philadelphia, have recently put on the market a zinc bushing under the trade name of "Bushette" for rigid-steel conduit.

Electric Cloth Cutter

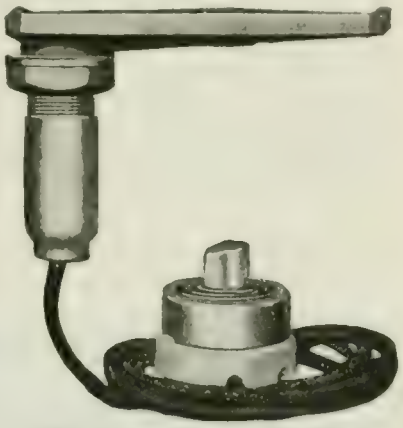
The Simplex Cloth Cutting Machine Company, 169 West Twenty-first Street, New York City, has brought out a motor-driven cloth cutter.

Motor-Driven Liquid Stirrer

A device for stirring chemicals and other liquids in the laboratory has been developed by the Central Scientific Company, 460 East Ohio Street, Chicago, Ill. The device may be attached to any support stand and the speed is variable from zero to 3,000 r.p.m. It is made for 110-volt or 220-volt alternating or direct current.

Immersion-Type Water Heater

A water heater adapted for use with sterilizers, glue pots, paste kettles, stills, etc., has been developed by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., which is de-

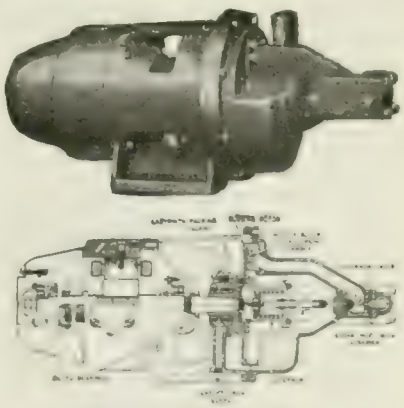


RIGID CASE TO PROTECT HEATING ELEMENTS

signed for permanent attachment within the bottom of the utensil. The nickel-chromium heating elements are incased in flat brass castings, which protect them from mechanical injury. The heaters are made for standard voltages and in 300, 600 or 1,200-watt size.

Turbine Generator Units for Locomotive Headlights

Although developed especially for supplying energy for locomotive headlights, the turbo-generator just placed upon the market by the Westinghouse Electric & Manufacturing Company may be used as a portable unit for other lighting service. It is designed for



LIGHT PORTABLE TURBO-GENERATOR

severe outdoor service. It can be set up on a floor, on a heavy board or in any other horizontal place.

MANUFACTURERS' ACTIVITIES

Record of Changes Affecting Sales and Distribution Together with Trade Personals and Notes on Foreign Trade, Jobbers' News and New Trade Literature

THE KLEINSCHMIDT ELECTRIC COMPANY, 36 Flatbush Avenue, Brooklyn, N. Y., manufacturer of electrical apparatus, has filed notice of increase in capital stock from $100,000 to $500,000.

THE RELIANCE ELECTRIC & ENGINEERING COMPANY, Cleveland, has appointed George Sherrerd, Jr., manager of its New York sales office, succeeding Samuel G. Boyd, recently resigned. Mr. Sherrerd was formerly manager of the company's Philadelphia office.

THE RADI-ALL COMPANY, Ironton, Ohio, recently incorporated with a capital stock of $50,000, it is said, will place on the market an electric heating radiator invented by J. C. Clutts, which is now being manufactured under contract by a firm in Middletown, Ohio. The company, it is understood, will erect a plant in Ironton to manufacture the radiator. R. W. Blanton is president.

THE NATIONAL LAMP WORKS of the General Electric Company, with main offices in New York City, will build two factories in Indianapolis to manufacture incandescent lamps representing an investment of about $2,000,000 on a site at East Washington and Gray streets. It is proposed to build a finishing plant of three stories and a basement, 111 ft. 240 ft., to cost about $1,000,000, and a glass works of two stories and a basement, 80 ft. x 200 ft., at a cost of about $750,000. About 1,200 persons will be employed in this finishing plant and 500 at the glass works. The proposed plant will manufacture miniature incandescent and automobile lamps, and will have a capacity of 150,000,000 lamps a year.

REGINALD PELHAM BOLTON announces that James A. McHollan is now associated with him in consulting engineering practice as vice-president of the R. P. Bolton Company, 116 East Nineteenth Street, New York City. The company specializes in power plants, electrification of steam plants, etc.

SAMUEL G. BOYD has been appointed manager of the electric motor department of the Fairbanks Company, Philadelphia, effective Sept. 1. For the past few years he has been manager of the New York sales office of the Reliance Electric & Engineering Company, Cleveland, Ohio.

THE PITTSBURGH GAGE & SUPPLY COMPANY, Pittsburgh, Pa., has started the construction of a new building, 150 ft. x 150 ft., at the corner of Twenty-ninth Street and Liberty Avenue, which will be used for the cutting, fabrication and storage of pipe. The company is now producing 150 Gainaday washing machines per day and expects by the first of the year to increase the output to 300 machines a day. It plans eventually to manufacture 500 machines daily, or 150,000 a year.

THE NATIONAL SWEEPER DIVISION of the Torrington (Conn.) Company has recently purchased additional plant facilities at Worcester, Mass., for the manufacture of the Torrington electric vacuum cleaner. The new unit includes buildings, comprising more than 100,000 sq.ft. of additional floor space.

THE APEX ELECTRIC DISTRIBUTING COMPANY, Cleveland, Ohio, has announced a new $5,000 prize sales contest for Apex cleaner salesmen, to close Sept. 25. The distributer's wholesale and retail salesmen are eligible to compete.

THE FLEXIBLE STEEL LACING COMPANY, manufacturer of Flexco lamp guards, Flexco-Lok lamp guards, alligator steel belt lacing, etc., is now in its new factory at 4607-4631 Lexington Street, Chicago, Ill.

THE WISE ELECTRIC SHERARDIZING COMPANY, Detroit, Mich., has acquired the property of the Acme Plating & Specialty Company at 915 Fort Street, where it will establish branch works.

THE WILLYS-LIGHT DIVISION, of the Electric Auto-Lite Corporation, Toledo, Ohio, recently held a four days' convention at Toledo, which was attended by 150 sales representatives of the company, representing sixty-five sales organizations and territories in all parts of the country. The sales organization of the company now extends to every section of the United States, and through the John H. Willys Export Corporation to twenty-seven foreign countries. Plans were outlined for marketing the farm-lighting plants to be manufactured this year by the corporation, and trips were made through the plants of the company. Walter H. Roberts, general sales manager, presided over the convention.

THE CROWN CHANDELIER COMPANY, 103 Mott Street, New York City, manufacturer of gas and electric fixtures, has filed notice of increase in capital stock from $15,000 to $60,000.

THE CONSOLIDATED WIRE AND MACHINERY CORPORATION, 519-527 West Van Buren Street, Chicago, is issuing a loose-leaf price list of new and second hand motors, Kuhlman transformers and miscellaneous materials.

THE MONROE-LOUISIANA CARBON COMPANY, Monroe, recently organized, contemplates the construction of a large carbon plant at Hancock, near Monroe, to cost, including equipment, about $1,000,000. Barney Oakland of Monroe is superintendent.

THE LAKEWOOD ENGINEERING COMPANY, Cleveland, Ohio, announces the appointment of Robert M. Gates as managing engineer in charge of the Philadelphia district, with offices at 1034 Widener Building, Philadelphia.

THE WESTINGHOUSE LAMP COMPANY, 165 Broadway, New York City, is asking for bids for the construction of a four-story factory, 100 ft. x 200 ft., on La Salle Avenue, Indianapolis, Ind., to cost with equipment $2,000,000.

THE RAUCH & LANG COMPANY, Chicopee Falls, Mass., is reported to have awarded contract for its new automobile plant in the Willimansett section of Chicopee, consisting of a main building, 300 ft. x 325 ft., and several adjoining buildings. The total cost is estimated at $300,000.

THE ROBBINS & MYERS COMPANY, Springfield, Ohio, has purchased a plant on Home Street, Xenia, Ohio, which was formerly used to manufacture fuses. The company will utilize the building as a tool room in connection with its Xenia plant.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., is having plans prepared for a five-story factory addition, 70 ft. x 400 ft., to its Pittsfield Works.

THE PROGRESSIVE ELECTRIC PRODUCTS COMPANY, 2711 Church Avenue, Cleveland, Ohio, recently organized, has taken over the plant and business of the King Electric & Manufacturing Company, Cleveland. E. P. Maureer, formerly manager and owner of the King company, continues at the head of the production department of the new company.

THE VARNEY ELECTRIC COMPANY, Evansville, Ind., manufacturer of electrical equipment, recently lost a portion of its plant by fire. The damage is estimated at about $100,000.

THE MARION INSULATED WIRE & RUBBER COMPANY, Marion, Ind., has awarded contract for a three-story-and-basement, 35-ft. x 60-ft. extension to its plant.

THE NEW JERSEY GAS & ELECTRIC COMPANY, Newark, N. J., recently incorporated to manufacture gas and electric appliances, has acquired property at 36½ New Street, where it will establish a plant.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., has acquired the five-story, 60 ft. x 242 ft. factory of the Randal-Faichney Company at 76 Atherton Street, Roxbury, Boston, together with a large power plant.



SALES CONVENTION OF WILLYS-LIGHT DIVISION, ELECTRIC AUTO-LITE CORPORATION

THE CHAMPION ENGINEERING COMPANY, Kenton, Ohio, manufacturer of electrically driven traveling cranes, etc., will soon award contract for the construction of a 500-ft. addition to its gray-iron foundry. Bids are also being received for equipment. New buildings which will double the present capacity of the plant will be opened in the near future.

Supply Jobbers' Notes

THE W. C. NAGLE ELECTRIC COMPANY, Toledo, Ohio, has filed notice of increase in capital stock from $125,000 to $225,000.

THE AMBER ELECTRICAL SUPPLY COMPANY, 553 West Madison Street, Chicago, is planning to erect a seven-story building with basement, 68 ft. x 75 ft., at the corner of Desplaines and Adams Streets, to cost about $250,000.

Foreign Trade Notes

THE WESTERN ELECTRIC COMPANY ORGANIZES COMPANY IN ARGENTINA.—G. E. Pingree, vice-president of the International Western Electric Company, has announced the organization of a new company in Argentina, to be known as the Compañia Western Electric Argentina, which will take care of the telephone requirements of the countries in the lower part of South America. The capital stock of the new company consists of 5,000 shares of 100 pesos each. Its headquarters will be at Buenos Aires. H. C. Mitchell, who formerly acted as resident manager for the Western Electric Company in South America, has been elected president.

ORGANIZATION OF ELECTRICAL INTERESTS IN AUSTRALIA.—Owing to the lack of co-operation between the technical societies and organizations which represent the various branches of the industry in the Commonwealth of Australia, steps are being taken by the Electrical Traders and Contractors' Association of Victoria to reorganize the association and to bring into closer co-operation all the electrical interests in the state. In an article written by L. G. Hinwood on "Co-operation for Improvements of the Electrical Industry" the present unsatisfactory position was dealt with. He stated that the electrical industry was probably the only one in Australia which was not making money. Mr. Hinwood advised the Victorian Association to adopt American methods. He estimated that there was an immediate demand in Victoria for 50,000 fan motors, 50,000 vacuum cleaners, 50,000 electric irons 50,000 kettles, 50,000 washing machines and 50,000 table standards and that there were 135,000 dwellings to be wired. The value of the articles and work he estimated at over £5,000,000, and only organization and industry would secure it. As a community, he said, they were doing nothing to convince those householders of the advantages of electricity. The membership of the association consists of nineteen importers and twenty-three contractors out of 241 contractors.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A trading company in Holland (No. 33,630) desires to purchase and secure sole agencies for appliances to be used in the electrification of railroads.

A mercantile firm in France (No. 33,637) desires to purchase sheet iron for the construction of electric generators, 1 m. x 2 m. x 4 mm.

A machinery importing company of the Netherlands East Indies (No. 33,640) wishes to establish business relations with manufacturers of electrical equipment with a view to obtaining large quantities for large installations.

An agency is desired by a mercantile company in India (No. 33,648) for the sale of electric lighting sundries, fans, etc.

Trade Publications

SALES ENGINEERING.—The J-B Engineering Sales Company, Hartford, Conn., is distributing a four-page leaflet containing a short article on the profession of sales engineering.

ELECTRIC SWEEPER.—The Pneuvac Company, Worcester, Mass., has issued a booklet entitled "Electric Sweeper-Vac with Motor-Driven Brush," in which it describes and illustrates its electric sweepers.

INSULATORS.—The Jeffrey-Dewitt Insulator Company, Huntington, W. Va., is distributing catalog No. 3, entitled "Rugged Insulators," covering different types of its disk insulators, etc.

ELECTRIC SHOVELS.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is distributing motor application circular No. 7132, entitled "Electrification of Excavating Shovels," which describes and illustrates the various uses to which electric shovels may be put.

ELECTRIC GEAR SHIFT.—"The C-H Magnetic Gear Shift" is the title of a sixteen-page booklet, known as publication 819, published by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., which explains the operation of the C-H magnetic shift.

WATER SOFTENER.—The Graver Corporation, East Chicago, Ind., is distributing bulletin 509, describing and illustrating the Graver Zeolite water softener.

SWITCH BOXES.—The Appleton Electric Company, Chicago, Ill., has issued bulletin No. 14, in which is listed a complete line of solid and sectional switch boxes with bevel and square corners, furnished for loom and flexible conduit, also ½-in. and ¾-in. rigid conduit.

New Incorporations

THE HERCULES MANUFACTURING COMPANY, Indianapolis, Ind., has been chartered with a capital stock of $400,000 by Jackson Carter, E. M. McDaniel and W. L. Taylor. The company proposes to manufacture electrical machinery.

THE WALTER H. TAVERNER CORPORATION, New York, N. Y., has been incorporated by W. H. Taverner, R. B. Fenner and H. S. Lockwood, 1811 Avenue J, Brooklyn, N. Y. The company is capitalized at $60,000 and proposes to manufacture electrical machinery and parts.

THE AUTOMATIC SCREW CAPPING CORPORATION, Ridgeway, N. J., has been incorporated with a capital stock of $200,000 to manufacture special machinery, electrical equipment, etc. The incorporators are J. V. Ryan, Eble and Charles W. C. Baiter.

THE E. G. WENTWORTH MANUFACTURING COMPANY, Indianapolis, Ind., has been incorporated by E. G., Charles O. and M. W. Wentworth. The company is capitalized at $100,000 and proposes to manufacture automatic light controllers.

THE T. A. F. ELECTRIC EQUIPMENT COMPANY, 255 West Sixtieth Street, Los Angeles, Cal., has been formed to manufacture electrical devices. W. R. Fowler and John F. Andres are interested in the company.

THE RELIABLE ELECTRIC COMPANY, Newark, N. J., has been incorporated with a capital stock of $100,000 to manufacture electric appliances and fixtures. The incorporators are William Gross, 158 William Street, and Samuel Gross, 124 Little Avenue, Newark.

THE SAYLERSVILLE (KY.) HEAT & LIGHT COMPANY has been incorporated with a capital stock of $10,000 by Samuel J. Patrick, H. H. and I. E. Ramery.

THE SOUTH BOSTON (VA.) POWER COMPANY has been incorporated with a capital stock of $500,000. T. C. Watkins, Jr., is president and W. A. McCanless is secretary.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

CALAIS, VT.—The Hughes Granite Company, care of Walker & Walker, 101 State Street, Montpelier, plans to lay six miles of electric freight railroad for its own use, from Calais to East Montpelier.

CHELSEA, MASS.—Additions and alterations to the lighting system at the naval hospital are contemplated.

CRANSTON, R. I.—The Narragansett Finishing Company has plans under way for the erection of a power house, 45 ft. x 65 ft., at its textile plant.

MIDDLETOWN, CONN.—The New England Enameling Company has plans under way for extensions to its power plant and the installation of a new electric distribution system at its works. Westcott & Mapes, Inc., 207 Orange Street, New Haven, are engineers.

Middle Atlantic States

BUFFALO, N. Y.—Plans have been filed by Julius Schultz, architect, 1370 Main Street, for the erection of a power house at 835 Washington Street. Work will be done by day labor.

CANANDAIGUA, N. Y.—The Miller Corset Company contemplates the erection of a power house in connection with the proposed new factory on Chapin Street. The total cost is estimated at $100,000. E. H. Miller, 67 Court Street, Cortland, is president.

CORNING, N. Y.—Tentative plans are under consideration by the Corning Glass Company for the erection of a power plant at its works.

GLENS FALLS, N. Y.—The International Paper Company contemplates an expenditure of about $1,000,000 on the development of water power in the Hudson River near this place. Preliminary plans are under way for the erection of a plant on Sherman's Island and a dam. Floyd G. Simons, 30 Broad Street, New York City, is superintendent.

HAMILTON, N. Y.—Bonds to the amount of $28,000 have been voted for improvements to the municipal light plant.

NEW YORK, N. Y.—The Electric Bond & Share Company, 71 Broadway, has arranged for an issue of $4,000,000 in bonds, part of the proceeds to be used for extensions and improvements to the plants of two of its subsidiaries, one of which is the Southwestern Power & Light Company, El Paso, Tex.

ELIZABETH, N. J.—The Willys Corporation, Newark Avenue, contemplates the erection of a large power house in connection with its new automobile manufacturing plant now under construction. The initial station will have a capacity of about 6,000 kw. J. V. Hall is general manager.

JERSEY CITY, N. J.—The M. W. Kellogg Company, 117 West Side Avenue, manufacturer of power plant piping, etc., contemplates the construction of three shops. Plans also include the erection of a power house.

JERSEY CITY, N. J.—The Tidewater Oil Company, Bayonne, contemplates the erection of a power house and pumping plant on the Morris Canal at Jersey City.

RIVERTON, N. J.—The Campbell Soup Company, Camden, has plans under way for the construction of a power house at its farm in Riverton.

TRENTON, N. J.—The Cook Linoleum Company, East State Street, has plans under way for the construction of a power house at its plant.

TRENTON, N. J.—The City Commission has under consideration a report by Prof. C. E. Clewell of the University of Pennsylvania covering suggestions for extensions and improvements to the local street-lighting system.

CHAMBERSBURG, PA.—Application has been made to the Public Service Commission by the Warmspring Road Telephone Company for permission to install a system in parts of Franklin County.

CLARKSVILLE, PA.—The Furness Corporation, 343 South Dearborn Street, Chicago, Ill., is planning for the erection of a power plant for service at its proposed clay products plant at this place.

DARBY, PA.—The installation of an electric street-lighting system in the borough of Collingdale is contemplated. S. G. Davenport is chairman of the committee at Collingdale.

MECHANICSBURG, PA.—The erection of a hydro-electric power plant in this section is being planned for by the New Era Hydro-electric Company, recently incorporated with a capital of $250,000. Arthur C. Watkins of Mechanicsburg and others head the company.

PHILADELPHIA, PA.—Contract has been awarded to Fred A. Havens Company, 845 North Nineteenth Street, by the Pennsylvania Railroad Company, Broad Street, for the erection of an addition to its substation at the Arsenal bridge, to cost about $10,000. Cam Rea is president.

UNIONTOWN, PA.—The board of directors of the Uniontown Hospital is planning the erection of a new power house and laundry plant at the institution to cost about $30,000.

BALTIMORE, MD.—Bids will be received by Mayor W. F. Broening, president of the Board of Awards, until Sept. 22 to repair power plant at the Bayview Hospital.

HUNTINGTON, W. VA.—The Borderland Coal Corporation contemplates rebuilding the power house at its mine No. 2, recently destroyed by fire.

MADISON, W. VA.—Plans are under consideration by the Madison Water & Light Company for the erection of a power plant to cost about $25,000.

RICHMOND, VA.—Bids will be received by E. W. Trafford, superintendent of Public Utilities, until Sept. 20 for switchboard apparatus.

WASHINGTON, D. C.—Plans are filed in the office of the Chief Engineer, Washington, D. C., awaiting approval, for certain facilities including electrically driven pumps for the Key Bridge.

North Central States

CLEVELAND, OHIO.—Separate bids will be received at the office of the Commissioner of purchases and supplies, City Hall, until Sept. 24, for weatherproof copper wire, paper-insulated, copper-incased cable and electric meters; until Sept. 23, for about 53,961 ft. of underground lead cable for the division of fire-alarm system.

BLACKEY, KY.—The Dudley Coal Company contemplates the erection of a power house.

BLUEFIELD, KY.—The erection of a power house and tipple is contemplated by the Ulvah Coal Company.

DAVID, KY.—The Marion Coal Company plans to construct a power house, tipple, etc.

WINDOM, MINN.—Bonds to the amount of $17,000 were voted for improvements to the power plant and waterworks.

SIDNEY, NEB.—The city officials contemplate electrical improvements to cost about $70,000. Royal D. Salisbury, 1415 East Colfax Avenue, Denver, Col., is engineer

ATHOL, KAN.—Plans are under way for electrical improvements in Athol to cost about $12,000. Clarence E. Reid of Manhattan is engineer.

WILSEY, KAN.—The city officials contemplate electrical improvements in Wilsey to cost about $18,000. Clarence E. Reid of Manhattan is engineer.

Southern States

CHARLOTTE, N. C.—The Great Mountain Power Company has been incorporated with a capital of $2,000,000 and contemplates the erection of a hydro-electric plant. H. S. Taylor and G. B. Chapin head the company.

NEW HOLLAND, N. C.—Bids have been received by Benham & Richard, Columbus, for the installation of electric lighting, water and sewer systems for the North Carolina Farms Company, New Holland. The cost is estimated at about $50,000.

NORTH WILKESBORO, N. C.—The city officials are considering the installation of electric light and water systems to cost about $30,000.

REBECCA, GA.—A committee has been appointed to arrange plans and means for the installation of electric lights in the town.

ROCHELLE, FLA.—Bonds to the amount of $45,000 have been voted to purchase new equipment for improvements to the power plant.

DOTHAN, ALA.—The erection of a hydro-electric plant on the Choctawhatchee River is contemplated by the city officials.

FORT PAYNE, ALA.—The Wills Valley Light & Power Company has been organized with a capital of $75,000 and contemplates the erection of a hydro-electric plant on Wills Creek at Hughes Mills.

LOUISVILLE, MISS. — An issue of $36,000 in bonds has been arranged by the Town Council for the establishment of an electric light and power plant.

WICHITA FALLS, TEX.—Bids will be received by the State Board of Control, Austin, until Oct. 4 for the installation of electric wiring in buildings of the Northwest Texas Insane Asylum. C. H. Page & Brothers, Austin, are architects.

Pacific and Mountain States

SEATTLE, WASH.—According to W. F. McAuliffe, local manager of the Radio Corporation of America, the company plans to install a commercial radio station on Puget Sound for marine work, at an estimated cost of $30,000. Mr. McAuliffe also stated that similar commercial stations will be established at all principal ports of the Pacific Coast.

PORTLAND, ORE.—The Public Dock Commission, foot of Stark Street, has had plans prepared for furnishing and installing equipment including ten centrifugal pumps, four electrically operated capstans, ten 100-hp., 440-volt motors, etc., for the 15,000-ton floating drydock.

BRIGHAM CITY, UTAH.—At an election held recently bonds to the amount of $200,000 were voted for rebuilding and enlarging the municipal power plant in Boxelder County.

OGDEN, UTAH.—The Mountain States Telephone & Telegraph Company contemplates improvements to its system in Ogden to consist of new aerial and underground lines at a cost of about $125,000.

FLEMING, COL.—The Board of Trustees of Fleming contemplates the construction of a municipal power plant for light and water service. The cost is estimated at about $50,000.

DEMING, N. M.—The Deming Roller Mills contemplates the installation of an electric light plant.

WAGON MOUND, N. M.—The city authorities have under consideration a proposition of A. Corey, Des Moines, Ia., who, on certain terms agrees to establish a light and power plant at this place.

Canada

FREDERICTON, N. B.—Bids will be received by the New Brunswick Hydro-Electric Commission until Sept. 21 for the construction of earth dams in connection with the development of the power projects at Shogomoc and Musquash. Bids will be receivd at a later date for dynamos, wheels, power-house construction, etc. Henry Holgate, 285 Beaver Hall Hill, Montreal, Que., is engineer.

AYTON, ONT.—R. H. Fortune contemplates the erection of an electric light and power plant to cost about $25,000. Work will be done under the direction of the Ontario Hydro-Electric Commission engineers.

Miscellaneous

BERNE, SWITZERLAND—The erection of an electric power plant to develop 350,000 hp. on St Gothard Mountain is being planned. The cost is estimated at about $100,000,000.

(Issued Sept. 7, 1920.)

1,351,514. FIRE ALARM SYSTEM; Simon B. Hess, New York, N. Y. App. filed April 24, 1917. Distinctive trouble signals.

1,351,518. CUTTING HOLES IN SHIP'S WALLS; Walter J. Jones, New York, N. Y. App. filed Dec. 24, 1919. Magnetic device to clamp cutter against ship.

1,351,531. AUTOMATIC TELEPHONE SYSTEM; Trygve E. Meyer, Lombard, Ill. App. filed Feb. 9, 1916. For party lines.

1,351,662. AUTOMOBILE SIGNAL; Herman Klatt, Pueblo, Col. App. filed March 24, 1919. For day or night.

1,351,684. METHOD AND APPARATUS FOR UNITING TOGETHER PIECES OF BRASS, ALUMINUM AND SIMILAR METALS OR ALLOYS BY ELECTRIC-RESISTANCE HEATING; Norbert Prostler, Berlin, Germany. App. filed May 26, 1915. Improved process.

1,351,707. INDICATOR; Michael F. Sullivan, San Francisco, Cal. App. filed Aug. 22, 1918. For street cars.

1,351,717. DUPLEX ROTARY ELECTRIC WELDING MACHINE; Joseph Ledwinka, Philadelphia, Pa. App. filed April 17, 1919. Rotary control.

1,351,724. CONDUIT SEAL; John I. Mislener, Syracuse, N. Y. App. filed June 18, 1918. Prevents accumulation of foreign substances in conduit.

1,351,729. ELECTRIC HORN; Butler Ames, Lowell, Mass. App. filed March 14, 1917. Vibrating diaphragm.

1,351,775. SYSTEM OF TRANSMITTING INTELLIGENCE; George A. Long, Hartford, Conn. App. filed Aug. 3, 1917. Telautograph.

1,351,776. OSCILLATION-GENERATOR SYSTEM; Charles V. Logwood, New York, N. Y. App. filed Feb. 21, 1917. Radio communication.

1,351,779. ELECTRIC HEATER; Alonzo C. Mather, Chicago, Ill. App. filed Nov. 25, 1918. For liquids.

Record of Electrical Patents

Notes on United States Patents

1,351,787. CONDENSER UNIT AND METHOD OF MAKING THE SAME; William H. Richter, Philadelphia, Pa. App. filed July 14, 1919. Solid housing of insulating material.

1,351,788. CAR-LIGHTING SYSTEM; Harry D. Rohman, New York, N. Y. App. filed April 23, 1917. To hold steady voltage.

1,351,799. TELEPHONE SYSTEM; Frank M. Slough, Rochester, N. Y. App. filed May 15, 1915. To count connections made.

1,351,800. TELEPHONE SYSTEM; Frank M. Slough, Rochester, N. Y. App. filed March 31, 1917. Trunk operation.

1,351,815. APPARATUS FOR AND METHOD OF WELDING; Edmund J. von Henke, New York, N. Y. App. filed Jan. 18, 1919. Alternating current.

1,351,828. CAR-LIGHTING SYSTEM; William L. Bliss, Niagara Falls, N. Y. App. filed March 6, 1917. Generator-battery system.

1,351,863. TELEPHONE REPEATER; John Mills, Wyoming, N. J. App. filed Jan. 15, 1917. No singing.

1,351,876. SEMI-AUTOMATIC TELEPHONE SYSTEM; Michael Schwartz, Chicago, Ill. App. filed May 22, 1913. To indicate that called line is busy.

1,351,877. METHOD OF SEPARATING NICKEL AND COPPER FROM COPPER-NICKEL MATTES OR MATERIALS; Robert C. Stanley, New Brighton, N. Y. App. filed Feb. 5, 1919. Electrolytic.

1,351,886. ELECTROLYTIC CELL; Edward A. Allen, Portland, Me. App. filed Dec. 19, 1918. To produce chlorate of sodium or potassium.

1,351,897. ROTOR FOR DYNAMO-ELECTRIC MACHINES; George M. Eaton, Pittsburgh, Pa. App. filed Feb. 7, 1916. Current-collecting leads in shaft.

1,351,898. ROTATABLE MEMBER FOR DYNAMO-ELECTRIC MACHINES; George M. Eaton, Pittsburgh, Pa. App. filed July 12, 1917. Current-collecting leads in shaft.

1,351,907. ARRANGEMENT OF LEADS FOR DYNAMO-ELECTRIC MACHINES; Rudolf E. Hellmund, Swissvale, Pa. App. filed July 5, 1917. Prevents displacement.

1,351,909. METHOD OF AND APPARATUS FOR HEAT-TREATING METALS; Lawrence E. Johnson, Melrose, Mass. App. filed Nov. 11, 1918. For treating parts of objects.

1,351,926. COMMUTATOR; Herman R. Saxon, Toledo, Ohio. App. filed April 17, 1918. Disk type.

1,351,929. MOLD AND PROCESS FOR FORMING PORCELAIN INSULATORS THEREIN; Ernest J. Taylor, Everett, Mass. App. filed Aug. 9, 1919. For spark plugs.

1,351,975. ELECTRIC GENERATOR ATTACHMENT FOR WINDMILLS; Harry H. Taylor, Hutchinson, Kan. App. filed Aug. 5, 1919. Improved gear connection.

1,351,977. ELECTRIC FURNACE; John Thomson, Brooklyn, N. Y. App. filed Nov. 19, 1919. Thermal element of monolithic, zigzag resistance.

1,351,986. HOT APPLIANCE; Hjalmar V. Barclay, New York, N. Y. App. filed May 22, 1918. Pad or bandage.

1,351,988. ELECTRICAL TESTING DEVICE; Carl L. Begas, Brooklyn, N. Y. App. filed June 8, 1918. Tests bulbs, horns, etc.

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Associate Editors: P. S. BIEGLER, C. T. BALDWIN, S. N. CLARKSON

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How to Antagonize the Public

THE recent suspension of electric service at Delaware, Ohio, without warning to the consumers, because the central-station company was unwilling to buy more coal at the prevailing price unless it should first receive authority to increase its rates, was no doubt meant to be an object lesson on the financial predicament of the utility and on the indispensable part it fills in the community. It will, perhaps, serve an even more useful purpose as an object lesson in how not to do things; for naturally the summary action taken by the company aroused much indignation among the citizens, and in applying for increased rates the good will of the local public is the central station's highest card. The company, which the Delaware manager is reported as saying is losing $600 a month in that city, no doubt smarts under a sense of injustice; but to refuse to play the game on that account is merely to invite forfeiture of franchise and to threaten private operation with the loss of its birthright.

The Federation Must Go Forward

THIS week we publish the program for the first meeting of the American Engineering Council, which is to be held in Washington on Nov. 18 and 19. From now until that time every local and national engineering society will have the opportunity of deciding whether it is going to become a part of the Federated American Engineering Societies or whether it is going to take the attitude of having first "to be shown." No finer spirit of enthusiasm could be desired than that displayed at the organizing conference last June. Since that time, however, the edge of this enthusiasm has been dulled by the critical and the skeptical. These men—and it must be confessed that they play no small part in shaping engineering association policy—are not acting up to the qualities that brought them their high position in the engineering world. They are throwing cold water on a movement longed for through many years simply because they fear that the new organization may not accomplish its purposes. They are not filling the part of good soldiers in the engineering army. This is no time to hold back. It is time to go ahead and make this federation something big and fine that the American engineer can be proud of. It would be discreditable to the profession of engineering to have the movement fail for want of courage. If the federation does not go through, and go through strong, then the profession will be branded as a body of men who cannot agree among themselves because they cannot trust one another. Once that impression prevails, the profession will no longer occupy the high plane upon which it now stands, nor will it attain that still higher place which the federation would speedily make for it. The federation will not fail for want of work to do. There is enough work already waiting to keep it busy for some time. It may prove to be slow, but that can be remedied; it may show lack of leadership, but that lack can be supplied; it may in the beginning be unwieldy, but that can be cured. In short, it may be one of a hundred things none of which is irreparable if only the movement goes forward.

Cost of Low Power Factors

JUST how serious low-power-factor loads on central-station systems have become is well illustrated by a recent estimate that a correction of existing power factors to unity would release 500,000 kw. of generator capacity for additional loads that might be expected to return at least $30,000,000 per year. This amount is therefore being donated to present power customers simply because no adequate steps have been taken to improve power factors or devise metering methods and rates comprehensive enough to correct this situation. Since it is not altogether practicable to establish a universal power factor of unity, the rate solution seems the most logical point of attack, for in cases where a customer uses transformers and induction motors he not only secures from the central-station system a certain amount of power but as well a certain amount of magnetizing current for which he now pays nothing. As one engineer has stated this situation, it is just as illogical for a customer to ask the central station to furnish magnetizing current free as to ask a manufacturer to furnish an alternator and throw in the exciter. The time has come, with labor, coal and materials at new levels, when the serious leaks in revenue must be stopped. Measuring central-station service in kilowatt-ampere-hours instead of kilowatt-hours is the remedy for one of these leaks.

At the Mouth of the Mine

THE new steam-power plant of the West Penn Power Company at Springdale, Pa., which is described in this issue, is conspicuous because its relation to the coal supply has influenced to a very large degree the major parts of the station design. Serving a territory where the principal customers are coal mines and steel furnaces, it is particularly fortunate in having an extremely good and cheap coal supply which is right at the plant. This has been accomplished by the lease of nearly 4,000 acres of twin-vein Freeport coal having on the average the unusual thickness of 7 ft. 5 in. (2.2 m.). In securing a tract along the Allegheny River of about 80 acres it proved practicable to place the tipple practically at the station, thus obviating the need for railroad transportation, the coal being received directly from the mine cars. As the coal is of good quality and easily mined, the advantage in cost is very considerable. Incidentally such a fuel

supply means freedom from railway strikes and a comparatively uniform price. The uniform price is a matter of great importance where economical generation of power is attempted, since it is not easy for a supply company to change its rates to correspond with the fluctuating coal market. Further, the possession of a uniform grade of coal greatly facilitates economical firing.

The mine coal, as already indicated, is taken directly from the mine cars into the skips and raised to the top of the tipple, where the coal is screened and picked ready for delivery to either power house or railway cars. Ultimately the coal is carried by belt elevator and conveyors to the bunkers, there being a capacity of five days' supply for each boiler. From these bunkers the coal is served to the boilers by mechanical stokers. It is worth noting here that the boilers are built for a pressure of 350 lb. (24.5 kg.) and are worked at 235 deg. superheat, both of these figures representing a considerable improvement in economy over average current practice.

Publicity Which Is Detrimental to the Electrical Industry

ONE of the significant accomplishments of recent years within the electrical industry has been the creation of an appreciative understanding of electric service alike in the largest of industrial installations and in the humblest of homes. Important among the factors that have brought this about are its availability, its small cost and its safety. In the development of this service safety in all its aspects has been jealously guarded, and through the National Board of Fire Underwriters we have today standards of inside construction equaled in no other country. In spite of this fact there are those who, in their overzealous ambition to promote safety, overlook the fundamental principles involved and malign, without apparent consideration of the far-reaching effect, the good safety record that electric service has as a whole maintained. We refer to the tendency of overworked reporters and others to attribute the origin of unexplained fires to "defective electric wiring" and also to such publicity as is now being used by the Square D Company in the popular magazines, which is based upon the terrible dangers of carelessness in the operation of the open-knife switch. The work of that particular company in the development of the safety switch is commended in a conspicuous way by the general adoption of that device, but the use of its prestige in a campaign of frightfulness directed to the general public is to be deplored. It simply tears down the constructive work of such agencies as the Society for Electrical Development, the National Electric Light Association, the National Safety Council and others and can only bring censure and criticism to a manufacturing enterprise that is a vital factor in protecting the safety of electrical workers.

Instead of advertising the safety switch as a thing embodying the deadly and fearful elements of the electric circuit, it should be widely proclaimed as a product of engineering that adds another link of safety to electric service, and the idea should be spread by an appeal to the reasonable and clear-thinking men of the industry, not through the terrorizing of unskilled men and women and children who have no conception of the engineering considerations involved. We hope the Square D Company will change its advertising appeals to the general public and to the electrical industry as well in such a way as to eliminate this element of terror and direct them toward the creation of confidence in safety service. Along such lines all associated in the electrical industry, workers and employers, will cooperate to build good will for the company that was among the first to give to the industry a true safety switch.

Efficiency in Small Plants

THESE are days when the high cost of fuel brings the question of efficiency very much to the front. Big plants where the total losses run into large figures have on the whole been fairly well taken care of, but in small plants rather shocking conditions are to be found. E. H. Tenney in this issue gives consideration to the efficient operation of small plants, especially with reference to boiler and furnace conditions, which are commonly much less good than in the large stations. It also is true that prime-mover efficiencies are very frequently extremely bad where the output is not large, both on account of the accompanying poor load factor and because small engines have received relatively little attention in this country. Before the war there were many small steam units in use abroad giving one brake-horsepower on 10 lb. or 12 lb. of steam at full load. But our own American practice has been and is very far behind these figures.

With respect to boilers much of the trouble comes from dirt and scale. The deposition of these on the heating surfaces is fatal both to the efficiency of steam production and to the output of the plant, for where the space which should be free for hot gases is taken up by débris combustion is very seriously impeded. With water such as is only too common in that part of the West of which Mr. Tenney is specially speaking, and with the generally rather poor fuel, a bad situation is quickly created and it is hard to take too much care in the way of cleaning off soot and treating the water to reduce scale. A word of warning is given as to boiler compounds. Nearly all of them are effective on some particular waters, but a perfectly good compound for dealing with one quality of water may be almost useless on another and in fact may precipitate priming. Before deciding on preventive means, then, it is necessary to test the water and see to it that the scale-preventing compound used is such as will actually do the work without creating difficulties.

Outside the boiler proper, the furnace needs looking after, first to insure suitable combustion and second to avoid loss of heat through leakage in the settings, a not uncommon fault. If a first-class boiler efficiency is to be reached, the performance must be closely watched. It is highly desirable to weigh the coal and to have both water and steam meters, so that the final output as well as the intermediate steps may be closely watched. The cause of any failure in suitable performance then needs to be run down, and for this purpose the temperature and proportion of CO_2 in the flue gases should be watched instrumentally, along with close inspection of the actual working of the fires. Leaks in the settings of the flues and side walls can generally be observed. If these exist in the baffle system, detection is more difficult, but they may frequently be run down by a process of elimination when there is a notable departure from standard operating conditions. It must not be forgotten

that not only does neglect damage the performance of boilers but it may actually seriously reduce their factor of safety through corrosion of the flues and the overheating of the metal due to scale deposits.

The whole secret of success in operating a small steam plant is to exercise the same care that would be applied to a big one, for while the total amount involved is not so large in the former case, the relative gains possible are likely to be greater, and beyond the boilers every effort should be made to install engines of the best efficiency or to follow up those which are in place with the indicator and see to it that within their limitations they are doing the best of which they are capable.

Condenser-Tube Faults

NOT only is there an expense involved in maintaining the surface condenser itself in a steam-turbine station when the tubes fail, but where sea water is used for condensing the action of the salt in the boiler water affects boilers, piping and turbines. R. J. C. Wood points out in this issue that one of the principal faults of condenser tubing is the coarse structure of the crystals of copper and zinc forming the "admiralty" mixture generally used in such tubes. Electrolytic action resulting from stray currents or from local galvanic action induced by electronegative particles settling within the lower half of the tubes causes dezincification. Fairly simple corrective measures may be taken to eliminate or counteract the stray currents, such as short-circuiting them or circulating an equivalent current of opposite polarity.

Coating of the surface of the tubes has been tried with some slight success, but has the disadvantages that the coating is short-lived and the efficiency of the condenser is decreased owing to the relatively lower heat conductivity of the insulating coating. This is a problem worthy of the most thorough investigation.

Analysis of Maintenance Costs

SOME rather enlightening information is given this week in an analytical study of maintenance costs for seven central stations of fair size, covering on the whole half a dozen years of service. As might be expected, it turns out that there are many irregularities in the question of maintenance expenses generally. It does not seem possible, for instance, to derive any valuable information from month-to-month records inasmuch as repairs are not effects which immediately follow causes, but come along in due time, sometimes in an orderly fashion and sometimes bunched. For example, while it is probable that on the whole low output lessens repairs, these must be executed as nearly as possible when necessary; but periods of low load are the only available ones for carrying out certain kinds of repairs, and hence the actual work due to heavy output may be charged to periods of low output. If a plant has hydroelectric connections, this again complicates the situation.

Some general facts stand out conspicuously as a result of this study. First, the electrical repairs are very much less than those due to the steam supply system—smaller in the ratio of one to eight or nine. Of the steam supply costs, about 60 per cent are chargeable to maintenance of boilers and stokers in about equal proportion. The average cost of repairs from these two items over two years' careful tabulation amounted to 1½ cents per kilowatt-hour. On the other hand, the total electrical cost amounted to only a little over ¼ cent per kilowatt-hour, and the interesting feature of this figure is that more than half of it was due to the switchboard. It is, of course, a commonplace that the switchboard has become a serious, perhaps unnecessarily serious, item of station costs and that the apparatus concerned is more than usually delicate, yet it certainly seems as if care and simplification should unite in relieving the switchboard of so large a share in electrical maintenance cost. In general the age of the equipment proves to be a very important factor of repairs and their total amount is roughly proportional to the size of the plant; that is, fairly constant per kilowatt of rating.

It would be interesting to follow the clues a little further and find out how much improvement has been worked out in successive equipments in the matter of maintenance. In other words, is the maintenance cost of a recent station, considering its age, improved over that found with the older stations? How much have we really progressed as the art has changed?

Inspection of Electrical Equipment

THE experienced station operator acquires two pieces of exact knowledge that stand him in good stead—that trouble generally comes when it is not expected and that it commonly has its source in small things rather than in big. A lightning arrester flashes over in a substation and the ensuing surge plays havoc with the switchboard, or a too friendly and inquisitive cat rubs confidingly against a high-tension bus that every one supposed safely housed and poor kitty's obsequies cost well into four figures. We have sometimes been tempted to say that the switchboard is the root of all evil, and it certainly needs watching even when best disposed.

It is attention to details that counts heavily in the operating department, and it is this principle that lends special value to A. S. MacDowell's account in this issue of the system of inspection carried out by the Rochester Gas & Electric Corporation. It is unusual not in its frequencies or its elaboration of system, but rather for its thoroughness in looking after and testing out systematically the apparently minor items of equipment. Not only do generators and cables receive their proper routine tests, but particular attention is paid to the relays and instruments, including the entire control equipment from the many generators to the remotest corner of the last substation. A couple of striking examples of trouble from the control system point the moral. Despite the fact that the company operates ten stations, the inspection force requires only five men, who go about their work chiefly in the light-load period from 5 p.m. to 1 a.m. This rather unconventional worktime gives them a better chance to cut things clear and investigate than a much larger day shift would have and enables them to do their work more systematically. They get completely over the system every six months, this being in addition to the ordinary activities of the regular staff. Careful records of everything found in bad order are kept which give a good clue to negligence at any particular point or on any particular thing. The details of this inspection program are well worth studying, as bearing directly on items of upkeep that sometimes get altogether insufficient attention.



Nathaniel Allen Carle

An engineer whose executive ability and extensive knowledge of plant operation have been widely reflected in analysis of national engineering problems

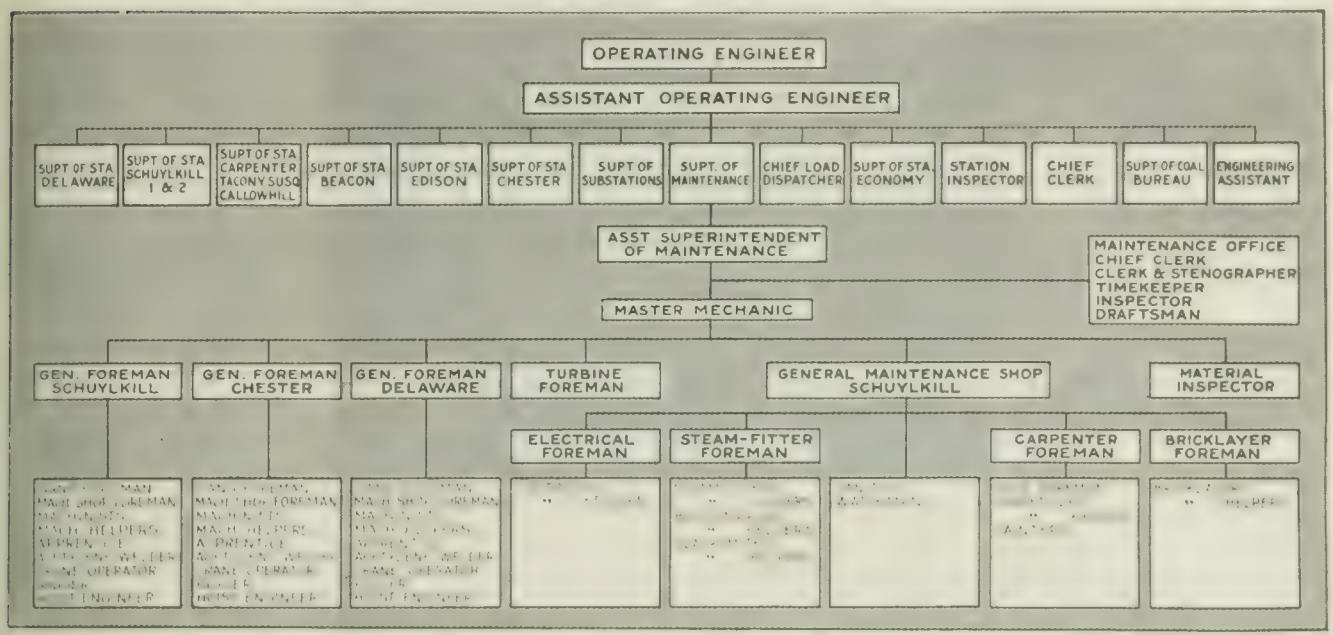
ALTHOUGH actively heading the engineering and operating activities of a state-wide electric service system in New Jersey, which alone is a man-size job, N. A. Carle has a capacity for work and a personal interest in problems of the entire industry that have elected him chairman of three national engineering committees and a member participating in the activities of nineteen others. In these positions he has never been a passive onlooker, but has always furnished impetus to the work in hand. On non-technical committees he has demonstrated that his professional activities as an engineer have not stunted his judgment on financial, public policy and similar subjects. Little other information on steam-plant practices has been made available in as compact and segregated a form as that which he has presented each year as chairman of the N. E. L. A. prime-movers committee. When the A. S. M. E. sub-committee, of which he is chairman, shall have completed the power-station testing code a distinct service will be rendered to the 5,000 or more central stations and many more industrial plants in bringing standardization where widely diversified practices have existed. Moreover, no little credit is due Mr. Carle for bringing about a closer co-operation between turbine manufacturers and users which should assure higher reliability, more economy and lower cost.

Born in Portland, Ore., in 1875 and graduated at Leland Stanford University in 1898, he is a Westerner in origin, but his activities have connected him with Alaska, Canada, New England, Colorado, the Northwest and the Middle Atlantic seaboard. After two years in the mining field he became associated with Westinghouse, Church, Kerr & Company and supervised many large construction jobs for them. He was later made first assistant to the superintendent of construction in connection with the electrification of the Pennsylvania Railroad. In 1906 he went to Denver, where he became vice-president and general manager of the Colorado Power Company. Subsequently he did consulting work and was associated with the Puget Sound & Dredging Company of Seattle. Finally he was induced to join the Public Service Electric Company of New Jersey as chief engineer. In this capacity he has enlarged and reorganized the engineering staff and supervised the development and operation of a 270,000-kw. system, involving 850 miles of overhead and underground transmission lines. In addition to the engineering committees mentioned, Mr. Carle is active in the A. I. E. E., A. E. R. A., A. E. I. C., American Metric Association and Engineering Council.

Centralizing Power-Plant Maintenance

By Separating Maintenance of Plant Equipment from Operation Uniform Standards of Work Can Be Established and a Group of Repair Specialists Developed Material Purchases Handled More Efficiently

By W. C. L. EGLIN* and F. C. RALSTON†



CENTRALIZED SHOPS FOR MAINTENANCE WORK ALLOW THE DEVELOPMENT OF FACILITIES FOR HANDLING ALL CLASSES OF WORK

PRIOR to 1915 the maintenance work of the generating stations of the Philadelphia Electric Company was handled by each individual station with a small machine shop under the supervision of the station superintendent. To this shop were assigned such repair jobs as could be handled with the limited shop force and equipment. Only one large generating station was then in operation, and work that could not be handled at this station was done by outside contractors. The decision how and by whom the work should be done and the responsibility for its being completed in the proper manner and time rested with the operating superintendent or his assistants. The labor and supervision required of the operating force for this purpose naturally diverted a part of their attention and efforts from their prime function of operating the stations at the best possible efficiency. Another consequence would have been that different stations would have developed various methods of handling similar jobs.

In view of the conditions mentioned and the fact that another large station was nearly completed and others were in the course of design, the formation of the present maintenance section of the station operating division, with a definite policy and organization, was started, the basic idea being (1) the separation of all the details of maintaining plant equipment from those of its operation, (2) the establishment of uniform standards and methods of maintenance and inspection, and (3) the development of specialists in the work of overhauling and repairing plant equipment.

From the results of more than five years' experience with this plan it has been demonstrated that a centralized maintenance section can handle the work efficiently and at a low cost, and that it can be enlarged by simple expansion to any degree required by the growth of the system it serves, adhering to the fundamental principles upon which it is built.

Definite performance data, from the maintenance point of view, on various types of apparatus can be collected much more quickly under this plan, because the maintenance records from all the stations, covering a large number of units of each kind as compared with those of any single station, are compiled and studied, and conclusions are drawn from them, by one group of men. Moreover, analysis of maintenance cost by the statistical method, while at present important for comparatively few items of maintenance work, will apply more and more as the system expands and as similar jobs recur more frequently. It is obvious that this analysis will be greatly facilitated by the facts (1) that all of the necessary records are available at one point (the maintenance office) and (2) that all of the work to be analyzed has been performed by one group of men under one head.

The plan of handling work is shown in the accompanying organization chart, listing the personnel of the maintenance section and showing its relation to the other groups comprising the station-operating division. It will be seen that the maintenance section is separate from the station operating forces and co-ordinate with them in responsibility to the operating engineer. This chart shows also the plan of distribution of the maintenance forces, namely, a central general maintenance shop, operated on a twenty-four-hour basis, for handling routine work throughout the greater part of the system and all emergency work, supplemented by branch shops at each of the important generating stations for the routine work at those points.

*Chief engineer Philadelphia Electric Company.
†Technical assistant Operating Division Philadelphia Electric Company.

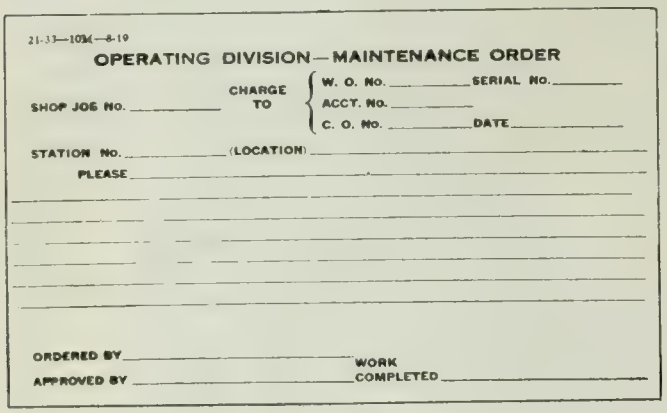
Starting with the machine shop of the large generating station then in operation as a nucleus capable of handling very few repairs other than those to mechanical equipment, the section has taken over successively, as the organization has been enlarged, carpenter work, bricklaying, electrical repairs and steamfitting work. Besides enlarging the scope of its work in this way, the section is also increasing the amount of detail which it handles; for example, at the outset orders were issued to the section for only such work as could be performed by its own force, while in cases which required the services of outside contractors the orders for the work were issued by the operating superintendent directly to the contractor. Later this practice was revised, so that all maintenance orders are now issued to this section, which calls in outside firms as sub-contractors if necessary. Besides this, the ordering of all station maintenance material, even such as is to be applied by the station-operating forces, is now being done through the maintenance section.

Following out this plan, there is a central machine shop with a full complement of modern electrically-driven machine tools, small tools, welding outfits and all the accessories of a well-equipped repair shop, capable of handling practically the largest work required in the maintenance of the system. At this point are situated also the office of the superintendent of maintenance, the clerical force, the carpenter, electrical and steamfitting shops. The carpenter shop is fully equipped with modern woodworking machinery, and the steam-fitting shop carries a full stock of pipe, fittings, etc., for handling practically any steamfitting repairs which may be required. It will be noticed from studying the lower right hand view on page 611 that the machines in this shop are also equipped with individual motor drive.

As an adjunct to the above shops there is provided an emergency truck, having as regular equipment a full outfit of tools and rigging for emergency repairs. This truck, with a driver, is held ready at all times to respond to emergency calls which require tools and material.

At each of the important generating stations a smaller machine shop is provided, with the necessary machine tools and facilities for properly handling all routine maintenance work. A view of the branch machine shop at Chester station in its present temporary quarters is shown at the lower left hand side of page 611.

The work at the central machine shop and that at each of the station machine shops is in charge of a general foreman. At the central machine shop the general foreman has under his charge a full corps of foremen, machinists, helpers, etc., sufficient not only to perform the work originating at that station but also to send out men through the system wherever it may be necessary. The shop is operated on a twenty-four-hour basis, so that in case of trouble occurring anywhere at any hour of the day or night a gang from this point can be rushed to the job and started to work immediately while reinforcements are being mobilized, if necessary.


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OPERATING DIVISION—MAINTENANCE ORDER

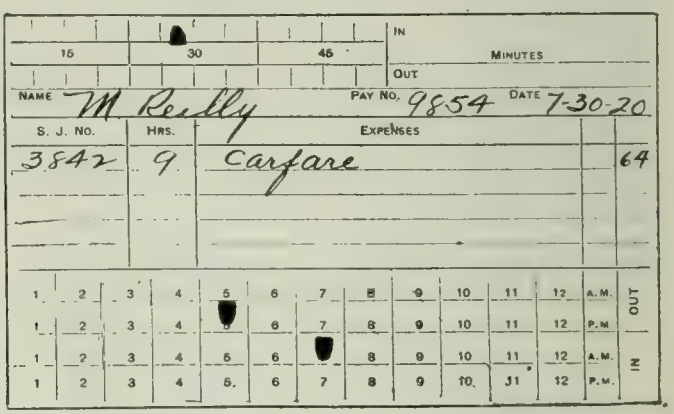
SHOP JOB NO. _____ CHARGE TO { W. O. NO. _____ SERIAL NO. _____ ACCT. NO. _____ C. O. NO. _____ DATE _____

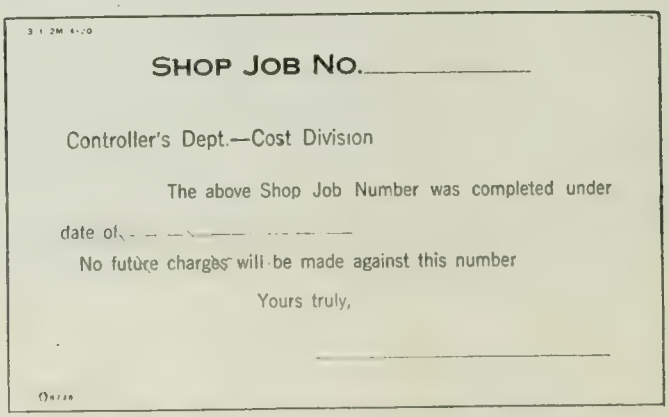
STATION NO. _____ (LOCATION) _____

PLEASE _____

ORDERED BY _____ WORK COMPLETED _____

APPROVED BY _____




3-1-2M-6-20

SHOP JOB NO. _____

Controller's Dept.—Cost Division

The above Shop Job Number was completed under date of _____

No future charges will be made against this number

Yours truly,

_____

Over

CAREFUL CLERICAL ROUTINE IS NECESSARY FOR AN ORDERLY MAINTENANCE SYSTEM

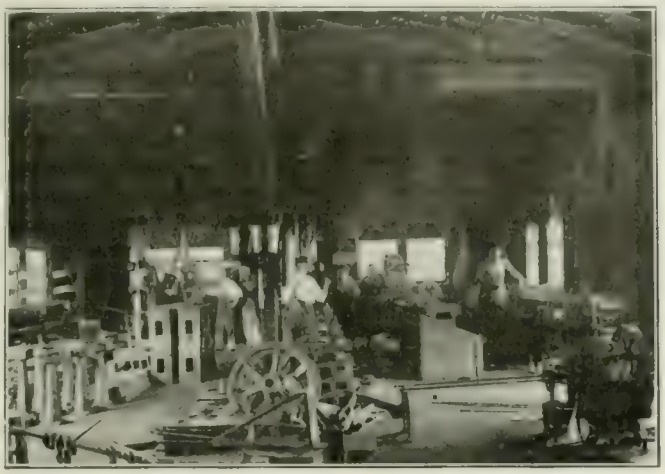
The operating superintendent initiates a maintenance order by filling out, in duplicate, the operating division maintenance order. A daily time-card record is kept by each man, and the one shown is used where time clocks are not available. Each station has a distinctive punch. When a job is finished a completed job notice is furnished to the accounting department.

At each of the station machine shops the general foreman has a force sufficient to take care of the routine maintenance work only, this force being augmented from the central machine shop as required by the nature of the work. It will be noted that the station machine shop forces are directly under the control of the superintendent of maintenance and entirely separate from the operating organization of the stations at which they are located. As indicated on the organization chart, the forces at the central and branch machine shops include gang foremen and machine shop foremen. The latter are in charge of the shops and such of the work as is performed there, while the gang foremen handle the portion of the work carried on outside of the machine shops.

The work of the carpenter shop includes the maintenance of wooden structures, interior and exterior woodwork, the building of forms for concrete work and for boiler baffles, the repairing and renewing of bus and switch compartment doors, the building of scaffolds and shoring required for maintenance work, the making of insulated stools and switch hooks, the making of pat-

terns for castings required by the machine shops or stations, painting, glazing and any other task of a woodworking nature.

The work of the electricians is principally in connection with overhauling and inspection of electrical equipment (oil switches, lightning arresters, transformers, rotating machinery, etc.), but they also disconnect and reconnect equipment being repaired and perform special electrical work of various kinds. This section does not attempt to handle such jobs as the rewinding of armatures, fields, transformers, etc., as it is believed that this can be done to better advantage by the manufacturers of such equipment.



AT EACH OF THE MOST IMPORTANT POWER STATIONS THERE IS A LOCAL SHOP TO HANDLE ROUTINE MAINTENANCE

The work of the bricklayers is principally in connection with the repair and renewal of boiler settings and furnace walls, but they also make any repairs that are necessary to brickwork, masonry, concrete work, machine foundations, etc., throughout the company's entire system.

The duties of the material inspector are to receive from the foremen in charge of the various sections of the work lists of the material required and to see that all of the material thus listed is ready at the site of the job at the proper time, so that the work may proceed without delay.

The turbine foremen, whose positions are indicated on the organization chart, are men particularly expert in overhauling and repairing turbines of all sizes, and in case of any work being done on a turbine they take charge of it, having a sufficient number of men assigned to them from the central machine shop to perform the actual work.

The duties of the inspectors shown in the office force are particularly important in carrying out the general policy of the maintenance section. These duties consist of inspecting cases of failure of apparatus (particularly failure by breakage) to determine, if possible, the cause of the failure and to suggest a remedy. This remedy may consist of changes in design, methods of operating or grade of material of certain parts to secure longer wearing life. The inspectors also obtain from the manufacturers data and recommendations based on practice developed since the installation of the particular apparatus which has failed, and they are thus enabled in many cases to suggest improvements which postpone or even prevent a recurrence of the particular trouble. Another duty of the inspectors is to compile comparative costs of doing jobs which are repeated at intervals, to determine whether improvement in the methods of handling the work is actually being obtained; also to prepare unit costs, where such can be obtained, for convenience in estimating on future jobs.

The operating superintendent initiates a maintenance job by filling out in duplicate and signing an "operating division maintenance order," specifying the station, the nature of the work to be done and the account or order number to which the cost of the work is to be charged. The duplicate is made by folding the order sheet along the dotted line and inserting a carbon sheet before filling out, the back of the lower half of the sheet being printed like the front of the upper half, so that when folded the back of the lower half is in the proper position for duplicating. In the space marked "Serial Number" each operating superintendent numbers his orders consecutively as he issues them, this number being thereafter a convenient means of identifying orders during the progress of the work. The superintendent retains the duplicate copy of the maintenance order for his files and sends the original to the office of the maintenance section, where a shop job number is assigned to it and two more copies are made. One of these copies is filed in the maintenance office and the other is issued to the foreman who is to do the





THE MACHINE AND CARPENTER SHOPS ARE FULLY EQUIPPED IN EVERY DETAIL

On the left is shown the machine shop furnished with all the accessories of a well-equipped repair shop. The carpenter shop, shown on the right, is also fitted out with a complete line of woodworking machinery. There is also a steam fitter's shop, an electrical shop and the office of the superintendent of maintenance to make up the centralized system.

work, while the original is sent to the accounting department, where an account is opened under the assigned shop job number and all costs incurred are charged to this job. In emergency cases requiring immediate action telephone notification giving the proper information is accepted and the work started at once without waiting for the written order.

On receipt of his copy of the order the maintenance foreman consults with the operating superintendent to learn when the job can be done, also to obtain any other information not detailed on the order card. Then he turns in to the material inspector a list of the material required, with the time it must be at the site of the job. The men proceed to the job, by train or trolley in the case of ordinary jobs, or in emergency cases by the emergency truck.

For recording the arrival and departure time at the location of the job standard time cards are used where recording clocks are installed. For other places, including most of the substations, a special time card has been developed on which the record is made by a hand punch. The punch assigned to each station has a distinctive die, so that the record is clear and unmistakable even if the man has worked in more than one station during the day. On the card illustrated the time of arriving is 7:30 a.m. and that of leaving 5 p.m.

When a job is completed the foreman turns in his copy of the shop job order, signed. When the operating superintendent has accepted the job, a "completed shop job notice" is sent to the accounting department, which closes the account and returns to the maintenance office the original shop job order with the costs of the job entered on the back. This cost is then entered on the maintenance office copy, and the original is returned to the superintendent who issued it, where it forms his record of the cost of the job.

The foregoing routine is modified slightly at the large generating stations. Weekly conferences are held between the maintenance foremen and the operating men who issue the orders. At these conferences the progress of all jobs is freely discussed and the approval of the operating men given or withheld, as the case may be, on the orders which the maintenance foremen report as completed during the week. These conferences form a very important link in the success of the plan by preventing friction and bringing maintenance and operating men to a common viewpoint.

If a job is to be assigned to an outside contractor, a requisition issued to the contractor takes the place of the foreman's copy of the maintenance order. The maintenance section thus becomes the channel for all communications and dealings with the outside firms in regard to maintenance matters. This simplifies conditions for the outside firms and relieves the operating forces of a large amount of detail work.

Centralized Purchase of all Maintenance Supplies

By reason of purchasing all maintenance material used in the stations of the company, even that to be applied by the operating forces, the maintenance section is enabled to reduce costs in three principal ways: (1) Purchase can be made in quantities which command better prices; (2) a smaller total stock of material is adequate because of the time diversity in the requirements of the station, and (3) when material is ordered which cannot be obtained or which the experience of the maintenance section has shown is not the most satisfactory for the purpose, recommendations are made embodying the objections and suggesting a substitute.

In accordance with the foregoing procedure, the maintenance section assumes the responsibility for all maintenance work. From the time that apparatus is released to the section until the work is completed and ready for inspection the operating forces are relieved of all details, except so far as they may wish to offer suggestions or to exercise supervision in connection with certain jobs.

In the course of the work of the maintenance section there have been developed a great number of methods of reducing costs, some of which are peculiar to individual jobs, while others are more general, expressing principles applicable to a variety of jobs.

For example, on performing for the first time a job which is likely to recur with regularity, such as grinding the commutator of a rotary converter, the foreman in charge makes a sketch showing exactly what size and number of bolts, clamps, I-beams, blocking, etc., were required in setting up the job. This sketch and bill of materials are transferred to the maintenance office records, and when the job is to be done again it is not necessary to take out a large amount of miscellaneous rigging material to be sure of having enough, but rigging material can be selected from the stock which either is the proper size or will cut to size with minimum waste. Moreover, the cutting, drilling, etc., can be done by the machine at the shop, where it will not delay the completion of the job. On the back of these record cards is entered, each time that the job is performed, the number of man-hours required.

Standardization of Electrical Batteries

ONE of the most productive lines of research at the United States Bureau of Standards recently, said Edward B. Rosa, chief physicist of the bureau, in an address before the Washington Academy of Sciences, has been a study of electrical batteries, primary and secondary. They are used in great numbers for starting and lighting automobiles, for tractors and other electric vehicles, for electrical power stations, for telephone exchanges, railway signals, doorbells, flashlamps and a hundred other purposes. No adequate specifications or methods of test had ever been generally agreed upon when the bureau took up the work. They were sold without guarantee or adequate statement of performance, and the purchaser had no way of ascertaining just what he was getting. The manufacturers have co-operated cordially and intelligently in the study that has been in progress, and in time it is expected that a complete set of specifications and methods of test will be developed. In the meantime the manufacturers have derived important benefit from the investigation and the public is getting a better product.

Possibly a hundred million dollars' worth of these batteries are made and sold each year, and if this work could be carried on more adequately and as thoroughly in all lines as it has already been in some lines, it seems a safe statement that the public would be benefited not less than 5 per cent on the entire product. This would amount to $5,000,000 a year, which is several times the cost of all the work of the Bureau of Standards and more than a hundred times what the battery work would cost.

Analyzing Maintenance Costs

Age of Equipment a Greater Factor Than Energy Output Electrical Apparatus Far Less Expensive to Repair Than Steam Equipment—Total Repairs Virtually Proportional to Plant Rating

WHAT connection exists between the cost of steam and electric equipment maintenance in the modern central station and station output? Can any relation be shown between plant age and repair expense per year per unit of station capacity? Are certain kinds of equipment generally heavier contributors to upkeep outlay than other kinds? Do the variations in maintenance cost from month to month reflect cyclic or casual conditions? To attempt to answer these and other points analyses of maintenance expense are given below from the operating experience of seven New England central stations, ranging in size from about 12,000 to 60,000 kva., covering for one station a month-to-month study of these costs for the past two years and for the entire group of plants six years of recent service.

One very striking conclusion follows from this study: The cost of maintenance in a given station for a given period cannot be controlled today with the precision



FIG. 1—COMPARISON OF MONTHLY OUTPUT, STEAM AND ELECTRICAL EQUIPMENT REPAIR COSTS IN PLANT OF 63,000 KVA.

desirable in attaining high over-all operating efficiency. The larger the plant, in general, the greater the maintenance expense, and the greater the output the less the repair cost per kilowatt-hour generated. But to a great extent repair costs are spasmodic in their variations. Deductions from the data presented herewith must be made with reservations and the curves shown must be looked upon as establishing median lines in zones of probable cost instead of marking the limits of exact practice. The graphs illustrate a line of attack upon the maintenance problem, however, which may well be utilized in the scientific analysis of plant operation.

Station G had a rating of 63,100 kva. on June 30, 1920, and is a plant equipped with three 1,250-hp., two 700-hp. and six 600-hp. water-tube boilers fired by mechanical stokers and serving three 2,500-kva., two 7,800-kva. and two 20,000-kva. horizontal turbo-generators. It was built about nine years ago, generated 74,323,400 kw.-hr. in the fiscal year 1920, and in the last two years 144,844,900 kw.-hr. Steam plant maintenance costs are subdivided under boilers, stokers, turbines, piping and conveyors, and electric plant repair costs under generators, switchboard, batteries, motors and wiring. Fig. 1 shows the variations in output, steam and electric equipment repairs by months from July, 1918, to July, 1920. Steam plant and electric plant maintenance costs are plotted above an independent base line, but the relative variations in magnitude can be followed without difficulty upon a common time basis.

The idea that lower repair costs accompany reductions in output is considerably upset by this diagram. When repairs become necessary, they must be executed, and as the load decreases the more favorable the time becomes for withdrawing units from service and overhauling them. This plant is interconnected with a large hydro-electric system, and when the high water of late winter and spring yields excess energy it is purchased, if other conditions are favorable, thereby releasing considerable steam plant capacity for thorough going over. This is probably the reason why in the spring of each year shown repair costs rose so rapidly for two to four months. Again in the fall surplus hydro-electric energy is seen to release steam plant equipment for maintenance which could not be handled so opportunely in midsummer and midwinter. It should be noted that the output curve shown in this figure is only the curve of energy generated and not of the total energy delivered at the system buses from month to month.

The remarkably low cost of electric plant repairs as compared with steam plant maintenance cost is not peculiar to this installation. This relationship has been noted in scores of cases analyzed during the past decade. In plant G steam plant repairs totaled $117,954 and electric equipment repairs $12,627 in the past two years. (Minor discrepancies in the tabulations are due to the omission of cents in transcribing the records.) It is evident that the processes of handling fuel, of combustion and of hot water and steam are more severe upon station equipment than are the transmission, control and measurement of electricity. The wear and tear upon stokers and boilers is of major importance in plant repairs.

Semi-annual graphs of the outlay for labor, material and total repair costs for the principal groups of steam plant apparatus are shown in Fig. 2. In nearly all of these half-year periods the cost of materials far exceeded the cost of labor. Turbine repair costs ran considerably behind boiler and stoker maintenance expenses, in the long run, and piping repairs were of minor importance throughout the entire two years. The

average cost of repairs per kilovolt-ampere of station capacity for the two years was: Boilers, $0.745; stokers, $0.76; turbines, $0.388; piping, $0.079; conveyors, $0.450; total, $2.42. The average station rating for the two years was 48,517 kva. The excuse that piping repairs should be deferred on account of expense is clearly untenable in the light of the foregoing graph, but boiler, stoker and conveyor maintenance offers the largest target for the efficiency engineer seeking to reduce operating costs and to improve service.

The total station operating expenses in the two years were $1,505,607 and the total steam plant repairs represented 7.83 per cent of these. The repair cost of boilers figured 2.42 per cent of the station operating cost, the other items being stokers, 2.46 per cent; turbines, 1.25 per cent; piping, 0.25 per cent, and conveying apparatus, 1.45 per cent. Table I shows the cost of labor and material for steam equipment maintenance from month to month for the two-year period, cents omitted. The wide variations shown reflect the instability of conditions surrounding the use of such equipment and indicate that an enormous amount of work will have to be done in future if the wear and tear of equipment is to be brought into better control, probably along the line of far more scientific inspection methods than are at present practiced. The dates of installing the plant equipment are given in the table above.

No.	Equipment	Unit Rating	Plant G Year Installed
6	Boilers	600 hp.	1911
2	Boilers	700 hp.	1913
2	Boilers	1,250 hp.	1915
1	Boilers	1,250 hp.	1918
3	Turbo-sets	2,500 kva.	1911
1	Turbo-sets	7,850 kva.	1913
1	Turbo-sets	7,850 kva.	1914
1	Turbo-sets	20,000 kva.	1917
1	Turbo-sets	20,000 kva.	1919

The average cost of steam equipment repairs per kilowatt-hour generated in the two years was 0.083 cents, the average cost of production excluding fixed charges being 1.04 cents.

No direct relation appears to exist between the total cost of steam equipment maintenance and the output generated during the two-year period analyzed, but there is a well-defined reduction in steam plant repair costs per kilowatt-hour generated as the output grows. Fig. 3 shows this relation, which exhibits a sharp falling off in unit maintenance cost as the output increases from 3,500,000 to 6,000,000 kw.-hr.

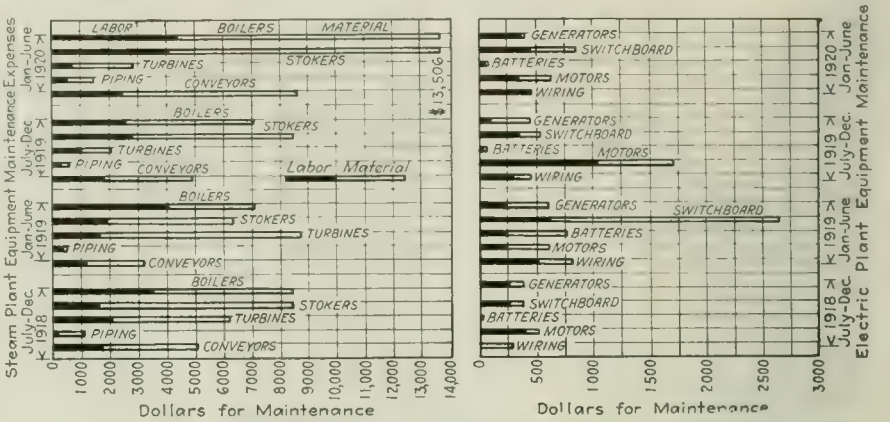


FIG. 2—DIVISION OF LABOR AND MATERIAL COSTS AND RELATION OF ELECTRICAL AND STEAM EQUIPMENT REPAIRS

Low Cost of Electrical Repairs

Semi-annual data covering electric plant repair costs are plotted in Fig. 2 for Station G, two years' service being included. Very little regularity in recurrence of such repairs appears. Battery maintenance runs low and a tendency for auxiliary motor repairs to exceed other items is evident at times. Switchboard equipment repairs command close attention, including control mechanism, oil circuit breakers and instruments. In plant construction the cost of switchboard and control apparatus has become a heavy proportion of the

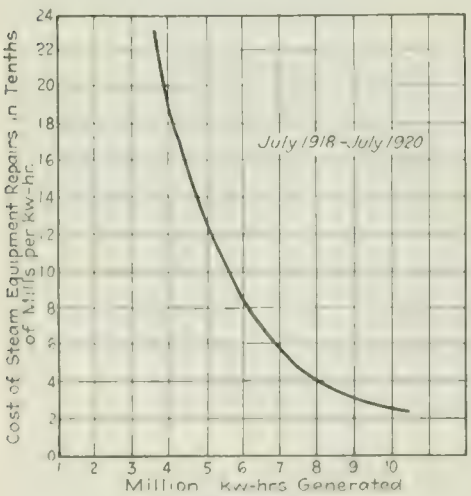


FIG. 3

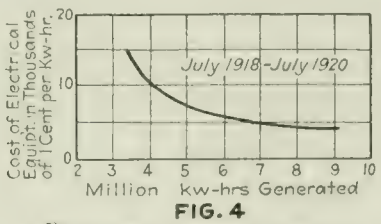


FIG. 4

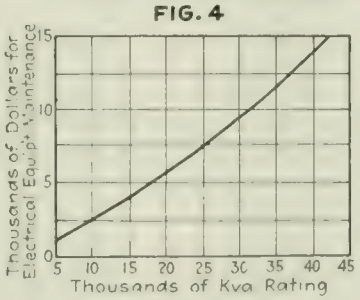


FIG. 6

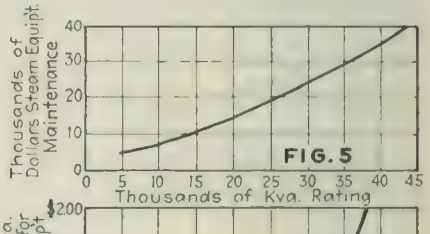


FIG. 5

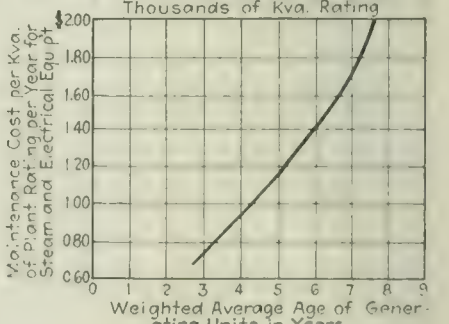


FIG. 7

MAINTENANCE COSTS VARY WITH MANY FACTORS, AS SHOWN BY THESE CURVES

Fig. 3—For a plant with given rating the maintenance cost per kilowatt-hour falls off as the output increases, as shown in this curve of steam repairs for Plant G.

Fig. 4—Relation of electrical repairs to output for Plant G.

Fig. 5—Plotting maintenance cost of seven typical stations against rating of station results in this curve, which gives an indication of what good steam equipment maintenance may be.

Fig. 6—This curve is similar to that in Fig. 5, except that it is for electrical equipment maintenance expense.

Fig. 7—The relation of plant age to maintenance cost is here shown very strikingly. This curve was made up from a careful analysis of maintenance costs over a period of six years for seven typical plants. While an approximation, it is indicative of what may be expected.

total during the past ten years, owing to the increase in the size of stations and amounts of energy to be handled, the use of higher voltages, provision of remote-control features and higher standard of mechanical and electrical materials demanded. Hence it is not strange that the maintenance of such highly refined equipment of specialized design should become a substantial charge upon operating repair costs. The importance of regular and thorough inspection of station electrical service is apparent from the distribution of outlays shown.

The average cost of electrical equipment repairs per kilowatt-hour of station capacity for the two years was: Generators, $0.038; switchboard, $0.09; batteries, $0.02; motors, $0.074; wiring, $0.041; total, $0.263. Electric plant repairs represented 0.84 per cent of the total cost of station operations, and of this small proportion switchboard and wiring maintenance accounted for 0.53 per cent of the total, other items being yet smaller. The electrical repair cost at the station per kilowatt-hour manufactured in the two years was only 0.0088 per cent. Fig. 2 shows electrical repairs by years.

Because the money expended on electrical repairs in the station in a two-year period was only slightly over $500 per month, compared with nearly $5,000 per month on steam equipment repairs, it by no means follows that electrical repairs are unimportant. For the most part the monthly labor and material costs associated with the various segregated items are virtually in the incidental expense class. The maintenance of reliable and high-class service, however, far transcends the question of such expense as the table exhibits, and it is a fair statement that the facilities with which electrical equipment can be regularly inspected and tested helps materially in establishing the excellent records of maintenance cost shown in the accompanying compilation.

The average cost of electrical equipment repairs in the two-year period was 0.009 cent per kilowatt-hour generated, an insignificant proportion of the manufacturing cost of 1.04 cents.

As in the steam equipment analysis, no apparent connection was discovered between the cost of electrical maintenance and output, but the cost of electrical repairs per kilowatt-hour decreased rapidly in this plant between 4,000,000 and 6,000,000 kw.-hr., as is shown in Fig. 4. The total cost of steam and electrical repairs for the two years was $130,581, or 0.092 cents per kilowatt-hour, this representing 8.36 per cent of the total station operating expenses.

How Size and Age of Plant Affect Maintenance Costs

From the operating records of stations A to G inclusive for the six years ended June 30, 1919, an investigation of the relation between weighted age of generating units and annual maintenance cost per kilovolt-ampere of plant rating per year has been completed, together with studies of the relation between size of plant and annual steam and electrical repair costs. During this period the plants in question generated 1,100,496,424 kw.-hr. Their combined ratings increased from 71,871 kva. in 1914 to 173,799 kva. in 1919. The total cost of operation at these stations for the six years was $10,813,112, or 1.018 cents per kilowatt-hour; the total cost of steam and electric plant repairs was $959,219, or 0.087 cents per kilowatt-hour. These equipment repairs, which do not include repairs to the station building, represent 8.85 per cent of the station operating cost and ranged from year to year between 7.05 and 10.6 per cent of the operating cost. Table II summarizes the more important data for the several plants for the first and last years of the period covered, showing the growth of maintenance expenses, outputs and plant ratings.

Data for intermediate years were omitted from Table 11 on account of lack of space, but in Figs. 5 and 6 are shown approximate relations between the size of plant and the annual cost of maintenance, based upon the results in the seven central stations through the entire six-year period. Both steam and electrical repairs tend upward as the size of plant gains. As noted before, the

TABLE I.—MAINTENANCE COST OF STEAM PLANT EQUIPMENT, 1918–1920. STATION RATING VARIED FROM 43,100 KVA. TO 63,100 KVA. DOLLARS EXPENDED IN REPAIRS

	Labor					Materials					Total
1920	Boilers	Stokers	Turbines	Piping	Conveyors	Boilers	Stokers	Turbines	Piping	Conveyors	
June	1,020	300	110	58	409	1,245	768	1,194	273	464	5,841
May	846	630	70	89	290	2,124	3,252	7	341	1,082	8,731
April	472	904	0	172	685	1,838	1,408	350	219	1,726	7,774
March	642	835	229	88	362	1,656	1,302	119	62	1,642	6,937
Feb	696	746	111	48	238	1,708	1,318	248	67	799	5,979
Jan	725	645	161	46	475	534	1,158	217	54	434	4,449
	4,401	4,060	681	501	2,459	9,105	9,206	2,135	1,016	6,147	39,711
1919											
Dec	217	699	13	44	289	499	1,504	6	78	532	3,881
Nov	275	466	35	149	206	589	1,099	300	75	878	4,072
Oct	283	426	281	0	571	1,378	730	171	0	791	4,631
Sept	583	429	261	28	294	935	813	28	16	572	3,959
Aug	511	313	258	32	208	911	613	146	93	195	3,280
July	714	446	207	29	247	277	982	400	99	189	3,590
	2,583	2,779	1,055	282	1,815	4,589	5,741	1,051	361	3,157	13,413
Year	6,984	6,839	1,736	783	4,274	13,694	14,947	3,186	1,377	9,304	63,124
1919											
June	546	562	145	47	31	568	1,006	1,153	0	0	4,058
May	858	161	382	8	70	924	316	2,550	67	861	6,197
April	877	419	5	61	180	432	2,010	2,833	26	626	7,469
Mar	677	204	313	113	345	323	626	56	54	538	3,249
Feb	431	286	385	44	218	421	99	196	65	0	2,145
Jan	673	289	447	58	306	384	412	269	0	69	2,907
	4,062	1,921	1,677	331	1,150	3,052	4,469	7,051	212	2,094	26,025
1918											
Dec	537	393	443	67	165	508	1,919	319	165	156	4,672
Nov	658	372	476	0	117	1,089	1,379	698	226	763	5,778
Oct	712	211	333	20	532	981	1,125	669	88	898	5,569
Sept	535	189	149	10	333	1,325	1,247	155	160	765	4,868
Aug	533	315	270	0	389	481	475	1,015	187	389	4,364
July	534	151	414	56	167	588	701	269	155	410	3,445
	3,509	1,631	2,085	153	1,703	4,972	7,156	3,125	981	3,381	28,696
Year	7,571	3,552	3,762	484	2,853	8,024	11,625	10,182	1,193	5,475	54,721
2 years	14,555	10,391	5,498	1,267	7,127	21,718	26,572	13,368	2,570	14,779	117,845

TABLE II—GROWTH OF STEAM AND ELECTRIC EQUIPMENT REPAIR COSTS, SEVEN STATIONS

Station	Kva. Rating	Kw.-Hr. Gen.	Maintenance—Steam	Maintenance—Electric	Station Operating Expense
		1919			
A	23,150	34,748,750	$17,778	$9,171	$400,083
B	13,187	25,173,319	10,678	9,035	373,370
C	19,062	32,090,300	32,098	4,252	387,488
D	11,950	28,131,053	90,852	4,149	491,894
E	21,250	37,116,830	23,881	1,042	416,334
F	42,100	37,111,279	65,098	24,589	535,681
G	43,100	70,546,500	56,469	15,848	726,295
		1914			
A	10,926	13,990,203	7,870	1,472	138,376
B	7,400	12,396,367	4,099	3,766	115,519
C	10,000	13,578,430	1,841	6,170	93,168
D	5,400	12,785,899	8,388	2,706	122,258
E	4,500	9,188,860	4,919	595	71,477
F	19,025	26,914,708	11,743	8,476	216,246
G	14,620	30,031,300	18,557	4,961	209,584

TABLE III—DATES OF PRIME MOVER INSTALLATION

	No.	Unit Rating, Kva.	Year		No.	Unit Rating, Kva.	Year
Plant A	2	2,200	1908	Plant E.....	1	500	1902
	1	6,250	1914		1	750	1902
	1	12,500	1917		1	1,250	1906
					1	3,125	1912
Plant B....	1	1,500	1903		1	7,812	1916
	1	2,000	1908		1	7,812	1917
	1	1,875	1912				
	1	7,812	1915	Plant F .	2	400 .	*1902
					3	1,000	1905
Plant C	1	1,000	1906		1	2,500	1908
	1	4,000	1910		1	3,600	1910
	1	4,000	1913		1	4,500	1913
	1	6,250	1918		3	750	*1917
					1	20,000	1917
Plant D...	2	300	1899				
	2	675	1899	Plant G.....	(See page 613)		
	1	2,500	1907				
	1	7,500	1916				

* Hydro.

curves presented represent only average zonal media and in individual plants the actual outlay will vary widely from this average according to local and temporal conditions. It is interesting to note that no great change occurred in the ratio between plant repairs and station operating costs during the six years studied, notwithstanding the enormous increases in plant rating, output and in station running cost resulting from the war.

The dates of prime mover equipment installation in plants A to F inclusive are given in Table III, and in Fig. 7 is shown the relation between annual maintenance cost of plant equipment per kilovolt-ampere of rating and the weighted average age of generating units.

High Economy in Small Steam Plants

Experience Gained in Operating Twenty-eight Plants Containing One to Three Boilers — The Causes of Low Efficiency Are Passed in Review, as Well as the Means Adopted to Prevent, Detect and Correct Improper Operating Conditions

By E. H. TENNEY,

Chief Engineer of Power Plants Union Electric Light & Power Company, St. Louis

EXPERIENCE in the operation of many different types of small steam plants indicates that the necessity for sustained effort along the line of mechanical operating economy is not always obvious to the average decentralized plant operator. This may be due to his inattention to details, to indifference or ignorance on the part of his employees or to lack of a proper complement of recording and measuring devices in the boiler room. The most important causes of low plant efficiency are, first, dirty boilers; second, leaky settings, and third, improper firing.

Effect of Dirty Boilers

The loss due to accumulation of soot and scale is the greatest single item of loss incident to the operation of boilers. The accumulation of soot in horizontal tubular boilers not only insulates the heating surface, thereby reducing the capacity of the metal to conduct heat from the fire to the water, but by decreasing the area of the flues it also acts to reduce the quantity of coal that may be burned in the furnaces and consequently limits the capacity of the boilers for making steam. The heat-absorbing capacity of water-tube boilers is likewise greatly reduced where a coating of soot is present on the tubes, and efficient plant operation should provide for the systematic cleaning of all exposed heating surfaces by means either of mechanical soot blowers, the lance or the brush. Where there is sufficient steam pressure for their operation, mechanical soot blowers should be installed, as with systematic operation they will pay for themselves in a comparatively short period.

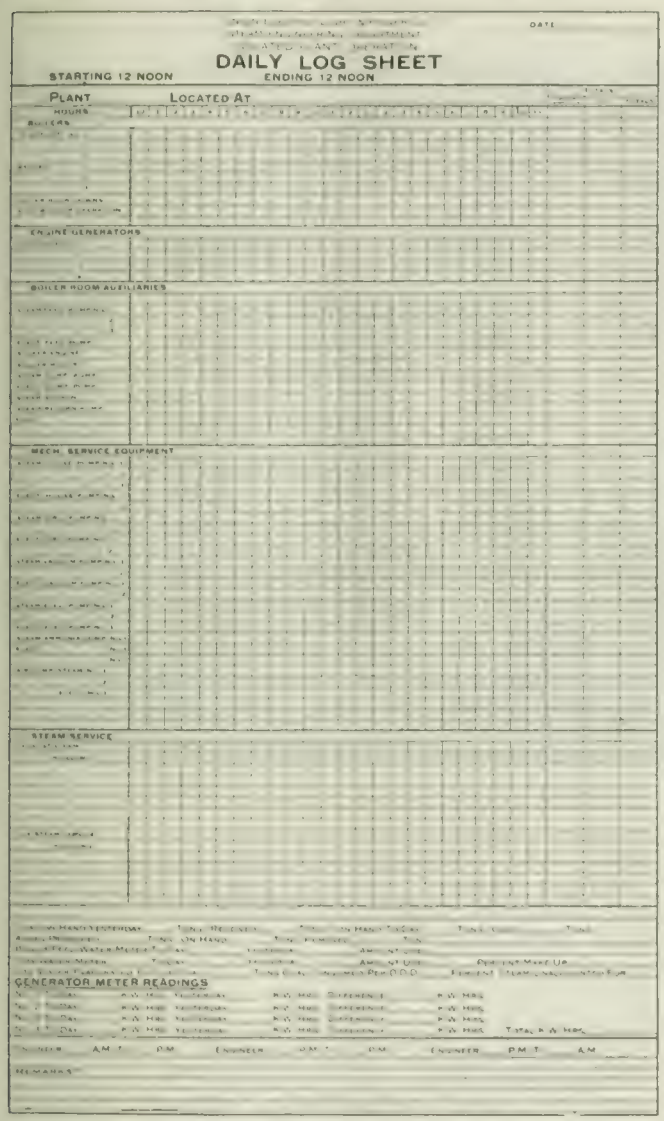
Even more important than the necessity for keeping the dry surfaces of the boilers free from soot is the need of systematic and regular washing to keep the wet surface free from the accumulation of scale and foreign matter. The intervening time between washings is governed by the feed water utilized and by the quantity of steam generated, but as a general rule the boilers in these St. Louis plants are washed once a month. In a similar manner at proper intervals boilers should be made entirely free from scale. With St. Louis water one or two cleanings per year suffice, but in the Missouri lead belt the water is so hard that, with the exception of those plants equipped with water softeners, the boilers need cleaning every month.

Treating Water to Eliminate Scale Troubles

Where the water utilized in a boiler plant contains large quantities of scale-forming matter, this material should be removed before the water is delivered to the boilers. An analysis of the water used for boiler-feed purposes can readily be obtained, and in a majority of cases a large proportion of the scale-forming solid matter may be removed at no great expense. In many waters containing sulphates of lime and magnesium the introduction of barium hydrate will react with the sulphates in the water and reduce them to a sludge (instead of a scale), which may be easily removed with the boiler blown-downs. Only sufficient barium sulphate is used to react with the quantity of sulphates shown in the analysis of the water.

Many of the boiler compounds on the market are guaranteed to prevent or remove scale, but unless the

proper compound is used for the particular characteristics of the water to be treated, the compound may do more harm than good. The priming of boilers is due to the over-concentration of certain impurities which are in solution in the water, and the tendency of many of the boiler compounds now on the market is to increase the concentration of these particular substances in the water, thereby causing foaming or priming. Soda ash has been commonly used in boilers for the prevention of scale. The amount of soda ash which can


DAILY LOG SHEET

STARTING 12 NOON ENDING 12 NOON

PLANT LOCATED AT

HOURS

ENGINE GENERATORS

BOILER ROOM AUXILIARIES

MECH. SERVICE EQUIPMENT

STEAM SERVICE

GENERATOR METER READINGS

COMPOSITE LOG SHEET USED IN RECORDING DAILY OPERATIONS IN TWENTY-EIGHT PLANTS LISTED IN TABLE I

safely be used without causing an over-concentration of the chemical in the water depends upon the particular conditions of the boiler plant, but under no circumstance should the amount of sodium sulphate exceed 100 grains per gallon (1.7 gr. per l.).

The chlorine content of the boiler water is a good indicator of the concentration of the impurities which tend to cause priming. A simple test to determine the chlorine content consists in the titrating of 50 cu.cm. of the boiler water with a one-tenth normal silver-nitrate solution, using potassium bichromate as an indicator. If the chlorine content of the water is kept below 3 grains per gallon (0.05 gr. per l.) there will be little likelihood of priming even when operating the boilers at high over-ratings.

In some of the plants being discussed small steam-driven reciprocating units are utilized for mechanical service equipment, and in many there are engine-driven electric generators the exhaust from which is sent to a piping system and utilized for heating purposes. In the exhaust of such units oil is present and unless entirely removed will work its way back to the boilers. The presence of oil or grease deposits in a boiler offers a great deal more resistance to heat than does scale, and tests have shown that even a film 0.001 in. (0.025 mm.) in thickness can cause far more injury than 0.125 in. (3.17 mm.) of scale. Various explanations are given of this fact, one of which is that thin films of grease form tough bubbles on the heating surface and prevent the water from keeping it cool. To prevent the oil present in exhaust steam from working back into heaters and boilers, oil separators should be installed and kept in first-class condition at all times. The great loss in economy which is incident to the presence of oil within the boiler, as well as the danger of overheating the metal of the boiler, is of such a serious character as to warrant the taking of every possible precaution toward its prevention.

The second general cause for the gradual reduction in boiler operating efficiency is found in leaky settings. These may be internal leaks in the baffles which permit the gases to go directly to the stack before they have come in contact with the heating surface of the boiler. Leaks in the boiler settings may also permit the infiltration of air to the combustion space, thereby providing an excess supply of air with consequent imperfect combustion of the gases. Broken baffles and leaky settings defeat the very object for which the boiler was built—*i.e.*, to absorb the heat liberated from the coal.

Imperfect Combustion Results from Improper Firing

Even clean, tight boilers may be operated in such a manner as to result in imperfect combustion and very low plant economy. To burn coal effectively it is necessary that there be a proper supply and distribution of air throughout the fuel bed and that the fuel bed itself be in such condition and of such temperature as to permit the volatilization of gas from the fuel and its ignition after proper mixture with the air.

Proper firing of a furnace involves knowledge on the part of firemen of the fundamental principles of combustion. Firemen should be made to understand that the placing of large quantities of coal on the grates at one time retards the air supply, cools the fuel bed and prevents perfect combustion, with the result that the furnaces smoke badly. The men must learn too that accumulation of ash and clinkers on the grates will also reduce the proper distribution of air to the fuel bed, resulting in imperfect combustion. With improper firing it is entirely possible for one-half of the calorific value of the fuel to be lost through imperfect combustion.

Everything does not depend on the firemen. They must be supplied with the quality and size of fuel which is most suitable to the equipment and particular operating conditions of the plant. In some plants the station results are sufficiently improved by the change from a low-grade coal to a high-grade coal to warrant the use of the better coal regardless of price, while under other conditions the cheaper coal is more economical. After obtaining the most suitable coal, it should be conserved and the firemen instructed so to

handle the furnaces that a minimum amount of unburned coal gets to the ashpit. Tests should be made, preferably daily, to determine the amount of combustible in the ash.

Use of Boiler Room Instruments

In order to obtain sufficient data for a complete record of plant operation, it is necessary that there be a full quota of instruments. Aside from the ordinary instruments and accessories to be found on every boiler installation, it is almost essential, if economical operation is desired, that other instruments be provided.

Steam-flow meters are needed to indicate continuously the amount of steam delivered by the boilers. Whether these instruments should be of the type which record as well as indicate the steam output will depend upon the preference of the engineer in charge and upon local conditions. An indicating instrument is of prime importance to the fireman as it enables him to judge at a glance the results of his plant operation as shown by horsepower and output. The addition of the recording feature makes it possible to analyze conditions at a later date in the office.

Indicating draft gages should be installed on each boiler unit. Proper operating conditions should be established and the corresponding draft readings determined upon; then the draft gage will prove an important factor in indicating irregularities to the fireman.

The temperature of flue gases as they leave the boiler setting fluctuates with changes in operation conditions, and intelligent control of these conditions is almost impossible without a temperature record of the outgoing flue gases. Most efficient operating conditions are established upon the basis of a certain outlet gas temperature for each boiler, and without these instruments a proper temperature control can be established and maintained only with great difficulty.

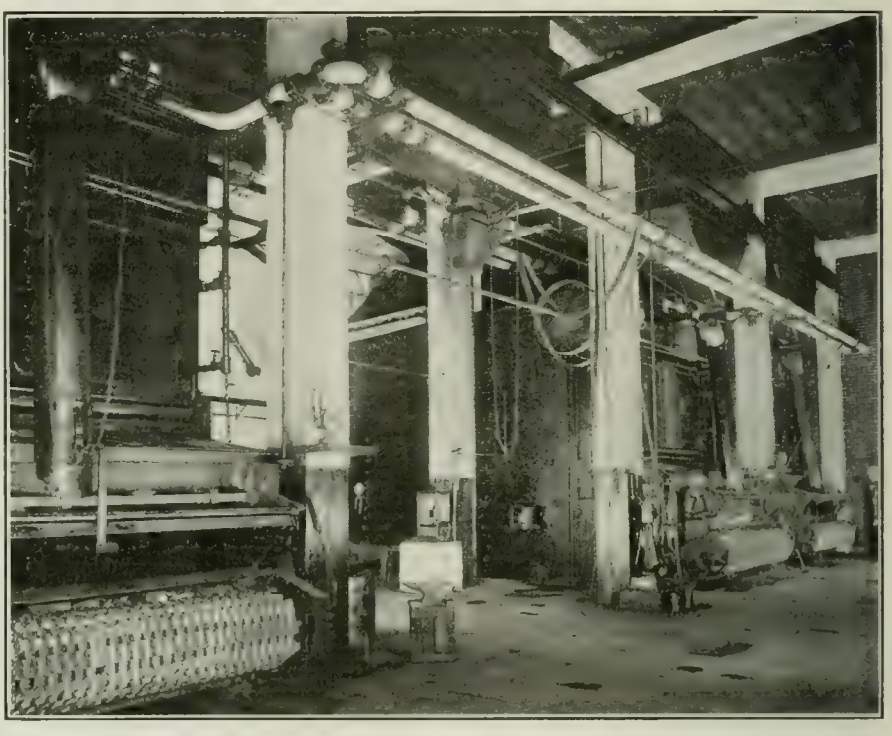
Orsat apparatus is required to determine the carbon dioxide content of the flue gases. Many simplified types of this apparatus are now upon the market, permitting the quick and accurate measurement of CO_2. Inasmuch as the carbon dioxide in the flue gases is a direct measurement of the completeness of the combustion, this instrument should be in active and constant use in every boiler room.

Water-metering apparatus is needed to measure accurately the quantities of water delivered to the boiler from the feed pumps, and a measurement should also be made of the so-called "make-up water" which is delivered to the system.

It is of especial advantage to be able to weigh all fuel which is delivered to the boilers, and when this is impracticable the coal bunkers may be calibrated so that the amount of fuel burned can be very closely estimated every day.

The amount of water evaporated per pound of coal gives a check upon the running efficiency of the plant, and these figures are derived from the daily record of the pounds of coal burned and the pounds of steam generated. The form shown in the log sheet on page 616 is utilized by the operating engineers of each plant to record the daily operations. This form has been made to cover the conditions in all of the twenty-eight plants listed in Table I on page 619.

Supplementing a proper and complete quota of boiler-room meters and instruments, the plant organization and supervision must be such as to insure continued and conscientious watchfulness on the part of the plant operatives. All data and records at best are but guides to assist the engineer in maintaining intelligent operating conditions, and unless such conditions are studiously maintained it is not possible to obtain high plant efficiencies.



IMPROVEMENT IN SMALL PLANT ECONOMIES OFFERS AN INTERESTING STUDY TO THE ENGINEER

This is a sample of the boiler rooms in the St. Louis decentralized plants designated as AX in the table. It contains three 500-hp. double horizontal-pass Heine water-tube boilers with sufficient space for the installation of a fourth unit. A single bucket conveyor is used to take both coal and ashes overhead. The coal is dumped into a 20-ton hopper over each boiler, and the ashes are carried into an overhead ash hopper, from which they drop by gravity into railroad cars. It will be noted that there is a steam flow meter for each boiler. There is a CO_2 recorder on a concrete pedestal near the center of the picture, and a Bristol recording pyrometer for the stack is located a short distance to the left. There are also Ellison differential draft gages on each boiler.

Falling off in the evaporation per pound of coal, increasing stack temperatures and increasing difficulty in maintaining boiler output are indications that the boilers should be cleaned. The trouble is probably due to the presence of fly ash, soot and accumulations of heat-insulating substances inside the boiler. The engineer's observation of his equipment, taking into account his knowledge of the length of time since previous cleaning has taken place, will tell him whether or not more attention should be devoted to this phase of operating maintenance.

Improper firing will be readily indicated by a lower carbon dioxide content of the flue gases, by an increased percentage of combustible fuel in the ashpits, by smoky

stacks, by the boiler-horsepower capacity being maintained only with difficulty, by reduced evaporation per pound of coal and by routine observation of the fires. Any one of these items will serve as an indicator that operating methods are not what they should be, and the very best preventive against such improper firing conditions is in an intelligent, conscientious fireman or expert supervision.

The detection of leaks in boiler settings may be a difficult matter. They cannot always be detected by observation, nor will the carbon-dioxide content of the flue gases necessarily indicate their presence. Leaks through the side walls, however, are readily detected by observation or by use of a candle flame and may then be remedied. Baffle leaks can only be detected by observation of the draft and temperature readings throughout the setting in reference to standard operating conditions. The tremendous waste which may occur inside boiler settings, both on account of the by-passing of hot gases directly to the stacks and on account of the admission of excess quantities of air to the detriment of the combustion processes, is of such extent and importance that it requires continuous conscientious vigilance on the part of the operator.

TABLE I—THESE TWENTY-EIGHT PLANTS ARE TYPICAL AS TO THE EQUIPMENT IN THE AVERAGE SMALL PLANT

F. T.—Fire-tube boiler. W. T.—Water-tube boiler.

	Boilers				Generators		
Plant	No.	Type	Firing and Furnaces	Total Hp.	No.	Prime Mover	Total Kw.
A	2	F. T.	Hand-fired down draft	300	..	....	
B	2	F. T.	Hand-fired down draft	150	..	..... .	
C	2	W. T.	Shaking grates	416	.	... .	
D	3	F. T.	Hand-fired down draft	300	2	Recip. eng	125
E	2	F. T.	Hand-fired down draft	180	2	Recip. eng	100
F	3	F. T.	Hand-fired down draft	450	3	Recip. eng.	225
G	3	W. T.	Shaking grates	721	3	Recip. eng	375
H	1	F. T.	Hand-fired down draft	60		.....	.
I	2	F. T.	Hand-fired down draft	300	..	.....	...
J	2	F. T.	Hand-fired down draft	500	..	.....	...
K	3	F. T.	Hand-fired down draft	375	..	.....	...
L	3	W. T.	Hand-fired down draft	450	..	...	.
M	2	F. T.	Hand-fired down draft	350	..	.....	...
N	2	W. T.	Hand-fired down draft	600		...	..
O	2	F. T.	Hand-fired down draft	300	..	.....	...
P	2	F. T.	Hand-fired down draft	600	2	Recip. eng.	500
Q	3	F. T.	Hand-fired down draft	825	3	Recip. eng.	544
R	3	F. T.	Hand-fired down draft	525	..	.. ..	
S	1	F. T.	Hand-fired down draft	100	.	.....	.
T	2	F. T.	Hand-fired down draft	150	..	.....	...
U	3	F. T.	Hand-fired down draft	375	3	Recip. eng.	131
V	3	F. T.	Hand-fired down draft	400	1	Recip. eng.	75
W	3	W. T.	Chain grates	1,350	3	Recip. eng.	600
X	2	F. T.	Hand-fired down draft	500	..	.....	...
Y	1	F. T.	Hand-fired down draft	175	..	.....	...
Z	3	F. T.	Hand-fired down draft	450	..	.....	...
AX	3	W. T.	Chain grates	1,500	2	Turbine	1,200
BX	3	F. T.	Hand-fired down draft	300	.	.. ...	. .

Neglect Reduces Safety Factor of Boilers

The seriousness attached to neglect of many of the points which have been referred to above is of such extent as to warrant the taking of radical steps for their prevention. For instance, soot deposits upon the dry surfaces of the boiler contain sulphur trioxide, which combines readily with moisture supplied from the air and the fuel and changes at ordinary temperatures to sulphuric acid. This acid reacts upon the boiler flues and headers and if allowed to remain will gradually waste them away and dangerously weaken them. Scale deposits, in addition to decreasing the conductivity of the material separating the water from the fire, also tend to overheat the metal, thereby reducing the boiler operating factor of safety. These reductions in strength of the metal parts of a boiler have in many instances resulted in damage to heads, drums and wrapper sheets.

One of the most dangerous features in the operation of boiler plants which are only required during the winter months is the temptation to neglect the necessary maintenance work after a season of heating operation has been completed. Good operating economy requires that the steam generating, mechanical and electrical equipment be put in a first-class state of repair prior to the opening of each heating season. However, to know when to replace worn parts with new parts—in short, to know what work to do and what work not to do—requires the exercise of sound judgment based on long operating experience.

In the case of boilers operated but a portion of the year the pitting of shells is apt to become serious, especially where water has been permitted to remain in the boilers at times when not in operation. At least once in twelve months every boiler drum should be dried out, thoroughly cleaned and carefully inspected for evidence of pitting and corrosion. Where such action is found its prevention must be the subject of special attention and concern. Exterior corrosion may be checked by cleaning and painting, but a panacea for internal corrosion has not yet been found. Probably the best preventive of pitting and corrosion in boilers is their continued operation under suitable conditions and with proper feed water. All attempts to check corrosion by the application of protective coatings to the inside of boilers are but temporary and seldom successful.

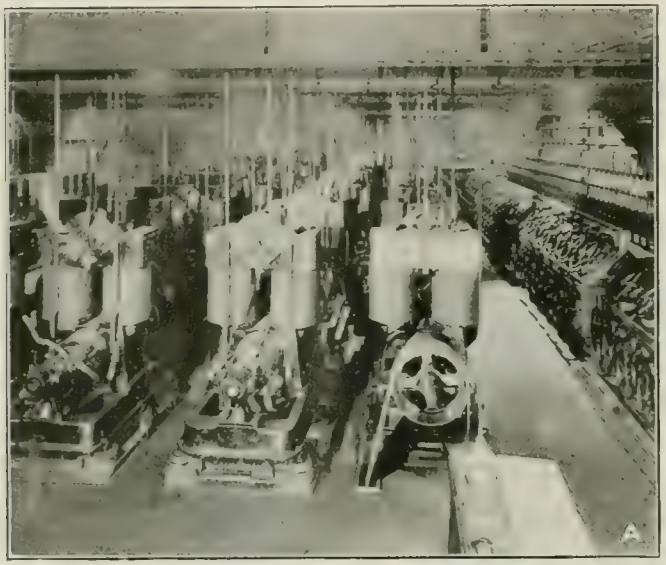
The maintenance of flues and tubes is a matter of routine for the plant engineer, who in most cases is periodically checked up on this feature of the maintenance by the municipal and insurance company inspectors. The maintenance of boiler settings, baffles, dampers, etc., is also a matter of routine for the plant engineer, and the success with which he maintains his equipment is a measure of his proficiency.

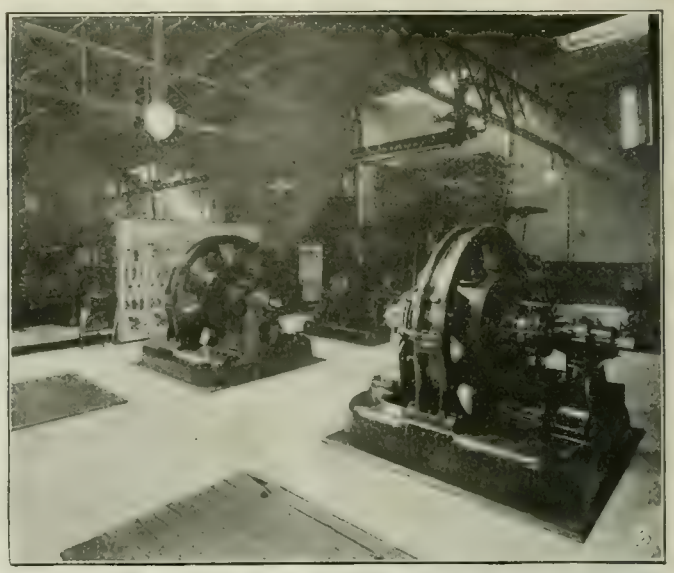
The most important feature of furnace maintenance is found in the necessity for continual renewals of bridge walls and furnace linings, as well as ignition arches and door liners. The frequency with which repairs of this nature must be made is a function, of course, of the extent of the furnace operation. Furnaces operated over extended periods and at high ratings require renewals more frequently than those operated for shorter periods and under less exacting operating conditions. Under ordinary conditions, with the type of boiler operation under discussion, a well-built furnace should stand up for eight months before the necessity for extending renewals in the furnace linings or bridge wall becomes apparent. In a similar manner down draft tubes, grate bars, door liners, etc., should not require extensive repairs oftener than once each season. The same is also true in the case of automatic stokers, which should be given a thorough overhauling and renewal of worn parts once each year.

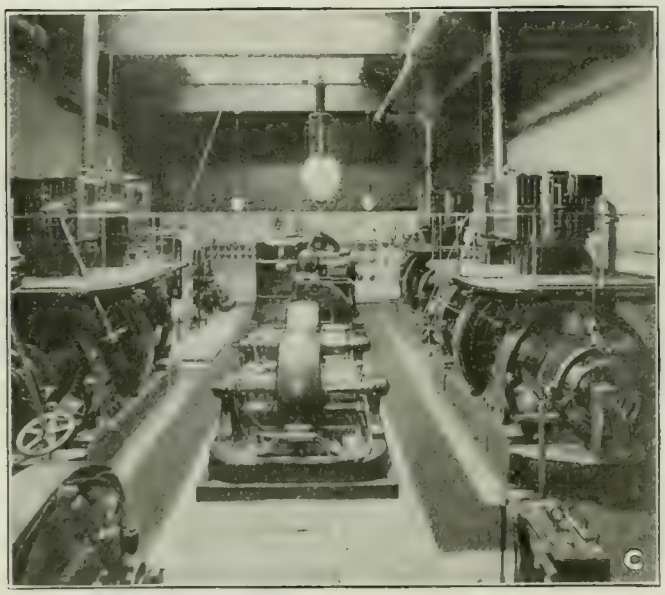
TABLE II—TYPICAL PRESENT-DAY COSTS FOR MAINTENANCE WORK IN BOILER PLANTS

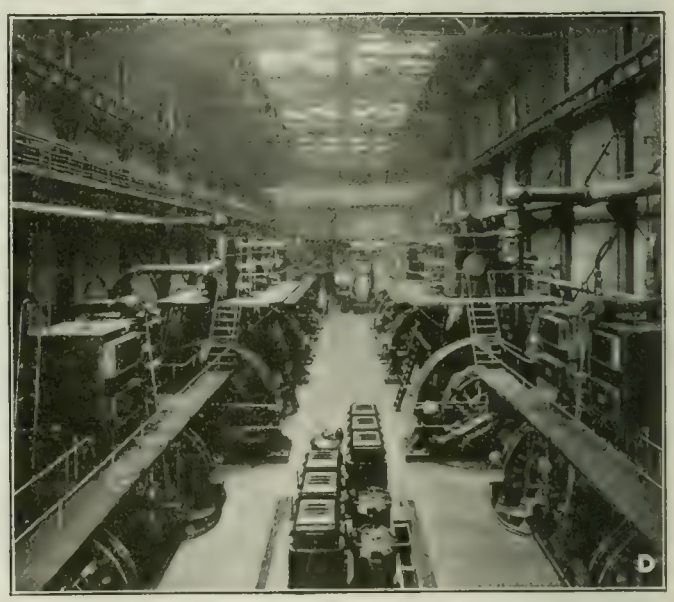
Cost Per Boiler Hp. of Rating Per Annum	
Plant W in Table 1	
Boiler and settings	$3 24
Furnaces and stokers	.77
Piping	.79
Total	$4.80
Plant A in Table 1	
Boilers and settings	$2 96
Furnaces and stokers	.29
Piping	.58
Total	$3 83

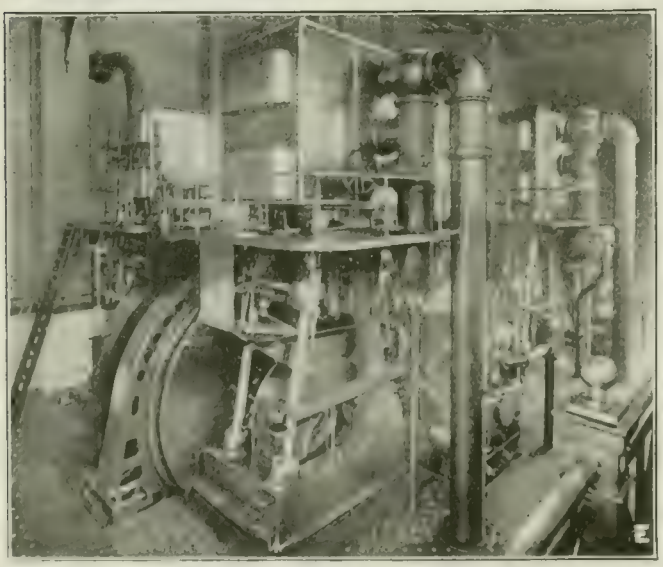
The Phenomenal Growth of Power Development Is Typified by the Rise in Thirty-two Years of the Commonwealth Edison Company

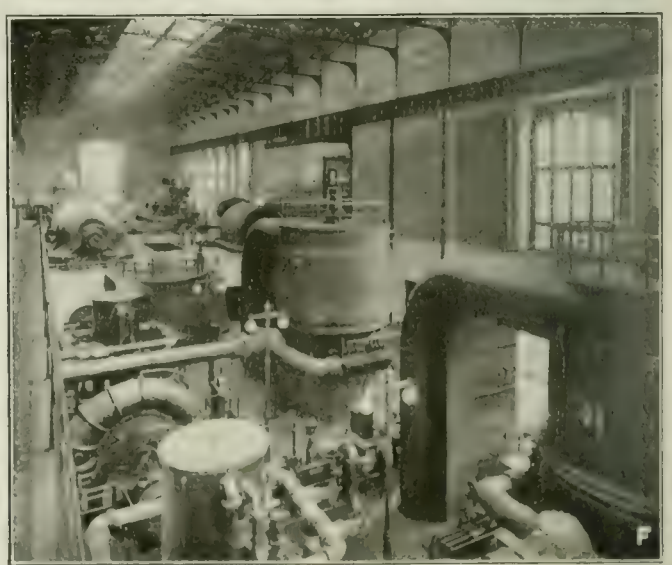










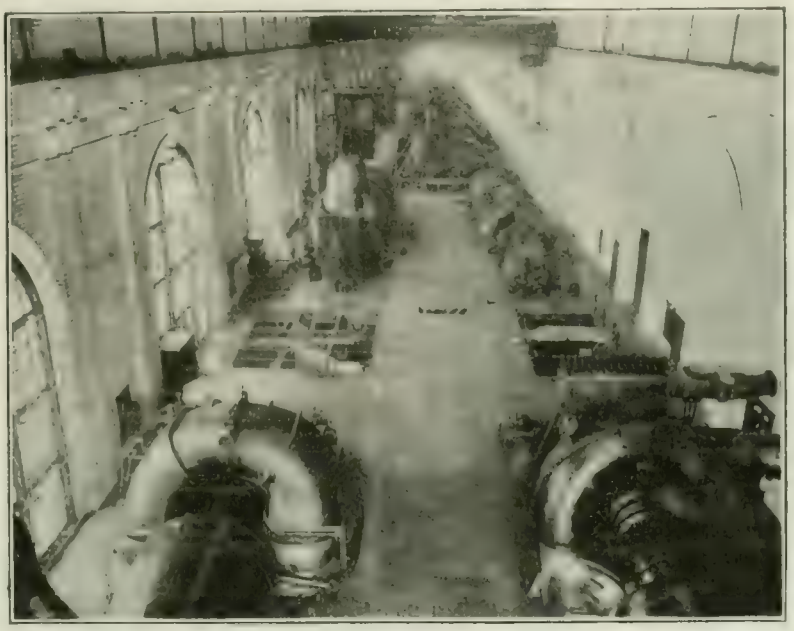


A. Adams Street generating station, placed in service in August, 1888, with maximum rating of 640 kw., which later grew to 3,000.
B. Rotary converters at Twenty-seventh Street station in 1904.
C. The first plant of this company using vertical engines with direct-connected generators was the North Clark Street station, first operated in September, 1893.
D. The Harrison Street station, placed in operation on Aug. 1, 1894, was the last word in central stations at that time.
E. Engine room of the Fifty-sixth Street station, which was built in 1899.
F. The Northwest station, with a rating of 165,000 kw., is the latest station, having been placed in operation in July, 1912

Power Development in Chicago

Since 1888, When First Generating Station of Commonwealth Edison Company Was Placed in Operation, System Has Grown to 550,000 Kw.—Largest Plant 230,000 Kw. —Output for 1919 Was 1,628,340,000 Kw.-Hr.

THE Commonwealth Edison Company stands as one of the splendid developments of the electrical industry. In the brief space of thirty-two years since the first generating station was placed in operation its progress has been always forward, with clear-visioned leadership that has had a keen appreciation of what the future meant to the industry. To Samuel Insull must go the major share of credit for the building up of the first comprehensive plan for a united power development of a great city. The utilities now under his management comprise the Commonwealth Edison Company; Peoples Gas Light & Coke Company; Chicago Elevated Railways; Chicago, North Shore & Milwaukee Railroad; Public Service Company of Northern Illinois, and the Middle West Utilities Company, with a combined capitalization of about $470,000,000. The gross income for this year will be more than $100,000,000.



MANY INTERESTING DEVELOPMENTS HAVE TAKEN PLACE AT FISK STREET STATION, WHICH, WITH A RATING OF 230,000 KW., IS THE LARGEST STATION IN THE WORLD

It is of particular historical interest to note that the first central station was opened at 139 and 141 Adams Street, the site of the present "Old Edison Building" at 120 West Adams Street, Chicago. The original building was two stories high with offices in the front and the plant in the rear. The dynamos shown in photograph A were belted to non-condensing steam engines on the floor below. This generating station was put into service in August, 1888, with maximum rating of about 640 kw., and was disconnected in 1894, six years later. During this time additional machinery was installed and the maximum load carried in 1892 and 1893 was 3,200 kw. During much of its existence Adams Street Station was greatly overloaded, and in 1892 the building of the Harrison Street Station was begun. The late Frederick Sargent was the designing engineer for the Adams Street Station and the electrical equipment was designed by Mr. Edison's technical assistants in the East, including W. S. Andrews.

From 1888 to 1915 the Adams Street building was used with brief interruptions as the headquarters office building of the Chicago Edison Company, succeeded by the Commonwealth Edison Company. From 1894 to 1915 it was also a distributing center or substation. In 1899 the building was entirely reconstructed and greatly enlarged, assuming then its present appearance. In November, 1915, the building was completely vacated by the company, which removed its offices to the present Edison Building on the northeast corner of West Adams Street and South Clark Street.

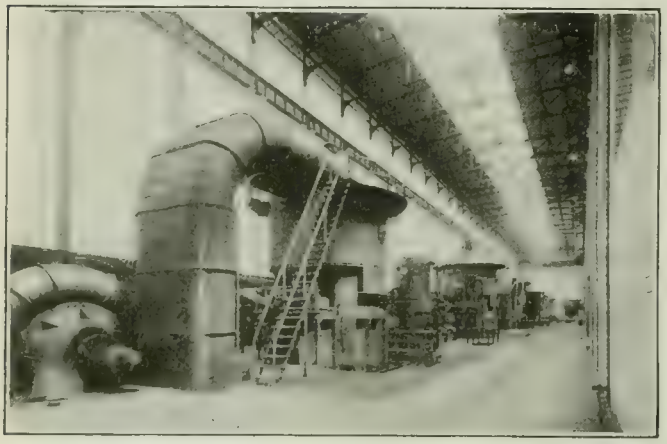
In 1890 and 1891 the second generating station, known as the Twenty-seventh Street Station, was built at 2640 South Wabash Avenue. This station is of particular historical interest because under the personal direction of Louis A. Ferguson, then electrical engineer of the company, the first rotary converter in the company's system, as well as the first in the United States in central-station service, were here operated in 1897. Alternating current was transmitted from the Harrison Street Station, which had been built in the meantime, and was transformed and converted into direct current for local distribution. This use of alternating-current transmission and rotary converters in connection with Edison direct-current three-wire distribution made possible the centralizing of production and was a great step in advance in central-station operation. The Twenty-seventh Street station continued to produce electrical energy until January, 1907, when it was shut down permanently as a generating station. At the time of its greatest capacity as a generating station it contained an aggregate rating of about 1,500 kw.

In April, 1893, the Chicago Edison Company absorbed the Chicago Arc Light & Power Company, and thereby acquired the large arc-lighting generating station of the latter at Washington and Market Streets, known first as Washington Street Station and later as Market Street Station. This station was put in operation in 1887 and was shut down as a generating station in 1904.

In 1893 a small generating station was built at 926 North Clark Street, adjoining the Newberry Library Building, to serve a part of the North Side. This plant, shown in photograph C, was first operated in September of 1893, and was shut down permanently as a generating station in February, 1909. The building is now used for a substation. This was the company's first station to have vertical engines with direct-connected generators. Its total rating as a generating station was about 600 kw. It was first tied into the downtown network in 1895.

In 1892 the company began construction on what was

known as the Harrison Street Station, which was at that time probably the largest, most economical, and most modern electrical generating station in the world. It was designed by Frederick Sargent and was built by the Chicago Edison Company on the west bank of the South Branch of the Chicago River, on the north side of Harrison Street. The original installation had a rating of 6,400 kw., which was gradually increased until 1902, when it reached the maximum of 16,200 kw. For a period of about ten years the Harrison Street Station was the principal generating station and was also the principal point from which radiated ideas relating to the production and distribution of electrical energy which had been worked out practically. One of these ideas was the evolution of the substation system network. The total output of this Harrison Street Station during the sixteen years of its operation was 534,783,000 kw.-hr., or a little less than 33 per cent of the output of the Commonwealth Edison Company for the year of 1919.



TURBO-GENERATOR ROOM OF THE QUARRY STREET STATION, WHICH WAS PUT IN SERVICE OCT. 29, 1908

In the year 1897 a new company called the Commonwealth Electric Company came into existence and was granted a fifty-year franchise by the City Council to supply electric light and power throughout the whole area of the city of Chicago. In 1898 the Chicago Edison Company took over the control of this new company, although it was operated under the name of the Commonwealth Electric Company until 1907, when the final consolidation took place. In photograph E is shown one of the plants known as the Fifty-sixth Street Station of the Commonwealth Electric Company.

LARGEST RATING IN WORLD

Built in 1902 and 1903, the Fisk Street Station was put in operation in October, 1903. Originally the station was planned for fourteen 5,000-kw. vertical turbo-generator units and a 70,000-kw. station was thought to be something wonderfully large at this time. This historic station with its present rating of 230,000 kw. in perhaps the largest and certainly one of the best known in the world. It was the first large all-turbine electric generating station to be built anywhere and the first to use steam turbines of the then amazingly large size of 5,000 kw.

It required a high degree of courage at that time to make the decision that the steam turbine should be used exclusively in place of the familiar and dependable reciprocating steam engine. Frederick Sargent was the designer of this great station and the General Electric Company took the risk of manufacturing a 5,000-kw. steam turbine on the condition that the Chicago Company should take the risk of installing and operating it.

The station, as it actually stands today, is equipped with ten vertical turbo-generators of 12,000 kw. each and four horizontal units of more recent construction of 20,000, 25,000, 30,000 and 35,000 kw. respectively.

QUARRY STREET STATION FIRST OPERATED IN 1908

Electrical energy was produced so economically and efficiently at Fisk Street Station that the company was enabled to go after new business with great energy. Contracts were secured to supply electric power to the elevated and surface railways of Chicago, and the load on the system grew by leaps and bounds. Harrison Street Station was now practically obsolete, and the company secured land across the South Branch of the Chicago River from Fisk Street Station and built the Quarry Street generating station, also designed by Frederick Sargent.

Ground for this station was first broken in 1907 and the first unit was put in service on Oct. 29, 1908. This was the first generating station built by the company's own engineering department. It is a compact, homogeneous plant, consisting of six vertical 14,000-kw. turbo-generators, making the total rating of the station 84,000 kw. The station was practically completed in 1910. In it the switching apparatus is under the same roof as the boilers and turbo-generators instead of being in a separate building as at Fisk Street. The large ventilating ducts leading to the tops of the turbo-generators are a conspicuous feature of this plant. Fisk Street and Quarry Street stations are run by one operating force under the direction of a chief engineer and his assistants. They are, however, two distinct generating stations, although connected by tie lines laid in two separate tunnels under the river, which is here about 200 ft. wide.

So rapidly did the demand on the system grow that the Quarry Street Station was barely completed before ground was broken for the Northwest generating station. This station, which was first put in operation in July, 1912, has had successive additions from time to time until it is now the second largest in the system, being rated at 165,000 kw.

The total generator equipment at this station consists of two vertical units of 20,000 kw. each, three horizontal units of 30,000 kw. each, and one horizontal unit of 35,000 kw. A feature of this property is a private elevated electric railway belonging to the company and used as a branch line to haul coal to the station. Recent additions to Fisk Street and Northwest stations have been made alternately or at about the same time.

For some time the company has been in possession of a tract of land about 48 acres in area on the Calumet River in South Chicago, near 100th Street. In the annual report to the stockholders for the year ended Dec. 31, 1919, it was announced that during 1920, on this site, the company would begin the erection of a new steam generating station designed to have an ultimate rating of 180,000 kw. It is expected that a portion of this plant will be ready for operation late in the fall of 1922. The new station will be about 10 miles from Fisk and Quarry Street stations and about 18 miles from Northwest generating station.

Surface-Condenser Maintenance

Composition and Structure of Tubes Have Great Effect on Life—Many Steam-Station Troubles Directly Traceable to Salt-Water Leakage in Condensers—Over-All Plant Economy Decreased by Improper Condenser Maintenance

By R. J. C. WOOD
Electrical Engineer Southern California Edison Company

THE many troubles directly due to leaking condensers in steam stations using salt water for condensing makes the proper maintenance of such equipment of prime importance. The Southern California Edison Company had many difficulties from sea-water leakage in the condensers of its two largest steam stations until a change was made in condenser-tube composition and careful attention was given to the concentration of salt in the boiler water, after which the troubles were brought under control.

The plants are at Long Beach and Redondo Beach. The Long Beach plant has three vertical turbines of 12,000, 15,000 and 20,000 kw. capacity. Redondo has three 5,000-kw. reciprocating engines and two 12,000-kw. vertical turbines. Each plant uses sea water for condensing and both have had condenser troubles. Leakage of circulating water into the steam space occurs at the tube packing or through holes in the tubes. Packing leakage is unimportant compared with the corrosion of condenser tubes.

Both plants used tubes of Admiralty mixture. Early in the operation of Redondo extensive failures occurred, without doubt because of electrolysis by stray railroad currents.

A marked decrease in tube failures and the entire elimination of electrolytic corrosion were accomplished by connecting the negative of a low-voltage direct-current generator to the condenser-tube sheet at the discharge end and the positive to the iron pipe through which the sea water enters a screen chamber, later to be pumped to the condensers. Both tube sheets were insulated from the condenser shell and water box, and a bond was made from the positive to two electric railway tracks adjacent to the station. It was thought that the stray currents entered the condensers through the inlet water and flowed to the tubes and sheets. No attempt is made to keep this current at zero; on the contrary, the low-voltage generator supplies an excess over the railroad current—this excess averages 1 amp. per 1,000 sq.ft. (92.9 sq.m.) of tube surface, there being about 5 volts at the generator terminals. Although there is still tube corrosion, it seems of another variety.

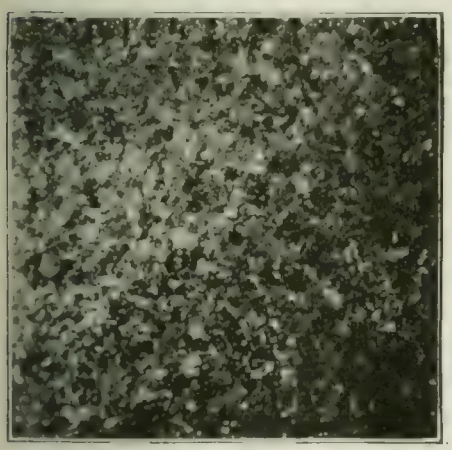


Fig. 1—Fine grained tube from No. 1 condenser, Long Beach station.

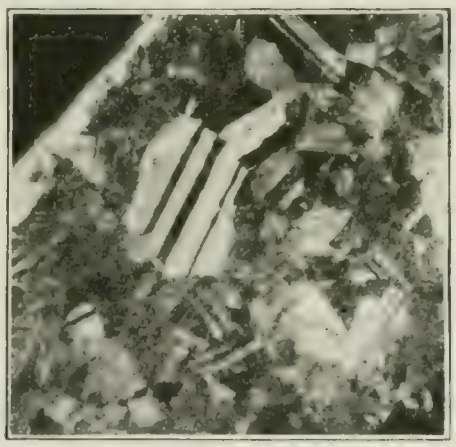


Fig. 2—Coarse grained tube from No. 3 condenser, Long Beach station.

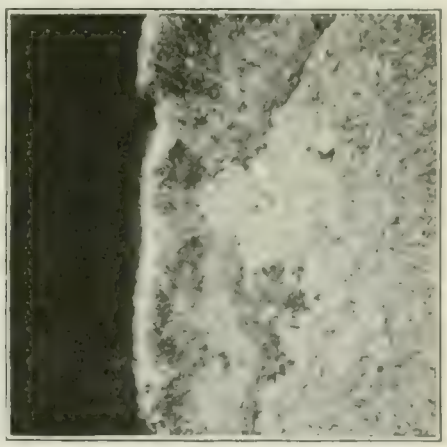


Fig. 3—Dezincification of a fine grained tube after four years' use.



Fig. 4—An acceptable grain in new tube. This grain gives best service.

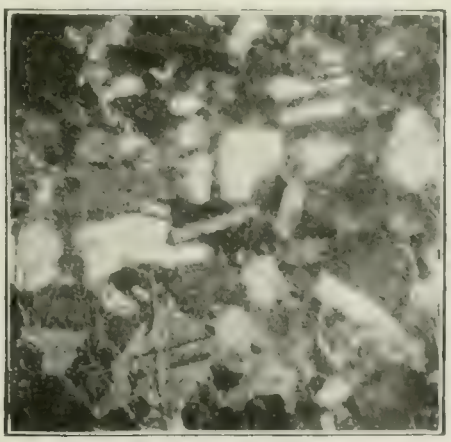


Fig. 5.—Extremely coarse-grained tube, not acceptable.

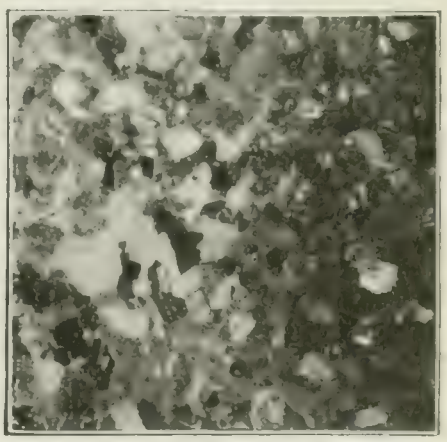


Fig. 6—Ordinarily coarse tube, too coarse to be acceptable.

CONDENSER-TUBE SECTIONS MAGNIFIED TO FIFTY DIAMETERS BRING OUT DIFFERENCES BETWEEN GOOD AND POOR TUBES

At Long Beach the tube failures and corrosion cannot be laid to electrolysis. The plant is practically on an island. No evidences of earth currents are to be found, and the corrosion of tubes has occurred in very different degrees in the three condensers. The tubes in the No. 3 condenser, installed in April, 1914, failed by pitting, some 80 per cent of the pits being along the bottom of the tubes. The greater part of the condenser had to be retubed in two years, and after four years practically none of the original tubes were in service. In the other two older condensers the tubes dezincified and gradually thinned down more or less uniformly. The No. 1 condenser, installed in 1911, has had about 15 per cent of its tubes replaced. The No. 2 condenser, put into operation in 1913, has had 61.5 per cent of tube replacement.

An investigation to determine the essential difference between the tubes of the No. 1 and No. 2 condensers and those of the No. 3 condenser showed that the microstructure of the former was uniformly fine, whereas the No. 3 tubes had an exceedingly coarse grain. This is shown in Figs. 1, 2 and 3. Other photomicrographs indicated that dezincification could occur around the crystal boundaries, which would facilitate the erosion of comparatively large portions of the tube. Thereafter all further purchases of tubes were made upon a specification which required the grain size to be fine. If, on an order of 5,000 tubes, eight to ten samples were satisfactory, as in Fig. 4, the shipment was accepted. If more than 20 per cent of the samples showed coarse grain, as in Figs. 5 and 6, ten more tubes were examined. So far all tubes purchased under this specification have met the requirements. The specification further covers the mixture and mechanical requirements as to size and smoothness.

Many turbine step-bearing failures may have originated in a condenser tube corroding. The accumulation of scale in the turbine blading and the shock of a slug of water entering caused a momentary touching of the step plates sufficient to cause a roughening, which under suitable conditions resulted in a failure of the bearing. The only temporary remedy for these troubles is either to waste the condensate or blow down the boilers until such time as the turbine can be shut down and the leaks be found and removed. Both methods have been used—the wasting of a condensate at Redondo and frequent blowing down at Long Beach. In both cases the lost water must be made good with an equal quantity of make-up water, introducing scale-forming and soluble substances subject to concentration and therefore necessitating further blowing down.

At the present time tubes still perforate or break and let circulating water into the condensate. To detect this, the practice has been to titrate samples of condensate several times a day, using a decinormal silver-nitrate solution. Lately an electric detector has been employed, the conductivity of the water being used as a measure of its salt content. This has proved satisfactory and keeps in close agreement with the chemical method, is simpler and quicker, and can be made continuously recording.

After detection of a leak by either method the condenser is opened at the soonest convenient time and the damaged tube sought. A tube entirely broken is easily detected by the rush of air into it when the vacuum pump is kept running. Smaller leaks require a candle flame as an indicator.

At the time of the rapid failure of tubes in the Long Beach No. 3 condenser it was necessary to patch up old tubes as there was no supply of new ones on hand. Perforated holes were soldered and at times tubes were spliced, making a half-and-half joint about 1½ in. (3.7 cm.) long, the joint being sweated together with solder. Such repaired tubes, when replaced, had what had been the bottom placed at the top to get a maximum of service out of them.

When first installed the screen just ahead of the turbine throttle was of about ⅛-in. (3-mm.) mesh. The slugs of water coming over washed sufficient loose scale out of the piping to plaster the screen, shutting down the turbine. Enlarging the mesh to ⅜ in. (9 mm.) solved this problem, but, of course, permitted the entrained scale or mud to pass into the turbine. A large proportion of this mud collected in the turbine blading, reducing both the capacity and efficiency of the turbine and necessitating periodic cleaning of the blading.

The concentrated boiler water and mud also collected in the lower carbon packing and prevented the springs from properly closing it around the shaft, causing an air leakage that materially affected the station economy. The mud and salt would further collect around the interior parts of valves, baking hard when the priming was over and superheated steam again in service, with the result that open valves could not be closed nor closed ones opened.

While it has been felt that some progress has been made toward obaining durable tubes, yet some better method is needed of determining their physical condition as to grain, size or whatever condition it may be that is associated with fine microstructure and may tend to inhibit corrosion. It is understood that the corrosion committee of the Institute of Metals of England is carrying on researches to determine what protection may be afforded by direct current keeping the tube negative—not so much with the object of neutralizing stray currents as for the purpose of eliminating local galvanic action between the tube and foreign particles that may settle in it, or possibly even to overcome differences of potential between adjacent portions of the tube itself.

Storage-Battery Buses Used by Brazilian Tramways

THE editor of *Ingeniería Internacional*, the engineering periodical printed in Spanish by the McGraw-Hill Company, who has just returned from Rio de Janeiro, Brazil, brings the information that storage-battery omnibuses are being used by the Rio de Janeiro Tramway, Light & Power Company to supplement track-and-trolley tramway service in the Brazilian capital with great satisfaction to the company and the public.

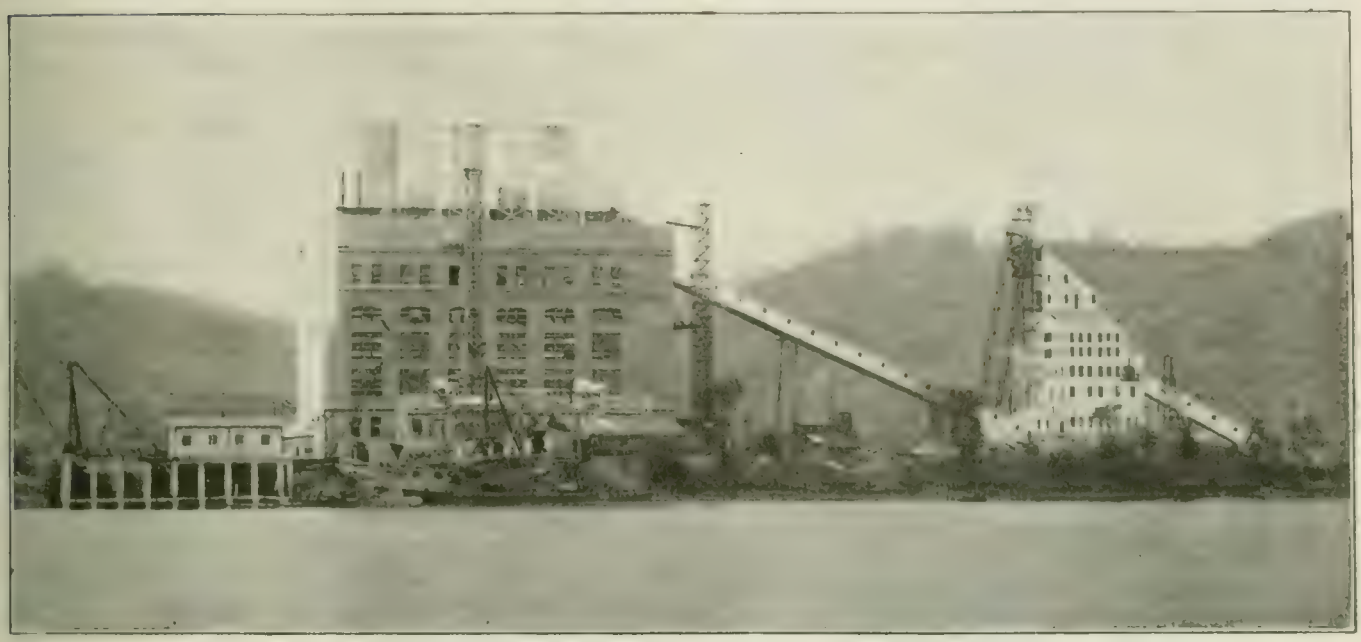
Seven buses weighing 15,000 lb. and seating thirty-two passengers each are being operated by Edison or nickel-iron-alkaline batteries. The power consumer per bus-mile is approximately 2.328 kw.-hr. alternating current or 1.701 kw.-hr. direct current. The corresponding amounts per bus-kilometer would be approximately 1.46 kw.-hr. alternating current and 1.06 kw.-hr. direct current. The amount of power consumed is infinitesimal when compared with the total output of the generating plant, amounting to about 0.15 per cent. When charging, the direct current is supplied from a 110/150-volt, 760-amp. generator, this being driven by a 150-hp. motor.

Generating Plant at the Mouth of Mine

New Springdale Plant of the West Penn Power Company Will Be Assured of Coal for Fifty Years, and the Delays and Expense Due to Freight Shipments Will Be Eliminated—Ample Condensing Water Is Available in the Allegheny River

By G. G. BELL

Manager Power Generating Department West Penn Power Company, Pittsburgh, Pa.



SPRINGDALE PLANT OF THE WEST PENN POWER COMPANY ON THE ALLEGHENY RIVER

AN OUTSTANDING feature of the policy of the West Penn Power Company is its acquisition and operation of coal fields in connection with its power houses. The company now has under construction a steam-turbine plant at Springdale, Pa., on the Allegheny River, so located with respect to coal fields leased by the company that coal is delivered to the bunkers direct from the mine tipple, thus eliminating the cost and delays due to shipment by freight. Two units of 25,000 kw. each are being installed at present, and the ultimate rating of the plant will be 300,000 kw. It has been estimated that a saving of $420,000 per year per 100,000 kw. installed will be effected by the elimination of freight. The coal now leased should provide the ultimate plant with an ample supply for a period of fifty years. The supply of water for condensing purposes is sufficient in the Allegheny River for a plant of 250,000 kw. to 300,000 kw.

The territory served includes the great coal-producing fields of western Pennsylvania, and the power company's largest customers are the coal companies. There are about 400 mines connected, one company having thirty-three mines and a monthly consumption of 2,800,000 kw.-hr. Next in importance to the coal mines are the steel mills, particularly the steel furnaces. There are seventy of these furnaces, ranging in capacity from very small units to those of 10-ton rating, with a gross demand of 25,000 kw. to 30,000 kw. The company has grown out of the amalgamation of fifty-seven smaller companies serving individual communities. It operates nine steam stations, two water-power and two gas-engine stations. But, with the exception of two, these are small and inefficient and will be shut down as soon as modern generating capacity is available to take care of the load. The main source of power is the Connellsville station of 60,000 kw. maximum rating, which is in the center of the Connellsville coke region, in the eastern part of the territory served. The West Penn Power Company also owns 30,000 kw. of the capacity of the Windsor station, at the western edge of its territory. This is a modern station having four 30,000-kw. units installed as described in the ELECTRICAL WORLD of Feb. 9 and 16, 1918. The owners of the Windsor plant have 11,000 acres of Pittsburgh coal, sufficient for the ultimate capacity of 250,000 kw. for between fifty and sixty years.

For a long time the growth in the Allegheny Valley district has been hindered by the lack of proper power generating facilities. But in 1917 two 25,000-kva. units were contracted for, to be installed in a new station in this vicinity. On account of war financing conditions the construction of the power house was held up until the fall of 1918, when a contract was closed with the United States government for the erection of these two units, on the basis that the government would advance 40 per cent of the cost of the power house and the necessary transmission lines. The total cost was estimated at $6,000,000. This contract called for a valuation three years after the close of the war and required the company to return to the government the difference between 60 per cent invested by the company and the appraised value of the plant at that time.

On the advice of its consulting engineer, S. A. Taylor, the company purchased a block of 3,734 acres (1,510

hectares) of twin-vein Freeport coal close to the town of New Kensington and at the border of the town of Springdale, on the Allegheny River. This coal has an average thickness through the field of 7 ft. 5 in. (2.26 m.) On approaching the owners of the tract of coal, however, it was found impossible to purchase it, so a lease of the coal acreage was concluded, calling for an initial rate of mining of 200,000 tons per year, to increase in twelve years to 750,000 tons, which is to be continued until the field is exhausted.

Condensing Water from the Allegheny River

The company was fortunate in securing the last large tract of land available for manufacturing purposes on the Allegheny River. At this point the river has a maximum rise of about 32 ft. (9.8 m.), but the turbine room floor is 7 ft. (2.1 m.) above the highest flood on record, and an additional protection of 3 ft. (1 m.) can be obtained by increasing the height of the light wells. The tract is 83 acres (33.6 hectares), and was covered with about 17 ft. (5.2 m.) of silt, below which is about 50 ft. (15 m.) of gravel overlying the rock formation. In addition, the ground is low-lying, affording considerable ash storage. The site is served by the Conemaugh division of the Pennsylvania Railroad and by the Allegheny Valley Street Railway Company (affiliated with the power company), which provides street-car service both up and down the river from this point. The site is within 2 miles (3.2 km.) of New Kensington, so, under normal conditions, there should be ample labor supply.

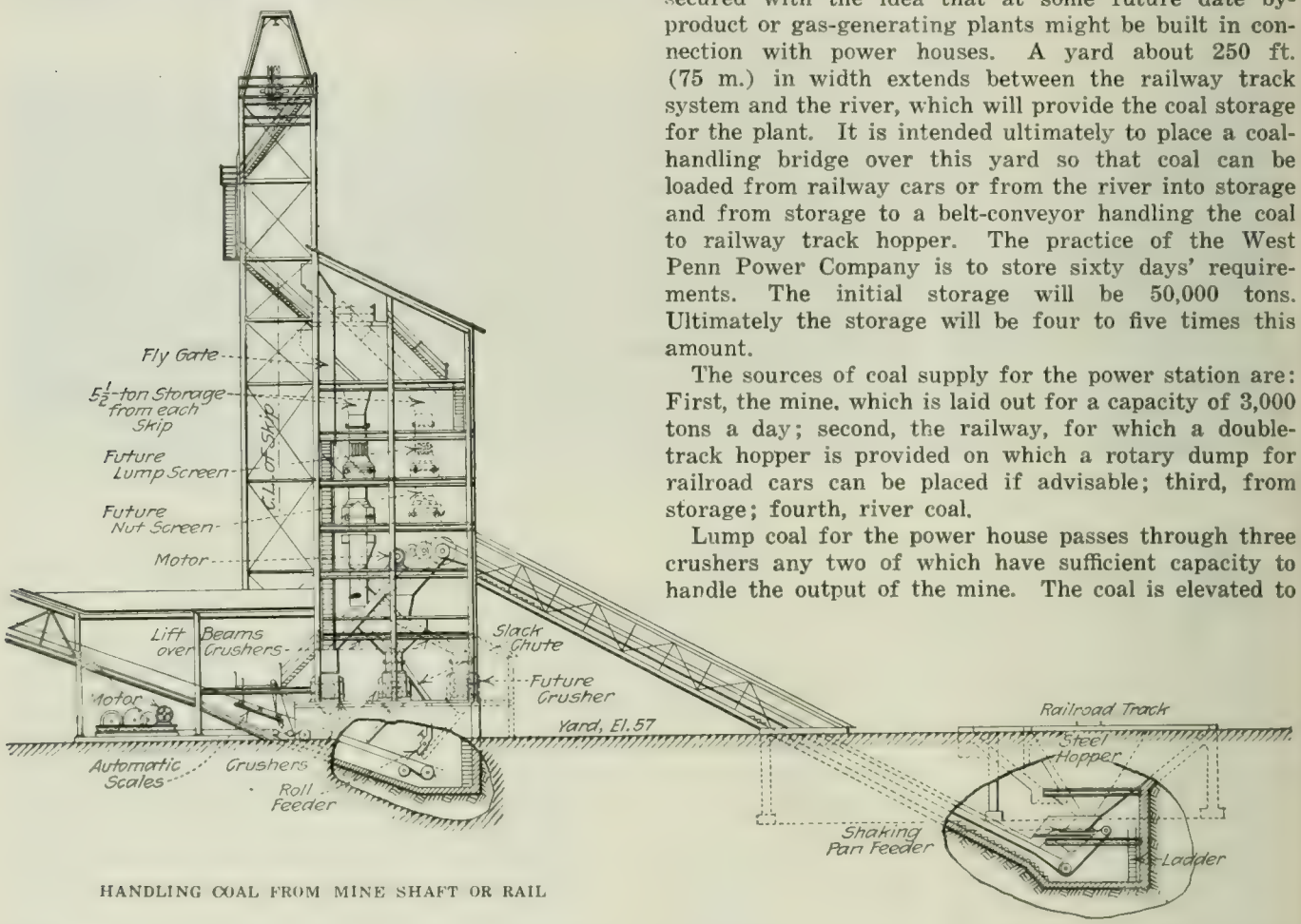
The properties of the coal to be used are as follows, in percentage: Moisture, 0.91; volatile matter, 33.35; fixed carbon, 56.06; ash, 9.68. The content of sulphur is 0.79 per cent and of phosphorus 0.036 per cent. The B.t.u. on a dry basis, determined by bomb calorimeter, is 13,866.*

The power-house tract includes 83 acres (33.6 hectares) of level ground, which would furnish sufficient space to dump ashes from at least 10,000,000 tons of the coal used. In addition, there is a large ravine back of the power house, which, following the typical steel mill and railroad practice in the Pittsburgh district, can be filled to a depth of 200 ft. (60 m.) and will furnish sufficient additional storage to take care of the entire field of coal.

The large acreage around the power house was also secured with the idea that at some future date by-product or gas-generating plants might be built in connection with power houses. A yard about 250 ft. (75 m.) in width extends between the railway track system and the river, which will provide the coal storage for the plant. It is intended ultimately to place a coal-handling bridge over this yard so that coal can be loaded from railway cars or from the river into storage and from storage to a belt-conveyor handling the coal to railway track hopper. The practice of the West Penn Power Company is to store sixty days' requirements. The initial storage will be 50,000 tons. Ultimately the storage will be four to five times this amount.

The sources of coal supply for the power station are: First, the mine, which is laid out for a capacity of 3,000 tons a day; second, the railway, for which a double-track hopper is provided on which a rotary dump for railroad cars can be placed if advisable; third, from storage; fourth, river coal.

Lump coal for the power house passes through three crushers any two of which have sufficient capacity to handle the output of the mine. The coal is elevated to the power house by means of a 42-in. (1 m.) belt, having an ultimate capacity of 500 tons per hour, the slack being fed on to the belt first and the crushed coal dropped on top of it, thus reducing the wear on the belt.



HANDLING COAL FROM MINE SHAFT OR RAIL

Coal received by railroad or from storage is dumped into a double-track hopper 32 ft. x 40 ft. (9.7 m. by 12.2 m.), the coal being fed to a pan conveyor having a capacity of 500 tons an hour and delivered to any of the three crushers. Where it is desired to handle river coal directly to the power house it will be unloaded by a coal bridge directly into this track hopper, and from there through the crushers to the power house.

At the top end of the belt elevator the coal is either discharged directly into the large center bunker of the

*Including the high-ash band, the B.t.u. would be reduced to 13,250, but the average fusing point of the ash would be increased about 30 deg. and the percentage of ash to 12.2 per cent. It is not the present intention to burn the high ash coal.

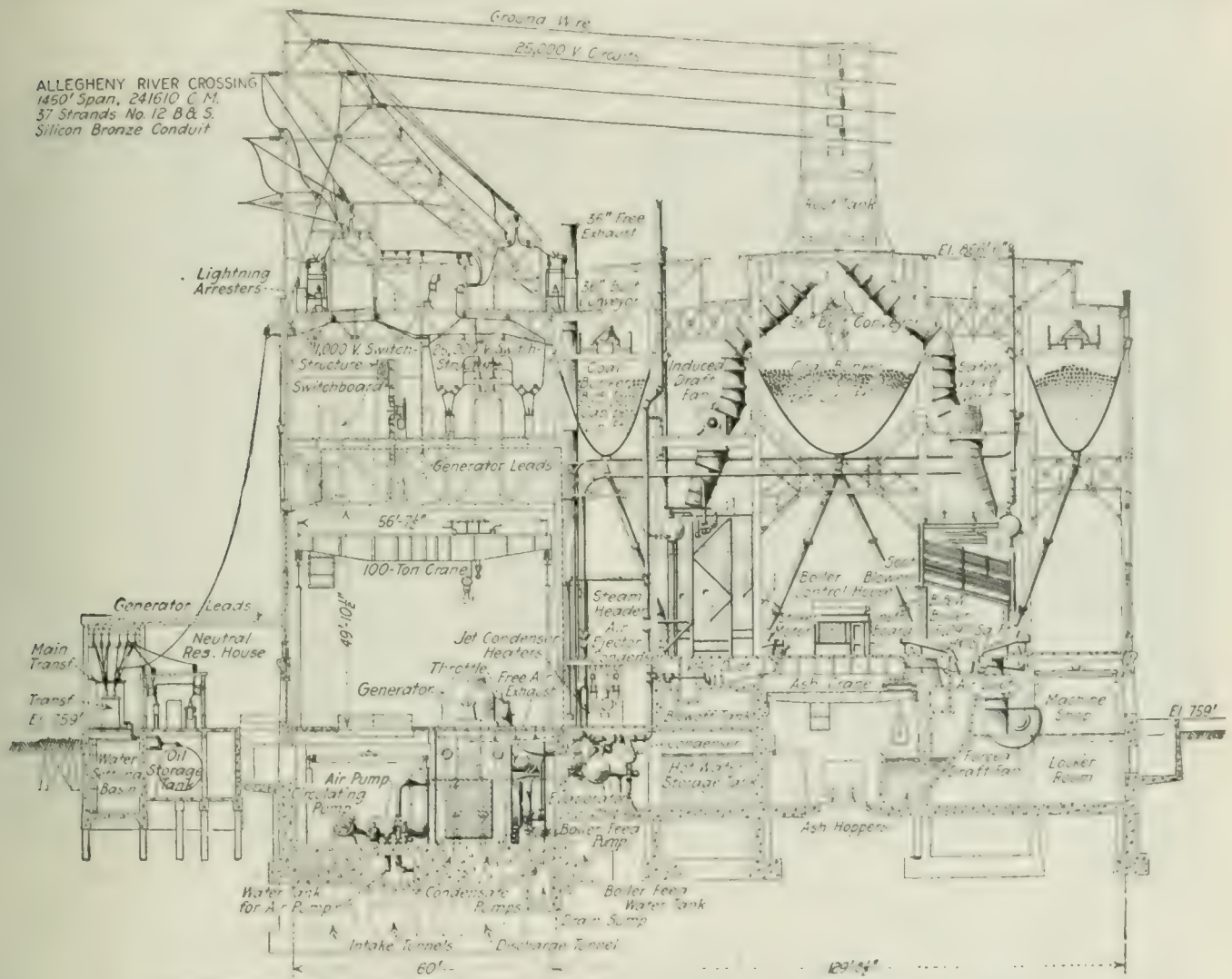
power house or fed to either of two conveyors running along the end of the power house, which deliver the coal in turn to the belts over the side bunkers. These five belts have a capacity of 250 tons an hour each.

Coal Bunkers.—The bunkers are of the suspension type, lined with concrete. Their capacity is about 800 tons per boiler, or about five days' supply for the plant when running under ordinary conditions. By reducing the load factor on the plant and conserving coal in the bunkers the plant could probably run ten days on its bunker coal. At the head of the 42-in. (1-m.) inclined conveyor is a sample crusher, which takes a continuous sample of the coal being delivered to the power house, and crushes it, retaining it for analysis if this should be desired.

Measuring Coal.—The coal to the power house is measured as received from the miner, or on a Merrick "weightometer" on the 42-in. inclined belt. Coal to the individual boilers is measured by stoker counters. As the same type of coal will be used continuously in the power house, this means of measuring should be at least as accurate and probably more so than with the lorry system, when the personal element and the tendency to forget to record a portion of the charges to the boiler are taken into consideration. The disadvantage of the dust caused by the latter system is also eliminated. While not so accurate as the individual weighing devices, it is much simpler and also is less expensive to maintain.

The coal bunkers will be walled off from the boiler room to reduce noise and dust.

There are two rows of boilers in the plant, each equipped with two thirteen-retort Westinghouse stokers, the coal being fed to the boilers by three spouts on each end of the boiler. The spouts are staggered so that the boiler tubes can be pulled either on the front or on the back of the boiler, without moving the 16-in. (40-cm.) coal spouts. The boilers are of the Babcock & Wilcox cross-drum type of 1,529 hp. each, sixteen tubes high, built for a pressure of 350 lb. (24.5 kg.) and stokered so that with an average grade of coal having about 10 per cent ash they can deliver a maximum of 185,000 lb. (83,900 kg.) of steam per hour. Under these conditions the drop through the superheater and dry pipes is 25 lb. (1.75 kg.) and the superheat is 235 deg. Fahr. (113 deg. C.).



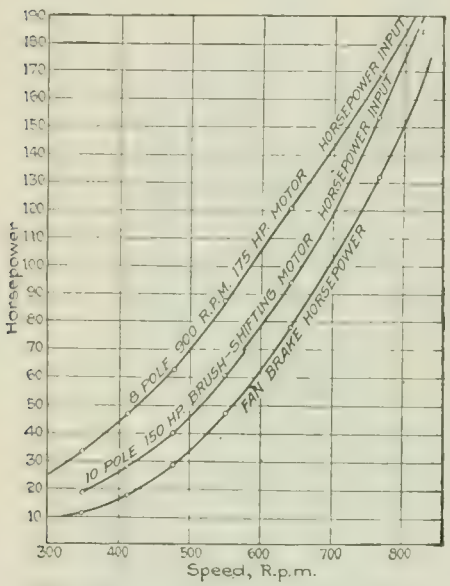
CROSS-SECTION OF SPRINGDALE STATION; GENERAL ARRANGEMENT OF GENERATING EQUIPMENT

Reducing Soot-Blowing Operations

The boilers are equipped with Diamond soot blowers, having nine elements on each side. One soot-blower element is placed under the bottom row of tubes near the front header, another element just above the two lower rows of tubes near the baffle, so as to remove the slag from the bottom of the first pass. From experience in the company's other plants, the soot blowers

lengthen the period of actual service of the boiler 300 per cent, it being necessary to take the boilers off once a week to have the tubes scraped when not so equipped and only once a month with the elements installed. The experience of the West Penn company is that the proper protection and cooling of these blowers has much more effect on the life of the units than the material of which the blower is made. For this reason each element is placed in a brick or tile pocket, permitting air from the forced-draft system to blow through and cool the element, except when the tubes are being cleaned; under the latter condition the pressure of the steam closes the check valve.

The boilers are being provided with a set of platforms, giving accessibility to the various inspection doors and valves. The boilers are covered on the front, back and top with steel plate. The side walls are not covered. The boilers are wide enough for a fourteen-retort stoker, but one retort was eliminated in order to thicken the walls at the bottom 11 in. (28 cm.), thus giving a 32.5-in. (82.5-cm.) brick wall at the bottom and a 21.5-in. (54.5-cm.) wall at the top.



ECONOMY OF BRUSH-SHIFTING MOTOR FOR FORCED-DRAFT FAN

Stokers.—Each stoker is divided into four sections. Three steel plates are placed in the wind box under the stoker, separating the wind box into corresponding divisions. Each section has its own air supply and valve so that the air admitted to any of the eight sections into which the stoker is divided can be regulated. The stoker is provided with a double clinker grinder similar to that in use in several other plants, the manufacturer guaranteeing that the percentage of coke in the ash shall not exceed 14.

Driving each stoker at each side of the boiler is a double-speed alternating-current motor of the pole-changing type, a maximum range in speed of from 25 per cent to full speed being obtainable. The two motors are regulated by a double controller worked by a single pilot motor and arranged so that either stoker may be set a maximum of two notches ahead of the other.

Forced-Draft Equipment.—Each boiler has its own individual forced-draft fan. These fans take the air from the generator discharge on the turbine side of the boiler room, getting what additional air they require from outside. The air is forced by the fan into a duct supplying both sets of stokers under the boiler. The ducts for the various boilers are separated by dampers, which can be opened in case of failure of any of the forced-draft fans, thus providing breakdown capacity. The fans have a maximum capacity of 105,000 cu.ft. (2,970 cu.m.) of air a minute at 7 in. (18 cm.) pressure, sufficient to operate the boilers at 450 per cent rating. The fans are driven by brush-shifting alternating-current motors with direct-current motor characteristics.

The boilers will ordinarily be operated at a maximum of from 300 to 350 per cent, and the average will be 200 to 250 per cent. The losses at these partial loads for the straight alternating-current motor are excessive, although this can be partly overcome by using two motors. The brush-shifting motor, however, is more efficient and has considerable advantage where automatic regulation is contemplated. The efficiency, for instance, at 250 per cent rating of the boiler is estimated at 47.5 per cent for the slip-ring motor, as against 80 per cent for the brush-shifting motor. These motors are rated at 175 hp., and the studies indicated that there was an average reduction in the losses of 21 kw. by using the brush-shifting motor. This type of motor has been tried out with very satisfactory results by one of the large coal companies in the Pittsburgh district for driving ventilating fans.

Induced-Draft Equipment.—Each boiler is equipped with two single Sturtevant fans with two motors, one of 175 hp. and one of 400 hp. capacity, the whole set being interconnected by flexible couplings. There is a Francke coupling between the 175-hp. motor and the fans and a Cutler-Hammer magnetic coupling between the 400-hp. motor and the fan. Ordinarily the two fans will be driven by the 175-hp. motor, which has sufficient capacity to operate the boilers at 300 to 350 per cent rating. In case of serious breakdown it will be necessary to open the Francke coupling and disconnect the 175-hp. motor. In case it is desired to have more draft than can be furnished by the small motor, the 400-hp. motor is brought up to speed, the magnetic clutch closed and current supply to the 175-hp. motor disconnected. With this combination, in case of any one unit going down, considerable capacity can still be obtained out of the boilers. Either half of this unit will operate the boiler up to 300 per cent rating, but not so efficiently as the two fans will together.

The induced-draft fans are installed on a concrete platform some distance above the boiler, there being sufficient space between the boiler and the induced-draft fan to permit of the installation of an economizer. The characteristics of the fan are such that, with the cooler gases that would be obtained from an economizer, they will operate the boilers at the same rating. The maximum draft required to operate the boilers at 400 per cent rating is 5 in. (12.7 cm.); with economizers this would be increased to 7 in. (17.8 cm.).

The controls for the stoker and two 175-hp. fan motors are of the clapper type, the dials being operated by pilot motors controlled either by hand or automatically. The 400-hp. induced-draft fan motors are arranged to operate by hand only; the automatic regulation would then be on the stoker and forced-draft fans only.

Ash-Handling Required Considerable Attention

The problem of ash handling is one of the most serious in the operation of large power plants. Ashes usually constitute one-fifth to one-sixth of the bulk of coal to be handled, and the conditions under which they are usually handled in most plants make it much more difficult to obtain labor. This is due to a great extent to the fact that air for the forced-draft fans is very frequently brought in through the ash tunnels and that

where ashes are dropped into hoppers under the stokers having gates on the bottom there is sufficient leakage of water from the gates to produce vapor so dense that it is impossible in cold weather to see any distance. When ashes are dumped from a stoker not having a continuous discharge, water is applied to quench the ashes. This produces carbon monoxide and probably hydrogen. This gas will escape from the bottom of the ash pit through the doors, and with sufficient pressure to give a blow-torch flame, sometimes shooting out from 8 ft. to 10 ft. (2.4 m. to 3.4 m.) from the ash-pit door. Such a flame is, of course, very destructive to ironwork, and in connection with the sulphur in the ashes it makes the life of a steel ash hopper very short.

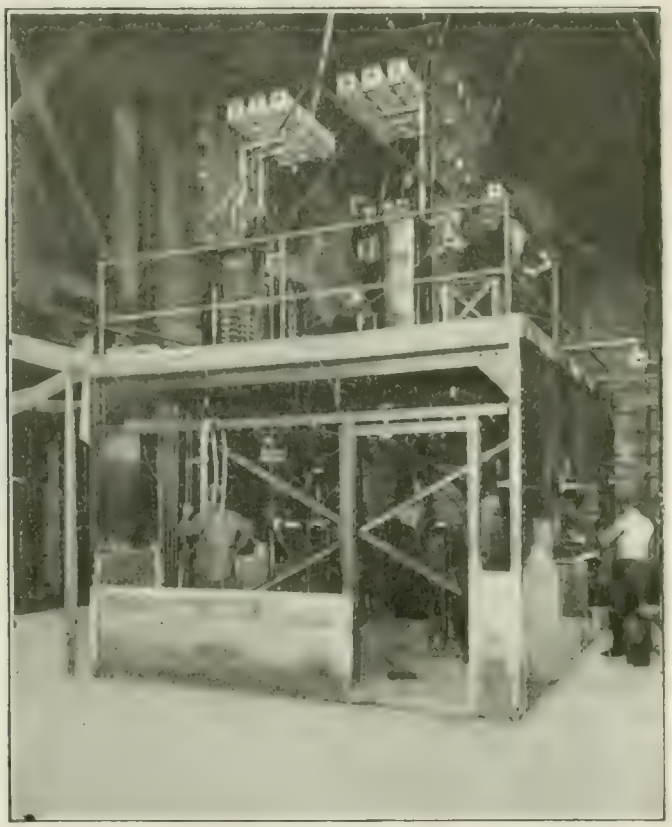
To overcome these difficulties the Springdale plant is equipped with an ash-handling system modeled after that installed at the power house of the Kansas City Power & Light Company, modified, however, in that there are two ash-handling galleries in that plant, whereas in the Springdale plant both rows of boilers discharge to a single gallery, so that a single railroad track and crane runway handle the ashes. The ashes in falling from the boilers drop directly into a large tank of water, are immediately quenched and fall to the bottom of the pit. Sprays are placed at the elevation of the stokers, so that with the large pocket above the clinker grinders the ashes and clinkers should be dead before being discharged by the clinker grinders. With ordinary operation the height of the ashes should not exceed the top of the water in the pit; however, in case of breakdown or flood there are four to five days' ash storage in the chute, and doors are provided to give access to the chute to remove clinker in case the ashes bridge in the chutes. One crane operator with a train crew of two men will handle the entire ash output from the plant. The design also has the additional advantage that if disposal of the ash by means of a continuous cableway system is more economical, the cableway can be run through the ash tunnel and loaded by the crane, at a very slight expense for modifications. The ashes can also be dredged out by a centrifugal pump and delivered by a pipe line in case of emergency.

Boilers Are Controlled from a Central Board

The control for the four boilers is centered in a room in the main firing aisle of the boiler room. The switches controlling the supply to the various motors are inside the room, and the instruments and controls for the motors for four of the boilers are on the outside. The piping will all be in the inside of the room, which will be steam-heated to prevent freezing of instruments in the winter. This will also eliminate the open salamander quite frequently found in power houses in the cold weather, so that when the boilers are being operated at a capacity that will not make the boiler room comfortable the operators can get warm at the heater in the control room.



VIEW OF BOILER ROOM DURING CONSTRUCTION



BOILER-ROOM INSTRUMENT BOARD UNDER CONSTRUCTION

The instruments for each boiler are Bailey boiler meters, recording the steam flow, air flow and pressure in the furnace; four-in-one draft gages, manufactured by the Precision Instrument Company, and Foxboro three-in-one recording gages, recording the steam temperatures and pressure, degree of superheat, etc.

The stoker and fan motors are arranged for automatic boiler control. No economizers were installed in the initial installation because it was believed that the government would not care to advance money for apparatus that was not absolutely necessary.

Another installment, dealing particularly with the turbine room, will appear in an early issue.

Steam-Plant Metering Practice

The Checking of Losses in the Boiler Rooms and the Turbine Rooms of Large Central Stations by the Aid of Records from Instruments Is Passing Through the Stage Today Which Was Reached by the Electrical End of the Station Years Ago

By ROBERT E. DILLON

Assistant Superintendent Generating Department Edison Electric Illuminating Company of Boston

NOT very long ago the usual steam equipment included little more than the steam-pressure gage and the U-tube draft gage, the integrating watermeter and the coal scales. Other factors were interpreted from actual observations, according to the judgment of the fireman and engineer. The fireman noted the condition of the fire by its appearance; the engineer noted the temperature of the bearing by feeling it. To be sure, thermometers were made use of during tests and water-weighing and flue-gas sampling devices were used, but test methods were not then applied to every-day operation.

Today, however, every-day operation is nothing but a continual series of tests. Instruments have been developed within the past few years and have come rapidly into common use giving indications by which the fireman and the engineer can supplement their experience in interpreting observable conditions; or, rather, they can supplement the indications of these instruments by their experience, for it has come to the point now where the instrument and the meter give the more reliable and dependable information. The operator, however, has advanced also with the development in metering, for with the greater information at hand his problem is not merely to keep the plant running but to keep it running at maximum efficiency.

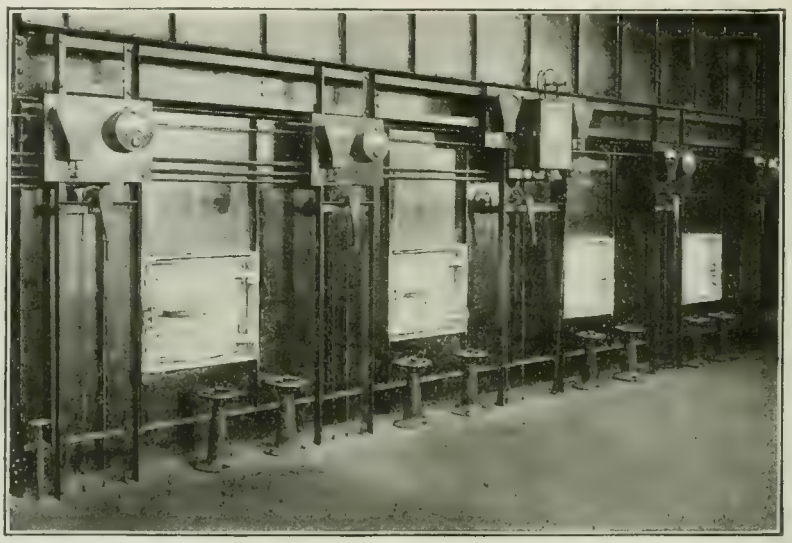


FIG. 1—ONE OF EIGHT 1,232-HP. BOILERS EQUIPPED WITH METER PANELS

From left to right are a pressure gage on the wind box and a stoker motor tachometer on the first section of the furnace, a pressure gage on the wind box and tachometer on the second section, gage showing the draft over the fire, a boiler meter and a gage showing the draft in last pass for the entire furnace, wind-box pressure gage and tachometer for the third section, and wind-box pressure gage and tachometer for the fourth section. The steam pressure gages are mounted at the side of the boiler but are not visible in this view. The rheostat control handles for the four stoker motors are shown under the four sets of sectional meters. The rheostat control handle at the middle of the boiler regulates the blower fan speed. The set of hand wheels at the base of the boiler operates the aprons on the clinker grinder. The draft for each section of the furnace is controlled by levers on the side of the boiler. Since this picture was taken two other meters have been installed on the front of each boiler. One records on a circular chart the economizer incoming and outgoing feed-water temperatures, and the other records the incoming and outgoing flue-gas temperatures.

Flow Meters and Flue-Gas Thermometers are a Great Help

The steam-flow meter of indicating type has an extensive field of application. It has been developed to a high degree of dependability. When used with the diaphragm orifice it is practical and accurate. The law governing flow through an orifice has been established and the rules for the installation of the meter and orifice have been fixed, eliminating the uncertain errors of older installations. One feature of the diaphragm orifice which commends itself is the ease with which it may be installed in an existing steam line without changing the piping.

The remote-reading type is the most recently developed type of this meter. It consists of a means for varying an electric current in proportion to the steam flow and measuring the current with an alternating-current meter. Wherever a constant-potential current is available these meters will give good results if they are properly installed and regularly inspected.

Most of the energy wasted in the boiler room is in the form of heat in the flue gases, and the importance of checking this waste as much as possible has brought the flue-gas thermometer and pyrometer into common use. Cheap pyrometers are entirely unreliable. Good ones, however, can be obtained and, although expensive, must be considered an important part of the metering equipment of the boiler room.

The greatest stride in development perhaps has been made in curve-drawing instruments. Until recently there was no practicable method of getting a continuous record that would show separately the performance of boiler and furnace. There are now, however, reliable instruments that will give continuous records from which the efficiency and output of the boiler and furnace separately and other conditions may be figured.

From the theoretical standpoint, the CO_2 recorder, in conjunction with the steam-flow meter and flue-gas thermometer, offers the surest record of the condition of the furnace. The CO_2 recorder, however, has not yet been developed to the point of reliability which the theory demands, unless given constant skilled attention, and at this time a better average accuracy can be obtained by comparing records of steam flow, air flow and flue-gas temperature. One form of meter is on the market which conveniently gives these three records on one chart.

The value of such an instrument in the boiler room depends upon the principle that for efficient operation

a definite amount of fuel per hour is required to produce a given steam flow, and a definite volume of flue gas holding a given proportion of excess air must pass through the boiler in order to burn this fuel. Any change in the relation between steam flow and air flow is due to a change in the proportion of excess air. There are several factors which tend to upset this ratio, as, for example, soot on the tubes, scale, etc., which condition is indicated by the flue-gas temperature; but if this type of meter is applied to a boiler which is maintained in good operating condition, the instrument will give reasonably accurate records with fewer maintenance troubles than are experienced with the CO_2 recorder.

In order to determine the over-all efficiency of the boiler and furnace the coal supplied to the furnace should be measured. The non-automatic platform scale has given good service in this capacity for several years. At the present time these are being installed on the traveling larry in many new plants.

Automatic scales, however, have been coming forward. The integrating conveyor type and the automatic platform scales have been developed and are accurate and reliable. Many companies are using these types of scales and paying for their coal on the basis of the records from them. The conveyor types, however, still require frequent adjustment and calibration.

Tachometers are useful in the boiler room and the turbine room. These consist either of the direct-current magneto and voltmeter type or the vibrating-reed type. The former of these is well adapted for indicating the speed of stokers, giving the fireman, in conjunction with the draft gage, information which is of valuable assistance. The dial of this instrument may be calibrated in terms of the speed of the stoker, pounds of coal per hour, or in draft pressure required to burn the coal which is being fed.

The vibrating-reed type of speed indicator is a convenient device which will indicate the speed of a turbine or other high-speed machine by means of mechanical vibration when bolted to the machine. It may also be used as a remote instrument and its range may be extended for low speeds, in which case it is connected electrically to a special form of inductor-type alternator with split rotor which can be clamped around the shaft of the machine to be measured.

The draft gage is one of those instruments which are indispensable to the fireman as an aid in operating. The fireman must have a set of draft gages that are reliable, reasonably accurate and easily read. The U-tube has long been the only instrument available. It is difficult to read this gage at a distance, however, and it becomes inaccurate frequently, owing to the evaporation of the liquid. Another type is being brought forward, designed on the principle used in the aneroid barometers. This can be provided with a large pointer and scale so that it can be easily read from a distance of 15 ft. or 20 ft. (4.5 m. or 6 m.). One maker has put out an instrument with several gages mounted in the same case. This is a convenient type to use for indicating the pressure or draft at different points along the path of the flue gases.

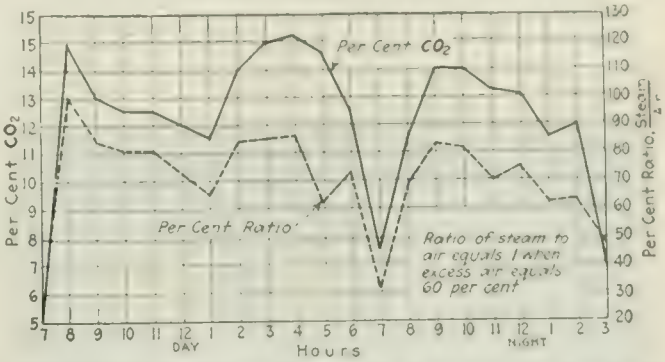


FIG. 5—PLOT MADE FROM CO_2 AND BOILER-METER CHARTS TO COMPARE THE INDICATIONS

With the increasing tendency toward interconnection of power systems the subject of regulating the system frequency has become a matter of prime importance. A device finding favor in a number of central stations consists of a very small self-starting synchronous motor which drives a hand on a clock dial so that it keeps step so long as the frequency is maintained accurately, with another hand on the same dial driven by an accurate clock movement.

The small synchronous motor ought to find a considerable field for use driving meter movements such as demand indicators and graphic meters, thus dispensing with winding and regulating and enabling the meters to run for a long period without attention.

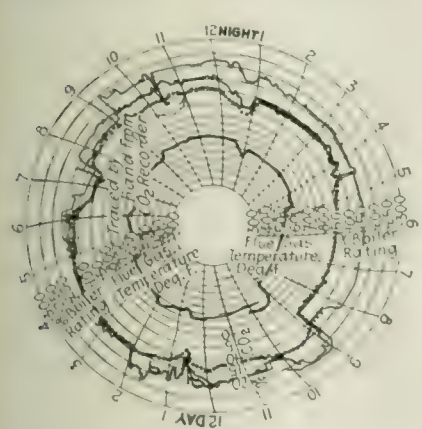


FIG. 2—SAMPLE OF BOILER-METER CHART.

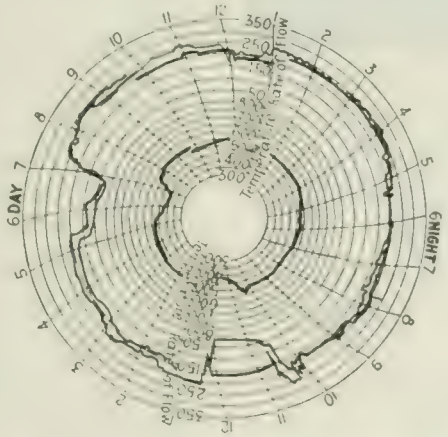


FIG. 3—BOILER-METER CHART INDICATING GOOD OPERATING CONDITIONS.

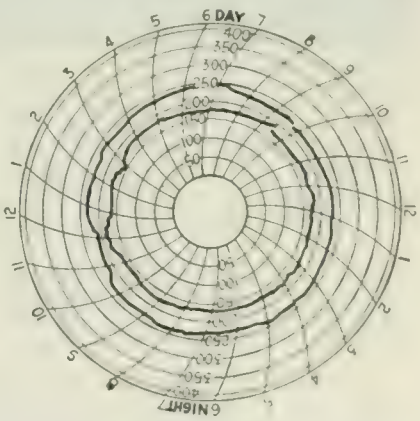


FIG. 4—ECONOMIZER FLUE-GAS AND FEED-WATER TEMPERATURES DURING THE CORRESPONDING PERIOD

In Fig. 2 the outer line on the chart was traced by the air-flow pen. Just inside of this line is the steam-flow line. These two lines are drawn on a scale marked off in percentage of the boiler rating and should coincide when conditions of boiler, furnace and firing are at their highest standard. The line on the inner scale of the chart is the flue-temperature line. A CO_2 recorder chart was taken on the same boiler during the same time, and this has been plotted in by hand and is shown by the dotted line.

The use of automatic damper and stoker regulators has made considerable advance in central stations. Recently a new type has been developed which holds much promise of overcoming the inherent faults in former apparatus for this purpose. The new apparatus is operated from the pressure in the steam line beyond an orifice so that an increase in steam flow acts upon the regulators, thereupon anticipating the resulting drop in pressure, and the stokers are speeded up before the difference in boiler pressure takes place. The sensitiveness of this regulator can be adjusted within wide limits

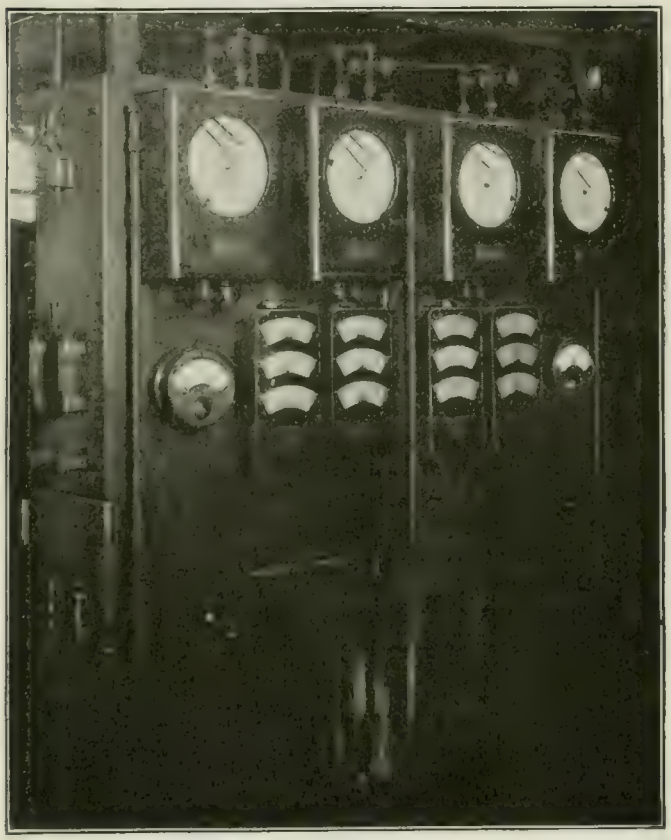


FIG. 6—METERING AND CONTROL FOR FOUR 512-HP. WATER-TUBE BOILERS EQUIPPED WITH UNDERFEED STOKERS

There is one boiler meter for each of the four boilers recording the air flow, steam flow and flue-gas temperature; a three-in-one draft gage for each boiler indicating the pressure in the ash pit, over the fire and in the back connection, and a tachometer on each stoker motor. At the bottom of the panel may be seen the rheostat controls regulating stoker motor speeds and the rheostat control regulating the motor on the forced-draft fan.

to fit the requirements of the installation, and separate adjustment is possible for the regulation of each boiler controlled by the regulator.

V-Notch for Measuring Blow-Down

Feed water is an item for measurement which should be accounted for in the figures for station efficiency. Today the V-notch water meter and the Venturi meter are proving to be the most practical types for this purpose. If the V-notch meter is used, precaution should be taken to install the meter so that it will not be subject to surges which will affect its accuracy.

The V-notch meter has also come into use for measuring blow-down. When used for this purpose it should be installed in connection with a tank so as to permit the use of a meter of smaller capacity. One make of meter built for this purpose has an auxiliary pen which magnifies small rates of flow and furnishes an indication of any leakage through the blow-down valves.

On account of the evaporation a blow-down meter will not record the total blow-down and an allowance must be made for this. Theoretically at 200 lb. (14 kg.) pressure there is about 19 per cent evaporation. In practice, however, it is not so high as this, depending upon various factors such as the length of the blow-down line from boiler to vent, the duration of the blow-down and the temperature of the water in the mud drum.

The increased interest in the question of efficiency in the steam plant within the past few years and the necessity for making each pound of coal produce the maximum work in these days of expensive coal has extended the practice of measuring all quantities which have any bearing on the efficiency or economy. Thermometers on the steam line, the condensate, the feed water and the oil line, U tubes and barometers for measuring vacuum, steam-flow meters installed on each unit, thermometers on the entrance and exit end of the economizer, recording flue-gas temperatures and water temperatures—all these may be used to advantage in pointing out where the losses are greater than they should be and during what period the condition exists.

Modern Boiler Control

Illustrating the method by which boilers are controlled in a modern way there is shown in Fig. 6 a control board installed in a plant operated by a large utility company. Since the picture of the panel was taken the controls for the back dampers have also been mounted on the panel, so that now the fireman may observe the conditions of the fires from the boiler meters, regulate the stoker feeds, adjust the pressures in the ash pits according to the readings of the tachometers and bring the pressure over the fire to a slight draft by control of the rear damper without leaving the board.

A similar board was installed on a companion installation of four boilers at the same plant, but this board was equipped as a trial installation with CO_2 recorders on the four boilers and a boiler meter on one of them. As a result of this trial equipment a later installation of boilers in the same plant was not furnished with the CO_2 recorders.

By comparing the CO_2 and boiler-meter graphs in Fig. 2, which were made simultaneously on the same boiler, it will be noted that the conditions represented in one are closely followed in the other, but that the CO_2 chart is a little less responsive to sudden changes. In scanning the chart it will be seen that the conditions indicated from 9 a.m. to 6 p.m. are excellent, but that after this period the steam-flow pen fell away from the air-flow pen, showing that there was maintained enough excess air to produce one-third more steam flow than was actually produced. During this period the CO_2 dropped to 10 per cent while the boiler was steaming. These indications show that the fuel bed was not in good condition after 6 p.m. or that the air pressures were not maintained properly.

The completeness of the information afforded by the boiler-room meters and their reliability have influenced the design of many new boiler rooms toward remote control and the operation of all the boilers in a plant from a central point will undoubtedly be seen in the near future. As a result of the advancement in metering, the operation of this part of the station is becoming systematized and losses are being reduced where this is most needed.

Inspection Tests for Electrical Equipment

Methods Followed by Rochester Gas & Electric Corporation in Inspecting and Testing Generators, Relays, Oil Switches, Transformers, Distribution Circuits, Meters and Batteries

By A. S. MacDOWELL

Superintendent Electric Generation Rochester (N. Y.) Gas & Electric Corporation

AS THE most effective method of maintaining apparatus in proper operating condition is by regular and frequent tests, it is evident that the procedure adopted by the maintenance organization is of extreme importance. During the war period it was not possible to follow this work as closely as its importance warranted, and the result was an epidemic of breakdowns of equipment that probably could have been prevented had the pre-war schedule been in effect.

As a result of this experience the Rochester Gas & Electric Corporation has adopted a more vigorous main tenance schedule. The maintenance force, consisting of five men, operates during light-load periods from 5 p.m. to 1 a.m. These men continuously make the rounds of the ten stations and substations on a schedule which permits inspection and tests of all station electric equipment and tie lines approximately once every six months.

TYPICAL REPORT ON RELAY TESTS AT STATION NO. 3

Name	Phase	Time Found, Sec.	Amp. Found	Time Set, Sec.	Amp. Set	Current Trans. Ratio	Current Trans. Normal Load	Current Trans. Relay Operating Load
Frequency changer, 60-cycle, end	A	1	8½	1	7½	120 1	600	900
	B		9½	1	7½	120 1	600	900
	C	2	8½	1	7½	120 1	600	900
Frequency changer, 25-cycle, end	A	2½	13	1	10	40 1	200	400
	C	1	12	1	10	40 1	200	400
No. 11 Ry. rotary, 25-cycle	A	Inst.	8	Inst.	5	30 1	150	150
	C	Inst.	7½	Inst.	5	30 1	150	150
No. 306 tie line to station No. 4	A	1⅛	16½	1	15	40 1	200	600
	B		12½	1	15	40 1	200	600
	C	1	16½	1	15	40.1	200	600

Testing and maintenance records are filed by stations with subdivisions for the different types of apparatus, such as relays, oil switches, etc.

Inspecting and Testing Generators

The procedure followed for generating equipment is as follows: A megger test is applied separately to the armature winding and to the three-phase cable between generator and station bus. The cable is then reconnected to generator and a megger test is applied to the combination. Values under 1 megohm for every 1,000 volts for which generator and cable were designed are considered unsafe, and the necessary steps are then taken to dry out equipment or locate fault. The generator-field winding is given a leakage test with voltmeter to determine insulation ohmic resistance. For this test the following values are considered safe:

Less than 10 volts for field designed for 125 volts.
Less than 25 volts for field designed for 250 volts.
Less than 50 volts for field designed for 500 volts.

Alternating-current generators installed within the last ten years have been specified with all armature leads brought out of winding, as shown in Fig. 1, to permit the use of differential relays. While a generator is running in parallel with other units carrying the load, the relays are tested by successively short-circuiting each current transformer connection at the relay, which should cause the relay to operate, tripping main and field switches. The minimum current in generator windings required to trip switches under these conditions is also noted. On older types of alternating-current generators equipped with reverse-energy relays a similar test is made by reversing current transformer connection at relay and noting current at which oil switch trips. A high-potential testing transformer is

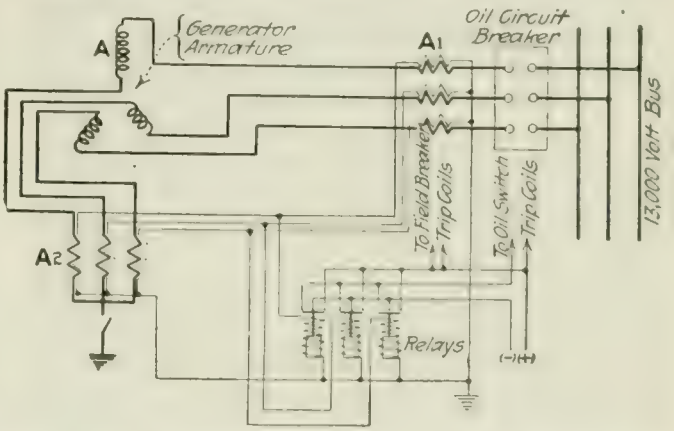


FIG. 1—RELAY CONNECTIONS WHERE ARMATURE LEADS ARE BROUGHT OUT OF WINDING FOR DIFFERENTIAL RELAYS

now on order for applying a 150 per cent voltage test to the armature winding of alternating-current generators. This test will be made once a year after the seasonal peak period.

Only two serious cases of alternating-current generator trouble have occurred during the past ten years, as follows: One 3,000-kva., 11,000-volt, 25-cycle water-driven generator was completely burned out owing to the station being flooded. The field of a 7,500-kva., 11,000-volt, 25-cycle turbo-generator heated, burning the insulation of field winding, and the insulation of a sec-

REPORT FOR OIL SWITCH INSPECTION AND MAINTENANCE AT STATION NO. 4

Cleaned oil switches on tie line No. 404. Found oil O.K. Contact fingers either broken or badly burned. Replaced six of them and put in good condition.
Cleaned oil switches on tie line No. 408. Found one tank about quarter full of oil (no apparent leakage in tank). Replaced four contact fingers which were broken or burned. Cross-bar on one phase lagged behind the other in making contact. Put in good condition and filled tank, which was partly filled.
Cleaned oil switches on B and C phase (A phase reported last week) of railway rotary. Found oil very dirty. Contacts broken, one missing. Wooden connecting rod on cross-bar loose at the top support and C phase lagged in making contact. Filled with clean oil and put in good condition.
Cleaned oil switches on No. 403. Found oil O.K. Contacts badly burned. Cross-bars on B phase badly fitted. Replaced burned contacts and put in A-1 shape.
Cleaned oil switches on tie line No. 414. Found oil fairly clean. Four broken contacts. Potential fuse burned out. Put in good condition.
Cleaned oil switches on tie line No. 409. Found one phase lagging behind on making contact. Four contacts badly burned. Put in clean oil and left in good condition.
Low-voltage release on positive breaker of Bullock generator mechanically defective. Replaced same.

tion of the armature winding was charred from the severe unbalance currents in armature phases caused by opening of one phase of the main transmission line. It subsequently developed that this unit was not designed to carry an unbalanced load in excess of 15 per cent. Generators with this characteristic should be equipped with proper balanced relay protection.

Insulation ohmic resistance test is taken on armature and field windings of direct-current generators, motor-generators and rotary converters. All direct-current units are equipped with reverse-current circuit breakers, which are tested by reversing relay armature connections and connecting the machine to the bus, the tripping current being noted. Breakers should trip at approximately 2 per cent normal load of machine. Necessary adjustments are made to secure correct operation. When once properly set these relays require very little adjustment over a period of years.

Speed-limit devices are removed from shaft and adjusted at the shop to operate at 7 per cent above normal speed. They are then reinstalled on the unit, which is started from the alternating-current end and cut in on

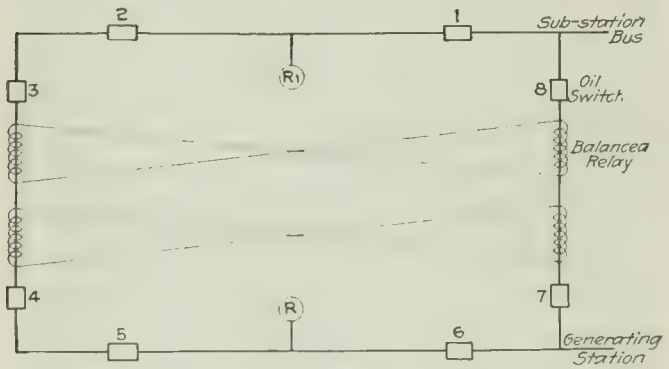


FIG. 2—SWITCHING IS SO ARRANGED THAT THE STARTING CURRENT OF ROTARIES MAY BE USED TO TEST TIE LINE RELAYS

the direct-current end. The direct-current, reverse-current relay is blocked and the alternating-current switch opened. The speed is then increased by decreasing field resistance until the tachometer records the speed at which the device should operate. If necessary, adjustments are made to secure operation at proper speed, but this is seldom the case, as the shop adjustment is usually correct and prevents subjecting the rotary to a great number of overspeed tests in adjusting the speed-limit device.

Windings of all open-type generators, rotaries, etc., are blown out at least once a month with air at a pressure of approximately 30 lb. (2.1 kg.). In some of the centrally located stations where dust accumulates more rapidly they are blown out as often as twice a week. Turbo-generators equipped with an air-washing system have the end bells removed once a year for inspection, and windings, ventilating ducts, etc., are blown out at that time. All units are inspected by station operators twice a week. Short brushes are replaced, all connections examined and cleaned, and a report is made to the maintenance department of details needing attention.

Relays are first thoroughly cleaned and all mechanical defects such as poor contacts are corrected. The following tests are then made:

(a) Time-limit overload relays on feeder circuits are tested with a cycle counter and phantom load, the former registering the time required for the relay to trip, and the phantom load, supplied to the relay from a low-voltage alternating-current circuit through an adjustable resistance, showing the current values. Feeder circuits are set for 200 per cent load and two seconds time.

(b) Parallel tie lines between stations are equipped with balanced discriminating relay protection designed automatically to segregate a faulty line without interfering with the balance of the system. These balanced relays are given an approximate service test, twice a year, by using the starting current of a large rotary to duplicate as far as possible trouble on one of a group of parallel tie lines. Station buses are so arranged that a rotary can be conveniently connected between any two tie lines, as shown in Fig. 2. In this case relays are set for current normally flowing from generating station to substation. In this method tests are taken as follows:

Procedure in Testing Tie Line Relays

(1) Switch 6 is opened and current fed from generating station through switches 7, 8, 1, 2, 3, 4 and 5 to rotary R. Switches 3 and 4 should trip out from reverse current as the current flow is toward the generating station. (2) Switch 5 is opened and current fed from generating station through switches 4, 3, 2, 1, 8, 7 and 6 into rotary R, which should trip switches 7 and 8 from reverse current. (3) To test for unbalance, such as one line carrying the entire load, switch 8 is opened and current fed from generating station over 4, 3 and 2 to rotary R_1, tripping switch 4 from unbalanced current. (4) Switch 3 is opened and current fed from generating station over 7, 8 and 1 to R_1, tripping switch 7 from unbalanced current.

After the relays have once been thoroughly tested at the time of installation to insure correct connections, this periodic test is very valuable, as everything is checked from the oil switch to the primary current flowing in the tie line. A few single tie lines between stations are still equipped with time-limit overload relays to which are given a test similar to feeder relays and set for 300 per cent load and two and one-half seconds time. Tests on generator and transformer relays are noted under their respective headings. Switch-control wiring is tested for grounds.

Two interesting cases of control trouble have occurred during the past two years as follows: Control wiring at one station was connected to the exciter bus. Several grounds developed and fuses melted owing to the unbalancing of phases of an alternating-current generator, inducing a high voltage in the field winding which was communicated to the control system. The control bus at another station was supplied from a grounded Edison system which caused an oil switch to pump because of ground developing on this particular switch control wiring. Control buses at all stations are now supplied from motor-generator sets with floating storage batteries. Oil switches are regularly tripped by station operators from relays instead of control switches when cutting a circuit out of service. This gives control wiring and relay connections a very frequent test.

Time of Operation for Oil Switches Checked

Oil switches are tested with a cycle counter to note time required to open and close. Adjustments are then made to give switch time values for which it is designed. Switch contacts are thoroughly cleaned and any faulty contacts repaired or replaced. Oil is tested, and if it breaks down under 40,000 volts at 0.2 in. (5

mm.) spark gap, it is dried with a portable filter press until this value is reached.

All auxiliary switches on oil-switch-operating mechanism are cleaned and adjusted. Switch arcing tips are changed approximately every two and a half years. The most usual trouble is that of contacts working out of alignment owing to loosening of various parts of the switch mechanism. Very often this trouble can be detected by unbalanced ammeter readings on phases of circuit, but frequent inspection is particularly necessary in the case of oil switches.

CARE OF TRANSFORMERS

All station transformers receive a megger test from high-tension winding to ground, low-tension winding to ground and also a test with combined high and low tension windings to ground. Terminals and bushings are then cleared and the megger test is repeated. Oil is tested, and if breakdown occurs at less than three times the operating voltage of transformer, it is brought up to a standard with the filter press. All oil which has remained in the transformers over one year is passed through the filter press. All lowering transformers are equipped with differential relay protection, and a test is taken similar to the one described in connection with alternating-current generator relays.

Cooling coils of water-cooled transformers are inspected, and any accumulated sediment or scale is removed with a 10 per cent solution of muriatic acid. Considerable trouble has been experienced with iron cooling coils becoming plugged where copper coils under the same condition remained open. For this reason copper coils have been adopted by this company as standard for all future equipment.

No recent cases of power transformer trouble have developed with the exception of excessive temperature on six 5,000-kva., 11,000/4,150-volt, 25-cycle water-cooled transformers. This was due primarily to faulty design and was corrected by cutting additional slots in the iron core to improve oil circulation. Arc transformers receive a megger test (both primary and secondary coils).

Voltage drop is taken across primary and secondary coils to detect short circuit. Induction feeder regulators have a megger test similar to that given to regular station transformers. The oil is tested and contact-making voltmeters, as well as all auxiliary equipment, are carefully inspected and cleaned.

Cones of electrolytic lightning arresters are removed from the tanks. Electrolytic lightning arresters and each cell are tested with a bank of lamps. If any one cell shows a light and cannot be repaired, it is returned to manufacturer to be recoated.

RULES FOR TESTING DISTRIBUTION CIRCUITS

Arc circuits are given daily tests as indicated by the following rules governing testing of series street-lighting circuits:

All circuits except as hereinafter stated should be tested as follows: Immediately after shutting down circuits in the morning, between 12.15 p.m. and 12.45 p.m., at 4.15 p.m. and each hour thereafter, and a final test one-half hour before starting time.

Be sure all connections to testing equipment are properly made.

Test for Live Cross (Fig. 3)

This test should be made before any other by flashing both sides of each circuit to a dead ground. The ground wire should be used on the end of a pole not less than 3 ft. (1.5 m.) long and should be applied to the jaws of the high-tension testing switches, they being the uninsulated point furthest removed from the operator.

A live cross will be indicated by a flash when breaking contact.

Provided that a circuit is found to be crossed with a live wire, the voltage of the cross should be ascertained by use of a lamp bank provided for the purpose.

No other test should be applied to the circuit until the cross is reported clear by the line dispatcher.

Tests for Grounds (Fig. 4)

Insert the low-voltage test plugs alternately in first the positive (+), then in the negative (—) side of the circuit. A ground will be indicated on either side of the circuit by a slightly reduced light on the low-voltage test lamps.

Test for Opens (Fig. 4)

Insert both testing plugs in positive (+) and negative (—) sides of the circuit. An open circuit will be indicated by a dark lamp (no light) on the low-voltage testing lamps. Provided that a circuit is found to be open the Edison current should be applied direct to the positive (+) side and a dead ground to the negative (—) side to assist in locating the trouble.

High-Voltage Test (Fig. 5)

The high-voltage testing equipment may be used for closing open circuits between 12.15 p.m. and 12.45 p.m. and at 4.15 p.m. or any time thereafter until cutting-out time in the morning. It should never be applied to a circuit at other than the time specified without previous arrangement with the line dispatcher.

To Use High-Voltage Test

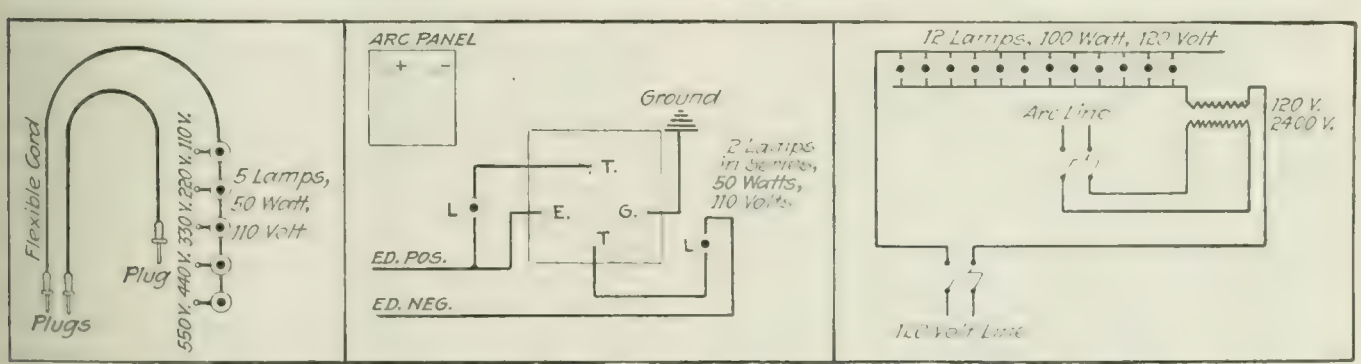
First—Be sure workmen are clear from the testing equipment.

Second—Make same alive by closing the low-voltage hand-operated switch. This operation makes the testing transformer, the high-voltage test bus and the high-voltage test switches (one of which is placed just above each circuit) alive with 2,400 volts. If when testing for open circuits with the low-voltage plugs a circuit is found to be open, remove the low-voltage plugs from the circuit and close the high-voltage test switch directly over that circuit with a switch hook provided for the purpose. A closed circuit will be indicated by a full candlepower light on the series lamp bank.

The results of all tests should be reported promptly by telephone to the line dispatcher.

No current of any voltage should be applied to any circuit being "held" except on instructions from the line dispatcher.

Gloves and goggles should always be worn by operators when testing arc circuits.



LEFT, CONNECTIONS USED IN TESTING FOR LIVE CROSS. CENTER, LOW-VOLTAGE TEST CONNECTIONS USED IN TESTING FOR GROUND. RIGHT, HIGH-VOLTAGE TEST CONNECTIONS USED FOR CLOSING OPEN CIRCUITS

These tests are of great value in reducing the cost of maintenance by advising the line repair men of the exact nature of the trouble. The high-voltage test is a great economy as it very often closes an arc circuit which the Edison test shows to be open at the lamp and thereby saves the line trouble men an unnecessary trip.

To insure continuity of operation on an underground system it is very desirable to have a routine system of testing the important cables which will disclose defects at such times as these can be repaired without interference with service. The more frequent causes of

cable trouble are surges, broken insulation at duct entrances, defective joints and mechanical injury due to work in streets by gangs laying or repairing gas, water or sewer piping.

With the method of testing at present employed, it is necessary to disconnect both ends of the section of cable under test and to clear it of all connected apparatus. The cable is then tested with a megger, the insulation resistance of the cable being measured by megger from each conductor to ground and between conductors. A defect is more likely to be discovered from an unbalance of readings than from the absolute values of insulation resistance obtained, as the latter vary greatly with the temperature of the cable. The following readings were obtained on a 4,100-volt, three-phase, paper-insulated, lead-sheathed cable, 2,500 ft. (762 m.) long, on which there was a defective joint. A, B and C are the phase conductors:

A to ground, 8 megohms; *A* to *B*, 35 megohms;
B to ground, 25 megohms; *B* to *C*, 60 megohms;
C to ground, 40 megohms; *C* to *A*, 55 megohms.

The following readings were obtained on a similar cable having a cracked insulator on the cable side of a station disconnecting switch:

A to ground, 50 megohms; *A* to *B*, 50 megohms;
B to ground, 2 megohms; *B* to *C*, 40 megohms;
C to ground, 30 megohms; *C* to *A*, 80 megohms.

Surges are productive of trouble by breaking down a cable at its weakest point. To test the ability of cable to withstand surges due to ordinary switching operations, it is necessary to subject it to an overvoltage test. To carry out such tests this company has on order a 132-kva., 24,000-volt testing transformer with induction regulator voltage control. With this equipment it is proposed to test all important cables every six months, subjecting 11,000-volt cables to 75 per cent overvoltage and 4,100-volt cables to 100 per cent overvoltage. Megger tests will still be made monthly according to the practice now followed.

SCHEDULE FOR TESTING METERS

Rated capacity	Should Be Tested at Least Once in Every
Direct-current meters:	
Exceeding 450 amp.	Six months
Exceeding 200 amp. to 450 amp. inclusive	Twelve months
Exceeding 25 amp. to 200 amp. inclusive	Eighteen months
25 amp. and less	Twenty-four months
Alternating-current meters:	
Single-phase—	
Exceeding 25 amp.	Twenty-four months
25 amp. and less	Thirty-six months
Polyphase	
Exceeding 150 amp.	Twelve months
150 amp. and less	Twenty-four months

Single or polyphase meters installed on circuits having a voltage of 2,000 volts and over should be tested at least once every twelve months.

Periodic Testing of Electric Meters

For the reason that each type of electric meter must be passed on and accepted by the Public Service Commission before it can be used in New York State, the selection of meters is not so serious a problem as it was a few years ago, before the commission had been vested with this authority.

Direct-current meters will not maintain their accuracy without readjustment over as long a period as the alternating-current meters, on account of the brushes and commutator and heavier moving element. Therefore it is necessary to test the direct-current meters more frequently than the alternating-current meters. Electric meters generally are tested in accordance with the schedule which is printed in the left-hand column.

Careful records are kept of batteries on regular forms giving gravity of each cell, etc. Low cells are immediately inspected, repaired and recharged with individual booster.

Readers' Views and Comments

Protection for Public Utility Investment

To the Editor of the Electrical World:

Sir: I am unable to concur wholly with the editorial in the Aug. 21, 1920, issue of the Electrical World, page 366, entitled "Danger in Valuations at Present-Day Figures." I feel that the attempts to socialize or sovietize the utilities have progressed too far. There is little difference in principle between municipal ownership and a guaranteed return upon construction cost. The only nominal difference is in the apparent control of the management of the property. The element of private risk which carries with it the hope of private gain and the fear of private loss is the mainspring of initiative and personal efficiency, which are regarded as the principal and moving causes for the industrial efficiency and large-scale production and distribution for which United States business methods are famous all over the world.

Of course the man who already has his money in a public utility property which has been in charge of a weak, compromising management would much prefer a guarantee upon the actual expenditures, be they wise or otherwise. In these times, with the present price conditions, the local politicians would undoubtedly prefer it, and particularly if with the current "service-at-cost plan" they get the right to control the political situation and have the property operated and managed in accordance with their own ideas of what is most to be desired.

Such a course, however, means the end of progress so far as public utilities are concerned. While the "service-at-cost plan," including a valuation of the property based on costs, may be all right where intolerable conditions and a complete wiping out of an honest investment, honestly made, seem likely, the true remedy is higher returns, less fixed-charge financing and a fighting Anglo-Saxon management which will not give up its rights guaranteed by the Constitution of the United States, and particularly the Fourteenth Amendment, until the last word has been said by the last court in the land, and even when that has been done will continue to work with public opinion in city councils and legislatures until money invested in public utilities is accorded the same recognition and protection as is true of money in farms, lands, factories and banks—no more and no less. H. C. Hopson.

New York City.

Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Street-Lighting Maintenance Cost Analyzed

ELEVEN hundred and sixty-nine 4-amp. magnetite-arc lamps and 613 luminous arcs of the 6.6-amp. size were operated in an Eastern city during the year ended June 30, 1920, at a total expense for maintenance of $37,160. The service required an input of 3,604,480 kw.-hr., delivered at an energy cost of $41,250, making a total service cost, excluding fixed charges, of $78,410. The fuel cost was $0.0084 per kilowatt-hour, with coal costing an average of $7.17 per ton during the year. The segregated costs of maintenance and operation are shown in the accompanying table.

ANALYSIS OF STREET-LIGHTING COSTS

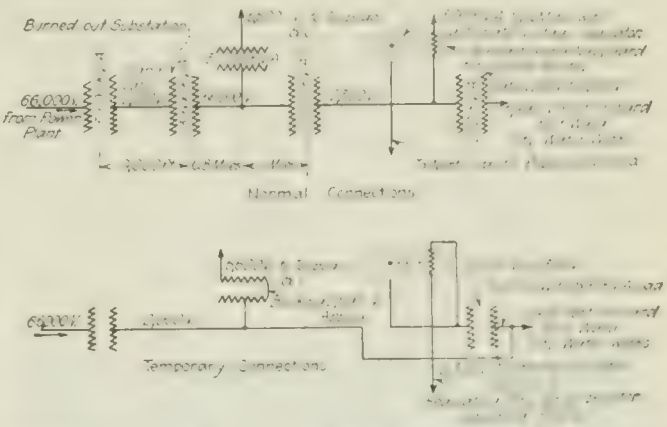
	Magnetite Lamps — Total	Per Lamp	Luminous Arcs — Total	Per Lamp
Wages, trimmers	$1,357 82	$1 16	$1,243 78	$2 03
Wages, patrolmen	3,797 54	3 25	625 77	1 02
Wages, repairmen	2,242 15	1 92	847 18	1 38
Materials, repair	944 61	81	1,082 68	1 76
Globes	1,506 50	1 29	803 79	1 31
Electrodes	2,117 70	1 81	2,547 29	3 37
Rectifier tubes	2,705 83	2 30	2,076 72	3 37
Wages, line repairs	2,154 90	1 84	0 00	0 00
Wages, underground	3,549 42	3 05	707 29	1 15
Materials, line repairs	1,222 79	1 04	0 00	0 00
Materials, underground repairs	2,527 60	2 16	429 45	70
Tools	1,948 13	1 67	811 72	1 32
Total maintenance	$26,074 99	$22 30	$11,085 67	$18 07
Energy used, at bus, kw.-hr	2,399,941		1,204,540	
Cost of energy at bus, kw.-hr	1.145 cents		1.145 cents	
Total cost of energy	$27,500	$23 50	$13,750	$22 40
Total operating and maintenance cost	$53,574	$45 80	$24,835	$40 44

The magnetite lamps burn nightly from sunset to dawn. About two-thirds of the ornamental units burn until 1 a.m. nightly, the remainder until dawn. The magnetite arcs were employed in general street illumination and the luminous arcs in the ornamental lighting of the down-town district.

Serving 6,600-Volt Load Over 66,000-Volt Line in Emergency

A 66,000-VOLT line, 22 miles (35.4 km.) in length, was used to deliver its normal load at 6,600 volts in a recent emergency of the Northwestern Power & Manufacturing Company. While this caused a very large voltage drop in the 66,000-volt line, customers were kept supplied with energy in spite of the burn-out of the transformer station usually supplying 66,000 volts to the line. The power for this line is normally transmitted at 66,000 volts from a plant near Port Angeles, Wash., to Bremerton, about 30 miles (48 km.) distant. The transmission line crosses Hood's Canal, stepping down to 13,200 volts by means of a transformer station on one side of the canal and up again to 66,000 volts on the other side of the canal, the 13,200-volt connection being through a submerged cable. The energy is then transmitted at 66,000 volts about 22 miles to Bremerton, where it is stepped down to 2,300 volts for local distribution. Some power is stepped up to 6,600 volts to serve the city pumping plant, Fort Ward and other outlying districts near Bremerton. Also about half way between Bremerton and Hood's Canal a tap is made to feed Torpedo and Radio Station by stepping down to 6,600 volts.

The emergency scheme of supplying energy was necessitated by the burning down of the transformer station on the Bremerton side of the canal. When this substation burned connection was made directly from the 12,000-volt cable to the 66,000-volt transmission line. The 66,000/2,300-volt transformers at Bremerton were cut out of the line, and the 66,000-volt line was connected to the original 2,300-volt line. This 2,300-volt line was then connected to the high-tension side of the 6,600/2,300-volt transformers in Bremerton, and the load at Bremerton was connected to the 2,300-volt side



SCHEME SHOWING HOW LOAD WAS CARRIED AT 6,600 VOLTS OVER A 66,000-VOLT LINE

of this transformer. When voltage was put on the transformers at the canal they delivered about 12,000 volts to the canal cable. There were no transformers between this cable and Bremerton, but owing to the high resistance of the line the voltage at Bremerton dropped down to 6,900 volts with 1,000-kva. load.

By means of a 500-kva. synchronous motor and a voltage regulator the voltage was raised to normal. However, in order to hold it fairly constant under a load varying from 200 kw. to 800 kw. on the two 250-kva., 6,600-2,300-volt transformers, a series booster was connected reversed in the 2,300-volt line and this was regulated by hand. The Northern Pacific Service Company also carried some of the load on its steam plant. The 6,600-volt circuits leading to Fort Orchard, Fort Ward and the city waterworks were connected directly to the incoming line.

At Key Port a load varying from 25 kw. to 250 kw. at 6,600 volts was carried by bucking down the voltage at that point. As this point was about half way between the canal and Bremerton, the voltage on the line was

approximately 9,000, and therefore it had to be bucked down about 2,400 volts.

The chief difficulty with this arrangement was that any trouble on the 6,600-volt system with fuse protection only kicked out the automatic switch at the canal, and the voltage had to be lowered in order to get this back into service. This was done by fixed rule without waiting for telephone communication. As soon as the switch was out voltage was lowered to about 50,000 volts, the load at Bremerton was taken off the line, the synchronous motor was started, and when this motor was back on the line the plant was again brought to normal voltage.

ARTHUR L. LOFSTRAND.
Northwestern Power & Manufacturing Company,
Port Angeles, Wash.

Surface Condenser Maintenance Where Scale Forms on Tubes

AS A VARIATION of an inch in vacuum at the turbine exhaust may make a difference of a pound or more in the water rate of a modern turbine, it is readily seen that maintenance of the condensing apparatus in the best possible operating condition is of vital importance to a power plant.

Februar

CONDENSER REPORT - WATERSIDE STATION #2

Turbine #	1	2	4	7
Load Kw.	23000	17000	9000	9000
Vacuum at Condenser Top (in. mercury)	29.25	29.05	28.81	28.63
Vacuum at Condenser Bottom(in. mercury)	29.22	29.44	29.00	28.81
Vacuum at Dry Vacuum Pump (Pump suction valve closed)	29.72	29.69	----	28.95
Circulating Water Inlet Temp.deg.F.	57.0	58.0	55.0	56.0
Circulating Water Outlet,deg.F.	49.0	51.0	52.0	52.0
Hot Well Temp.deg.F.	72.0	65.0	47.0	50.0
Air Leakage,Cu.ft. per min.	2.06	3.78	3.24	0.93
Circ.Water,gal.per min.	46,000	27,200	15,350	17,450

Vacus corrected to 30 in.

FIG. 1—REPORT OF TESTS FOR LOCATING POSSIBLE TROUBLE ON SURFACE CONDENSER

The first requirement in maintaining condensing efficiency is a means for knowing immediately when the vacuum falls below normal and to what part of the condensing apparatus the lowered operating efficiency is due. In order to keep the condition of this apparatus constantly before the engineers of the New York Edison Company, hourly log records are kept of the vacuum and the water and steam temperatures which control the vacuum. Hourly tests are also made by the oiler of the percentage of sea water leaking into the condenser. In addition, a test is made once a week which shows in detail the condition of all parts of the apparatus. A report of this test (Fig. 1) gives virtually everything needed to locate any trouble.

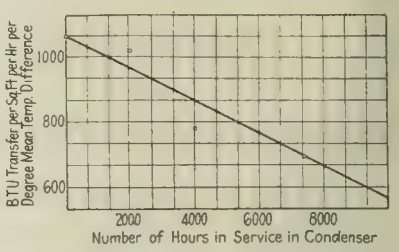


FIG. 2—DECREASE IN HEAT TRANSMISSION ON ACCOUNT OF SCALE IN CONDENSER TUBE

If the vacuum at the top of the condenser is normal, there is no necessity to look further; but if it is low, the reason is usually apparent from the other items of the report. For example, if the shut-off vacuum at the dry vacuum pump is low, the pump should be examined, the trouble located and necessary repairs made to bring its performance to normal. If the air leakage is high, the first opportunity should be taken to fill the condenser with water and locate and repair the leaks. The amount of air leakage which will begin to affect the vacuum varies, of course, with the type and size of air pump, but with the pumps in use at the Waterside stations a leakage of about 8 cu.ft. (0.2 cu.m.) per minute begins to give trouble. For making air leakage test a gasometer of about 25 cu.ft. (0.7 cu.m.) capacity is connected to a header into which the discharge of each of the air pumps may be turned and the time necessary to fill the gasometer is noted on a stop watch. When other than the reciprocating type of air pump is used, it is necessary to have one reciprocating pump which can be connected to any of the condensers while the test is being made.

If the temperature rise of the circulating water is excessive, it indicates either that the circulating pump is not operating properly or that the tube sheets are covered with trash.

If the vacuum is still too low, even when the air pump pulls a good vacuum when shut off, and air leakage and temperature rise of circulating water are normal, it will usually be found that there is some non-conducting material on the cooling surface. With some condensing waters this material will be soft mud which can be blown or brushed from the tubes. At the Waterside staions the difficulty is mainly with the hard scale which does not yield to brushing or blowing. The decrease in heat transmission or condenser tubes after extended service is shown in Fig. 2. This scale is removed by periodically sand-blasting the inside of the tubes by the use of the apparatus shown in Fig. 4. The operation is as follows: The water supply is cut down to a very small stream, the nozzle is inserted in the end of the condenser tube, a quart of clean, dry, sharp

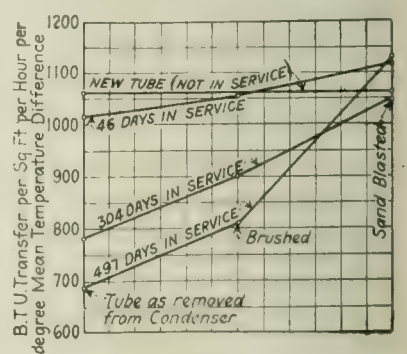


FIG. 3—SHOWS SUPERIORITY OF SAND-BLASTING CONDENSER TUBES OVER BRUSHING

sand is poured into the funnel and the air cock is opened wide. About twenty seconds is required to drive a quart of sand through the tube, and one operator can clean from 100 to 200 tubes per hour. The effects of brushing and sand blasting dirty condenser tubes may be compared in Fig. 3. Sand blasting frequently increases the vacuum at the top of the condenser 0.5 in. to 1 in. (1.3 cm. to 2.5 cm.).

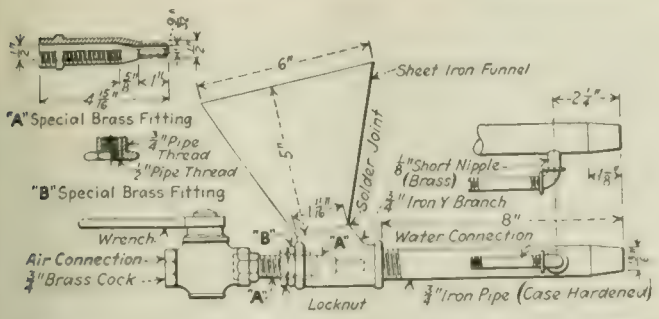


FIG. 4—SAND-BLASTING OUTFIT FOR CLEANING SCALE FROM CONDENSER TUBES

EDWIN B. RICKETTS,
Assistant Chief Operating Engineer.
New York Edison Company,
New York, N. Y.

Seventeen Rules for Efficient Boiler-Plant Maintenance and Operation

THESE concise rules followed by the firemen of twenty-eight coal-firing plants in the Middle West have given remarkably good results, and thus might be of general application:

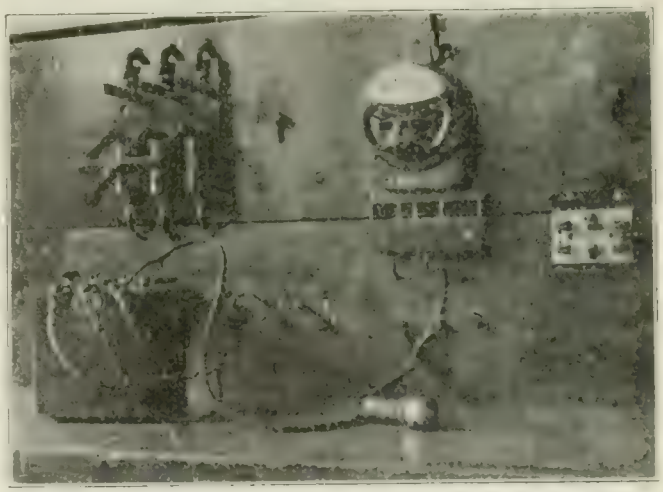
1. Stop all air leaks in boiler settings and flue doors. Leaks can be very easily found with a lighted candle. Air should be admitted to a furnace through the fuel bed and at no other place.
2. Keep boiler tubes free from soot and scale both inside and outside. Special attention should be given to the regular cleaning of flues and tubes.
3. Keep side walls and bridge walls free from ashes and clinkers; these retard the draft, cut down the available grate surface and cause a waste of fuel.
4. Keep ash pits cleaned out at all times; if they are full of ashes, not only is the draft retarded but also the grate bars are burned out more quickly.
5. Experiment to determine the draft required to burn the fuel to the best advantage.
6. Fire little and often rather than a large amount less frequently. By such firing it is easier to prevent holes from forming in the fire and better fuel economy results. Holes appearing in the fuel bed should be immediately filled up with fresh coal.
7. Do not fire large lumps of coal. These should be broken up to the size of a man's fist before firing. Air holes form around a large lump, and it is also harder to spread an even fire with large lumps than with smaller pieces.
8. Use the poker or slice bar as little as possible to minimize carrying unburned coal down into the ash pit.
9. Watch the ashes after cleanout periods to determine whether all the coal is being consumed as well as it can be. A simple test for determining the presence of unburned fuel in ashes is to pour water over them; the ashes will be red and all unburned coal or coke will show itself immediately.
10. Use the damper as much as possible to control the fire and the steam pressure.
11. Keep the hand-fired grates or automatic stokers in repair at all times. Be sure the great bars are not warped and twisted out of shape, allowing coal to fall through into the ash pit. Be sure the fronts around stokers are not allowing excess air to go into the furnace over the fire.
12. Use draft gages on boilers. Determine the draft which gives the hottest fire and maintain it at all times.
13. Keep no more boilers on hot banks than are absolutely necessary to carry the load during a peak. Be sure that the boilers are banked in the most efficient manner.
14. Keep the steam leaks about the plant down to a minimum and give special attention to see that all small valves, drips, drains and traps are tight and not leaking live steam.
15. Make sure that the most is got out of the exhaust steam from pumps and auxiliaries. See that the overflow valve on feed-water heaters is not leaking and wasting hot water.
16. Keep the boilers in fit condition by thorough cleaning and repairing. A boiler should never be put back on a load after having been taken down for cleaning or repairs until it has been thoroughly inspected and all defects have been remedied. Irregularities noticed in any boiler during the time it is on the load should be noted in the log in order to be sure that they are taken care of when the boiler comes down for cleaning or repairs.
17. A plant should at all times be clean. A dirty and ill-kept plant is virtually always an inefficient one. A clean plant not only indicates that the plant is being cared for but that the man in charge is trying to run the plant efficiently.

Union Electric Light & Power Co., E. H. TENNEY,
St. Louis, Mo. Chief Engineer of Power Plants.

Meter Block Which Speeds Testing

MORE than 100 per cent increase in speed of meter testing with the same number of men has been accomplished through the use of the meter test block illustrated, which has been developed by the Connecticut Light & Power Company. This rapid testing is made possible by the spring connection block, which automatically makes the proper connections when the meter is put down on the three prongs shown in Fig. 1.

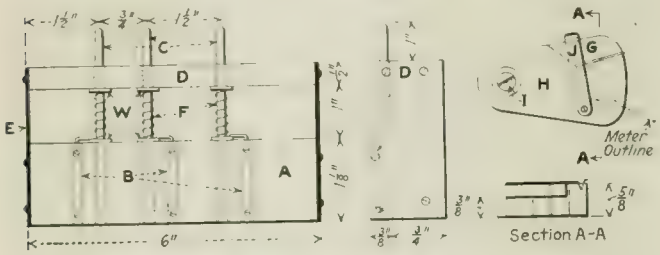
The test block is of wood drilled to receive three rods and three single-screw connectors, *B*, so that the screws



CONNECTIONS ARE MADE BY SETTING METER DOWN ON THREE SPRING PRONGS

are accessible for connection between the leading-in wires and the rods. The rods, *C*, may be taken from a discarded meter but they must be straight. A piece of fiber or hard wood, *D*, is drilled so that the rods make a sliding fit, and all holes should be drilled on a drill press as it is difficult to get them straight and parallel with a breast drill. *E* shows end pieces cut from an old

meter disk; *F* shows springs to hold the rods tight against the meter screws—each spring acting against two washers, *W*, the upper one soldered to the rod, the lower one soldered to the connecting wire, allowing the rod to slide through. To hold the meter solid a split block is used instead of hanging the meter on a screw.



DETAILS OF SPRING-CONNECTING PRONGS AND METER-HOLDING BLOCK

This is shown in Fig. 2 and is of hard wood in two parts *G* and *H*. Part *G* is fastened to the test board, while part *H* revolves around the screw *I*, being held in place when closed by a spring *J*, which snaps over part *G*. The spring is fastened solidly to piece *H* and does not move relative to it. Lamps used for loading the meter are placed back of the board.

In operation a meter is placed on the block so the rods enter the terminal holes, *H* is swung down and the spring *J* snapped over part *G*. The service switch *S* and the double-throw switch at the left are closed, the latter to the left for light load and to the right for full load. This method may be used with any rotating standard, but in case the standard has a switch for changing current coils, a jumper is placed across 1 and 10 on the test board, when the procedure is as outlined above.

This board was designed for General Electric type I-14 and Fort Wayne K-5 meters, which are the meters most commonly used by this company. Other meters are hung from a screw and flexible leads are brought to them, but if desired a similar block might be built to fit any type of meter.

D. A. McNULTY
Waterbury, Conn.

Effects of Multiple Grounds on Transmission Systems

THOUGH engineers have generally agreed that grounded neutrals are advisable for transmission and distribution systems, the value of more than one ground is not clearly understood. The principal reason for multiple grounds is, of course, to insure that even if part of the system is cut off by trouble or otherwise, the remainder of the system will still have a grounded neutral. It also has the effect of reducing the length and impedance of the path for the short-circuit current and insures that the grounded line is brought to approximately zero potential from an accidental ground. The ground current is likely to cause telephone interference in case of short circuit, whether one or more than one grounded neutral is used, but a ground on an isolated system will also have the same effect. Fear of telephone interference under normal operation has undoubtedly been a factor of some importance in discouraging the use of more than one neutral ground.

If the low-voltage side of the transformers is connected delta, troubles from this source are not probable, although there have been some cases reported in which even with this delta winding neutral currents have circulated of sufficient magnitude to cause serious disturbance. A circulating current could be produced from one of three causes: (a) An unbalanced voltage due to a difference in the three legs of the transformer; (b) an unbalanced current due to a single-phase load, and (c) a difference in the characteristics of the transformers or generators at each grounding point, resulting in a small residual third-harmonic voltage.

In case "Y-Y" transformers were used with grounded neutral and there was a delta-Y bank on the system also with grounded neutral, then there would be a tendency for the third-harmonic magnetizing current of the "Y-Y" bank to circulate between the two banks of transformers. If the "Y-Y" transformer is a three-phase, three-legged core-type unit, the third-harmonic magnetizing current will be greatly reduced, and hence also the circulating current that can be obtained. A number of transmission systems are operating with more than one neutral ground, but the evidence as to the value of such operation and as to the danger of telephone interference is not at all conclusive. Where there are so many variables actual experience is an extremly valuable supplement to purely theoretical considerations in determining to which of the many factors the most weight must be given.

ROBERT TREAT,
Engineer Power and Mining Department,
General Electric Company,
Schenectady, N. Y.

Determining Average Fuel Cost in Combination Coal and Oil

MIXED plants burning both coal and fuel oil bring to the power-station accountant the problem of ascertaining the average periodical cost of fuel, whether monthly or otherwise. An example of an unusually clear-cut computation of this kind is afforded by a central station whose April, 1920, generated output was 13,771,680 kw.-hr. and which burned during the month 418,506 gal. of oil and 10,578.11 tons of coal. The method of determining the fuel cost follows:

		Per Ton	Tons	Cost
Coal on hand, April		$8 651	17,338 64	$150,013 27
Coal received during April			9,018 15	73,958 54
Total			26,356 79	$223,971 81
Weighted average price per ton		$8 497		
Price adjustment for heat units, including oil		10 443		
Delivered to bunkers, burned in April			10,578 11	$89,882 20
Oil burned during April			2,015 51	12,570 01
Coal equivalent at $6 236*		$8 135	12,593.62	$102,452.21
Handling, storage, etc	$3,024 85	0 316		
Losses	322 60			
Insurance	173 92	0 099		4,396 45
Interest	875 08			
Carrying charges (coal)	$4,396 45			
Cost delivered to bunkers (burned in April)		8 550		$106,848 66
Price adjustment for heat units, including oil†		0 443		
Cost per ton		$8 993		

* The coal equivalent is obtained as follows: Gallons oil burned, 418,506, pounds per gallon, 7.951; B.t.u. per pound oil, 18,497; B.t.u. per pound coal, 13,633; cost of oil burned, $12,570.01. 418,506 × 7.951 × 18,497 ÷ 13,633 = 4,514,745 or 2,015.51 coal-tons. $12,570.01 ÷ $2,015.51 = $6,236, cost of oil per coal ton.

† Adjustment for heat units, including oil: Tons coal burned, 10,578.11; heat unit adjustment for coal per ton, $0.528; total tons both coal and oil burned, 12,593.62.

(10,578.11 × 0.528) ÷ 12,593.62 = $0.443

Adjustment for heat units, including oil: Tons coal burned, 10,578.11; heat unit adjustment for coal per ton, $0.528; total tons both coal and oil burned. 12,593.62; (10,578.11 × 0.528) ÷ 12,593.62 = $0.443.

Industrial Applications

The Economical Utilization of Electrical Energy
in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

Two Motors Connected in Parallel Drive Same Load

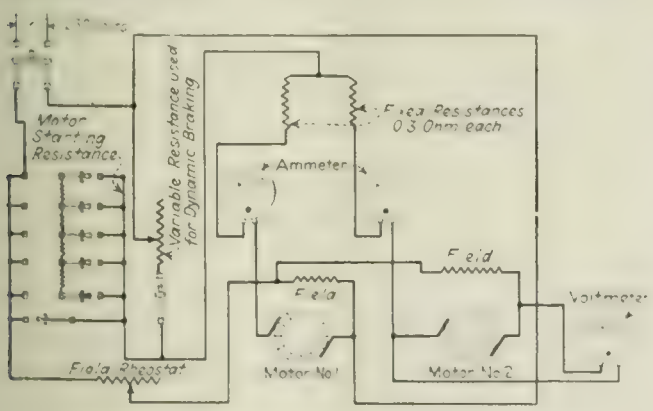
BY INSERTING resistances in series with the armatures of two machines shown in the drawing they were made to drive the same shaft without trouble. These two 20-hp., 230-volt, 1,200-r.p.m. shunt motors were connected in multiple with the fixed resistance of 0.3 ohm in each armature circuit. One field rheostat was used to control the field circuits of both motors. A variable resistance was so arranged that it could be used for dynamic braking. Even distribution of the load between the two motors was obtained by trial by shifting the brushes of one of the motors. The readings of the motors after adjustment were:

	Motor No. 1		Motor No. 2	
	Armature Volts	Armature Amp	Armature Volts	Armature Amp
No load	232	8.7	232	10.7
Half load	217	49.0	217	49.5
Full load	192	99.0	192	91.0

Line volts, 235

The low voltage across the motors at full load was due to the resistance in the armature circuit.

It was necessary to use two motors on this drive as the pulleys available were not large enough to transmit



TWO MOTORS OPERATED SATISFACTORILY IN PARALLEL WHEN CONNECTED AS SHOWN

the power through a single drive. Probably two 115-volt motors connected in series would have been preferable to connection used, but no such motors were available.

Ampere, N. J. EUSTACE C. SOARES.

Pointers on Maintenance and Use of Edison Batteries

KEEPING the battery temperature below 115-deg. Fahr. (46-deg. C.) during charge and maintaining proper height of electrolyte are the most important requirements for satisfactory operation of alkaline, or Edison, storage batteries. For highest efficiency the temperature of charge and discharge should take place between 75 deg. and 115 deg., the maximum being at 95-deg. Fahr. (35-deg. C.).

Batteries may be charged by either the "constant-current" or the "tapering-current" method. In using the constant-current method, if the battery is totally discharged, recharge at the normal rate for seven hours; if half discharged, recharge at normal rate for one-half of seven hours, etc., in proportion. If the extent of the previous discharge is unknown, charge at normal rate until the voltmeter reading has remained constant for thirty minutes, at about 1.8 volts per cell, with normal current flowing. The use of an ampere-hour meter on each battery is recommended. It should be set to operate 20 per cent slow on charge.

If the tapering current method is used, the rate should be set high enough above the normal (about 50 per cent above in most cases), so that as it decreases owing to the rise of battery voltage it will average normal. The time should be the same as though the rate were constant at the normal value. By this method the rate will automatically taper until at the end of the charge it will be considerably below normal.

When a new battery is installed and ready for service, it should be charged for twelve hours at the normal rate. This long charge must be repeated after thirty days' service and again after sixty days' service. Before starting an overcharge the battery should be discharged completely and the solution brought to the proper level.

Provided that the temperature of the solution, in cells near the center of the battery, does not rise above 115-deg. Fahr., the battery may be boosted at high rates during brief periods of idleness, thereby materially adding to the charge. The following figures may be used under average conditions, but values that will not cause excessive heating must be determined in each case by experience:

Five minutes at five times normal rate.
Fifteen minutes at four times normal rate.
Thirty minutes at three times normal rate.
Sixty minutes at two times normal rate.

Frothing at the filler opening is an indication that the boosting has been carried too far (if the solution is at the proper height), and the high rate should be discontinued at once.

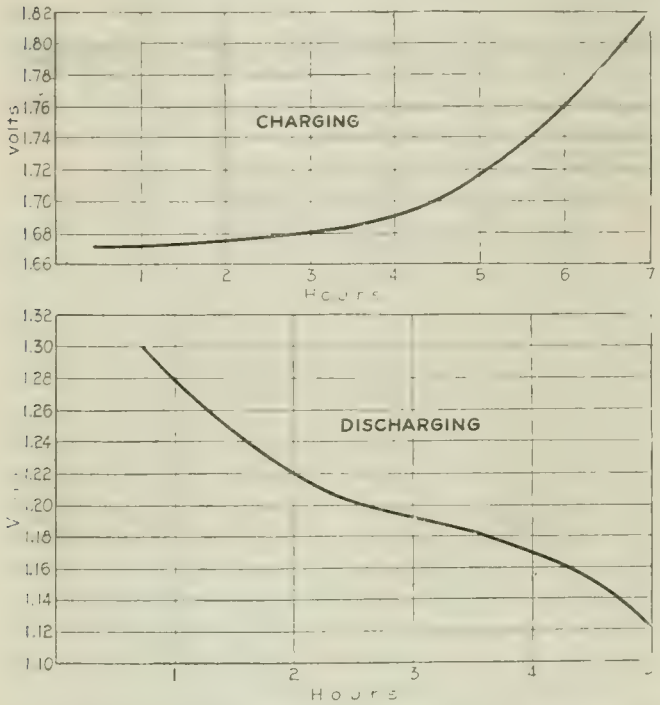
It is not advisable to charge at less than the normal rate except toward the end of a tapering charge.

The Edison storage battery differs from other types in that the ampere-hours delivered are constant, if the entire charge is taken out and the voltage carried to zero, regardless of the rate of discharge. The total energy output diminishes with the rate of discharge owing to the lower voltage at the higher discharge rates.

The capacity for any given rate of discharge varies with (a) the temperature of charge, (b) the temperature of discharge, (c) the length of time the battery stands

idle after charge, (d) the density of the electrolyte, and (e) the age of the battery.

The capacity of the Edison storage battery increases with the number of cycles of charge and discharge through which it passes, up to about the fiftieth cycle, and there remains practically constant until near the



VOLTAGE OF EDISON BATTERY ON CHARGE AND DISCHARGE

Voltage per Cell	Charge Voltage	Discharge Voltage
Half hour	1.67	1.30
One hour	1.67	1.28
Two hours	1.68	1.22
Three hours	1.68	1.19
Four hours	1.69	1.17
Five hours	1.71	1.12
Six hours	1.77	
Seven hours	1.82	

Normal charging time, seven hours for "A" type, 4.75 hours for "G."

end of the six hundredth cycle, after which it begins to diminish gradually. An important characteristic of this battery is its ability to store a considerable amount of energy in excess of the normal capacity if a prolonged overcharge be given it. This excess may amount to as much as 40 per cent of the normal battery capacity. It is the opinion, however, that continual rapid rate of charging will reduce the life of the battery 50 per cent.

If a battery is charged by the tapering-current method, watering will usually be required about once a week in normal operation. If a constant current is employed for charging, watering may be required about twice a week. If this is found insufficient, it is an indication that the battery is being charged too much.

The proper height of the solution is ½ in. (1.2 cm.) above the plate tops. A battery should never be watered while it is on charge because of the false level produced by the gassing. Only pure distilled water should be used for replenishing. However, when solution has been spilled standard renewal solution may be added. The normal strength of solution is about 1.170, as measured by hydrometer, but may at times be as high as 1.190. In time it becomes weak, and if when tested after a full charge the specific gravity is found to be 1.130 or less, the cells should be entirely emptied and refilled. This will usually be required after about twelve months of daily service, but the period may be longer or shorter. Before measuring the specific gravity of the solution in a cell always make sure that it is filled to exactly the proper height, otherwise a misleading reading will be obtained. Do not pour out the old solution until you have received the new, and never allow cells to stand empty. When ready to refill, first discharge the battery completely, then remove the old solution.

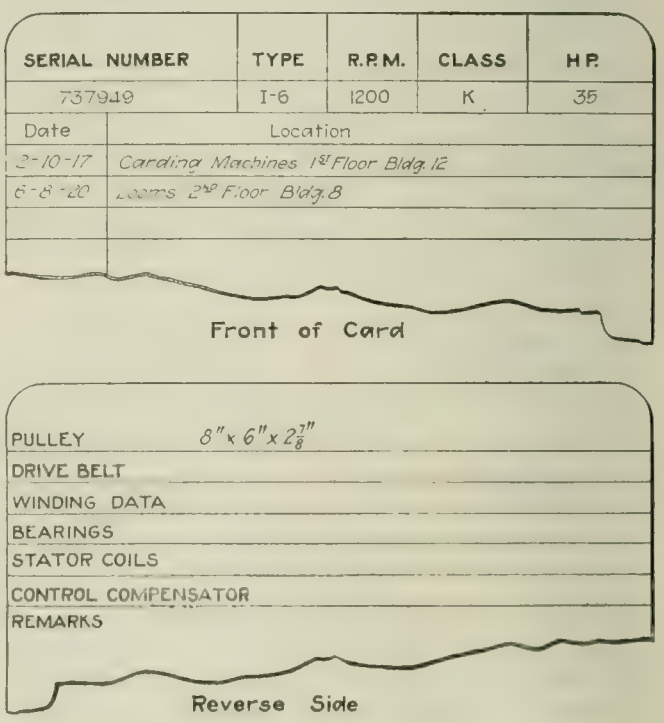
If a battery falls off in capacity after eight or more months of use, it is usually an indication that the solution needs to be changed. Solution renewal, followed by three or four charges and discharges in regular service, should restore the capacity.

The cells, trays and battery compartment should be kept dry and care taken that dirt and other foreign substances do not collect at bottom of or between cells.

Chicago, Ill. ANDERSON PACE.

Card Record Saves Time in Motor Maintenance and Installation

ORDERING of repair parts and rearrangements of and additions to the equipment of the McCleary, Wallin & Crouse carpet-manufacturing plant are facilitated by the use of card records of motors. Two cards are kept for each motor installation, one card listing the data in connection with the motor itself and the other containing data regarding the application of the motor. The cards are filed in groups according to the motor sizes, and in each group the cards are filed with motor serial numbers in order. The two cards are pinned together, and when a motor is moved from one



A TIME-SAVING CARD RECORD

A card similar to this is filled out for each motor in the plant, and a second card contains a diagram of the shafting and pulleys driven by the motors.

location to another the layout card, showing the application of the motor, is changed from one motor card to the other and the change is also indicated on the motor card. All shutdowns of the motors, together with the cause and duration, are noted on the individual motor cards.

Amsterdam, N. Y. A. R. McDONALD.

Reconnecting 220-Volt Compound Motor for 110 Volts

A 220-VOLT, six-pole compound motor was recently changed for 110-volt operation by a New York repair shop by changing the commutator pitch as described below. Without disturbing the armature winding it was found that the armature had 79 slots and 158 commutator bars, the pitch of the coils being 1-14 and the pitch of the leads on the commutator 1-54, forming a single-series progressive winding. The coils were one-turn strap copper, therefore the coils could not be connected with half the number of turns. Changing from wave to lap winding could not be done on a six-pole motor as a six-pole lap winding has six paths, whereas four are required. The last recourse was a double (four-circuit) wave winding, which was secured by changing the lead pitch to 1-53, which gave a series of three coils ending two bars behind the bar started on, the coils connecting to bars 1-53- 105- 157. This made a double-wave, retrogressive winding with four paths instead of two, which halved the voltage and doubled the current-carrying capacity of the armature, as was required.

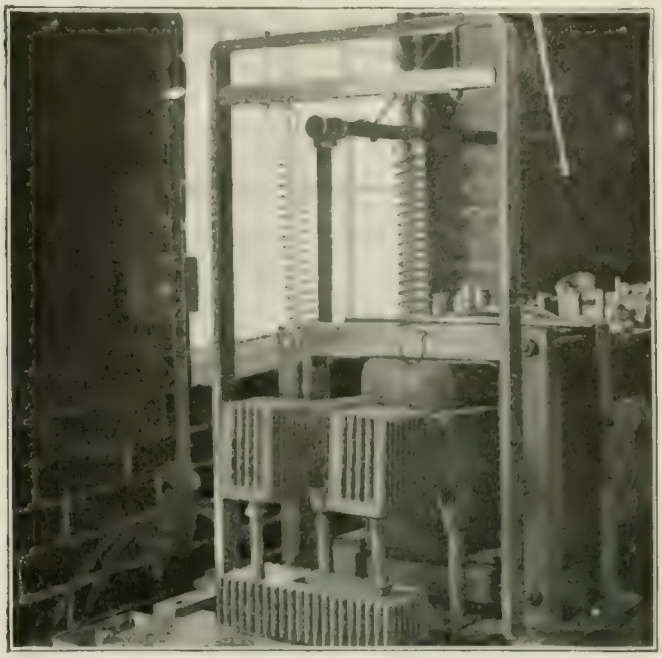
To make this change all the top leads were raised out of the commutator necks while the bottom leads were not disturbed. The armature was then reconnected, with a lead pitch of 1-53. The shunt field coils were paralleled, giving three coils in series per path. New brushes, brush holders and series coils were ordered from the motor manufacturers. The brushes were ordered to be twice as thick as the 220-volt brushes, or wide enough to cover two bars and two-thirds.

The armature leads had to be reversed to obtain the right direction of rotation and give cumulative compounding on account of changing the wave winding from progressive to retrogressive, which changes the polarity of the brushes in a generator and changes the direction of rotation of the armature in a motor.

The motor was repaired within four days and has operated satisfactorily ever since. C. A. JOHNSON.
Bronx, N. Y.

Machine Electrically Heats Rivets in Series

AN ELECTRIC heater which sends current through rivets in series is in use at the factory of the Pratt & Cady Company, Inc., Hartford, Conn. The machine is designed to heat two rivets at once, and whenever the hot rivet is withdrawn for driving the circuit is broken through the remaining rivet. The time interval which thus elapses until a cold rivet can be inserted allows a soaking period in which the heat in the remaining rivet is diffused, and this results in a more uniform heating when the circuit is again completed. As appears from the accompanying photograph, energy passes through the rivets lengthwise. The shanks are uniformly heated throughout their length, and the heads, being of larger cross-section, need not attain so high a temperature as the shanks. The riveter will accommodate rivets up to 5 in. (12.5 cm.) long without adjustment and has a capacity of 75 lb. (34 kg.) of rivets an hour. Energy is supplied from a shell-type transformer with a one-turn secondary, with primary-tap switch voltage control to permit different lengths to be handled at the proper heats. Power is used only when heating rivets. In continuous operation from 3 lb. to 5 lb. (1.5 kg. to 2.3 kg.) of rivets can be heated per kilowatt-hour of energy input, and on a recent test 500 ½-in. x 1¼-in. (1.2 cm. x 3-cm.) rivets were heated



AVERAGES 4-LB. OF RIVETS HEATED PER KILOWATT-HOUR

per hour with a demand of 15 kw. and an energy consumption of 10.5 kw.-hr. ALEX. STIRLING,
Pratt & Cady Company, Inc., Plant Engineer.
Hartford, Conn.

Classified Causes of Electric Crane Shutdowns

REASONS for breakdown of cranes which indicate the relative attention that should be given to different crane parts are shown in the following table, compiled from six weeks' operation of fifty-six cranes in the Fore River shipyard. It will be noted that just 30 per cent of the trouble occurred in the controllers and about 18 per cent in the motors, while mechanical trouble on the brakes amounted to 10 per cent.

CLASSIFICATION OF EIGHTY CRANE BREAKDOWNS, FORE RIVER SHIPYARD, IN MAY-JUNE, 1920
(About Six Weeks, Fifty-six Cranes)

	No.
Brake trouble (mechanical)	8
Broken controller resistance	6
Ground in controller	5
Field-coil failures	5
Ground in motor armatures	4
Crane trolley-wire grounds	4
Broken or loose connection in controller	3
Hoist repairs	3
Broken trolley wheel	3
Broken trolley arm	3
Open circuit in motor	3
Burned-off contact in controller	3
Open circuit in limit switch line	3
Bearing trouble	3
Loose brushes in controller	2
Miscellaneous controller troubles	2
Wheels changed	2
Miscellaneous mechanical trouble	2
Controller open-circuited	1
Armature-coil trouble	1
Loose connection in motor	1
Broken axle	1
Trolley arm bent	1
Control contacts worn	1
Trolley arm disconnected	1
Crane gearing repairs	1
Controller tests	1
Motor fuse blown	1
Cable off sheave	1
Brake coil lead grounded	1
Broken trolley wire	1
Controller drum required changing	1
Open wire in conduit	1
Controller magnet burn-out	1
	80

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

City of St. Louis Street-Lighting Cost Nearly Doubled

THE handicap under which central stations furnishing light or power under long-term contracts have been laboring is shown by the new lighting contract tendered the city of St. Louis by the Union Electric Light & Power Company. The bid submitted represented an increase of approximately 100 per cent. The company has provided and maintained 2,287 arclights in various sections of the city for $49.66 per lamp under a ten-year contract which expired Aug. 28 last. The new rate is $98 per lamp, and the total cost under the new one-year contract will be $223,226, as against $112,672 in previous years.

Investments That Will Reduce Operating Expenses

UNDER present conditions all utilities, and more particularly the electric companies, are forced to adopt any measure which will reduce operating expenses, and it is doubtful if there is any central station which cannot cut its operating expense by the use of the most modern station equipment, large units, underground distribution or high-voltage distribution, according to a statement of G. A. Neal, manager of the Northern Indiana Gas & Electric Company, Michigan City, Ind., before the recent convention of the Indiana Electric Light Association.

The present tendency to postpone improvements until an uncertain future date when they can be made more cheaply than at present is not entirely logical. Improvements which offer a large return should be carefully investigated and made if possible, after establishing that they will be continuous producers of dividends and that the new operating costs plus interest and depreciation charges will be less than present expenses.

With the present outlook for the future any large investment for new equipment should be retired within a short time, or as an alternative the capital investment should be reduced by a sinking fund, over a period of approximately three years, to the average cost for the same equipment during the five-year period from 1914 to 1919. Any improvement which is for continuous use and which can show a return of 33⅓ per cent per year should be carefully considered, as this amount is ample to provide a sinking fund and a suitable return on the investment. In arriving at this percentage it is estimated that money will cost 10 per cent, the depreciation of the equipment purchased will be 10 per cent and the balance of 13⅓ per cent is to be applied to a sinking fund or divided between a sinking fund and interest on the whole property. These percentages are taken very liberally to allow a proper factor of safety to insure the income.

A few examples of the improvements which will often show large returns may serve as a guide in analyzing conditions with a view to reducing costs through new methods and equipment. The following proposals are for central stations having sufficient capacity but operating with a high ratio between cost and expense with costs which are above the average.

1. Can the station load be combined with other loads, either utility, traction or industrial, and one station be closed down? Is it possible to purchase from a reliable transmission line, particularly from a hydro-electric source? If feasible, can the station be salvaged and the money so received be made to cover the cost of proposed improvements? This plan of action has been one of the most profitable procedures.

The solution of this problem has often been the salvation of the small town central station and is now the objective of many companies supplying towns of even 20,000 to 50,000 population. In almost every situation where combinations are possible the concentration of loads into one plant is the economical thing to do, and the final net revenue more than compensates for the increased fixed charges.

2. The average electric utility operates with a loss of "unaccounted-for energy" varying between 10 per cent and 25 per cent. With present busbar costs varying from 1 cent to 4 cents per kilowatt-hour the value of such lost current has become one of the big items—in fact, next to coal the largest in the budget. Because of the reduced capacity throughout the entire system from the generator to the consumer's meter this factor measures more than is apparent upon the expense sheet.

It is possible in some situations to reduce this so-called line loss sufficiently to provide for one or two years' growth without generating additional current. In general this is managed by the use of high distribution voltages, especially for transmitting the bulk of the load, and by improved loading of distribution and station transformers.

3. The cost of handling coal and ashes is usually the biggest single labor item incurred in a central station. The class of help, the urgency with which it is always needed, the fact that such labor, which is highly competitive as to rate, is the basis for all rates in the station, all combine to recommend the use of genuine labor-saving machinery especially adapted to the work. Locomotive cranes, conveyors, industrial railroads, coal crushers, elevated trestles and overhead bunkers are the most prominent items to be considered.

4. The reduction of plant water rates through the use of large turbine units, high vacuum, high superheat, high-pressure steam and electrically driven auxiliaries becomes more important with the high price of coal. The coal price may remain excessive for a long time, and it will be one of the hardest and most expensive obstacles to overcome if rates for service return to the pre-war basis.

Educating Consumers to Best Use of Central-Station Service

ONE of the most effective methods of advertising that the commercial department of the Wisconsin-Minnesota Light & Power Company has found is through the use of stickers on customers' bills. Such stickers as shown here are brief and definite, in con-

In our recent service campaign we asked you to be kind enough to detail the facts covering any faults of the service which you may have observed, or that may have happened to you in your personal use of gas or electricity.

Our inspectors were told to make note of them, and we, on our part, guaranteed that such troubles if they were existing at that time or threatened to exist in the future, would have prompt attention and a successful termination.

It is our aim to have the results of this service campaign continue in effect as part of our present or future service, and we ask you to be kind enough to inform us if any such troubles still exist. If they do, we will give them our immediate attention.

We want you to feel free to call upon us for all of your troubles, especially those of adjustment to appliances, poor supply of gas, high bill complaints, leaks, or any discourtesy which you may experience in contact with the employees of our company.

WISCONSIN-MINNESOTA LIGHT & POWER CO.

ELECTRIC POWER IN INDUSTRY

Ever ready for use at any time of day or night, and with less waste, since it is used only when needed and because the efficiency of electric motors is from 85 to 90 per cent; clean and instantaneous, electric power eliminates all transmission losses by bringing the motor close to the work.

Increased flexibility of both arrangement and operation of machines secured, and you can add small or large units to your plant at will.

Production is increased, speeds are steadier, overhead expense is reduced, both in investment and superintendence, and yet it works overtime without protest and eliminates all other labor troubles in your power department. Requiring no storage, you need not set aside space for it nor worry over a possible shortage. We have unlimited quantities of it and we have expert power engineers, technical men who are accustomed to solve problems like yours. Let us have one of them call on you and examine, free of cost to you, your power situation. Possibly by this co-operation we can be of assistance to you.

TWO STICKERS USED ON BILLS BY THE WISCONSIN-MINNESOTA LIGHT & POWER COMPANY

veying the idea on to the reader. One seeks to encourage consumers in bringing faults of service to the attention of the company for remedy. It is a direct and effective appeal for the co-operation of the customer in removing service troubles. The other shows how the advantages of electric power for industrial uses can be set forth. These appeals are backed by a thoroughly competent organization capable of remedying service troubles or advising the consumer as to the best methods of utilizing electric service. Advertising of any character cannot be effective unless supported by an organization into which the idea of true service has been thoroughly drilled.

Customer-Owners of Byllesby Properties Exceed 24,000

PREFERRED stock sales to customers of the local Byllesby properties during the first eight months of 1920 reached a total of $4,174,500 par value, compared with $3,421,900 for the twelve months of 1919. Separate sales thus far for 1920 number 7,690, the average investment being $543, compared with an average investment of $598 last year. Since the Byllesby companies started to build up customer-ownership in 1915 there have been more than 24,000 local sales, aggregating upward of $13,000,000 par value of the preferred stock of the properties.

In addition to the companies selling their preferred stock direct to their customers, the Mountain States Power Company, Sandpoint, Idaho, is distributing an issue of 8 per cent convertible notes in the community served.

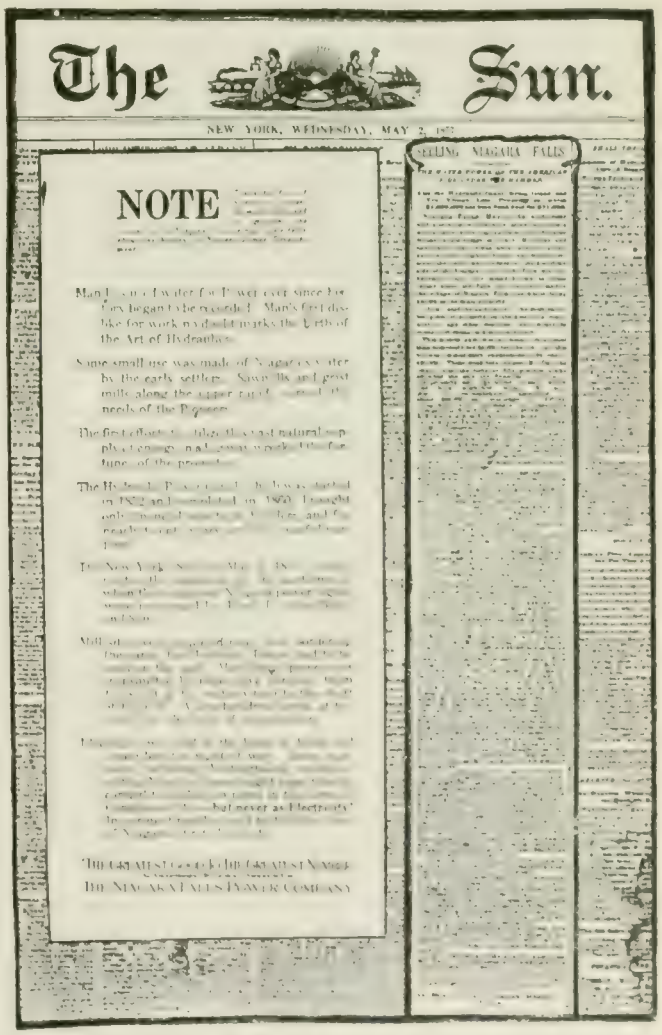
Boston Company's New Business Exceeds Last Year's Record

FOR the fiscal year ended June 22 last the sales department of the Edison Electric Illuminating Company of Boston took 21,771 applications for service, as against 19,272 for the corresponding months of the previous year. There were also approximately 11,000 orders executed for increased capacity, representing a 33 per cent increase in the number of orders issued. The total contracted load for the twelve months' period was 60,760 kw.

The business of the company's sales department this year has been marked by the closing down of several isolated plants, and in recent months contracts totaling over 3,000 kw. were signed with ten large business houses of Boston.

Historical Advertisement of Niagara Power Development

THE accompanying illustration shows the first of a series of advertisements prepared by the Niagara Falls Power Company designed to acquaint the citizens of the territory served with some facts about the history of Niagara power development. This advertisement


The Sun.

NEW YORK, WEDNESDAY, MAY 2, 1877

SELLING NIAGARA FALLS

NOTE

THE NIAGARA FALLS POWER COMPANY

TYPE OF HISTORICAL PUBLICITY

appears with a reproduction of a page from the New York *Sun* of May 2, 1877, on which was related the sale of the water-power rights on the American side of the Falls for $71,000.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Graphical Method for Analyzing the Performance of Cascade-Connected Three-Phase Motors.—J. KOZISEK.—The author derives a straight-line diagram for determinjng the slip in a cascade-connected system, the diagram being applicable whether the second machine be synchronous or induction-motor type or a commutator machine. The method is said to be particularly useful for analyzing the behavior of an induction motor with a shunt-connected three-phase commutator motor in concatenation, it being possible to study the influence of several variables on one diagram.—*Elektrotechnische Zeitschrift,* June 10, 1920.

Design of Commutating Poles in Direct-Current Machinery.—OELSCHLATER.—Although the theory of commutation in direct-current machinery has been carried to a remarkable degree of precision and refinement, the most crude and inaccurate formulas are often used in practice in designing commutating poles. The author therefore has developed—on the basis of accepted commutation theories of Arnold, Niethammer and others—a more accurate formula, giving the needed flux in the commutating poles in terms of the total armature current flow, due regard being given the configuration of the magnetic circuit and other factors of importance.—*Elektrotechnik und Maschinenbau,* June 6, 1920.

Lamps and Lighting

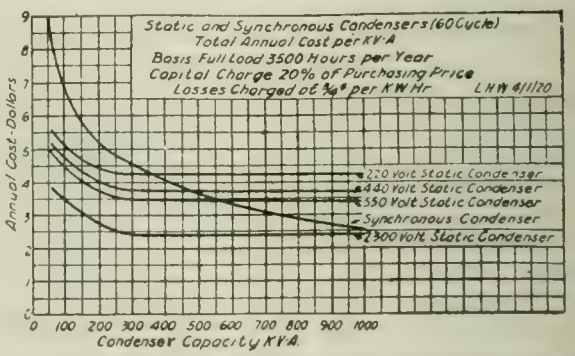
Necessity for Standards in the Relation Between Illumination and Output.—WARD HARRISON.—In order to make tests of the dependence of production upon illumination intensities of value and intelligible, the author specifies what conditions should be fixed upon as governing these tests.—*Transactions I. E. S.,* July 20, 1920.

Maintenance of Indirect Lighting Equipment.—J. L. STAIR.—Among the factors which tend to cause deterioration of an indirect lighting system are said to be the following: (1) Renewal of lamps has been neglected. (2) Cleaning of fixtures has not been taken care of. (3) The color of the ceiling is not proper, or it has been allowed to darken, or has not been kept clean. (4) The position of the lamps in the reflectors is wrong. (5) The suspension of the fixtures is not correct for proper lighting results. (6) The results from the reflector equipment have been ruined by the use of the wrong lamps. A scheme is described wherein a company was formed for the special purpose of maintaining fixtures in office buildings, factories, etc. The average cost for cleaning a variety of types of installations is found to be about 21 cents per fixture per month. This includes cleaning only once a month. Costs for various types of installations vary from 13 to 38 cents for one cleaning per fixture. This fee includes any breakage that might occur to the lamp or to the reflecting equipment during the cleaning operation. Tests made at the Chicago plant of Armour & Company show that the deterioration due to dirt and dust settling on the fixture equipment amounts to about 10 per cent a month.—*Transactions I. E. S.,* July 20, 1920.

Generation, Transmission and Distribution

Application of Mild and Alloy Steels to High-Tension Suspension Lines.—L. R. O'NEILL.—A discussion of the application of stamped and pressed steel units of mild, structural and alloy steel to the suspension problem in high-tension transmission lines. The factors to be considered in the design of hardware for line construction are stated.—*Journal A. I. E. E.,* July, 1920.

Power-Factor Correction on Distribution Systems.—D. M. JONES.—The ill effects of low power factors on distribution systems are pointed out and some of the causes to which low power factor can commonly be traced are given. The writer then takes up methods of remedying low power factor and in particular gives the characteristics of synchronous condensers, static transformers and overexcited synchronous motors.



CHOICE BETWEEN STATIC AND SYNCHRONOUS CONDENSERS

Curves giving the annual cost of various power-factor corrective devices applied under definite conditions are given in this article. One showing when it is economical to use static condensers and when synchronous condensers is reproduced here.—*Journal A. I. E. E.,* July, 1920.

National Fuel Economy and the Government Super-Power Station Scheme.—DAVID BROWNLIE.—The writer attacks the British super-power station scheme as being extremely wasteful of a lot of good apparatus which is now in service but which would be scrapped in case the government super-power station scheme were put into effect. He says that, even assuming that the coal consumed annually for power generation should be reduced from 80,000,000 tons to 25,000,000 tons, which he considers doubtful, scrapping of good equipment is not justified.—London *Electrician,* July 2, 1920.

Economy and Safety Are Secured by Use of Aiternating Current Coal Cutters.—CHARLES B. OFFICER.—It is said that savings in equipment cost, in energy expense

and in maintenance charges are secured by the use of alternating-current coal cutters and that greater safety accompanies the use of alternating current for driving undercutters.—*Coal Age*, June 24, 1920.

Traction

A Powerful Three-Phase Locomotive.—Eighteen large electric locomotives have just been completed for the Italian State Railways. These locomotives conform to the following conditions: Line voltage, 3,000 to 3,700; frequency, 15 to 17; number of traction motors, 2; number of driving wheels (coupled), 6; number of bogie wheels, 8; diameter of driving wheels, 1,630 mm.; diameter of bogie wheels, 960 mm. Each locomotive must be able to accelerate a 335-ton train up a grade of 12 in 1,000, with a mean acceleration of 0.042 m. per second from rest to a speed of 75 km. per hour. In order to obtain four running speeds, motors with wound rotors have been adopted, for work in parallel or in cascade. The stator and rotor windings are symmetrical, and at a frequency of 16.7 the following combinations are possible:

Velocity in Kw.-Hr	Number of Poles	Connection of Motor	Synchronous Speed R.P.M.
37.5	8	In cascade	125
50	6	In cascade	167
75	8	In parallel	250
100	6	In parallel	333

The locomotives were furnished by the Brown-Boveri Company of Milan.—London *Electrician*, Aug. 20, 1920.

Installations, Systems and Appliances

On the Necessary Sluggishness of Maximum-Current Relays.—W. HÖPP.—In order that a plant shall be effectively protected against overloads but still not be oversensitive against current rushes of short duration, which may cause unnecessary interruptions if the breakers trip out too quickly, the controlling relays must have certain definite time characteristics. The author concludes that the relays should have a certain sluggishness, and maintains that the best characteristics are obtained in thermal relays, since these physically behave in the same manner as the copper conductors themselves. On the basis of these theories the author has designed a thermal relay made by the A. E. G. The new relay is described in detail, and its construction and action are clearly shown on a number of photos and diagrams. The heater is a metal tube inserted like a fuse in the current path and containing alcohol. One end of the tube is closed by a flexible membrane. When the walls of the tube get hot, owing to Joulean heat, the vapor pressure of the alcohol increases, and the membrane is forced out, thereby actuating a lever which closes the relay contacts.—*Elektrotechnische Zeitschrift*, May 13, 1920.

Electrophysics and Magnetism

Reduction in the Temperature of a Wire When Covered with Insulation.—A. B. EASON.—It is shown in this article that insulation on a wire may help to hold down the temperature of the conductor under load. A conductor may be kept cooler by reason of having insulation upon it, this depending upon the relative thickness of the insulation and diameter of wire, and also upon the material with which the insulation is made. Constants for various insulating material commonly used in connection with cables are given by the writer. —London *Electrician*, Aug. 20, 1920.

Design of Air-Core Inductance Coils of Minimum Weight for a Given Weight Inductance and Resistance. —C. O. GIBBON.—The writer states that the calculation of inductance and resistance of any air-core inductance coil is a simple matter, but to design a coil which shall have any preassigned values of resistance and inductance, with this added condition that the coil have minimum possible weight, is a problem that prevents no little difficulty. He undertakes the development of formulas for this purpose.—*Journal A. I. E. E.*, July, 1920.

Units, Measurements and Instruments

Method for Measuring Dielectric Losses in High-Tension Apparatus.—A. SEMM.—Upon a suggestion by Dr. Schering, the author employed the following bridge arrangement: The bridge contained, in order: A standard high-tension air condenser, a resistance with a small condenser in parallel, a pure standard resistance and the imperfect condenser to be investigated. A vibration galvanometer was connected across the two resistance arms, while the common point of these arms was grounded. Alternating voltages up to 100 kv. could be impressed between ground and the point common to both condensers. As examples of the results obtained, the author presents curves of losses as a function of voltage for a 5-m. piece of high-tension cable and for a 50-kv. transformer bushing.—*Archiv für Elektrotechnik*, April 15, 1920.

Telegraphy, Telephony and Signals

Duplex Wireless Telephony.—P. P. ECKERSLEY.—The paper deals with experiments on duplex wireless telephony for aircraft carried out at the wireless experiment establishment of the Royal Air Force of Great Britain.—London *Electrician*, Aug. 20, 1920.

Overstresses Due to Resonance Phenomena in High-Tension Direct-Current Machines for Radio Spark Transmitters.—K. W. WAGNER.—In the Königswusterhausen radio station a 10,000-volt direct-current machine is used, in connection with a storage condenser and a spark gap, for energizing the antenna. The spark frequency is determined by a condenser which is reversed by a commutator, causing one train of waves for each reversal. The direct-current machine, although protected by choke coils, broke down after a short run, and when the machine was replaced the same thing happened over again. This caused an investigation, which is described in detail by the author. In a series of very instructive oscillograms a peculiar resonance phenomenon is demonstrated. When the spark frequency reaches a certain critical value oscillations build up in the machine and the terminal voltage takes on dangerous values. Secondary, tertiary and other resonance points were observed when the spark frequency reached such values that the successive overtones in the zigzac voltage curve of the storage condenser resonated with the machine circuit. Having thus found the root of the trouble, it was easy to prescribe remedies. Choke coils were built in several series divisions to prevent puncture and were given such inductance that the resonance points did not fall within the operating range of spark frequency. The machine has since been running along for months without giving any signs of trouble.—*Elektrotechnische Zeitschrift*, July 29 and Aug. 5, 1920.

BASED on tonnage, electrically driven steel mills are rapidly equaling those operated by steam, according to statements made at the New York City convention of the Association of Iron and Steel Electrical Engineers.

WHILE unfair regulation may impair temporarily the earning power of public utilities, it cannot destroy the investment, declared Samuel Insull before the Chicago Association of Credit Men, in an outline of the elements of public utility credit.

APPOINTED by Governor Coolidge to assist Fuel Administrator Storrow in handling the fuel problem in Massachusetts, David A. Ellis of the Department of Public Utilities of that state declares that exportations of coal should be limited to those of former years.

AN INCREASE in the common stock of the Westinghouse Electric & Manufacturing Company from $75,000,000 to $125,000,000 and authorization of an increase of $30,000,000 in the company's debt will be voted on by the stockholders on Nov. 18.

ELECTRICAL exports for July are $500,000 ahead of July last year. For the first seven months of 1920 they reached a total of $53,000,000, or 2½ per cent below the figures for the corresponding period last year.

PLANS for the first meeting of the American Engineering Council of the Federated American Engineering Societies, to be held Nov. 18 and 19, are in process of formulation.

AN APPEAL has been made to its customers by the Milwaukee Electric Railway & Light Company to curtail their consumption of energy until the new plant of the company is ready for operation, which, it is thought, will be the first of the year.

ELECTRIFICATION of government-owned railroads at Rio de Janeiro, Brazil, is to go ahead, an appropriation for that purpose having been made.

AS ANTICIPATED, the coal-car priority order was continued and the New England order canceled by the Interstate Commerce Commission. The requirement that wagon mines must load from private tracks and from overhead loading devices was abolished and a general condition inserted that all cars must be loaded within twenty-four hours.

JOBBERS' stocks are now augmenting rapidly, and the problem presents itself of handling increasing inventories at a time when most of those connected with the industry think stocks should be reduced.

IMPROVED buying is reported from New England and there is also more business in the Middle West. In other sections, however, no increase is apparent. Fears for the cotton crop are expressed in the South based on adverse weather. The Intermountain States report excellent crop conditions. Low water supply has forced a return to war-time restrictions on the use of power in the San Francisco district. Collections are generally slow, deliveries improved and labor conditions more settled, but building is at a low ebb.

News in Brief

Summary of Market Conditions and of Recent and Approaching Happenings of Importance to the Industry

GUARANTEES from electrical manufacturers against declining markets are being asked by jobbers and dealers both in the East and the West. The whole subject of price guarantees is to be taken up at a hearing by the Federal Trade Commission at Washington, D. C., on Oct. 5.

A MONTHLY circulation of 1,000,000 has been reached by the "Kilo Watt" educational pamphlets sent to member companies by the National Electric Light Association.

ELECTRICAL manufacturers are mapping out a program of publicity to create public good will for the industry, working in connection with the publicity department of the N. E. L. A.

AN application for a project works license on the Deschutes River, Oregon, is the first application to be absolutely complete under the water-power law.

THE Railroad Commission of North Dakota has adopted the provisions of the National Electrical Safety Code referring to transmission-line construction and also the regulations governing inductive interference enforced in California.

TWO MILLION dollars' worth of preferred stock have been sold within the last two years to customers of the Central Maine Power Company.

EXHIBITS at the New York Electrical Show, to open Oct. 6, will number 141, or 48 per cent more than last year.

INDUSTRIAL business and merchandising will be the topics for discussion at the Baltimore convention of the National Association of Electrical Contractors and Dealers to be held Oct. 4-9.

VISITS to the Nela Park laboratories of the General Electric Company and to a number of power plants where electrochemical processes are employed will be features of the American Electrochemical Society's meeting in Cleveland from Sept. 30 to Oct. 2.

AT THE first annual convention of the Rocky Mountain Geographic Division of the N. E. L. A. at Glenwood Springs, Col., E. A. Phinney of Golden, Col., was elected president and A. C. Cornell of Denver secretary.

A PUBLICITY campaign to promote a better understanding of the jobber's functions has been started by the Electrical Supply Jobbers' Association.

A MESSAGE to the people of Indiana outlining central-station needs if high-class service is to be maintained was adopted by the Indiana Electric Light Association at its French Lick Springs convention.

FOR THE first time in the history of the New England Geographic Division, N. E. L. A., leaders in the manufacturing, jobbing and contractor-dealer branches of the industry united with the central-station men in plans for promoting progress when the division met at Kineo, Me., last week. Bowen Tufts of Boston was elected president.

A DRAFT of a uniform system of accounts for electric light companies and also one for gas companies were completed by the committee of statistics and accounts of public utilities of the National Association of Railroad and Utilities Commissioners at its recent Chicago meeting.

POLITICAL agitation on behalf of the state development of water powers is beginning in Maine in anticipation of the coming legislative session, but thus far popular opinion appears indifferent.

NEW ENGLAND electrical manufacturers are separately embarking upon vigorous though independent campaigns against excessive expenditures in production operations. Inefficient labor is being weeded out, and the improvement lately noted in labor relations is being well maintained.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

First Water-Power Application to Be Completed Filed for Deschutes River

THE first application to be absolutely completed and perfected so as to conform with the regulations which have been issued by the Federal Power Commission is that of the Columbia Valley Power Company, which plans project works on the Deschutes River in Oregon. This application was among the latest received and was applied for in person by C. D. Charles of Denver. The fact that Mr. Charles had all the necessary data in his possession enabled him to make out, with the assistance of Col. William Kelly, the engineer officer of the commission, an application which conforms in all particulars to the regulations. In each of the other applications which have been made certain information still is lacking as most of these applications were made before the regulations were issued. The application of the Washington Irrigation & Development Company for a preliminary permit to erect important project works on the Columbia River will probably be completed in all particulars in the next few days.

Coal-Car Priority for Utilities Continued in Separate Order

ASSIGNED cars for public utilities were continued last week by the Interstate Commerce Commission in Service Order No. 16. This order separates the authority for giving assigned cars to public utilities from that giving the coal mines the first call on open-top cars. This change was requested by the coal operators in the expectation that it would be possible to do away with the assigned cars before the commission would be justified in revoking the open-top priority. As the orders now stand one can be changed without reference to the other.

The new public utilities order defines precisely the activities entitled to come under the order, it having been charged that the old order was being abused. Assigned cars were being used, it is alleged, to carry coal to the plants engaged in the manufacture of public utility equipment.

The pertinent part of the new public utilities order reads as follows:

It is ordered that, effective Sept. 19, 1920, and until further order of the commission, all common carriers by railroad within said territory to the extent that may be necessary in order that public utilities which directly serve the general public under a franchise therefor with street and interurban railways, electric power and light, gas, ice, water and sewer works, also ice plants which directly supply the public generally with ice, also hospitals, schools and other public institutions of the United States, state or municipal governments, may be kept supplied for current use but not for storage, exchange, or sale, be, and they are hereby authorized to place, furnish and assign cars to coal mines for the transportation of such coal in addition to and without regard to the existing ratings and distributive shares for mines upon said railroads; provided that no cars shall be so placed, furnished or supplied by any such carriers without written application therefor, showing that such coal is needed solely for the current use of the applicant and not for storage, exchange or sale, in order that applicant may continue its public service in daily operation; which application, in the case of public utilities not owned by some government agency, shall be approved by the public service commission or railroad commission of the state in which said plant is located if there be one, and all such applications shall be concurred in by the delivering railroad; and provided further that such coal shall not be subject to reconsignment except to public utilities or public institutions as above described, and that a written report of the cars placed hereunder shall be made to the Interstate Commerce Commission by the railroad placing the cars as often as once each week.

Samuel Insull Outlines Elements of Public Utility Credit

SAMUEL INSULL in an address on the stability of utility investments, made on Tuesday evening before the Chicago Association of Credit Men, traced the rapid expansion of the utilities of Illinois—that is, gas, electric, railway and telephone—from 1902, when the gross investment was $375,000,000 and the gross revenue $48,000,000, to the present time, when the investment totals $1,200,000,000 and the yearly income $250,000,000. The utilities have approximately 100,000 employees in Illinois, Mr. Insull said, and their securities are held by 275,000 individual owners, not counting those who are owners indirectly through securities held by banks, insurance companies and other trusts. These security holders with their families constitute about one-sixth of the state's population.

The utilities of Illinois alone require about $100,000,000 of new investment each year to cover plant extension and other construction work necessary to meet the service requirements of the communities in which they operate. The foregoing facts and figures, Mr. Insull pointed out, emphasize the fundamental importance of permitting utility companies to be operated on a basis that will maintain their credit. Otherwise they cannot secure the new capital required from year to year to meet the service needs of the public. The speaker particularly emphasized the point that the owners of utility securities are not the only ones who suffer when this credit is impaired. It is the public that suffers in the long run; because the service necessarily runs down when utility companies are required to operate under conditions that are adverse to a high degree of credit.

The first requisite of maintenance of utility credit, Mr. Insull asserted, is the administration of utility regulatory powers by state commissions or other official bodies on a fair and businesslike and non-political basis. When partisan or factional politics enters into utility regulation steady development of utility facilities and

service is shackled. The utilities suffer and the public which they serve is in the long run the victim. Mr. Insull also pointed out how sane regulation, wherever applied, has eliminated the watered-stock and overcapitalization bugaboos. In Illinois, under the public utilities act, the value of a utility company's property, not its capitalization, is the basis of rate making. The capitalization gets no consideration unless it is, and only so far as it is, backed by property value. The steam railroads, he said, offered evidence of how the terms "watered stock" and "overcapitalization" have been overworked. The property of the steam roads of the country is now being valued by the Interstate Commerce Commission, and Mr. Insull said he thought it significant that, in every case of valuation thus far finished and made public—at least in all cases that had come to his notice—the value of the property was found to be greater than the total capitalization of the road. He believed the utilities of Illinois, if fairly valued, would make even a better showing.

Public utility securities are, therefore, among the most stable of investments, Mr. Insull declared, because they represent actual physical investment.

Cleveland Electrochemical Meeting of A. E. S. Will Be Full of Interest

A WELL-FILLED program has been arranged for the thirty-eighth general meeting of the American Electrochemical Society, to be held at the Hotel Statler, Cleveland, Ohio, from Sept. 30 to Oct. 2. Visits will be made to the Nela Park laboratories of the General Electric Company, where there will be talks by Dr. Eugene Fox Nichols, director of pure research, and by Ward Harrison, as well as an opportunity to inspect departments in which individual delegates may be especially interested, and to various industrial plants in the city where electrochemical processes are employed. An entertainment program for ladies accompanying the delegates, a smoker tendered by the National Carbon Company and an informal subscription dinner and dance will be among the other features of the gathering in addition to the business program.

Agreement Reached on Standard Accounting Classifications

THE committee on statistics and accounts of public utilities of the National Association of Railroad and Utilities Commissioners at a meeting in Chicago held Sept. 12-18 completed its draft of a uniform system of accounts for electric light and power companies and also a uniform system for gas companies. These systems of accounts have been prepared with the aid and co-operation of the accounting committees of the National Electric Light Association and the American Gas Association.

The meeting was the final one of a series of this joint committee, appointed as a result of action taken at the last convention of the commissioners' association. Agreement was reached by the committee upon practically all points involved, and the representatives of the commissioners who were present are now framing their report to the general standing committee on statistics, which will report upon the matter to the next convention of the commissioners' association in November. At that time it is expected that final action will be taken.

N. E. L. A. "Kilo Watt" Publicity Going Strong

THE monthly "Kilo Watt" educational pamphlets now being furnished member companies by the National Electric Light Association are having a large demand. Orders now on the books give to these pamphlets a monthly circulation of 1,000,000 copies, which go to electric light customers. This is in addition to the circulation gained through publishing the series in the local newspapers as some companies are doing.

Westinghouse to Increase Capital

AN INCREASE in the common stock of the Westinghouse Electric & Manufacturing Company from $75,000,000 to $125,000,000, and of $30,000,000 in its indebtedness, will be voted on by the company's stockholders at a special meeting on Nov. 18. The need for additional working capital to carry on the enormously increased business is given as the reason.

The manner in which the new stock and the obligations to be authorized are to be issued is not set forth in the announcement by the company. It is expected that after the ratification of the proposal convertible notes, not more than $30,000,000 in amount, will be issued. These notes probably will be short-term obligations, carrying privileges of conversion into common stock. That some of the new stock to be issued will be sold to the company's employees is indicated.

"The growth of the electrical manufacturing business," says Guy E. Tripp, chairman of the board, in a letter to the stockholders, "has been phenomenal. Since 1914 the capacity and output of the company's plants have about doubled, while by reason of increased costs and prices the volume of sales has almost quadrupled. The amount of unfilled orders on the company's books at the present time exceeds $95,000,000, an increase of about $24,000,000 in five months. This volume of business, coupled with the increased prices of labor and raw materials, requires a substantial increase in the company's capital to enable it to carry enlarged inventories and the increased volume of customers' accounts."

The company's report for four months ended July 31 shows net profit from operations of $4,726,555.70 against $2,019,523.92 in the corresponding period a year ago. Its other income was $402,533.15 against $473,195.73 and its interest charges $364,886.02 against $558,638.64, leaving a net income of $4,764,202.83 against $1,934,081.01.

Rocky Mountain Division, N. E. L. A., Completes Organization

AT THE first annual convention of the Rocky Mountain Geographic Division of the National Electric Light Association at Glenwood Springs, Col., on Tuesday of last week the preliminary steps taken toward organization at the Pasadena convention last May were ratified and officers elected. Routine business to enable the division to become active was dispatched, and a program for harmonizing the work of the division with the various state associations was mapped out. Officers were elected as follows: President, E. A. Phinney, Golden, Col.; first vice-president, E. P. Bacon, Casper, Wyo.; second vice-president, Arthur Prager, Albuquerque, N. M.; third vice-president, D. C. McClure, Denver; secretary, A. C. Cornell, Denver.

First Meeting of American Engineering Council of The Federated American Engineering Societies

NOV. 18-20, 1920

Headquarters, New Willard Hotel, Washington, D. C. All Sessions in the Small Ball Room

PROGRAM

THURSDAY, NOV. 18, 1920

Morning Session

8:30 a.m. Registration.

10:00 a.m. Opening Session of American Engineering Council.

1. Call to Order, Richard L. Humphrey, chairman joint conference committee, consulting engineer, Philadelphia, Pa.
2. Election of temporary chairman.
3. Election of temporary secretary.
4. Appointment of temporary committees: (a) Program. (b) Credentials. (c) Constitution and by-laws. (d) Nominations. (e) Plan and scope. (f) Budget. (g) Resolutions.

Afternoon Session

2:00 p.m. Address—"Engineering Council," by J. Parke Channing, chairman, consulting engineer, New York, N. Y.

2:30 p.m. Discussion of the field of activity for The Federated American Engineering Societies.

FRIDAY, NOV. 19, 1920

Morning Session

9:00 a.m. 1. Report of committee on nominations. 2. Election of permanent officers. 3. Report of committee on constitution and by-laws. 4. Formal ratification of constitution and by-laws. 5. Report of committee on plan and scope.

Afternoon Session

2:00 p.m. 1. Report of committee on budget. 2. Report of committee on resolutions.

Evening Session

8:30 p.m. 1. Introductory remarks by presiding officer, the president of American Engineering Council. 2. Address by Herbert C. Hoover, president American Institute of Mining and Metallurgical Engineers, New York, N. Y.

9:30 p.m. Informal reception and smoker.

SATURDAY, NOV. 20, 1920

9:00 a.m. Organization meeting, executive board, American Engineering Council of the Federated American Engineering Societies.

First Meeting American Engineering Council, Nov. 18-20

PLANS are now being shaped and the program has been outlined for the first meeting of the American Engineering Council of the Federated American Engineering Societies, to be held in Washington, D. C., at the New Willard Hotel, Nov. 18 to 20. Invitations to join the federation have been sent to national and local engineering societies having an aggregate membership around 120,000. Already acceptances have been received from some of these bodies. The others are bringing the matter to the attention of their membership either by letter ballot or at their fall meetings, which are occurring for the most part this month and next.

The Federated American Engineering Societies came into being at the organizing conference on June 3 and 4 last, when 140 delegates, representing seventy-one national and local engineering bodies with an aggregate membership of more than 110,000, unanimously voted for the creation of an organization "to further the public welfare wherever technical knowledge and engineering experience are involved and to consider and act upon the matters of common concern to the engineering and allied technical professions."

While the Engineering Council has been functioning in this capacity ever since the war, it was felt that a body more representative of the entire engineering profession was desirable. For that reason a joint conference committee from the four national societies of electrical, mechanical, civil and mining engineers was appointed to study the matter and make recommendations. A comprehensive organization as outlined above was suggested, and the delegates called to the organizing conference gave it their unanimous approval, as just stated.

Thus at that meeting in June the federation became a fact, a constitution (published in full in the June 12, 1920, issue of the ELECTRICAL WORLD) was adopted, and the purpose of the organization was clearly revealed. At that time it was emphatically stated repeatedly that this new organization is democratic in principle. Undue prominence is not given to the large national bodies, but rather to the smaller local bodies which have the weight of membership on the council. The federation does not undertake to interfere with the work of any member society. All that is asked of the member societies is their support.

According to the constitution, only engineering or allied technical societies, not individuals, can become members of the federation. The federation functions through the American Engineering Council, to which representatives are elected by the member societies on a membership basis. Each member society is entitled to one representative for a membership of 100 to 1,000 and one additional representative for each additional thousand membership or major fraction thereof, but in no case shall any member society be entitled to more than twenty representatives.

Funds for defraying the expenses of the federation are to be contributed by the member societies on a membership basis. Each national member society shall contribute annually $1.50 per member, while state, local, regional and affiliated member societies shall contribute only $1 per member.

The federation will have much to do right at the outset. The first of the year it takes over the uncompleted business of the Engineering Council, which at the present time consists of the following items: (a) Classification and compensation of engineers, (b) licensing engineers, (c) water-power conservation, (d) national board for jurisdictional awards in the building industry, (e) national Public Works Department, (f) assisting the preparation of information for the Senate committee on reconstruction and production, (g) public affairs, (h) military affairs, (i) New York State government reorganization, (j) international affiliation of engineers, (k) curricula of engineering schools, (l) patents, (m) payment for estimating, (n) Boston-Washington super-power system, (o) Russian-American engineering co-operation, (p) types of government contracts. Other lines of activity will be undertaken from time to time as conditions arise.

Better Era of Co-operation Seen in New England

CONSTRUCTIVE discussion of live questions marked the twelfth convention of the New England Geographic Division, N. E. L. A., at Kineo, Me., Sept. 14-16. The co-ordination of the division's work with the new organization and plans of development of the parent body was enthusiastically welcomed, and for the first time in the division's history leaders in the manufacturing, jobbing and contractor-dealer branches of the industry formally joined hands with the central-station men in New England for promoting the broader electrical progress of the Northeastern States. The latest developments in the Eastern seaboard super-power survey were recounted by W. S. Murray. Chairman Cleaves of the Maine Public Utilities Commission pledged his support in the public policy educational work of the division, and Executive Manager M. H. Aylesworth of the N. E. L. A., J. M. Wakeman, general manager of the Society for Electrical Development; M. R. Bump, vice-president N. E. L. A., and other speakers made addresses characterized by constructive thought.

President C. R. Hayes' address emphasized the co-ordination to be accomplished between the New England Division and the national association and the need of molding public opinion as to the necessities and importance of electric utilities. Greater co-operation between all interests in the industry is now being attained. The great question of financing the utilities forms the most important problem before the association and the public, coupled with the necessity for an adequate return.

On Tuesday afternoon there was a well-attended and enthusiastic technical session, during which the reports of the national committees on underground systems, prime movers, electrical apparatus and overhead systems were abstracted and discussed. Plans for the new detailed organization of the New England technical committees, under the chairmanship of L. L. Elden of the Boston Edison Company, were explained in a letter from I. E. Moultrop, chairman national Technical Section.

Credit granting in the public utility field is assuming a more commercial aspect, declared W. E. Dorsey, Narragansett Electric Lighting Company, Providence, R. I., in a paper on "Credits and Collections from a Public Service Company's Standpoint." The cost of collections at Providence is 0.5 cent per dollar of gross revenue.

More reliable records of investment account were urged in a paper by A. E. Lamb, chief accountant Maine Public Utilities Commission. I. S. Hall, auditor Charles H. Tenney & Company, Boston, read a paper emphasizing the importance of service ideals in building up public good-will through the accounting department. W. H. Blood, Jr., Stone & Webster, then gave an illuminating talk on the use and abuse of graphic statistics. The session was closed by an account of the Central Maine Power Company's preferred-stock customer-ownership campaign by P. H. Whiting.

Co-operative Movement

An all-day session devoted to commercial problems was held on Thursday, the concluding day of the convention. The most significant feature was a vote authorizing the contact committee, of which William Gould, Boston, is chairman, to undertake full co-operation with the other branches of the industry along the lines of the California campaign. The following representatives of the different branches bore testimony to the closer relations now rapidly developing: Jobbers, W. F. Abely; manufacturers, Frank J. Allen; contractor-dealers, George B. Quinby and J. E. Wilson.

The following officers were elected, after the constitution was amended to conform to the needs of the revised national organization: President, Bowen Tufts, Boston; vice-president, Charles L. Edgar, Boston. The executive committee will consist of C. R. Hayes, ex officio, and these state representatives: Maine, Fred D. Gordon, Portland; New Hampshire, F. A. Belden, Portsmouth; Vermont, D. W. Jardine, Burlington; Massachusetts, Walter L. Mulligan, Springfield; Rhode Island, E. A. Barrows, Providence; Connecticut, Samuel Ferguson, Hartford. It will also contain, as manufacturing members, Richard H. Rice, General Electric Company, Lynn, Mass., and A. B. Reynders, Westinghouse Electric & Manufacturing Company, Springfield, Mass.

Indiana Association to Aid Commission in Plans for the Future

THE last two days of the twelfth annual convention of the Indiana Electric Light Association at French Lick Springs were about evenly divided between problems of public policy, power factor rate clauses and golf. The association addressed a message to the people of the state pointing out the interdependence of the public and the utilities and outlining the requirements of the central-station companies if they are to continue to maintain the high class of service which a discriminating public demands. The president was also instructed to appoint a committee to aid the public service commission in formulating a plan to meet the pressing immediate and future needs of the respective companies and communities. The question of the association joining the Great Lakes Division of the N. E. L. A. was referred to the incoming executive committee after R. V. Prather of Springfield, Ill., secretary of the division, had explained its functions and plan of organization.

Chairman E. I. Lewis of the Indiana Public Service Commission in an address at the banquet on Thursday evening paid a tribute to the public utility operators of the state for the manner in which they had conducted themselves and their properties during the trying ordeals of the last few years. An early word of warning from a commission is much better for all concerned than to wait and ask the companies to make changes after they have proceeded with their plans, according to William L. Goodwin, who also suggested the appointment of "surveyors of finance" to pass on the merits of new public utility securities.

In the absence of T. F. English of Muncie, Ind., his paper, describing the application of a power-factor clause to his rate schedules and methods adopted by his customers to improve their power factor, was read by Morse Dell Plain, Hammond, Ind.

The officers elected for the year 1920-1921 were as follows: President, Morse Dell Plain, Hammond; vice-president, E. M. Walker, Terre Haute; secretary-treasurer, Thomas Donohue, Lafayette; executive committee, P. H. Palmer of Kokomo, S. W. Greenland of Fort Wayne, C. O'Brien Murphy, Harry Reid and C. C. Perry of Indianapolis.

Electric Steel Mill Drive Equaling Steam on Tonnage Basis



E. S. JEFFRIES

President-elect Association of Iron and Steel Electrical Engineers

THAT the question of steam versus electric drive for reversing mills and the even older question of shunt-wound versus compound-wound motors are still very much alive was shown at the fourteenth annual convention of the Association of Iron and Steel Electrical Engineers, held this week at the Pennsylvania Hotel in New York City.

K. A. Pauly, General Electric Company, presented various phases of this subject of reversing mill drives on a basis of tonnage, stating that although steam equipment exceeded tonnage rolled with electrically driven mills, the equipment had not reached the final stage of operation perfection. In discussing this paper R. B. Gerhardt stated that it was estimated that monthly tonnages of from 60,000 to 70,000 would be rolled on the 40-in. (101-cm.) blooming mill at the Sparrows Point plant of the Bethlehem Steel Company. This compares very favorably with the steam mill on a tonnage basis.

At the annual banquet on Wednesday evening Thomas Darlington was toastmaster. W. A. Berresford, president of the American Institute of Electrical Engineers, addressed the gathering, pointing out how the new developments in engineering associations would help the steel men. Affiliation with the Federated American Engineering Societies was urged.

Steel-mill work is now so specialized, Mr. Berresford said, that the formation of a standard code for the guidance of all members seems almost necessary. Present standards as formulated by the standards committee do not seem to be supported by the entire membership, Mr. Berresford observed. He also urged support of the Engineering Foundation and the American Engineering Standards Committee. Dr. F. B. Jewett, chief engineer research laboratory Western Electric Company, told about the development of the telephone system during the past fifteen years. John R. Freeman, past-president American Society of Mechanical Engineers, gave an illustrated lecture on China with reference to the development of artificial waterways.

Interesting papers covering heat, motor applications and control were presented and discussed at the convention sessions. These papers will be abstracted in detail in the ELECTRICAL WORLD of Oct. 2.

At the business session on Monday E. S. Jeffries, Steel Company of Canada, was elected president of the association for 1921. The other officers elected were: First vice-president, W. S. Hall; second vice-president, C. E. Bedell; treasurer, James Farrington; secretary, John F. Kelly; directors, Gordon Fox, F. E. Galbraith, S. L. Henderson and W. C. Suppler. The membership of the association has increased since Jan. 1 by 136 members, making a total of 1,139.

Reports of the various committees were given, summarizing the progress which had been made during the last year. For the electrical development committee E. S. Jeffries stated that a policy had been formulated, which was to keep the members posted on the development of equipment and also on the newest advances in engineering thought in steel-mill operation. Walter Greenwood stated that the safety committee had drawn up rules for the construction and operation of cranes, which had been submitted to manufacturers and steel-mill men for comment and suggestion. Specifications for electrodes have been drawn up for electric furnaces by the electric furnace committee, E. T. Moore chairman, with the help of electrode manufacturers. A practical educational course for steel mill electricians has been planned by the committee on education, B. A. Cornwell chairman, and the compilation of a textbook has been begun.

A number of exhibits were displayed by the manufacturers of equipment used in steel mills. Aside from the business sessions, there were several entertainment features arranged by A. H. Swartz, chairman of the convention committee.

Manufacturers to Create Public Good Will for Utilities

ELECTRICAL manufacturers are mapping out a program of publicity through the advertising pages of the general national publications and local press for the purpose of creating public good will for the electric light and power industry. Monday of this week a committee of manufacturers' representatives met with the publicity department of the National Electric Light Association and agreed upon a plan to be taken up with all electrical manufacturers.

According to the plan this committee will urge the electrical manufacturers to make definite pledges of "white space" for good will advertising according to a definite schedule so that it will be continuous rather than sporadic. The committee hopes to have at least one page in each national magazine each week carrying a good-will story. The opinion of those at the meeting was that no attempt should be made to combine good will and merchandising copy in the same advertisement. The plan proposes that the N. E. L. A. publicity department will furnish the copy or statistics as desired.

The manufacturers also proposed at the meeting that the N. E. L. A. should furnish electrical manufacturers with good will publicity material for dissemination among employees.

The members of the committee who attended the meeting were: Charles F. Kinsman, Sterling Bronze Company, New York City, representing the Association of Lighting Fixture Manufacturers; L. D. Gibbs, Edison Electric Illuminating Company of Boston, representing the advertising and publicity service bureau of the N. E. L. A., Commercial Section; John Mustard, Wagner Electric Manufacturing Company, Philadelphia; Frank H. Gale, General Electric Company, Schenectady, N. Y.; W. H. Easton, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., in the absence of J. C. McQuiston, member of the committee; P. L. Thomson, Western Electric Company, New York City; Neil C. Hurley, Hurley Machine Company, New York City; J. F. Killeen, Edison Electric Appliance Company, Inc., New York City; E. B. Seitz, representing the American Washing Machine Manufacturers Association, Chicago.

Geological Survey's Figures on Energy Production and Fuel Consumption

FIGURES for the first six months of 1920 covering the production of electrical energy and the consumption of fuel by the public utility power plants in the United States have been issued by the United States Geological Survey. These figures are based on returns from about 3,000 power plants rated at 100 kw. or more, including central stations, electric railways and other plants, the capacity of the plants submitting reports being about 90 per cent of the capacity of all plants listed.

According to the Geological Survey's report, the average daily production of electricity during the six months, in kilowatt-hours, was as follows:

January	124,700,000	April	119,300,000
February	119,900,000	May	115,700,000
March	120,700,000	June	119,800,000

Total production of electrical energy for the six months is put at 21,846,515,000 kw.-hr.

Electrical Supply Jobbers Start Publicity Campaign

TAKING as its slogan "Ask your electrical supply jobber," the Electrical Supply Jobbers' Association has started and will finance from the association's funds a publicity campaign aimed at making the association "as truly co-operative and altruistic as possible." In its primary features the publicity will aim at promoting a better understanding of the functions of the jobber.

The underlying thought of the whole campaign will be to help develop the industry, to inspire confidence in its various elements and to promote a fair appreciation of the functions and place of each element in the industry, without in any wise restricting any results which may accrue to any particular electrical supply jobber or organization of electrical supply jobbers.

Practical Demonstration of Industrial Lighting for Jobbers at Nela Park

METHODS of making correct industrial lighting layouts, including the working out of two actual examples, occupied the attention of some seventy-five representatives of electric jobbers at Nela Park, Cleveland, Ohio, on Monday, Tuesday and Wednesday of last week. The program opened with a statement by R. W. Shenton of the National Lamp Works in which the backward condition of the lighting field was dwelt on.

A lighting demonstration Monday night by Ward Harrison displayed in a striking way the improvements possible in industrial lighting when intelligent application of available equipment is made. The men were shown the methods of calculating lighting layouts by Ward Harrison and Earl A. Anderson Tuesday morning, and the party was then taken to a local manufacturing plant and a retail store, where data were collected and each man was required to work out a lighting layout, prizes being offered for the best solutions. Between the inspection and 9 o'clock Tuesday evening complete installations designed by the lamp laboratories engineers were put in place without the knowledge of the men, and the party was taken to inspect the results.

Foot-candle meters were available at the demonstrations and the two installations, enabling those present to check results. Tables giving coefficients of utilization and room indexes were presented at the meeting which reduced the necessary calculation to one simple formula outside the selection of lamp spacings and the calculation of square feet of area per outlet. Wednesday was devoted to the discussion of sales policies and methods.

Plant Closed Without Warning Because of High Cost of Coal

DELAWARE, Ohio, a town of 10,000 or more population and the seat of a university, awoke recently to find itself without electric power or light. Industrial plants were forced to shut down for the day and all business dependent upon electrical energy was suspended. It soon appeared that the reason for the failure of service was that the power plant had no coal, the manager asserting that he had been forbidden to purchase any at current high prices by the officials of the Ohio Utilities Company, which owns the local plant. No warning of the impending shutdown had been given.

The situation, summarized, as explained by the manager to an emergency meeting of citizens, is that an increase in rates granted to the company by the City Council last February had proved inadequate owing to the great advance in the price of coal since that time; that the company had gone before the Ohio Public Utilities Commission seeking a 30 per cent advance but had been blocked by a protest from the City Council, and that it had been operating at a monthly loss of $600.

The citizens' meeting appointed a committee to confer with the City Council in an effort to adjust the trouble. In the meantime the manager of the plant undertook to borrow coal from the railroad company so that the workshops could reopen. Indignation was freely voiced at what was termed the arbitrary action.

Texas Company to Raise Power Rates to Protect Lighting Customers

TO PROTECT the smaller consumers from discrimination as against large power users, the Dallas (Tex.) Power & Light Company has asked for an increase in the rates charged the latter class of consumers. Under the terms of the franchise granted Jan. 8, 1917, provision is made for rewarding both the consumers and the company for increases in efficiency and economy of operation which decrease the operating costs. After paying operating expenses and providing an authorized return on the appraised property value four reserves are created—first, a sum equal to 8 per cent on the property value to protect the investment return; second, an accident revenue equal to 2½ per cent of the annual gross receipts; third, a depreciation reserve equal to 6 per cent of the property value, and, fourth, a final surplus reserve of all sums remaining. Should this last reserve increase 50 per cent above normal, the maximum rates for such service as lighting are decreased 0.5 cent per kilowatt-hour and the return on the property value is increased 0.5 per cent. In this way the small consumers get service at cost. However, if the power revenues are such as to decrease the final surplus, the lighting rates would have to be increased, and it is to prevent this that a change is desired in the power rates.

Alaskan Water-Power Development Urged to Release Paper-Pulp Supply

DEVELOPMENT of the large amounts of water-power available in Alaska will make 40,000,000,000 ft. of paper-pulp material available at the rate of approximately 1,200,000 tons per year. This will, according to the United States Forestry Bureau, supply from one-third to one-half the annual needs of the nation.

Among the water-power sites of Alaska the following have been investigated and are in the timber area from which the paper pulp will come: Fish Creek, 10,000 hp., using water from three storage lakes; Swan Lake, 9,000 hp., with several storage lakes; Malia Bay, 5,000 hp.; Beaver Falls, 5,000 hp. with storage; Shrimp Bay, 7,000 hp., one storage lake; Bailey Bay, 6,000 hp. and several storage lakes; Mill Creek, 4,000 hp. and other nearby sites; Karta River, 4,000 hp., small lake; Hetta Inlet, 4,000 hp., with several small lakes at high altitudes; Thomas Bay, 28,000 hp., 15,000 hp. continuously; Sweetheart Falls, 15,000 hp. with large storage lake; Long Lake, 20,000 hp., and Crater Lake, 10,000 hp.; Treadwell, 12,000 hp., already developed. Mitchell Bay, 10,000 hp.; Warm Spring Bay and Cascade Bay, 5,000 hp. each; Silver Bay, 6,000 hp.

Tennessee Contractors Pledge Support to Utilities in Fight for Relief

SUPPORT and co-operation to the public utilities of the state in their struggle for relief were pledged in a resolution by the Tennessee Association of Electrical Contractors at the recent annual convention. The resolution, copies of which were sent to all local utilities commissions, pointed out that the cost of production in the past few years had been multiplied out of all proportion to revenues.

Industrial Business and Merchandising to Be Discussed by Contractors

EMPHASIS will be placed on industrial business and merchandising at the annual convention of the National Association of Electrical Contractors and Dealers to be held in Baltimore at the Southern Hotel, Oct. 4-9.

The program includes an address by James M. Wakeman, general manager of the Society for Electrical Development; a paper by A. L. Abbott, St. Paul, on "Conducting a Contracting Business"; an address by J. L. Wolff, secretary of the Fixture Dealers' Association of America, on "The Proper Handling of Fixture Sales," and a paper entitled "The Sale of Motors for Industrial Work" by J. A. Clarke, Westinghouse Electric & Manufacturing Company.

The morning of Oct. 8 will be given over to merchandising principles, with addresses by H. B. Kirkland, Samuel A. Chase and W. L. Goodwin. At this session M. H. Aylesworth, executive manager of the National Electric Light Association, will speak on "What the N. E. L. A. Is Doing to Help the Electrical Contractor-Dealer to Improve Retail Distribution."

The afternoon of the same day will be devoted to industrial illumination, with an exhibit similar to that staged at the Pasadena N. E. L. A. convention last May. At this session the following papers will be presented: "A New Era in Lighting," by R. W. Sheuton; "Seeing Is Believing" (this paper will accompany the exhibit demonstration), by Ward Harrison; "Industrial Lighting Market and the Contractor's Part in Selling It," by P. B. Zimmerman. W. M. Thompson, bureau of advertising, American Newspaper Publishers' Association, will speak on "Advertising for Contractor-Dealers."

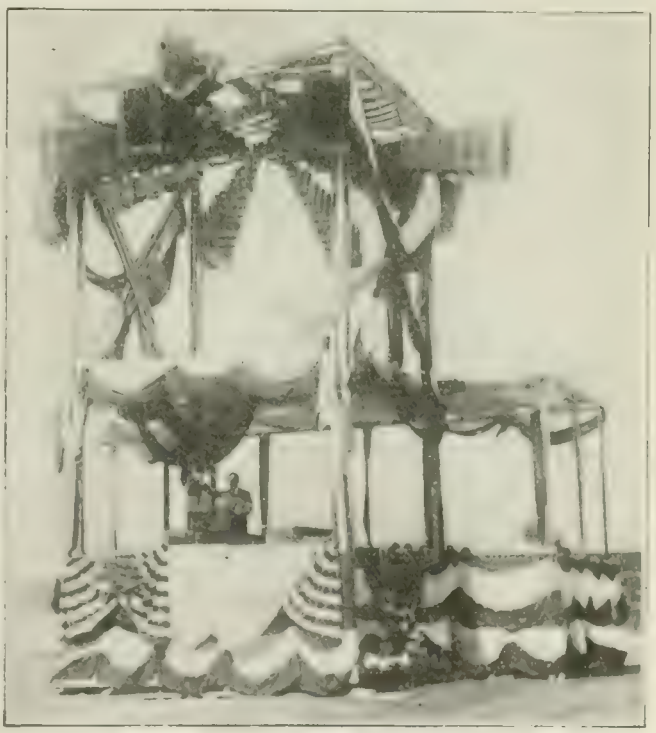
The annual dinner will be held on the evening of Oct. 8, at which addresses will be heard from Judge William H. Wadhams of the Court of Civil Sessions of New York on "Americanization," and Edward H. Ford, author and humorist, on "What the World Needs—More Humor."

Industrial Uses to Be Emphasized at New York Electrical Show

THE thirteenth annual New York Electrical Exposition will open in Grand Central Palace on Oct. 6 and continue for ten days with 141 exhibits, representing a 48 per cent increase over the 1919 show. The purpose of the exposition is to show the varied employment of electricity in the home, office, store and factory, and in each case whole series of displays have been prepared. Of special interest will be the servantless household. A therapeutic exhibit, demonstrating the use of electricity in the doctor's office and hospital, has been arranged, and also an exhibit of wireless telephony.

This year the entire third floor of the building has been given over to a series of working exhibits where the employment of electricity in a score of industries will be demonstrated. One will be material handling, with industrial trucks, conveyors and hoists all in operation. The Material Handling Machinery Manufacturers' Association and the Electric Hoist Manufacturers' Association are co-operating with different makers in this particular exhibit.

Coolidge Talks to Crowd By Means of Voice Amplifier



Gov. Calvin Coolidge of Massachusetts, nominee for Vice-President on the Republican ticket, speaking at Barnes Field, Boston, recently. His voice could be heard throughout the entire field.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Great Britain Has an Electrically Driven Sea-Going Ship.—The only electrically propelled ocean-going boat in the great merchant marine of Great Britain is the Wulsty Castle, which plies between European and South United States ports. This 6,000-ton vessel has two turbo-alternators, installed on each side of the engine room, which run in parallel and transmit power to two main driving induction motors amidships, these in turn energizing the single low-speed propeller shaft through double helical single-reduction gearing.

St. Clair, Mich., Favors Sale of Municipal Plant.—By a vote of 373 to 65 the citizens of St. Clair, Mich., have approved of the sale of their municipal electric plant for $42,000 to the Detroit Edison Company, to which they will in consequence soon look for energy. A controversy over the municipal plant had been waged in St. Clair for thirteen years. The great increase in operating costs and the need for expending $70,000 to put the plant in good shape were held accountable for the large majority in favor of giving up the local enterprise.

Denmark Celebrates the Oersted Anniversary.—In celebration of the centennial of the discovery of electromagnetism by Hans Christian Oersted a special edition of his works has been brought out in Denmark, his native country, and an exhibition where his original magnetic needle is shown has been arranged at the Polytechnical College of Copenhagen, of which he was the founder. A statue of the scientist has been unveiled in his birthplace, Rudköbing, and ceremonies have been held at his grave. Meetings in honor of his memory and lectures by distinguished scientists have taken place, and a movement to erect an Oersted museum at Copenhagen is on foot.

Europe's Largest Steam Plant.—European contemporaries give some recent statistics concerning the steam-driven generating station of the Rheinisch-Westfalsche electrical works at Goldenberg, Germany, which are said to be the largest steam central station in the Old World. During the war the annual output of this station rose from 200,000,000 kw.-hr. to 772,000,000 kw.-hr., owing to the metallurgical and electrochemical requirements of the government. Since the armistice the output has fallen to 688,000,000 kw.-hr., despite the withdrawal of war restrictions on private consumption. The working installation includes six turbo-generators of 15,000 kw. each and one of 50,000 kw. Another unit of the latter size is being made ready.

More Rate Increases.—The movement in the direction of increased rates for electric service companies still continues in all parts of the country. Among advances recently reported are these: Metropolitan Edison Company, Reading, Pa., 20 per cent except to residential customers; Easton, Pa., commercial rates, about 15 per cent; Rutland (Vt.) Railway, Light & Power Company and Vermont Hydro-Electric Corporation, 10 to 15 per cent; Binghamton, N. Y., 2½ cents per kilowatt-hour on lighting and ½ cent on power business; Sayre, Pa., 2½ cents per kilowatt-hour on lighting and revised schedule on power; Northern States Power Company, Chicago, 1 cent per kilowatt-hour on lighting and power; Elyria, Ohio, 2 cents per kilowatt-hour.

"Electric" Boilers in Sweden.—In rebuilding a large paper mill and sulphate factory at Vargo, Sweden, it was determined to adopt electricity throughout. The steam plant and the works now consume no coal, whereas 20,000 tons per annum would be needed under former conditions. The boiler house contains seven "electric" boilers, each of 3,000 hp., and the current enters the boilers at a pressure of 10,000 volts without having to be stepped down. Each of the boilers is provided with three electrodes, and the coupling arrangements are such that steam generation can be regulated within 5 per cent. It is stated that full steam pressure can be raised in from five to ten minutes after switching on the current, and considerable economy in attendance is obtained, as compared with coal firing. A steam accumulator has also been erected in order to insure an even consumption and economy in the use of steam. The installation is the first of its kind in Sweden.

Electric Furnace Installed in San Francisco Mint.—A Rennerfelt electric furnace of 1,000 lb. capacity, to operate on two-phase, 60-cycle service, transformed from 2,200 volts to 110 volts, is being installed in the San Francisco mint, to increase the output of minor coins. The furnace was originally in operation at the Philadelphia Mint and was only recently withdrawn from service there when replaced by furnaces of more recent design and greater capacity. It is hoped to have the furnace in operation by the end of September, but uncertain delivery of switching equipment may cause delay. The new furnace will be used in the melting of metals for nickels and pennies only, silver being handled in the oil-fired crucibles now in use. Several of these crucibles were taken out to make room for the electric furnace. A motor-driven topping machine and a motor grinder will be installed to handle the clipping and smoothing of the ingots, and a mechanical conveyor will eliminate most of the heavy work involved in carrying the molds by hand.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

San Francisco Section, A. I. E. E.—At a recent meeting of the executive committee of the San Francisco Section of the American Institute of Electrical Engineers the following officers were chosen for the year 1920-21: Chairman, J. P. Jollyman, Pacific Gas & Electric Company; vice-chairman, W. B. L'Hommedieu, Westinghouse Electric & Manufacturing Company; secretary, Allen G. Jones, General Electric Company; chairman membership committee, J. J. Reed, Pacific Telephone & Telegraph Company; chairman papers committee, W. B. L'Hommedieu.

Portland Sections, A. I. E. E. and N. E. L. A.—Association activities for the coming year in Portland, Ore., will start with a "get-together" meeting on Sept. 28. For several years the Portland Sections of the A. I. E. E. and the N. E. L. A. have been holding joint meetings, and this year it has been decided to permit the Portland Section of the Oregon Association of Electrical Contractors and Dealers to meet jointly each month with these combined sections. The contractors and dealers will bear their proportion of expense and occasionally there will be a program of particular interest to them. It is expected that this year will be the most successful in the history of local association activities. The officers are: Institute—E. F. Whitney, chairman; W. C. Heston, secretary. N. E. L. A.—A. D. Leach, chairman; W. A. Dunlap, secretary. Contractor-dealers—F. A. Bauman, chairman; F. R. Whittlesey, secretary.

Coming Meetings of Electrical and Other Technical Societies

National Safety Congress, Milwaukee, Wis., Sept. 27-Oct. 1. (For program of public utilities section see issue of Sept 18, page 592.)
American Electrochemical Society—Cleveland, Sept 30-Oct 2
Conference Club, White Sulphur Springs, W. Va., Sept. 30-Oct. 2.
Illuminating Engineering Society—Cleveland, Oct. 4-7. (For program see issue of Aug. 14, page 349.)
National Association of Electrical Contractors and Dealers—Baltimore, Oct. 4-6. (For program see issue of July 24 page 205.)
Electric Furnace Association—Columbus, Ohio, Oct. 6.
American Electric Railway Association—Atlantic City, N. J., Oct. 11-15
National Association of Electrical Inspectors—Philadelphia, Pa., Oct. 12-13.
British Columbia Association of Electrical Contractors and Dealers—Vancouver, B. C., Oct. 19.
International Association of Municipal Electricians—New Orleans, Oct. 19-22.
Association of Railway Electrical Engineers—Chicago, Oct. 28-31.
Electrical Supply Jobbers' Association—General meeting, Detroit, Nov. 10-12.
Electric Power Club—Hot Springs, Va., Nov 15-18
Southeastern Geographic Division, N. E. L. A.—Miami, Fla., Nov. 17-19.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Injury Must Be Shown in Order to Bring Reversal of Judgment.—A judgment will not be reversed, the Supreme Court of Pennsylvania declared in Borough of Greensburg vs. Public Service Commission of Pennsylvania, unless prejudicial error is shown, and hence a failure by the Public Service Commission finally to dismiss or sustain complaints filed with it cannot successfully be alleged as error unless appellants were injured thereby. (110 At. 750.)*

Manner of Flowing Water Over Another's Land Cannot Be Materially Changed Without Consent.—Where a right has been granted to discharge waters over the land of another and has been exercised, the consent of the subservient estate is necessary to the construction of a tunnel or canal across the subservient estate, the Supreme Court of New York observed in Hydraulic Power Company of Niagara Falls vs. Pettibone Cataract Paper Company et al. (183 N. Y. S. 374.)

Rate Increases Not Retroactive.—Rates increased by the Public Service Commission beyond those fixed by a public service company can only be made effective so far as the future is concerned, according to a decision of the Pennsylvania Supreme Court in Borough of Greensburg vs. Public Service Commission of Pennsylvania. On the hearing of complaints regarding the reasonableness of rates, only that which relates to the particular question under notice should be considered or decided. (110 At. 750.)

Cessation of Disability of Compensation Claimant Open to Inquiry After Final Judgment.—The Supreme Court of Louisiana has decreed, in Pye vs. Southwestern Gas & Electric Company, that where claim is made that an injured employee to whom compensation was awarded has completely recovered and is engaged in a lucrative business the facts may be inquired into even after final judgment has been entered and evidence may be taken as to the extent of the claimant's disability. (85 So. 232.)

Scheduled Rate Collectible Even if Commission Investigation Is Proceeding.—Under the public service act of Pennsylvania, which requires public utilities to file schedules of rates and permits complaints to be filed against such rates within the thirty days before the schedule becomes effective, at the expiration of the thirty days the scheduled rate becomes a legal, collectible rate which may be sued for regardless of a complaint filed within the thirty days, provision for reparation being the effective remedy provided if rates are found unreasonable. This was the decision of the Pennsylvania Supreme Court in Suburban Water Company vs. Borough of Oakmont. (110 At. 778.)

Legislative Power of Municipality to Fix Utility Rates Cannot Be Abridged. The legislative power conferred on cities to fix rates of utility companies is continuing, the Supreme Court of Iowa declared in Town of Woodward vs. Iowa Railway & Light Company, and may not be abridged or bartered away by contract or otherwise, the power being subject only to the constitutional limitation that the rates shall not be confiscatory or unreasonable, but reasonably compensatory. Therefore rates for an electric light company fixed by city ordinance were not fixed by contract. (178 N. W. 549.)

Burden on Utility to Show Rates Prescribed by Ordinance Unreasonable.—In a suit by the town of Woodward to compel the Iowa Railway & Light Company to comply with its franchise and continue to furnish service, the rates prescribed for the company by ordinance, being presumptively reasonable, the Supreme Court of Iowa held that the burden was on the company to show they were unreasonable. The presumption of reasonable rates, however, did not continue until new ordinance rates were adopted, since in that case the company would have no remedy if the city council refused to amend the rates. (178 N. W. 549.)

The Cupples Station Case.—The Supreme Court of Missouri, in State vs. Cupples Station Light, Heat & Power Company (see ELECTRICAL WORLD, June 19, page 1446), made the following findings among others: Courts have the discretion to enter or refuse to enter judgment of forfeiture accordingly as public injury appears serious or trivial, and in quo warranto proceedings the court will hestitate to declare an ouster of franchises to use city streets where such judgment would destroy large investments of an electric company and no public injury appears. Though respondent electric company restricted its service practically to persons owning its stock and to their tenants, yet where it furnished service virtually to the extent of its capability, and as persons refused service had their own remedy, such non-user, occurring a considerable time in the past, will not be construed as a sufficient non-user to work a forfeiture of respondent's franchise to use the streets. The court maintained the right of the Cupples Station company to operate either in the underground or overhead district of the city of St. Louis, applications for all territory not being required within the prescribed ninety-day period for acceptance. (223 S. W. 75.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Rate of Return and Amount of Sales.—The Indiana Public Service Commission in determining an application for increased rates by a gas company has fixed the rates at an amount which would not produce a return of 7 per cent on the basis of the sales of the previous year, the commission holding that rates which would produce a more satisfactory return would probably result in a material decrease in the sales.

Use of Depreciation Fund for Extensions Forbidden.—A refusal to modify its policy of prohibiting the use of the depreciation fund for extensions and other new construction for a period longer than one year has been made by the Indiana Public Service Commission in the case of a gas company which had not in the past taken care of realized depreciation and had even deferred maintenance so far as was possible with actual plant operation.

Free Service and Revenue.—Under the provisions of the Indiana statute requiring a utility to render free service to municipalities in accordance with the terms of its franchise, an amount equal to the revenue which would be derived from free services if they were billed at the regular rates must, according to a decision of the Indiana Public Service Commission in a water-rate case, be added to the actual revenues received in order to ascertain whether the revenues are equal to the requirements.

Duty to Serve in Relation to Line Extensions.—The mere fact that an electric utility has accepted a franchise from a city and has undertaken to furnish the community with electricity does not of itself, according to a decision of the Missouri Public Service Commission in a complaint because of the refusal of the Missouri Public Utilities Company to extend its transmission lines to serve an applicant, require the company to extend service to any residents who may ask it, but only to respond to reasonable demands. The commission denied an application for an order which would have forced the company to spend $396 to serve a consumer whose monthly bill would have approximated $1.50, but it required the company to extend its lines at its own cost about 600 ft. to serve a single patron upon condition that the patron would bear the expense of the further extension necessary, about 375 ft., and would guarantee to use electricity to the amount of $2.50 monthly for a period of five years.

Men of the Industry

Changes in Personnel and Position— Biographical Notes

L. T. Merwin, who has recently been promoted from general superintendent to assistant general manager of the Northwestern Electric Company, at Portland, Ore., was graduated from the University of California in 1896. The next five years he spent teaching mathematics and science in the high schools at Napa, Cal., and in the Polytechnic High School at San Francisco. Mr. Merwin began his electrical career with the San Joaquin Light & Power Company in 1901, as station operator, and soon became chief operator at the Fresno (Cal.) plant of that company,



L. T. MERWIN

where he originated and developed a meter-testing department. Later he became assistant to the city superintendent. In 1906 he accepted a position as superintendent of the Nevada-California Power Company at Goldfield, Nev., and in the following year became electrical engineer for the Nevada Consolidated Mines Company. While with the latter company he designed and installed all of the electrical equipment in the company's mines and mills, handling both underground and surface work. In the early part of 1912 he overhauled the electrical equipment in the Trinity Gold Mine, in the Trinity Mountains in the northern part of California. In May of the same year Mr. Merwin went to Portland to assist in the design and later took charge of the construction of the Northwestern Electric Company's transmission line on the north side of the Columbia River Gorge, from its White Salmon River development to Portland. When the plants of the Northwestern Electric Company were completed he took charge of them as superintendent of operation. In 1916 he was made general superintendent, in charge of all of the physical equipment of the company. In July of the present year he was promoted to assistant general manager and the executive head of the company in the absence of the general manager.

A. D. Morehouse has been appointed a hydraulic engineer in the division of power resources of the United States Geological Survey.

Fred D. Gordon, general manager Androscoggin Electric Company, Lewiston, Me., resigned on Sept. 1 to join the organization of the Cumberland County Power & Light Company, Portland, Me., Oct. 1. Mr. Gordon is one of the best-known central-station men in New England and has been identified with the upbuilding of the Androscoggin company for about fifteen years, his activities covering hydro-electric-plant and steam-plant development, the construction of the Portland-Lewiston interurban railway and the cultivation of lighting and power business in the lower Androscoggin valley. Mr. Gordon is the Maine representative of the executive committee of the New England Section, N. E. L. A., and has long been active in the affairs of this geographic division.

Dr. Clayton H. Sharp, technical director of the Electrical Testing Laboratories, New York, has been appointed chairman of the board of examiners of the American Institute of Electrical Engineers, succeeding F. L. Rhodes. Dr. Sharp is a past-president of the Illuminating Engineering Society, of which he was one of the founders, and is co-inventor with Preston S. Millar of several illumination measuring devices, including the Sharp-Millar photometer. Dr. Sharp was graduated from Hamilton College in 1890 and took his doctor's degree at Cornell University. For six years Dr. Sharp engaged in research and instruction work at Cornell, except for an interval of a year spent in European travel and in research in the Physical Institute at Leipsic, Germany.



DR. C. H. SHARP

Bowen Tufts, who has been elected president of the New England Geographic Division of the N. E. L. A., is one of the best known and most highly esteemed of the younger public utility administrators in the Northeast. Born at Lexington, Mass., about thirty-five years ago, Mr. Tufts entered business after one year in high school, joining the staff of the Boston banking house of Jose Parker & Company in 1899. He soon became a traveling salesman for this house, handling chiefly municipal securities in New England and Canada. In 1903 Mr. Tufts was made manager,



BOWEN TUFTS

and when the house of C. D. Parker & Company, Inc., was established in 1907 he became vice-president and general manager of the new organization. This banking house now operates directly seventeen central-station properties in Massachusetts and is interested in the management as trustee or director of five others in the state. Among these properties are the central stations at Amesbury, Franklin, Uxbridge, Palmer, Winchendon, Weymouth, Great Barrington, Plymouth, Marlboro, Athol and Westboro. Mr. Tufts is a trustee of the Massachusetts Lighting Companies, Franklin County Power Company and Commonwealth Gas & Electric Companies and a member of the Engineers' Club of Boston and of the executive committee of the Massachusetts Gas and Electric Association. He was for two years treasurer of the New England Section, N. E. L. A., for two years a member of the executive committee and for one year vice-president. Combining unusual powers of analysis with a broad vision of the possibilities of electric service based upon sound public relations and economical operation, Mr. Tufts brings to his new office talents which will find ample scope in advancing the central-station industry in the New England States to still larger spheres of usefulness and efficiency.

Homer E. Grosbach of the United States Geological Survey has been assigned to the Rocky Mountain surface water division. His headquarters will be in Denver.

Trade and Market Conditions

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

Use of Trade Acceptances Improving Collections

TRADE acceptances are materially improving the collections of the Western Electric Company, the largest electric supply jobbing house in the United States. In 1918, the year that the company adopted the use of trade acceptances, the loss on accounts under this basis was three-hundredths of 1 per cent. The loss during the same period on open accounts was thirty-nine-hundredths of 1 per cent. The following year the accounts closed under the new method increased 237 per cent in number and 211 per cent in value. The loss on these amounted to seven-hundredths of 1 per cent. The loss to sales on open accounts for that year was twenty-seven-hundredths of 1 per cent.

These figures would indicate a considerable reduction in the losses sustained on customers' accounts since trade acceptances were introduced by the Western Electric Company two years ago. The ease with which the system functions and the general satisfaction expressed by most of the customers who have participated in it have resulted in a campaign by the branch offices to explain the system's advantages to their customers.

For the first six months of 1920 the number of trade acceptances used by the Western Electric Company increased 126 per cent and the amount in dollars and cents 253 per cent over the same period in 1919, according to E. W. Shepard, general credit manager of the company. These results have been accomplished without giving long terms, it is stated. This is substantiated by the fact that the turnover on the receivables investment for the first half of 1920 increased nearly 25 per cent over the first six months of 1919. The company is more enthusiastic than ever over trade acceptances and believes its previous conclusion is justified that these do not represent secondary credits as claimed by some of the opponents of the system. Experience in this instance is said to have shown that this method of settling accounts has not only been a benefit to the company but to its customers. Many of the latter who were formerly slow are now very prompt in meeting their obligations.

Cancellations of Orders Menace Trade

FROM time to time reports are received from electrical manufacturers of cancellations in their field. This is a tendency which, if regarded as unimportant, may assume serious proportions, according to the Chamber of Commerce of the United States. The latter has completed a survey of the manufacturing field which reveals the great prevalence of the cancellation evil in almost every phase of business. No separate classification of the electrical industry is apparently made in this report, but the general conclusions are interesting.

Inquiries were sent to 106 leading trade associations to learn the situation. Some of the chief reasons given for cancellations were inability to make prompt delivery, overstock, business declining, revision of production schedule and financial embarrassment. The lumber industry seems to have been one of those hardest hit, as more than 3,500 cars have been canceled in one division alone since January.

Responsibility does not rest wholly with the buyer, however, it is stated. Some factories have been in the habit of accepting considerably more orders than they knew they could fill, with the expectation that a certain proportion would be canceled. It is this tendency to regard the practice leniently which is said to represent a menace to the integrity of the country's business structure, as even the most upright of customers have indulged in the practice.

Several trade organizations have taken steps toward remedying the situation by creating advisory bureaus to pass upon the claims for cancellation grounds. The Chamber of Commerce will also take further steps in attempting to preserve the validity of all contracts.

Electrical Exports for July Half a Million Ahead of Last Year

EXPORTS of all classes of electrical goods, locomotives excepted, reached a total value of $53,212,172 for the seven months ended July, 1920, according to the Bureau of Foreign and Domestic Commerce. This total is still about 2.5 per cent below the figures of $54,604,161 for the corresponding period of last year. The exports for July, however, represent a gain over July, 1919. The export total of $33,251,133 for the first seven months of 1918 is about 60 per cent below the figures for this year. If continued at the same rate as for the first seven months, exports will reach a total of more than $90,000,000 in 1920. The present year has recorded a higher total of exports than 1919 up to the end of July in ten items out of nineteen. These are batteries, generators, heating and cooking apparatus, interior-wiring supplies, arc lamps, magnetos and spark plugs, motors, rheostats and controllers, switches and accessories, and miscellaneous material. The difference is more than made up in value, however, for the largest excess of this year over last was only about $500,000

	July		Seven Months Ended July	
	1919	1920	1919	1920
Batteries	$379,021	$497,657	$3,576,146	$3,832,467
Carbons	70,991	119,309	927,588	791,686
Dynamos and generators	475,271	536,400	3,035,682	3,534,164
Fans	142,103	87,892	1,137,941	805,590
Heating and cooking apparatus	156,745	124,485	970,747	1,046,060
Insulated wire and cable	659,893	558,791	6,249,949	4,242,444
Interior-wiring supplies	160,099	336,881	1,417,281	1,851,701
Arc lamps	835	2,004	8,413	15,613
Carbon-filament lamps	4,076	5,303	117,247	63,766
Metal-filament lamps	240,719	244,010	3,065,531	2,298,822
Magnetos, spark plugs, etc	203,809	304,702	1,884,191	2,224,144
Meters and measuring instruments	125,589	202,612	1,192,676	1,525,273
Motors	546,794	709,086	6,382,144	6,822,986
Rheostats and controllers	26,854	26,283	290,957	397,477
Switches and accessories	403,748	299,615	2,075,795	2,482,289
Telegraph apparatus	44,892	33,150	560,500	411,438
Telephones	274,387	215,384	2,166,446	2,130,025
Transformers	285,496	165,728	3,518,571	2,050,456
All others	1,794,783	2,018,754	16,426,346	16,685,769
Total	$5,996,105	$6,488,046	$54,604,161	$53,212,172

on dynamos and generators, while 1919 leads by $2,000,000 on insulated wire and cable and by almost $1,500,000 on transformers.

The total of electrical exports for July, 1920, is $6,488,046, as compared with $5,996,105 for the same month in 1919 and $5,393,949 in 1918. The figures for July of this year represent a falling off from the year's average, as it is the lowest monthly total yet recorded in 1920 with the exception of January. The increase in exports for July, 1920, over 1919 of about $500,000 is well distributed over eleven articles. The largest advances were more than $100,000 on batteries and magnetos and spark plugs, almost $170,000 each on interior wiring supplies and motors, and about $225,000 on miscellaneous items. On the other hand,

July, 1919, was ahead of the July total for this year by more than $100,000 each on insulated wire and cable, switches and transformers. The exports of fans in July, 1920, were below the usual total for that month. The figures of $87,892 are lower than the exports of fans in each of the first seven months of last year and compare with $142,103 for July of 1919 and $105,823 in 1918. The accompanying table shows the comparison of electrical exports for July 1919, and 1920.

Easier Conditions Seen in Supply of Motors

FAMINE conditions prevail in the small motor supply, though some sections report a slight decrease in demand. Demand for 25-hp. and larger sizes is heavy but deliveries are better than in the 1-hp. to 10-hp. sizes. Fractional-horsepower motors are not being called for as they were in the spring, and in some instances cancellations are reported.

Plant extensions of large and small industries are responsible for much of the demand for motors. Among these industries are textile mills of New England and the South, small manufacturers all over the country, and irrigation companies and canneries in the West. There has been noted a slight decrease in demand from some points in the East and the Middle West. The call is for motors of 1 hp. to 10 hp. and deliveries have been lengthened to around twenty-eight to forty weeks for alternating motors, and fifteen to twenty-eight weeks for direct-current machines in these sizes. Inquiries for small slip-ring motors have brought promises of delivery in fifty to seventy weeks. About five or six months is required for motors of 25 hp. and over.

Railroad tie-ups are ascribed as the chief cause for the long deliveries. Manufacturers could not ship motors until quite recently, and at present the fact that raw materials were not received in adequate volume for some time is curtailing production. Railroad shipments, however, are now much improved and labor conditions are better.

In fractional-horsepower motors the demand has dropped sharply. Appliance manufacturers are not seeking motors and it is reported from Chicago that one motor manufacturer can find no outlet for his product.

Recent price advances of 10 to 15 per cent on power motors and 7.5 to 10 per cent on the fractional sizes, according to manufacturers, are not the result of recently increased costs of production, but were advances which might have been made earlier but were delayed in the hope that all prices were coming down.

For the next six months the outlook seems to be that the supply in all lines will grow easier and no price changes will be made.

Washing-Machine Prices Still Advancing

THE trend of washing-machine prices is still upward, according to the American Washing-Machine Manufacturers' Association, which met in Chicago on Sept. 8 and 9. Higher prices were especially noticeable among the new types of machines which different manufacturers contemplate placing on the market in the near future. Two manufacturers stated definitely that the price of their product would be advanced on Sept. 15, and a number of others contemplate price advances within the next thirty or sixty days. It was the almost universal experience that cost of production had increased during the past ninety days, and it was said that prices cannot be decreased or even maintained in the face of advancing costs. Foreign exchange rates are retarding sales for export. Deliveries are now virtually on a normal basis. Wringers, sheet copper and other items would be holding up production in some factories were it not for the fact that manufacturers in different neighborhoods are equalizing their raw-material stocks by interchanging supplies with competitors. There is a growing demand for sheet copper tinned on one side, but this is still difficult to obtain.

Metal Market Situation

BUSINESS in the domestic copper market continues quiet. The expected increase in buying has not yet begun to materialize. Producers seem to be confident that a heavier buying movement must develop early in October at least. Consumers at present, however, are apparently content to exist in hand-to-mouth fashion, eking out their supplies with the help of the outside market. They are hoping for lower prices to break under the influence of the dull market. A few small sales are being made for fourth-quarter delivery at 18.75 cents. Some of the smaller producers are even offering quantities for October and November shipment as low as 18.50 cents, it is reported. In general, the large interests are asking 18.75 for spot and 19 cents for fourth-quarter delivery.

In the outside market very little business is being transacted. Second hands, while not pressing to sell, are offering quantities of the metal as low as 18 cents for prompt shipment and at about 18.25 for October delivery, f.o.b. refinery. A somewhat weaker market in standard copper developed in London during the past week and spot eased off almost £3.

NEW YORK METAL MARKET PRICES

	—September 14—	—September 21—
Copper	£ s d	£ s d
London, standard spot	99 15 0	97 0 0
	Cents per Pound	Cents per Pound
Prime Lake	18.50–18.62½	18.50–18.62½
Electrolytic	18.75	18.75
Casting	17.87½	17.75
Wire base	22.50–23.00	22.50–23.00
Lead, trust price	8.50	8.50
Antimony	7.12½	7.12½
Nickel, ingot	43.00	43.00
Sheet zinc, f.o.b. smelter	12.50	12.50
Zinc, spot	8.00–8.25	8.12½
Tin	45.00	44.50
Aluminum, 98 to 99 per cent	35.10	35.10

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	15.50 to 16.00	15.50 to 15.75
Brass, heavy	9.00 to 9.25	9.00 to 9.25
Brass, light	7.00 to 7.25	7.00 to 7.25
Lead, heavy	7.00 to 7.25	7.00 to 7.25
Zinc, old scrap	5.25 to 5.50	5.00 to 5.25

THE WEEK
IN TRADE

IN NEW ENGLAND the fall spurt in buying is commencing. Trade has also quickened slightly in the Middle West. All other sections of the country, however, report a volume of business that either continues on the level of the past few weeks or slightly drops off. In the South concern is expressed over the cotton crop, which has been retarded recently by adverse weather conditions. This is somewhat offset by the bumper crops reported from the Intermountain section. The San Francisco district reports the return of virtually all the war-time restrictions on the use of power owing to the low supply of water.

Collections are slightly improved in the Southwest and on the Pacific Coast, but the general consensus of opinion seems to be that much effort in pushing accounts is necessary. Labor conditions are generally more settled. Deliveries are improved in all sections. Sizable stocks in most lines are reported. Shortages on a few items are still existent in some sections, however. The chief difficulty is experienced with conduit, porcelain, outlet boxes, motors and some of the heating devices. New building construction is at a low ebb in most parts of the country. Efforts are concentrated on finishing work already begun. Some price changes have resulted from higher freight rates.

NEW YORK

Volume of business is improving, but there has been no marked increase as yet from fall buying and some doubt has been expressed whether the condition of stocks will permit this. Too much of some of the higher-priced materials is being received. Shortage continues in steel products and porcelain. The generally expressed opinion is that collections are in bad shape, although some jobbers are well satisfied. Banks are loaning for other than speculative purpose at reasonable rates. Export business continues at same increasing rate. Suburban building is active, but city construction is largely confined to extensions and small rebuilding. Uncertainty of the labor situation makes builders unwilling to proceed with large projects until assurance is had that labor will stay with the job.

Transportation continues to improve and greatly reduces the capital tied up in stocks in transit—in some cases to 10 per cent of what it was.

The only price change of note in the week has been in flexible armored cable, which has dropped slightly and is plentiful in quantity.

Rigid Conduit.—Insufficient shipments are being received to allow stock to be built up satisfactorily. Generally shipments are resold while on cars. Black, ½-in., is selling at $98 to $105 per 1,000 ft.; ¾-in., $135 to $139.50; 1-in., $200 to $206. Galvanized conduit is 15 per cent higher. Five per cent discounts from these prices for ten days cash.

Knife Switches.—Demand is shifting to the safety type, it is stated. Sales are not heavy. Several jobbers report good stocks, but a few have broken supplies. Shipments are fairly prompt, coming through in about two to three weeks. Prices vary considerably. A representative jobber is quoting a 30-amp. single-throw, single-pole switch at 42 cents; two-pole, 68 cents, and three-pole, $1.02 net.

Metal Molding.—Standard, such as No. 333 for three-wire or four-wire, is far behind in deliveries and no stocks are on hand. Prices are stable.

Outlet Boxes.—Discount remains at 40 per cent, but boxes are not available to supply demand. Stocks are poorly distributed.

Tape.—Friction tape is plentiful, ¾-in. being priced at 50 cents per pound in 100-lb. lots, and all orders are being promptly filled from stock.

Heaters.—The fall demand for bowl-type radiant heaters is not expected to begin until toward the middle of October.

Lamps.—There is a good normal demand for all types and sizes with shipments coming in on time.

Porcelain.—Prospects are rather discouraging for tubes knobs and cleats. Stocks are low or exhausted and manufacturers offer no improvement for immediate future.

Hollow Ware.—Factories are sold out and are only filling orders months old, refusing to accept new orders.

Lighting Fixtures.—Demand for industrial types is brisk, and suburban demand for residence type is improving rapidly. Stocks are good, and shipments, except steel products, are coming through. Prices are stable.

Panelboards.—Demand is low owing to inactivity in industrial and city building. Shipments are two to three months on boards, but cabinets are three to six weeks.

CHICAGO

Trade has quickened the past week, most jobbers report. The general industrial situation is still comparatively quiet, however. Retail sales remain low, but the great volume of goods coming in to jobbers on back orders is being absorbed by the trade. This gives jobbers and manufacturers comfortable sales figures. New business is not heavy and inquiries are rather light. In many lines, however, the back order file is still far from normal size and stocks are not built up to the proper margin.

Non-employment is becoming current in the retail trade. Many lay-offs and reductions are made and concerns are not filling the places of men who quit. The state employment bureau reports that daily applications for work are triple the average for the past three years. Various large employers report a steady stream of applicants.

Collections are good in proportion to the attention devoted to them as they must be pushed. Higher prices on many lines have resulted from the new freight tariffs. Construction continues at a slow pace, building permits for this week and last amounting to $600,000 each.

Bare Copper Wire.—Prices are steady. The freight increase, amounting to approximately 25 cents per 100 lb., has been added to Chicago deliveries. In 200-lb. lots No. 8 is now priced at $24.25 per 100 lb. and No. 10 at $24.50 per 100 lb. Deliveries are prompt.

Weatherproof Wire.—No price change has occurred, as the freight increase has been offset by a decrease in various insulation materials. Most sources of supply require eight weeks for delivery. Current quotation on No. 6 triple braid is 31 cents per pound and on No. 12, 34 cents per pound in quantities of 500 lb. or more.

Locust Pins.—Continued improvement in the traffic situation has made a plentiful supply available in most hands. As yet no price advance has been recorded to cover freight. With the hardwood industry generally slack, prices will probably be no higher. The price in large lots is $59.94 per 1,000, f.o.b. Chicago.

Cross-Arms.—Higher freight rates have occasioned an advance. New prices on 3¼-in. x 4¼ in. x 4-ft., in lots less than 1,000, are $97.25 per 100; larger quantities, $86.44 per 100; on N. E. L. A. specification, 3¼-in. x 4¼-in. x 5-ft., less than 1,000, $164.98; larger quantities, $146.65 per 100. Deliveries are fairly prompt.

Porcelain Insulators.—Prices have not changed. Delivery conditions are about as bad as ever. A 5,000-volt, double-petticoat, single-groove type is quoted at $17 per 100, a 6,600-volt with top groove at $24 per 100. Orders are taken subject to fluctuation in price.

Glass Insulators.—Deliveries are steadily improving. Certain styles are now available from stock and conditions point to further betterment. Freight adjustments have not occasioned new lists, and decreased glass consumption in other lines seems to discount the chance of further advances.

Outdoor Lighting Equipment.—The slump in this equipment has not been so great as for the rest of the electrical line in the Middle West. Municipalities are active in the market and the amount of work already under way promises good business for some weeks.

Rigid Conduit.—Difficulty is experienced in securing ½-in and ¾-in. black, though some 1-in. material is in stock. New prices in lots less than 2,500 lb. are $91.03 per 1,000 ft. for ½-in. and $122 per 1,000 ft. for ¾-in. In quantities up to 5,000 lb. the price is $87.64 and $117.26 per 1,000 ft. respectively.

Fuses.—New sheets have been issued by the Economy Fuse & Manufacturing Company on which list prices remain the same but discounts are reduced. The increase is about 10 per cent. Discounts on "Economy" fuses for standard packages are now 18 per cent; one-fifth package, 10 per cent; less than one-fifth list. "Arkless" fuses in similar quantities are discounted 20, 10 per cent and list.

Fractional Motors.—Heavy production and some cancellations have brought about an easier market. Manufacturers are in a position to accept new business, and deliveries range from six to twelve weeks. Buyers are making no complaint over recent price advances. They are asking to be safeguarded against price decreases after placing their order, however.

Southern White Cedar Poles.—Demand is absorbing the entire supply, which is still limited by a shortage of cars in the Southern woods. New freight rates have occasioned revised prices. Representative quotations are: 7-in., 35-ft., $12 each; 8-in., 40-ft., $17.50 each, delivered Chicago.

BOSTON

Trade is beginning to hit its fall stride. Jobbers report improved deliveries in many lines, and shortages, while severe in rigid conduit, outlet boxes and small motors are not so acute as of late. Collections are fair, but are followed more sharply. Few surplus stocks are reported on

wiring material, though current demands are being well met. Prices are firm.

Building operations in the six days ended Sept. 15 in New England total $3,033,000, compared with $5,314,000 for the same period last year. Appliances are moving well, radiators especially showing signs of great activity. Public utilities are expanding along conservative lines and the danger of shutdown on account of coal shortage seems to be averted for the present. Industrial coal priority has been withdrawn from water-bound shipments, but at present the situation seems well in hand. Labor is less restive.

Dry Cells.—Prices are up on No. 6 cells to $37.35 per 100 in barrel lots, the ignition cells being quoted at $38.35. Good stocks and active demand are reported.

Flexible Armored Conductor.—Ample stocks are in hand and demand is quiet. No. 14 single-strip sells for $100 per 1,000 ft. in 1,000-ft. lots.

Non-Metallic Flexible Conduit.—Prices are steady, the ⅜-in. size bringing $33.50 per 1,000 ft. in 5,000-ft. lots, and the ½-in. size $36.50. Local stocks are substantial and the demand is active.

Rigid Conduit.—Stocks are shot to pieces, but occasional shipments are heartening the jobber. Outlet boxes are very scarce. Typical prices on pipe are as follows for less than 2,500-lb. lots: Black, 1-in., $189.50 per 1,000 ft.; galvanized, $200; ½-in. black, $96; galvanized, $102. Stocks are very spotty.

Tubes.—This material is scarce. The price of 3-in. tubes is $12 per 1,000 in barrel lots, net. "Nail-it" knobs are plentiful and quoted at $36.75 per 1,000 in barrel lots.

Tape.—Good supplies are in hand, and quotations are steady. The ¾-in. black brings 70 cents per pound in 25-lb. lots and 65 cents on 100-lb. lots.

Wire.—Small quantities are easily supplied from stock, but orders of 50,000 ft. to 100,000 ft., involving different sizes, are quoted on six to eight weeks in representative cases. Weatherproof base, 29 cents; bare, 24 cents. Rubber-covered No. 14 wire commands $11 per 1,000 ft. in 1,000-ft. lots.

Radiators.—A brisk demand appears under way, and some stocks are getting low. Lots of twenty-five are being sold at 25 per cent off list.

Motors.—Deliveries are shortening on some sizes of single-phase motors, one prominent distributer quoting from stock on 2-hp. to 5-hp. units. About eight weeks is quoted on other sizes. No uniformity in motor deliveries exists, however.

Meters.—Central-station demand continues, and manufacturers are far behind on orders. A few meters are in stock, but the market is poorly supplied.

Lamps.—The supply is keeping well up with the demand, although little opportunity is afforded of establishing a surplus.

Domestic Appliances.—Manufacturers are crowded to the limit with 1920 orders, and plant extensions to meet next year's business are in active progress. Heavy volumes of sales are noted in washers and cleaners.

ATLANTA

The inopportune spell of inclement weather seems to be definitely broken. The condition of the cotton crop is now approximately only 57 per cent normal as against 70 per cent a few weeks ago. It is freely predicted that the crop is going to be short. This fact and the low prevailing price have had an unfavorable effect on business in the rural districts. This condition has been somewhat offset by rumors that the Federal Reserve banks will encourage the loan of sufficient funds to permit the warehousing of cotton as ginned. Though reporting that the number of orders continues to decrease jobbers express the opinion that business is returning to a more normal basis. The pyramiding of orders and wild buying of the past are over. A few cancellations are reported but they are not in sufficient numbers to cause any alarm.

Building operations begun earlier in the year are calling for large quantities of electrical material. Deliveries on the whole are reported more satisfactory than for some months past. The only noteworthy exception is on certain lines of distribution-line material. Jobbers expect to accumulate fairly good stocks in the near future, with the possible exception of certain lines of heating devices. It is feared that the holiday demand there will create a shortage. Prices are steadier as jobbers have readjusted quotations to conform to the new schedule of freight rates.

Non-Metallic Flexible Conduit.—Jobbers report excellent stocks on hand. All outstanding back orders have been filled. Demand is rather light. Prices in lots of 250 ft. to 1,000 ft. for ⅜-in. are $5.52 per 100 ft.; ½-in., $5.06 per 100 ft.

Rigid Conduit.—Recent receipts have allowed contractors to lay in sizable stocks of assorted sizes. One jobber reports the receipt of two cars of galvanized this week. Buildings under construction are absorbing all shipments and the scarcity will continue for the next thirty days. Prices, lots of less than 2,500 lb., black, ½-in., $8.89; ¾-in., $11.80; 1-in., $17.44; 2-in., $37.90; galvanized, ½-in., $9.40; ¾-in., $12.49; 1-in., $18.46; 2-in., $40.18, per 100 ft.

Flexible Armored Conductor.—Receipts have shown considerable improvement in the past fortnight. The majority of outstanding back orders have been filled. No stocks have as yet been accumulated however. Prices, two-wire, No. 14, lots of from 250 ft. to 1,000 ft., $12.22 per 100 ft.

Distributing Transformers.—The shortage is still acute, and central-station customers throughout the section are being seriously inconvenienced. A price advance of approximately 10 per cent is reported. Shipments continue very unsatisfactory.

Meters.—The shortage in the popular-size meters continues. The principal difficulty is with the two-wire, 110-volt type in the 5-amp. and 10-amp. size. Large sizes of polyphase meters are hard to obtain, while shipments on high-tension apparatus are most unsatisfactory.

Washing Machines.—The recent slump in sales has been followed by a brisk demand and jobbers now report a satisfactory movement. Accumulated stocks should be sufficient to carry jobbers well into the fall.

ST. LOUIS

Most jobbers in this district report that September business is less than the corresponding period last month. The volume of trade is still large, however. Jobbers are taking advantage of the slight lull to build up depleted lines. They are greatly aided in this by improved deliveries. Porcelain is still short, but conditions are improving.

Building construction has almost come to a halt. Much of the work planned is being held up awaiting more favorable conditions. Electrical contractors are busy with rewiring jobs. Collections are showing signs of improvement, but only because of the intensive efforts of credit departments. Credit is extended very gingerly. Retail sales are fairly heavy. Small heating devices are showing a good demand.

Knobs and Tubes.—The small amount of building has resulted in a reduced demand. Stocks are spotty and deliveries from factories are long and uncertain. The 3-in. x ⅞-in. tubes are quoted at $9.90 in lots of 1,000 and the 5½-in. new code rail knobs are quoted at $32 per 1,000.

Outlet Boxes.—The shortage continues and jobbers are unable to build up any stock. Shipments, which are a trifle better, are applied on back orders. Discounts are 15 per cent for galvanized and 23 per cent for black.

Metal Molding.—Jobbers' stocks are in good shape, especially of the two-wire and three-wire size. Demand is steady but not exceptional. Deliveries are good. Two-wire and three-wire molding is quoted at a discount of 15 per cent.

Flush Switches.—Stocks are ample to supply the steady demand. Deliveries are becoming more satisfactory. The GE 632 is in good demand and is quoted at $29.75 per 100.

Flexible Armored Conductor.—Stocks are increasing and jobbers can make delivery of medium-sized orders imme-

diately. Demand is reported fair. The price is $125 per 1,000 ft. in lots of from 1,000 ft. to 5,000 ft. for immediate delivery. Larger orders are quoted with price in effect at time of shipment.

Non-Metallic Flexible Conduit.—Large stocks are in jobbers' hands. Demand is slow and the majority of jobbers can make immediate deliveries on all sizes. In lots of from 1,000 ft. to 5,000 ft. the price is about $33.50 per 1,000 ft. for the ½-in., and about $32.50 per 1,000 ft. for the ⅜-in.

Dry Cells.—Stocks are sufficient to care for all immediate needs. Demand is reported good. There has been an advance on Columbia dry cells of 3 cents plus freight, making the price from $36 to $39 on barrel lots.

Insulating Material.—A fair demand in conjunction with greatly improved deliveries has enabled jobbers to build up stocks to normal in many instances.

Insulators.—A scarcity of both porcelain and glass types exists. Demand is very strong. A few jobbers are securing deliveries but are applying them on back orders. An increase of about 10 per cent went into effect on glass insulators Sept. 3. The No. 9 pony type is quoted at $58.77 per barrel, and the deep-groove petticoat type at $91.95 per barrel.

Lead-Covered Wire.—A very good stock of 600-volt lead-covered wire is in jobbers' hands and fair stocks of other sizes. Demand is steady. No. 14 duplex is priced at $53.46 per 1,000 ft. in lots of 2,500 ft.

Line Hardware.—The shortage reported from other sections of the country is not felt here. Jobbers have good supplies, and manufacturers state that their production is keeping pace with orders.

SAN FRANCISCO

Conditions point to a buyers' market, rather than a sellers', developing in the near future. San Francisco has not only been placed on a restricted lighting and sign illumination schedule, but has also been requested to conserve power by "skip-stop" street-car regulations. This virtually marks a resumption of war-time regulations.

Collections are slightly improved, though they are still poorer than during the early months of this year. They now average about forty-seven days.

Lamp Cord.—Stocks are very uneven and broken. No. 18 cotton-covered twisted cord is selling for $30 per 1,000 ft. in coil lots, or $28.50 per 1,000 ft. in 2,500-ft. quantities. Small sizes of portable cord in 64-in. insulation, which will not be allowed by the underwriters after this year, are in big demand. Fancy parallel and No. 18 twisted silk cords are scarce. They sell for $60.75 per 1,000 ft. in coil lots, or $57.80 in 2,500-ft. assortments, with other cords in coil lots.

Rubber-Covered Wire.—In general stocks are excellent. Supplies are better in the smaller wiring sizes. No. 14 single-braid solid is selling for $13.35 per 1,000 ft. in coil lots and $12.75 in 5,000 ft. assorted lots in full coils.

Wireless Apparatus.—Increasing sales along the Coast and the growing importance of California as a radio manufacturing center have brought about the first annual convention of Pacific Coast radio manufacturers, which will be held in San Francisco during the latter part of October.

Conduit Fittings—On material such as condulets, taplets, etc., supplies in general are good, despite heavy sales which have run far above those of last year. Stocks have been good all the year and no serious shortage has been reported.

Ironing Machines.—Prices have increased about 10 per cent. The standard selling size which is the forty-two-roll, 110-volt motor-driven, gas-heated machine with stand, is now retailing for $193. Stocks in general are poor.

SEATTLE—PORTLAND

With the exception of increasing sales in certain domestic appliance lines such as washing machines, tableware and certain heating devices, Seattle jobbers and dealers report no change in business. The movement of heating devices is especially brisk at this time. The demand for schedule material and housewiring devices, on the other hand, is sluggish and little hope for improvement is held out.

The market for power apparatus is quiet. With but few exceptions, stocks of everything are in good shape. Shipments are coming through in comparatively satisfactory shape. Collections in general are also good.

Portland manufacturers report good business. Increased freight rates will not greatly affect prices of electrical goods, as quotations are usually f.o.b. factory. Lamp stocks are in exceptionally good condition. An increase of about 10 per cent is reported in transformer prices. The following trade prices are from Portland.

Lamp Cord.—Type C. No. 18, in lots less than a coil is quoted at $40 per 1,000 ft., and full coils at $33.30 per 1,000 ft.

Annunciator Wire.—The price of No. 18 in large spools, 6 lb. to 10 lb. each, is $71 per 100 lb. Small spools of 1 lb. each are $74.35 per 100 lb.

Porcelain.—Prices are as follows: Solid knobs, per 1,000, less than unit packages, No. 5½, $23; No. 4½, $45; in unit package lots, No. 5½, $20; No. 4½, $42.50. Knobs, split, less than unit packages, per 1,000, No. 5½, $34; "Nail-it" knobs, $46.50, and in unit package lots, $29.50 and $40.50 respectively. Tubes, per 1,000, less than unit packages, ⅞ in. x 3 in., $16; ⅞ in. x 4 in., $41.60; and in unit packages, $13.75 and $35.20 respectively. Cleats, two-wire and three-wire unglazed, per 1,000, in lots of less than a standard package, $37.80, and in unit packages, $35.70.

Rigid Conduit and Couplings.—The price of ½-in. black is $10.75 per 100 ft.; ¾ in., $14.25 per 100 ft.; 1 in., $21.10 per 100 ft. Couplings per 100, ½-in., are quoted at $9.35; ¾-in., $13.35; 1-in., $17.35. Elbows, ½-in., are $25.35; ¾-in., $33.35; 1-in., $49.35 per 100.

Flexible Armored Conductor.—No. 14, two-wire solid, is quoted at $175.50 in less than coil lots; No. 10, solid, $240.50; No. 8, solid, $370.50.

Non-Metallic Flexible Conduit.—The price per 1,000 ft., less than coil lots, for ⅜-in., is $60.50; ½-in., $66; ¾-in., $132. In coil lots or over prices for the same sizes are $44, $48 and $96 respectively per 1,000 ft.

SALT LAKE CITY—DENVER

Forecasts point to bumper crops all through the Intermountain region. Indications are that previous records will be broken in the yield of forthcoming harvests. The car shortage that threatened to impede shipping has been relieved.

Money stringency persists. Banks are conservative in their attitude and loan sparingly. As a consequence business prosperity is slow in appearing here. Potentially conditions are good, however. A big electrical market exists, backed by an immense buying power. Buying just now seems to be waiting on the conversion of marketable crops into cash. Little complaint is heard among jobbers about shipments. In almost all lines they are amply stocked. Many electrical manufacturers are having to urge their jobbers to buy. Some dealers are endeavoring to stimulate trade by special price reductions and attractive payment terms, but the response is not altogether encouraging.

All serious labor troubles in the electrical field have been settled. Union men have accepted the American plan of labor, but under protest, and some contractors foresee a future renewal of the struggle. Little new construction work is getting under way. Efforts are concentrated on finishing work already begun. Many jobbers and power companies are making ready to utilize state fairs as a publicity opportunity. Labor-saving electrical devices and farm-power plants are the chief items that will be promoted.

Heating Appliances.—There is a slight increase in demand, but the market continues sluggish. Dealers are not looking for any price decline, though the buying public confidently believes it will come. Stocks of most devices are plentiful.

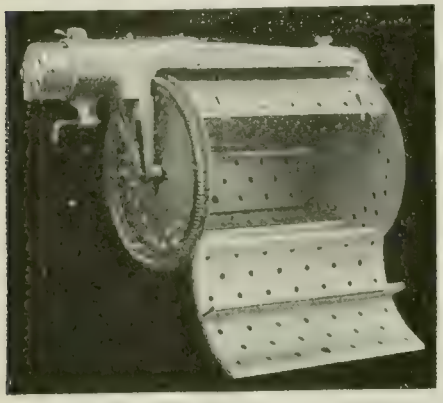
Bare and Insulated Wire.—Jobbers report that stocks are ample to meet the demand. Line construction work is at a standstill now, with the exception of one or two big jobs for which materials were ordered previously.

NEW APPARATUS & APPLIANCES

A Record of Latest Developments
and Improvements in Manufacturers' Products
Used in the Electrical Field

Portable Washing Unit

For use in its own tub or adjusted to any standard laundry tub, a portable clothes washer has been placed

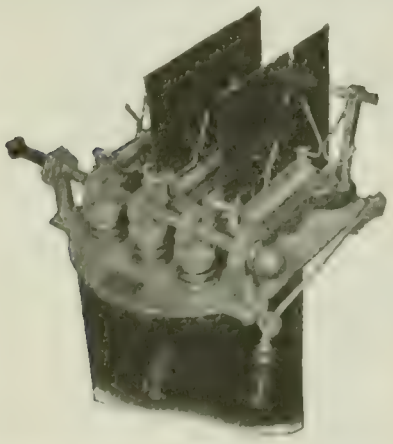


THE WEIGHT OF THIS WASHER COMPLETE IS 51 LB.

on the market by the Universal Utilities Corporation, Alpena, Mich. The cylinder rotates always in the same direction and is driven by a small electric motor which will operate on direct current or alternating current.

Self-Contained Low-Voltage Lightning Arrester

An innovation has been made by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., in a low-voltage, self-contained electrolytic lightning arrester by the placing of the transfer switch and gap structure on the top of the tank. The tank



COMPACT ARRANGEMENT IN THIS MOUNTING OF TRANSFER SWITCH

and spark gaps remain the same as previous models. The transfer switch is of the sliding-rod type. It consists of a rod with sections of conducting and insulating material and operates through five self-aligning contacts supported by the cover. The three middle contacts are insulated from the tanks by porcelain insulators while the end contacts are connected directly to the tank top through their metal supports and form a part of the ground circuit.

Traveling Lights for Display or Christmas Trees

A device for the continuous display of illuminated objects by means of a series of light bulbs traveling on a flexible moving shaft has recently been developed by Edward A. Dieterich, 910 Cauldwell Avenue, New York City. The device can also be used on a Christmas tree, causing illuminated birds, animals, etc., to travel around the branches. The flexible guideway along which the lamp bulbs travel is slotted to hold the flexible shaft to



GUIDEWAY FOR TRAVELING LIGHTS PLACED IN ANY POSITION

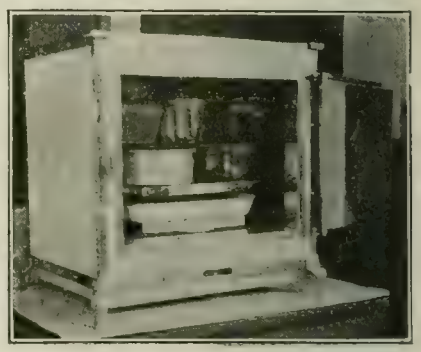
which the bulbs are attached, while the shaft is driven by a pair of friction rollers. The movement of the lamps around the guideway is continuous. The guideway is flexible and easily camouflaged and may be placed or hung in any position desired.

Industrial Lighting Unit

In the industrial lighting unit developed by the Perfection Sales Company, 329 East Twenty-second Street, New York City, there are two metal shades instead of an upper opaque one and a lower translucent shade as stated in ELECTRICAL WORLD, July 31, page 264. The lower shade is employed to direct some of the light in horizontal and upward directions without causing glare.

Combination Electric Oven and Fireless Cooker

A 660-watt electric oven, developed to give lamp-socket cooking for the small-size family, embraces (1) a fireless cooker; (2) two radiant grills for broiling, etc., and (3) a boiling device. A soapstone gives the fireless-cooker service. Temperature is indicated by a circular thermometer on the outside of the oven door. The oven is white enameled and is trimmed with a rust-proof finish. The inside, which is of aluminum, is 12 in. deep, 16½ in. long and 14½ in. high. The walls are 2¼ and 3 in.

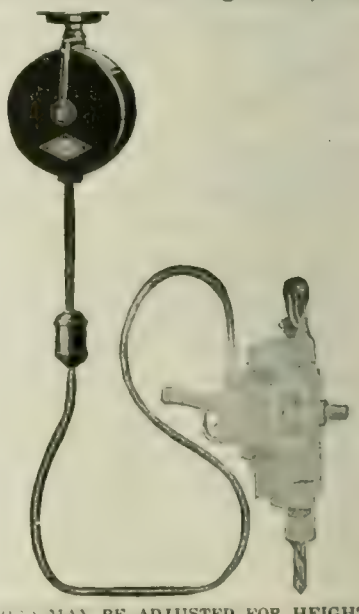


ELECTRIC OVEN WITH FIRELESS COOKER FEATURE

thick and insulated. Alternating or direct current at 110 volts may be used. The Home Helps Manufacturing Company, 39 West Thirty-eighth Street, New York City, is the maker of this oven.

Machine-Tool Cord Reel

A new application of the "Reelite" type of cord reel has been made by the Anderson Electric & Equipment Company, 154 Whiting Street, Chicago, Ill. This cord reel is designed for use with machine tools such as grinders, drills,



CORD MAY BE ADJUSTED FOR HEIGHT

hammers, fans or heavy soldering irons and the like and is provided with 20 ft. of heavy cord and a two-pin connector.

MANUFACTURERS' ACTIVITIES

Record of Changes Affecting Sales and Distribution Together with Trade Personals and Notes on Foreign Trade, Jobbers' News and New Trade Literature

THE BOWEN MOTOR RAILWAY COMPANY, Title Guarantee Building, St. Louis, Mo., manufacturer of electric railroad equipment, will ask for bids for construction of its new plant, to cost with machinery about $75,000.

CHARLES WHITING BAKER, for many years editor in chief of the *Engineering News* and since 1917 consulting editor of the *Engineering News-Record*, announces his resignation and the establishment under his direction of the Engineering Business Exchange, Hudson Terminal Building, 30 Church Street, New York City, an agency to bring together those desiring to sell any sound engineering or technical business manufacturing, constructing, selling, or professional—and those seeking opportunities to purchase.

NAVY DEPARTMENT SPECIFICATIONS—Specifications 17T8b, dated Oct. 1, 1920, superseding 17T8a, for ships' service telephones and switchboards for use on ships of the United States Navy, is now available.

THE VALLEY ELECTRIC COMPANY, St. Louis, Mo., which recently purchased the St. Louis Electrical Works, has begun to move into its new buildings at 3157 South Kings Highway. The offices and the automotive departments are in the new location, but all motor manufacturing is still being done at the old plant at 4,060 Forest Park Boulevard. The company now plans to keep the old factory building for the manufacture of its larger motors exclusively and to devote the new buildings to the manufacture of 5-hp. and smaller motors.

THE ELECTRIC HEATING & MANUFACTURING COMPANY, Seattle, Wash., has recently removed its plant from 1812 Ninth Avenue, South, to Westlake and Republican Streets, where it has much larger quarters.

THE HABIRSHAW ELECTRIC CABLE COMPANY, 10 East Forty-third Street, New York City, has issued a combined statement of the earnings of the Habirshaw Electric Cable Company, Inc., the Electric Cable Company and the Bare Wire Company, for the five months ended May 31, 1920, as follows: Sales (not including Bare Wire Company), $4,846,807; profit in trading, $412,617, from which $163,767 was deducted for interest, discount and bonuses, leaving a net income of $248,850.

THE GENERAL MOTORS CORPORATION, Detroit, Mich., is planning to erect two plants on a sixty-acre site at Grand Rapids, Mich. One plant will be used for the manufacture of Sunny Home electric lighting systems and the other for Frigidaire iceless refrigerators. The General Motors Exports Company, a subsidiary of the General Motors Corporation, has taken over the foreign department of the Delco-Light Company, and it is planned to cover intensively practically all the civilized world. Export sales have already been extended until today there are 125 distributing points established outside the United States.

THE INTERNATIONAL WESTERN ELECTRIC COMPANY is planning for the removal of its works at 152-56 West Thirty-sixth Street, New York City, after the first of the year. The lease of the building it now occupies expires Jan. 1, 1921, and the property has been taken over by the city of New York.

THE GENERAL LEAD BATTERIES COMPANY, 123 West Fifty-sixth Street, New York City, has filed notice of increase in capital stock from $800,000 to $2,000,000.

THE GREENFIELD TAP & DIE CORPORATION, Greenfield, Mass., has awarded contract for an addition to its forge shop at Turner's Falls, which will more than double the present capacity. A contract has also been placed by the corporation for a five-story and basement addition to the Wiley & Russell plant, which will increase the output about 70 per cent.

THE LOCOMOTIVE SUPERHEATER COMPANY, New York, through its industrial department, has issued what is called a "Data Book for Engineers." This is a book with flexible covers containing sixty-four pages of data of every-day interest to the steam-plant engineer. Besides an abbreviated steam table, it contains a table of the various coals of the United States arranged by states and giving an approximate analysis.

THE NATIONAL LAMP WORKS of the General Electric Company, Nela Park, Cleveland, Ohio, plans to erect a three-story factory on Alonzo Avenue near Aetna Road, to cost about $300,000.

DWIGHT P. ROBINSON & COMPANY, INC., engineers and constructors, of New York, have established a new branch office in Youngstown, Ohio, in the Home Savings and Loan Building, in charge of C. I. Crippen. The company recently moved its Cleveland office from the Leader-News Building to the Citizens' Building, and H. P. Clawson, who was for several years a member of the Chicago staff, has been transferred to Cleveland to take charge of this office. The company now maintains branch offices in Pittsburgh, Youngstown, Cleveland, Chicago, Dallas and Los Angeles, and in Sao Paulo, Brazil.

THE GRISCOM-RUSSELL COMPANY, 90 West Street, New York City, manufacturer of the coil-type Reilly Oil Heater, has recently placed on the market a new oil heater unit of the straight-tube type. This is to supplement its coil-heater line and is known as the G-R Oil Heater.

THE STERLING MANUFACTURING COMPANY has recently moved from 321 Frankfort Avenue to 2815-2853 Prospect Avenue, Cleveland, Ohio, where it will occupy its new three-story fireproof building.

SAM W. SMITH, formerly sales manager of the Uehling Instrument Company and at one time equipment engineer of the Southern New England Telephone Company, has joined the Smith Engineering & Supply Company, Boston, Mass., which represents the Uehling Instrument Company and the Adriance-Bate Company in New England.

THE CELITE PRODUCTS COMPANY, New York, manufacturer of Sil-O-Cel, has added Charles J. Parsons to its staff as a specialist in power-plant work.

THE M. H. DETRICK COMPANY has opened an Eastern branch at 30 Church Street, New York. The company makes suspended arches and steam-jet ash conveyors. The office will be under the direction of R. D. Foltz, Eastern sales manager. H. S. Sleicher will handle sales in New York as before.

GREENE, TWEED & COMPANY announce arrangements to manufacture their line of automatic lubricators in their new plant at Newark, N. J. In the future all shipments will be made from there and all repairing will be done there instead of at 109 Duane Street, New York, as formerly.

A. C. STREAMER, manager of the switchboard section of the supply department, Westinghouse Electric & Manufacturing Company, has been appointed industrial assistant to the manager of the supply department of that company, with headquarters at East Pittsburgh, Pa.

V. C. KYLBERG has been appointed sales adviser to the Navy Department. During the period of greatest activity in the disposal of the War Department's surplus property Mr. Kylberg was assistant chief of the machine tool section of the office of the director of sales. Later he organized the procurement division for the army's vocational training schools. More recently he has been acting head of the sales section of the United States Shipping Board.

THE BLUEBIRD MANUFACTURING COMPANY, of St. Louis, which was placed in the hand of receivers on May 23 and later absorbed by the Davis Sewing Machine Company, of Dayton, Ohio, will remove to the latter city within ten months. It has been announced by W. S. Ireland, former president of the St. Louis company, who has been placed in charge of Bluebird affairs by C. A. Heaton, president of the Davis company.

THE ECONOMY FUSE & MANUFACTURING COMPANY, 1205 Commerce Building, Kansas City, Mo., announces the appointment of S. W. Fries as district sales manager for Kansas City territory, succeeding R. P. Crawley, who has resigned to take over the active management of the Crawley Electric Company, Peoria, Ill. Mr. Fries has been with the Economy Fuse & Manufacturing Company for a number of years.

THE OIL ENGINES MANUFACTURERS' SOCIETY, which includes in its membership practically all builders of semi-Diesel fuel-oil engines throughout the country, held a meeting recently at Grove City, Pa. The society aims to promote the general welfare of the industry and through co-operative efforts to educate possible users in the benefits of oil engines. The officers for the ensuing year are: President, H. L. Dean of the Chicago Pneumatic Tool Company, New York City; vice-president, W. N. Durbin of the Anderson Foundry & Machine Company, Anderson, Ind.; treasurer, F. B. Morrison of the Power Manufacturing Company, Marion, Ohio; secretary, C. B. Humphrey of the Worthington Pump & Machinery Company, New York City.

THE E. C. ADAM COMPANY, St. Louis, Mo., lighting fixture manufacturer, has taken over the lighting-fixture department of the Frank Adam Electric Company of St. Louis. F. C. Adam formerly manager of the lighting-fixture department for the Frank Adam Company, is president of the new corporation, Herbert S. Griffin is vice-president and Richard N. Loeb is secretary. The company will be operated as a separate corporation.

THE STEWART MANUFACTURING CORPORATION, 4500 Fullerton Avenue, Chicago, manufacturer of bronze-back bearings and die castings, announces the opening on Oct. 1 of a new branch office at 30 Church Street, New York City, in charge of Louis Ruprecht.

HOBART BROTHERS COMPANY, Troy, Ohio, announces the addition of a line of 1-hp. to 10-hp. general-purpose bolt-bearing electric motors to its former interests. The motors will be made for both direct and alternating current. Heretofore the company has specialized on such equipment as motor-generator sets and lighting generators for battery-service stations.

THE UNITED STATES LIGHT & HEAT COMPANY has acquired property adjacent to its Niagara Falls (N. Y.) battery plant and is reported to be planning the erection of an addition to the plant.

LESTER G. MAMPLE has been promoted to assistant sales manager of the Northwestern Electric Equipment Company, St. Paul, Minn.

Supply Jobbers' Notes

THE ERNER ELECTRIC COMPANY has moved into its new four-story and basement building at 1,240 Ontario Street, Cleveland, Ohio. The building is 65 ft. x 151 ft. and is built throughout of reinforced concrete. The whole northern exposure is of glass, making the interior well lighted and ventilated. The company has recently become affiliated with the Westinghouse Electric & Manufacturing Company as agent-jobber and serves northern Ohio and western Pennsylvania. The Erner Electric Company was organized in September, 1902, as a combination of the Electrical and Manufacturing Company and J. A. Erner & Company. In 1907 the construction business formerly done was discontinued, and in 1918 retail sales were stopped. Since then the company has confined itself strictly to wholesaling. The personnel of the company includes: C. T. McKinstry, president-treasurer; George S. Milner, general manager; J. A. Milner, purchasing agent; F. W. Seywert, assistant treasurer; Warner Jones, sales manager; D. B. Graze, manager apparatus department; P. B. [illegible] C. Stanton, manager farm equipment department.

THE TOWER-PINFORD ELECTRIC & MANUFACTURING COMPANY, Richmond, Va., has just moved into its new two-story [illegible] structure of steel and brick, fireproof and equipped with gravity conveyors. The building is constructed so that additional

floors may be added when needed. Provision is made for trucks to load or unload on both floors. The company is an agent-jobber for the Westinghouse Electric & Manufacturing Company and it reports a rapidly growing business.

WILLIS H. GILBERT, 710 Conway Building, Chicago, dealer in Southern white-cedar poles, is opening a yard in Bainbridge, Ga., where water transportation facilities from the producing fields are available via the Apalachicola and Flint Rivers. This action is designed to improve the supply service in the South Atlantic region and to offset the increased rail freight rates to the territory.

THE B-R ELECTRIC COMPANY, corner Fifteenth and Walnut Streets, Kansas City, Mo., has recently organized an advertising department in charge of G. B. Carpenter, who has entire charge of directing all publicity. The initial number of the company's monthly house organ was published in July, and in it an account of the twenty-fifth anniversary of the company was given.

Foreign Trade Notes

JAPANESE ENGINEER VISITS THE UNITED STATES.—American standards of electrical power and traction are being studied by Y. Furukawa, director and chief engineer of the Kyushu Electric Light & Traction Company, Fukuoka, Japan, who is traveling through the United States. His itinerary includes Salt Lake City, Seattle, Butte, Chicago, and New York. In the latter place he expects to purchase some electrical machinery.

GREAT INCREASE IN ELECTRICAL IMPORTS OF CANADA.—According to a report recently issued by the Dominion Bureau of Statistics at Ottawa, the importation of electrical apparatus into Canada is increasing rapidly. Imports of dynamos, generators and motors increased from $1,917,861 in the fiscal year 1917-18 and $2,353,722 in 1918-19 to $3,020,742 during the past fiscal year, when the figures were $1,976,703 for motors and $1,044,039 for dynamos and generators, the business being almost entirely in the hands of United States firms. Incandescent electric lamps to the value of $1,335,016 were also imported last year, nearly all from south of the international boundary line, and other imports during the past fiscal year included electric insulators of all kinds, $614,523; sockets, $142,748; telegraph instruments, including wireless apparatus, $114,034; telephone instruments, $653,517; transformers, $124,356; primary electric batteries, $124,833; electric storage batteries, $1,474,724; electric cooking and heating apparatus, $112,152; electric light fixtures and metal parts, $732,020; electric meters, $280,868; electric apparatus, not otherwise provided for, $7,435,239. The above figures provide a total value of $16,164,772 in electrical material imported into Canada during 1919-20. The total exports of electrical material of the United States to Canada in the same period, according to the United States Bureau of Foreign and Domestic Commerce, amount to $18,436,915. The apparent discrepancy is probably accounted for by the fact that material included as electrical in the total of this country may be placed under a different classification by the Canadian customs officials.

THE COMPANIA HISPANO-AMERICANA DE ELECTRICIDAD, Madrid, Spain, is the title of the company which will take over the property and holdings of the German Overseas Electric Company, commonly known in the United States as the D. U. E. G. The company controls electric light plants and street-railway systems in Argentina and Chile, South America.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Urgent cable quotations on electric magnetic separators are wanted by a firm in India-China. (No. 33,711) Separators to treat 250 tons of sand per hour to remove ferro-titanium.

A South American Republic (No. 33,721) desires to purchase wireless sets of about 10-kw. size.

An Italian (No. 33,725) wants agency for electrical supplies, etc.

A firm of commission agents in India (No. 33,713) desires to import electrical goods, and agencies are desired for such in British India, Burma and Ceylon.

A merchant in Brazil (No. 33,702) desires to secure an agency and the direct importation of machines for electrical industries, etc., in that country.

Trade Publications

STEEL TANKS.—The Chicago Bridge & Iron Works, Chicago, is distributing five booklets covering its steel tanks for automatic sprinkler and general factory service, waterworks, railway service, etc.

INSULATOR TESTING.—T. F. Johnson, Jr., Atlanta, Ga., is distributing five booklets describing his insulator-testing methods and methods of working on live lines.

FITTINGS.—The Erie Electrical Equipment Company, Johnstown, Pa., describes its line of fittings and quotes prices in a booklet recently printed.

FARM-LIGHTING PLANTS.—The Delco Light Company, Dayton, Ohio, has issued a new set of literature describing, for the amateur, the theory of the Delco lighting products for farms, hotels, country clubs, etc.

BRUSH HOLDERS.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is distributing a small four-page leaflet describing its insulated pin-type brush holders for Westinghouse motors Nos. 49, 56, 68 and 76.

STANDARD UNIT-SWITCHBOARD PANELS.—The General Electric Company, Schenectady, N. Y., has issued bulletin No. 47,001-A, to supersede No. 47,001. It covers both large and small panels.

INSTRUMENT TRANSFORMERS.—The Packard Electric Company, Warren, Ohio, is to issue bulletin No. 208, which will be the first to cover its complete line of instrument transformers.

DEMAND METERS.—The General Electric Company, Schenectady, N. Y., describes its type H-2 maximum-current demand meter in bulletin No. 46,042.

DIRECT-CURRENT INSTRUMENTS.—The General Electric Company, Schenectady, N. Y., has issued bulletin No. 46,017, to supersede bulletin No. 4,879, on direct-current instruments.

AMMETERS AND VOLTMETERS.—The Roller-Smith Company, 233 Broadway, New York City, has recently issued bulletin No. 430, covering its direct-current switchboard-type voltmeters and ammeters; also bulletin No. 450, describing its alternating-current switchboard-type voltmeters and ammeters.

CONDULETS.—The Crouse-Hinds Company, Syracuse, N. Y., has recently issued a new bulletin on condulets for steam and electric railroads, for car wiring, locomotive wiring, signal-tower battery charging, locomotive and car-shop wiring, etc.

COMBUSTION CONTROL.—The Engineer Company, 17 Battery Place, New York, has just printed a booklet on "Modern Practice in Combustion Control," of interest to all steam-station engineers.

FRACTIONAL-HORSEPOWER MOTORS.—The Master Electric Company, Dayton, Ohio, has issued bulletin No. 20 covering its fractional-horsepower motors in sizes from 1/6-hp. to 1/2-hp.

LOCOMOTIVE HEADLIGHT UNIT.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued leaflet No. 3485, describing a new 500-watt, 33-volt locomotive headlight turbine-generator unit.

ELECTRIC FURNACES.—The Booth Electric Furnace Company of Chicago has issued an illustrated loose-leaf catalog in which detail specifications and drawings are given for the company's rotating electric furnaces of from 250 lb. to 2,000 lb. capacity. The catalog also contains a list of the company's principal installations and other data which prospective buyers might need.

TEMPERATURE INDICATORS.—The General Electric Company, Schenectady, N. Y., has issued the third edition of bulletin No. 46,028 describing its temperature indicators.

WATT-HOUR METERS.—The Second edition bulletin No. 46,209 has been brought out by the General Electric Company, Schenectady, N. Y. This bulletin covers types CS and CS-3 direct-current astatic watt-hour meters.

ELECTRIC IRONS.—The American Electric Heater Company, Detroit, Mich., is putting out a folder showing window displays and other means of advertising its electric irons.

SWITCHBOARD PANEL SUPPORTS.—The General Electric Company, Schenectady, N. Y., has issued bulletin No. 47,703-A, to supersede No. 47,003. It describes standardized fittings and such accessories.

New Incorporations

THE GREAT MOUNTAIN POWER COMPANY, Trust Building, Charlotte, N. C., has been incorporated with a capital stock of $2,000,000 by H. S. Taylor, M. M. Crandall and G. B. Chapman.

THE BEEBE (ARK.) LIGHT & POWER COMPANY has been chartered with a capital stock of $20,000 by C. A. Miller, Thomas Neely and F. A. Dove.

THE WILLS VALLEY LIGHT & POWER COMPANY, Hughes Mills, Ala., has been organized with a capital stock of $75,000 to build a hydro-electric plant on Wills Creek. The incorporators are C. C. Appleton, E. W. Wade and W. W. Hughes.

THE APPLE ELECTRIC MANUFACTURING COMPANY, Dayton, Ohio, has been chartered with a capital stock of $500,000 to manufacture electric motors. The company will soon open a factory in the United Brethern Annex Building on Fourth Street. The incorporators are Vincent G. Apple, H. F. Apple, R. G. Corwin, Clarence Keifer and P. H. Worman.

THE MEEK-DENNISON MANUFACTURING COMPANY, Huntington, W. Va., has been organized with a capital stock of $50,000 to manufacture electric automatic motion signs and fountains. The incorporators are E. C. Meek, R. C. Dennison, V. G. Bryan, J. H. Sellers and Paul W. Scott, all of Huntington.

THE HILLSBORO (IND.) ELECTRIC LIGHT COMPANY has been incorporated by Elwood Davidson, Evert P. Finch and Austin D. Keeling. The company is capitalized at $15,000 and proposes to supply electricity in Hillsboro.

THE ERMET MANUFACTURING COMPANY, Indianapolis, Ind., has been organized to manufacture a newly patented storage battery by Normal Metzger, Joseph Erpelding and Alexander Metzger.

THE AMERICAN ELECTRIC AIR PUMP COMPANY, Pittsburgh, Pa., has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $300,000. The incorporators are John G. Brickfield, Ralph F. Garrity, Wilmington and Gilliam G. Gold, Pittsburgh Pa.

THE MAXWELL ELECTRIC SPECIALTIES COMPANY, New York City, has been incorporated by L. S. and M. J. Gallubler, 855 Whitlock Avenue, New York. The company is capitalized at $20,000 and proposes to manufacture electrical goods.

THE ADAMS ELECTRIC ENGINEERING WORKS, 206 West Eleventh Street, Los Angeles, Cal., has been incorporated by Frank B. Adams, 1120 West Twenty-seventh Street, and others, for the purpose of manufacturing electrical products.

The BETTERBILT BATTERY COMPANY, 520 West Pico Street, Los Angeles, Cal., has been organized for the purpose of manufacturing electric batteries. Thomas W. Fouri, 245 South Serrano Avenue, is promoter of the company.

THE YANKEE BATTERY MANUFACTURING COMPANY, San Diego, Cal., has beeen chartered by C. D. James, C. C. Benjamin and W. E. Zelley. The company is capitalized at $250,000 and proposes to manufacture electric batteries.

THE KOMP ELECTRIC & MANUFACTURING COMPANY, Brooklyn, N. Y., has been chartered with a capital stock of $10,000 by G. A. Dewey, R. G. Dunbar and F. S. Komp, 2211 Nostrand Avenue, Brooklyn

New England States

BANGOR, ME.—The Keyes Fibre Company of Waterville contemplates the erection of an electrically operated mill at this place for grinding wood pulp.

MONTVILLE, CONN. — Contract has been awarded to Barney & Ahlers, 110 West Fortieth Street, New York, N. Y., by the Robert Gair Company, 50 Washington Street, Brooklyn, N. Y., for the erection of a paper factory and power house at Montville, to cost about $600,000. (Incorrectly reported in issue of Aug. 28.)

Middle Atlantic States

BUFFALO, N. Y.—The Buffalo General Electric Company has filed plans for the erection of an electric distributing station to cost about $7,500. Work is to be done by day labor.

DUNDEE, N. Y.—Bids will be received by Edward L. Bailey, general manager of the Dundee electric lighting plant, until Oct. 1 for furnishing materials and complete equipment for an 11-mile transmission line, including poles, insulators, copper wire, transformers, lightning arresters, etc. The cost is estimated at $15,000.

JAMESTOWN, N. Y. — Plans are under way by I. S. Burns, secretary of the board of park and city planning commissioners, for repairing the lighting and heating system at the Fenton homestead at this place, to cost about $25,000.

MEDINA, N. Y.—The Western New York Utilities Company, Medina, N. Y., has applied to the State Public Service Commission for permission to erect an extension to electric plant in the town of Gaines

NEW YORK, N. Y.—Improvements, including the installation of new equipment, to the electrical department of the New York Railways Company, 165 Broadway, to cost about $25,000, are contemplated.

NORTHPORT, N. Y. — Application has been made to the Public Service Commission, Second District, by the Long Island Lighting Company for improvements and new construction at Northport, Amityville, Babylon, Islip and several other places.

SHELTER ISLAND, N. Y.—The matter of having electric lighting service in this place has been taken up by residents with the Long Island Lighting Company of Sag Harbor. It is proposed to convey the current from the subsidiary plant at Sag Harbor by pole line and submarine cable to Shelter Island, a distance of twelve miles.

YONKERS, N. Y.—The Hudson Tire & Rubber Company has plans under way for the construction of a factory and power plant to cost about $300,000. The Osborn Engineering Company, 2848 Prospect Avenue, Cleveland, Ohio, is engineer

BRIDGETON, N. J.—The Illinois Glass Company, Alton, Ill., contemplates the erection of a power plant to cost about $200,000, including machinery, in connection with its proposed local glass manufacturing plant, in which considerable electrical and mechanical equipment will be installed.

DOVER, N. J.—The Richardson & Boynton Company, manufacturer of boilers, ranges, etc., proposes to replace steam operation with electric power at its local plant and is planning for the installation of considerable electrical equipment.

SUMMIT, N. J. — The Commonwealth Electric Company has been granted permission to issue bonds to the amount of $60,000 and $35,000 capital stock, part of the proceeds to be used for proposed extensions and betterments to its electric plant and system

TUCKERTON, N. J. — The local radio station has been acquired by the Radio Corporation of America, Woolworth Building, New York, N. Y., and plans are under way for the construction of additions thereto to cost about $250,000 and the installation of five additional poles with equipment.

MYERSTOWN, PA. — Notice has been filed by the Womelsdorf, Myerstown & Lititz Transit & Light Company, recently organized in Delaware, of intention to operate a light and power system in this place.

PHILADELPHIA, PA. — The Electrical Bureau contemplates extensions and improvements to cost about $250,000.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

PHILADELPHIA, PA. — Stockholders of the Philadelphia Electric Company have approved an issue of $15,000,000 preferred stock to provide funds for the company's new power plant at Beach and Palmer Streets and the Delaware River. Plans include the erection of a new substation and additions to existing substations and lines.

PHILADELPHIA, PA. — Contract has been awarded to Fred A. Havens & Company, 845 North Nineteenth Street, by the Ferguson Carpet Company, Rockland and Stenton Streets, for the erection of a power house, 40 ft. x 74 ft. Equipment has not been purchased.

PHILADELPHIA, PA. — The Bureau of Yards and Docks, Navy Department, Washington, D. C., contemplates the erection of foundations for turrets and crane track to include a conductor rail, underground electric conduit system, air line, etc. (Specification 4299.)

PHILADELPHIA, PA. — The Dearnley Brothers Worsted Spinning Company, Main Street, has plans under way for the construction of a new 25-ft. x 60-ft. power plant.

POTTSTOWN, PA.—In connection with extensions to its filtration plant, the Pottstown Gas & Water Company is planning for the installation of electrical and mechanical equipment including motors, control apparatus, etc.

BLUEVILLE, W. VA. — The Brownlow Service Company, recently organized, contemplates the installation of electric light and water systems at Brownlow Park. R M. Parrish, Grafton, W. Va., is president.

CHARLESTON, W. VA.—The Virginian Power Company of Charleston has secured right-of-way for the erection of an electric line through Cabell County. The Virginian company is to furnish power to the Ohio Valley Electric Railway Company of Huntington.

SPENCER, W. VA.—Arrangements have been made for the purchase of machinery to cost about $16,000 for the electric light and power plant recently purchased by the Spencer Water & Ice Company.

North Central States

ASHLAND, OHIO.—The Faultless Rubber Company contemplates the erection of a power house. The Osborn Engineering Company, 2848 Prospect Avenue, Cleveland, is engineer.

BRYAN, OHIO. — The Central Light & Power Company, recently incorporated by H. A. Graetz and others with a capital stock of $35,000, contemplates the erection of a power plant at this place.

CLEVELAND, OHIO. — Contract has been awarded to the Hunkin-Conkey Construction Company, Century Building, by the Variety Iron & Steel Company, East Fortieth Street and Hamilton Avenue, for the construction of a power house to cost about $10,000.

COLUMBUS, OHIO — At a recent meeting of the Board of Education it was decided to install electric lights in all schools.

LOUISVILLE, KY. — The Standard Oil Company, Inc., 424 West Bloom Street, contemplates an addition of a steam-power plant building for three new 500-hp. boilers, one of which is to be installed at once. The company also plans to instal one 75-hp., 220-volt, alternating-current motor. A. K. Whitelaw is general manager.

GOSHEN, IND. — Application has been made to the State Public Service Commission by the Electrical Transmission Company of Northern Indiana for permission to erect an electric transmission line from Goshen to Warsaw, to cost about $50,000 The purchase of the Hawks Electric Company of Goshen is also contemplated.

INDIANAPOLIS, IND. — Bids will be received by George C. Hitt, business director of the Board of School Commissioners, Meriden and Ohio Streets, until Oct. 1, for shop-building units power house, electric wiring, etc., at the Arsenal Technical Schools. D. A. Bolen & Son, 1001 Majestic Building, are architects.

SPRINGFIELD, ILL.—The State Utilities Commission has authorized the Athens Electric Company of Athens, Ohio, to supply current in the vicinity of Indian Point, Fancy Prairie and Cantrall. Early construction of transmission lines is contemplated.

FOND DU LAC, WIS — The Board of Education, care of A. M. Hunter, secretary, will soon award the contract for the construction of a senior and junior high school to cost about $500,000. Electric wiring and power equipment will be installed. Childs & Smith, East Van Buren Street, Chicago, Ill., are architects.

FOND DU LAC, WIS.—Plans are under way by J. E. Hennen, architect, Fond du Lac, for the erection of a tuberculosis sanatorium near this place to cost about $300,000. Plans include the installation of a power plant

HARTFORD, WIS.—In connection with the new municipal power house, to cost about $50,000, contracts have been awarded to the A. F. Wagner Architectural Works, 763 North Water Street, Milwaukee, for the iron and steel work and to the Chicago Conveyer Company, 116 West Twenty-second Street, Chicago, Ill., for coal conveyers. A. H. Martin, Hartford, is engineer.

PULASKI, WIS.—Articles of incorporation have been filed for a new electrical power concern to be known as the Badger Utility Company to be located at this place. It is reported that plans include the construction of an electric power plant. D. Riordan Fourth Street De Pere is one of the incorporators.

SHEBOYGAN, WIS.—The Northern Furniture Company, care of E. Hammett, South Water Street and New Jersey Avenue, has preliminary plans under way for the erection of an office building and power house to cost about $200,000. W. C. Weeks, 730 Ontario Avenue, is architect and engineer.

ALBERT LEA, MINN.—Except for the destruction of a temporary shed involving a loss of $250, there has been no damage done by fire to the plant of the Southern Minnesota Gas & Electric Company, as was erroneously reported in these columns on Aug 14

MILAN, MINN. The organization of an electric light and power company at this place is contemplated. Plans include the erection of a transmission line to Appleton. Oliver Haughland is reported interested.

RUSHFORD, MINN. — The Rushford Power Company contemplates the extension of its lines to Peterson.

CEDAR RAPIDS, IOWA — The Iowa Railway & Light Company and the Iowa Electric Company, both at Cedar Rapids, have preliminary plans under way for harnessing the Cedar, Wapsipinicon and Maquoketa Rivers for the development of power. According to Sutherland Dows, general manager of the Iowa Railway & Light Company, when the project is completed there will be probably from twelve to fifteen plants supplying a continuous load of from 12,000 kw. to 15,000 kw. The cost is estimated at about $5,000,000.

DES MOINES, IOWA.—Bids will be received by the Executive Council, Capitol Building, until Oct. 15, for the construction of a power plant at the Capitol grounds to cost about $200,000. The Canfield Engineering Company, Flynn Building, is structural engineer.

ST LOUIS, MO — The Sisters of Charity 3539 Pine Boulevard, have preliminary plans under way for the erection of a hospital to cost about $2,000,000. Electric light equipment will be installed. Lee & Rush, Syndicate Trust Building, are engineers.

ASHLEY, N. D.—Bids will be received by John Hildenbrand, auditor of McIntosh County, until Oct. 19, for electric light equipment for the court house, including one 12½-kw., 125-volt generator, direct-connected to engine, one 112-[illegible] Edison storage battery, one switchboard, etc.

VAN HOOK, N. D. — The city officials contemplate enlarging the electric light plant.

MONROE, NEB. — At a recent election bonds were voted for the installation of electric lights.

OMAHA, NEB.—The Platte Valley Power Company of this place contemplates the erection of transmission lines to a number of towns.

VALLEY FALLS, KAN.—It is reported that a local electric plant was destroyed by fire, causing a loss of about $50,000. It is understood that the plant is to be rebuilt.

Southern States

NEWTON, MISS.—Improvements to the municipal electric light and water systems to cost about $35,000 are contemplated.

PINE BLUFF, ARK.—It is reported that the Arkansas Light & Power Company has sold out its Missouri and North Arkansas holdings, public utilities estimated at about $500,000. According to H. C. Couch, president at Pine Bluff, this deal was made in order that the company might centralize its holdings near its big power plants at Pine and Pieron. The Missouri and Blytheville plants were somewhat isolated.

CROWLEY CITY, LA. — Arrangements are being made by the city officials for an issue of $500,000 in bonds for the erection of a municipal light, power, water and gas plant.

DALLAS, TEX. — Bids will be received until Nov. 15 for the construction of an exposition building to cost about $1,000,000 for the Rick Warehouse & Stores Company. An individual power plant will be installed. A. C. Rick is president.

SAN BENITO, TEX. — The San Benito Electric Light & Power Company has been incorporated with a capital of $50,000 and contemplates the installation of an electric light plant to supply light and power service to a city of 10,000 inhabitants.

Pacific and Mountain States

SEATTLE, WASH.—Bids will soon be received for the construction of an addition to the Cedar Falls power plant to develop 20,000 additional horsepower. Plans include the installation of a Pelton overhung turbine connected to a Westinghouse generator and to Allis-Chalmers transformers. This same system will be used at the new Lake Union steam plant.

BEND, ORE.—Plans are under way for the early construction of the first unit of the Bend Water, Light & Power Company's plant on the Tumalo River, to develop 2,000 hp., at an estimated cost of $100,000. The second unit will not be built until demands warrant its construction.

SALEM, ORE. — The Sacramento-Klamath Water, Land & Power Company, through Victor De Marais and Charles E. Watson of Sacramento, Cal., has applied to the state engineer for permission to divert 4,000 sec.-ft. of water from the Klamath River for the irrigation of 250,000 acres of land and the development of 150,000 hp. Plans include the construction of a dam and a power plant at Cantara, Cal. The cost is estimated at $15,000,000.

BLYTHE, CAL. — The Colorado River Telephone Company, operating in this place and surrounding territory in Riverside County, has applied to the Railroad Commission for permission to construct a telephone line between Blythe and Niland. The cost is estimated at $20,000.

SAN DIEGO, CAL.—Bids will be received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Oct. 13, for the construction of six hospital buildings, including a power house at the naval base in San Diego. An electric lighting system will be installed in the buildings. (Specification 4300.)

SAN DIEGO, CAL. — It is understood that the directors of the San Diego Consolidated Gas & Electric Company propose to increase the present capital stock of $6,000,000 to $14,000,000, the funds to be used for the development of water power.

Canada

EAST SANDWICH, ONT.—Proposals involving an expenditure of about $200,000 for a sewerage system including disposal plant, pumping station, etc., have been approved by the Border Utilities Commission. Motor-driven centrifugal pumps will be installed. Morris Knowles, Ltd., Heintzman Building, Windsor, is engineer.

NEWBURY, ONT. — A bylaw has been passed authorizing the construction of an electric light and power system to cost about $15,000. Charles Tucker is chairman of committee.

Miscellaneous

MEXICO, MEXICO.—Important improvements and possible extensions to the electric street railway system of the Mexican Tramways Company, Ltd., in the Federal District are contemplated. The company is also considering carrying out plans for the construction of electric lines from the city of Mexico to Pueblo, a distance of 130 miles, and to Toluca, 45 miles.

(Issued Sept. 14, 1920)

1,351,989. TELEGRAPH SYSTEM; John H. Bell, South Orange, N. J. App. filed Nov. 25, 1919. Over long submarine cables.

1,351,999. DRIVING MECHANISM; Harry E. Heath, Newark, N. J. App. filed June 19, 1915. For torpedoes, etc.

1,352,033. ELECTRICAL CONNECTION FOR SPARK PLUGS, ETC.; Howard B. Sherman and Frank D. Maltby, Battle Creek, Mich. App. filed Jan. 22, 1919. Spring connector.

1,352,040. ELECTRIC FURNACE; Frederick von Schlegell, Evanston, Ill. App. filed April 4, 1919. Special bottom contact.

1,352,049. VAPORIZER FOR CARBURETORS; George B. Cass, Ottawa, Ohio. App. filed Jan. 28, 1919. Electric heating coil.

1,352,051. REGULATING DEVICE FOR DYNAMO-ELECTRIC MACHINES; Oliver F. Conklin, Detroit, Mich. App. filed Dec. 19, 1916. For charging storage batteries.

1,352,059. RADIO-TELEGRAPHY; Leonard F. Fuller, Palo Alta, Cal. App. filed April 23, 1917. Arc radio transmitters.

1,352,081. SIGNALING SYSTEM; John F. Moran, Jersey City, N. J. App. filed June 8, 1917. Vibrating contact bells.

1,352,085. PROCESS OF AND APPARATUS FOR PRODUCING CARBON AND GASEOUS FUEL; James R. Rose, Edgeworth, Pa. App. filed April 25, 1918. Electric furnace.

1,352,086. PROCESS OF PRODUCING CARBON AND GASEOUS FUEL; James R. Rose, Edgeworth, Pa. App. filed Dec. 26, 1918. Electrical treatment.

1,352,087. ELECTRIC BATTERY; Otto E. Ruhoff, Madison, Wis. App. filed Nov. 21, 1918. Use of exceedingly pure manganese.

1,352,092. SPRING-CLASPING TERMINAL FOR ELECTRIC CONNECTOR; Howard B. Sherman and Frank D. Maltby, Battle Creek, Mich. App. filed Jan. 22, 1919. For attachment to binding posts.

1,352,105. COMBINED TROLLEY WIRE AND GUARD HANGER; Thomas W. Twyman, Avella, Pa. App. filed April 6, 1918. For coal mines.

1,352,116. TELEGRAPHY; George C. Cummings, East Orange, N. J. App. filed July 16, 1918. Secret service.

1,352,166. BATTERY-CHARGING AND STARTING SYSTEM FOR AUTOMOBILES; Charles E. F. Aldin, Cleveland Heights, Ohio. App. filed Oct. 31, 1918. Two armatures.

1,352,198. X-RAY CONE; Hector A. Lagain, Park Ridge, Ill. App. filed Sept. 21, 1918. Dental.

1,352,208. METHOD OF PRODUCING OXIDE OR OXIDES OF MANGANESE; Benjamin F. Loveless, Baltimore, Md. App. filed April 24, 1919. Electrolytic.

Record of Electrical Patents

Notes on United States Patents

1,352,217. SELECTIVE SIGNALING SYSTEM; Winfred T. Powell, Chicago, Ill. App. filed Aug. 23, 1916. Automatic telephone.

1,352,219. VIBRATOR; Henry Prell, Cleveland, Ohio. App. filed May 20, 1918. For molding.

1,352,235. TOTALIZING POWER SYSTEM; Leonard Wilson, Salt Lake City, Utah. App. filed April 20, 1918. Measures power supplied at several places.

1,352,242. WIRELESS RECEIVING APPARATUS; Ernst J. Berg, Schenectady, N. Y. App. filed Feb. 13, 1917. Small.

1,352,246. ELECTRIC SWITCH; Lawrence E. Carlson, Huntington, Ind. App. filed Nov. 20, 1919. Domestic lighting.

1,352,266. ELECTRICAL SYSTEM FOR MOTOR VEHICLES AND THE LIKE; Morris Hirsch, New York, N. Y. App. filed April 30, 1919. Ignition device.

1,352,310. AUTOMATIC SPEED REGULATOR; Carl S. Olson, Troy, Idaho. App. filed July 21, 1919. For automobile.

1,352,328. NICKEL PLATING; Edmund N. Todd, Millburn, N. J. App. filed Dec. 28, 1914. Electro-deposition.

1,352,331. PROCESS OF ELECTROPLATING NON-CONDUCTING SUBSTANCES WITH COPPER; Umikichi Unno, Tokyo, Japan. App. filed Nov. 21, 1917. Electrically depositing.

1,352,360. STATIONARY INDUCTION APPARATUS; William O. Dwyer, Pittsfield, Mass. App. filed Feb. 27, 1920. Economical use of material.

1,352,364. TEMPERATURE REGULATOR; Joseph Graziano, Newburgh, N. Y. App. filed Oct. 15, 1918. For compressed-air tanks.

1,352,387. METHOD OF CONVERTING REFRACTORY OXIDE; Lewis E. Saunders, Niagara Falls, N. Y. App. filed April 15, 1919. Resistance furnace.

1,352,388. METHOD OF SHRINKING MAGNESIA; Lewis E. Saunders, Worcester, Mass. App. filed July 28, 1917. Electric furnace heating.

1,352,427. SYSTEM OF CONTROL; Andrew H. Candee, Pittsburgh, Pa. App. filed Feb. 3, 1917. For storage-battery vehicles.

1,352,451. CIRCUIT-INTERRUPTING SYSTEM; Stephen Q. Hayes, Pittsburgh, Pa. App. filed May 14, 1917. Automatically disconnects portions of load to prevent overload on feeder.

1,352,480. CONTROL SYSTEM; Theodore H. Schoepf, Pittsburgh, Pa. App. filed May 8, 1916. Vehicle battery charged from trolley.

1,352,483. CONTROL APPARATUS; Walter H. Smith, Wilkinsburg, Pa. App. filed July 19, 1917. Pneumatic control of electric railway motors.

1,352,499. ELECTRICAL CONNECTOR; Victor H. Broc, Neuilly-sur-Seine, France. App. filed July 7, 1919. Screw-plug connector.

1,352,526. SPARK-PLUG INTENSIFIER; Raymond S. Patchen, Marion, Ind. App. filed Oct. 22, 1919. For automobiles.

1,352,546. ARRANGEMENT FOR PHONOGRAPHICALLY RECORDING AND REPRODUCING TELEPHONIC MESSAGES; Franz Seelau, Berlin-Wilmersdorf, Germany. App. filed Nov. 30, 1915. Applied to dictaphone.

1,352,564. ELECTRIC METER; Thomas W. Varley, New York, N. Y. App. filed Dec. 12, 1918. Direct-current watt-hour meter.

1,352,568. TELEPHONE SYSTEM; Charles White, East Orange, N. J. App. filed May 8, 1918. Improved busy-test signals.

1,352,589. ELECTRICAL TRANSMISSION OF INTELLIGENCE; Cornelius D. Ehret, Philadelphia, Pa. App. filed March 26, 1919. Multiple transmission.

1,352,597. RECEIVER; Henry C. Harrison, New York, N. Y. App. filed Oct. 23, 1918. High sensitivity.

1,352,605. AUTOMATIC TELEPHONE SYSTEM; Emil Jacobsen, Evanston, Ill. App. filed July 1, 1918. Improved selector switch.

1,352,660. TELEPHONE-EXCHANGE SYSTEM; Alfred H. Dyson, Montclair, N. J. App. filed Dec. 8, 1915. Automatic.

1,352,828. FOUR-WIRE TELEPHONE CIRCUIT; John Mills, Wyoming, N. J. App. filed June 7, 1918. Greater degree of amplification.

1,352,839. ARRANGEMENT FOR AUTOMATICALLY REGULATING THE VOLTAGE OF DYNAMOS; Ludwig Schon, Essen-on-the-Ruhr, Germany. App. filed Dec. 23, 1913. Quick-acting.

1,352,860. INCANDESCENT ELECTRIC LAMP; Nathan Wise, Brooklyn, N. Y. App. filed Aug. 21, 1916. Stem extends toward tip.

1,352,873. TELEGRAPHY; William M. Bruce, Jr., Springfield, Ohio. App. filed May 15, 1916. Selenium-cell receiver.

1,352,874. AUTOMOBILE INDICATOR; William H. Burch, St. Louis, Mo. App. filed June 13, 1918. Indicates turning.

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Abolishing Utility Commissions

WHEN a candidate for governor can be nominated or almost nominated as was the case in Illinois on a platform of home rule for public utilities and the abolition of the State Public Utilities Commission it is time for the electrical industry to indulge in some introspection, even though a well-organized and financially oiled political machine in Chicago was mainly responsible for the large anti-commission vote. True, the utilities of Illinois managed to get along before the public utilities commissions were appointed and can probably do so again; but that does not explain the action of the people, who seem to be as much against the public utilities as they are against the regulatory commission. It is evident that there is still a lot of educational work to be done before every one shall appreciate the interdependence of the utilities and the public. There is nothing discouraging about the situation, however, if public utilities will take the lesson to heart and get busy on campaigns of public information. Their policy should be such as to bring the people and the commission closer to the companies, and that without much further delay.

Good-Will Campaign

REALIZING the gravity of the present financial situation and the necessity for higher rates if money is to flow into the electric light and power business, the National Electric Light Association has launched a good-will campaign on a very large scale. Of course, if the utilities are to obtain higher rates they must have the sympathetic understanding and good will of the public. To that end the campaign is designed to be informative, with the hope of awakening the public to the fact that its interests are identical with those of the industry. It augurs well for the movement that so far more than a million copies of the literature have been ordered; but to be effective every user of electric light and power in the country must be reached. This means that ten times that number of booklets must be disposed of. The present campaign should go over 100 per cent, and there can be no doubt as to the outcome if only the executives of electric light and power companies will do their part.

To Buy or Not to Buy?

MERE establishment of an interconnection between a steam station and a hydro-electric station by no means assures operation at maximum efficiency. Skillful handling of loads and equipment must be accomplished if the full benefits of such an arrangement are to be reaped. Where separate ownership or control is involved, the decision to buy or sell energy rests usually upon mutual convenience, and unless the operation of each plant tied into the line is managed with due regard to the conditions elsewhere, both fuel and water are liable to be wasted, to say nothing of labor. It is a great temptation for a steam plant to buy hydro-electric energy whenever it is advisable at surplus rates, but sight should not be lost of the effect of a material reduction in steam-plant load upon fuel economy. A careful inquiry into the relations between interconnected load distribution and station efficiency in every group of plants so tied together would be interesting.

Higher Rates Imperative

THE census of central electric light and power stations for 1917 reveals the startling fact that in that year there were 1,976 companies which paid no dividends whatsoever. While these were mostly small utilities, they comprise 67.8 per cent of the total number of incorporated central electric stations and 71 per cent of all which had outstanding capitalization. This certainly does not show a very healthy condition among the smaller utilities of the country, and it emphasizes anew the necessity for greater attention to their problems. It may be and probably is true that these smaller properties cannot be operated economically, yet nevertheless investments in even very economic stations have not proved lucrative. The rate of increase in revenues has been subject to a noticeable retardation during the past decade, and while the gross income has increased enormously the net income is constantly shrinking. Owing to the present high cost of coal and the increase in freight rates, the showing this year will probably be worse than ever. Further economies in generation and distribution are out of the question. The only way to keep the utilities solvent is by increases in rates, and those utilities which still delude themselves with the belief that they will be able to weather the storm should make haste to apply to commissions for immediate increases ere the psychological time has passed. It will be hard to face the public with increases in rates when all other living costs have begun to come down. The time for action is quickly passing.

Utilities Need Support of Business Men

INDUSTRY demands more electric power. To generate it would cost individual manufacturers far more than it would cost the central stations. The central stations, however, cannot supply the demand in full because of lack of capital. Capital cannot be raised when rates are unprofitable. Therefore industry must consent to higher charges. These are the steps in the chain of logic by which John Milton McMillin in this issue of the ELECTRICAL WORLD seeks to show manufacturers how vitally their interests are intertwined with those of the electrical supply companies. Quite rightly, he does not stop there. He contends also that the industries served by the central stations should them-

selves help to finance the companies from which they buy their power. In this way they will assure themselves of an uninterrupted and plentiful supply of a commodity as essential to them as machinery or raw materials, while at the same time they will encourage the electrical companies in redoubled effort. The idea can be carried further still. The commercial prosperity of a manufacturing town depends on the prosperity of the factories, so that the bankers, the merchants and all the citizens have a personal object in keeping the power supply adequate to the community's needs. Willingness to pay what the service is worth and a practical exhibition of confidence in the company's securities will save the day in many a community. It is the old story of self-interest told in a different way, with the appeal emphasized by the serious shortage of electric power that is threatened in the industrial centers of the land.

Productive Illumination

RECENT experiments have forcibly shown the importance of high intensities of illumination in increasing production. The ordinary and generally approved standards, as expressed in the various codes, may often fail to do this, and the reason for the failure is admirably explained by D. H. Tuck in this issue. It has long been known that there is a real physiological basis for proper illumination and that the intensity required in any case is a simple inverse function of the coefficient of reflection of the work, but the fact is quite too often neglected. It will, we hope, be better appreciated after a perusal of Mr. Tuck's article, which is reinforced by very practical examples. The industrial lighting codes implicitly recognize the situation, although they are hampered by being based on the safety and comfort of the workman alone, rather than on the full development of his productive powers. In other words, he may get along without serious danger of ocular trouble with somewhat less illumination than is necessary for working to the best advantage. If really efficient lighting were demanded the figures would be somewhat startling to the uninitiated.

As Mr. Tuck shows, working on black goods may require nearly 40 foot-candles in order to bring the eye really up to par, but usually only a small fraction of this value has been supplied even under this severe condition. The result has recently been shown in England by the occurrence of "miner's mystagomus" among seamstresses working on black goods. Another fact which has been disclosed by experiment is that in work where quickness of perception is required the amount of illumination must be very materially increased, suggesting that Fechner's fraction is larger in case of a hurried glance than for steady vision. Consequently any work which requires quickness of vision needs increased illumination. How far the difference is psychological rather than physiological remains yet to be determined, but it certainly exists. The moral of all this is that the illuminating engineer should not trust too implicitly to the mere readings of a foot-candle meter at the work as compared with code requirements, but should make a careful study of the character of that work and increase the lighting accordingly. If he will figure the cost of extra illumination, it will generally be surprisingly low when the output is taken into consideration.

Cost of Steam Plant Maintenance

IN AN editorial of last week's issue in which reference was made to an analysis of maintenance costs in steam generating stations an unfortunate combination of typographical error and ambiguous statement appeared in the statement on average cost of repairs to boilers and stokers and to electrical equipment over two years. Instead of this being 1½ cents per kilowatt-hour for boilers and stokers alone, it should have read $1.50 per kilovolt-ampere of average station rating for a two-year period, as noted at the top of page 614 in the article under discussion. Translated into kilowatt-hours output, the maintenance cost of boilers and stokers was 0.051 cent per kilowatt-hour for the period of 1918 to 1920 as compared with 0.083 cent for all repairs to steam equipment and 0.092 cent per kilowatt-hour for the total of steam and electrical repairs. It is interesting to note that the maintenance charges referred to are for a station having a rating of more than 60,000 kva. with the major part of the boiler and turbine equipment installed in 1918 and some of it from five to six years before that date. Compared with the average steam and electric plant repair costs (0.087 cent per kilowatt-hour) of seven other stations similar as to age and location, the unit costs referred to seem typical for plants of the size and character of load considered.

Reconnecting Induction Motors

WE TAKE pleasure in publishing, this week, with a full working chart to accompany it, a valuable paper by A. C. Roe, completing his instructions for reconnecting induction motors, which he began in our issue of July 24. The present paper deals specifically with two-phase motors as the previous one did with three-phase, covering precisely the same ground, that of furnishing to the practical winder precise data for reconnecting induction motors for a different number of poles or a different voltage from the original design. The description of the use of the charts is so simple and to the point that the armature winder should have no substantial difficulty in carrying out the instructions and producing within its possible limits the desired result. The scope of the charts is for a reconnection of from two to twelve poles for motors containing initially from 12 to 240 coils. Not all combinations are feasible either with two-phase or three-phase design and where such is the case or where coils must be "killed" the situation is plainly shown on the charts.

The only place where the winder not familiar with details of design may go wrong is in trying changes which are intrinsically bad considering the actual motor in hand—a situation which no charts can disclose. For instance, it is broadly true that extreme multipolar winding in small motors with a moderate number of coils is almost always productive of very bad power factor and frequently bad efficiency as well. The pole surface connected for four poles so as to produce a motor of excellent running qualities is likely to be altogether insufficient with twelve poles leading to a much less desirable configuration of magnetic circuit, and the same is true of extreme changes in the other direction, in which case neither the copper nor the iron is utilized to the best possible effect.

There may be instances in which a change of speed will be beneficial, but if attempts are made to adapt machines to other conditions than those for which they were designed dissatisfaction may result. Years ago a series of induction motors was put on the market made, so to speak, by piling together a long cylinder of toothed laminas of uniform diameter and then cutting off for an armature such length as seemed necessary for the required output. The result was that one of the series was an admirable motor with very advantageous distribution of iron and copper in the poles. Those with armatures longer or shorter were relatively poor, one or two of them very poor indeed.

In general, reconnection can be done very well with most motors for changes either in speed or voltage in no greater ratio than two to one. Sometimes in particular machines this ratio can be considerably extended without great disadvantage. More often there will be trouble with power factor and efficiency. So the electrician should go rather cautiously and judiciously into anything but rather simple changes. Within this limitation one may actually come out somewhat better at the finish than at the start, since a somewhat extreme multipolar design with long and narrow equivalent pole surfaces may be actually improved by reconnecting for a higher speed. The better the original design the more likelihood of damaging the performance by change of winding.

In all events these admirable charts and instructions of Mr. Roe put in the hands of the constructor or repairer information heretofore hardly to be found outside the designer's notebook and will undoubtedly enable many a motor to be reconnected and put to excellent service.

Organizing Maintenance on a Production Basis

MAINTENANCE work is nothing more or less than a permanent contract to keep equipment in first-class operating condition. The obligation is none the less pressing because of the fact that it is supposedly secondary to the business of producing power. The central station has been rather inclined to slight the general organization because of this fact of apparent secondary importance. As a result the general scheme of carrying out repair work has been somewhat inefficient. The Philadelphia Electric Company has, however, by working out a centralized system for maintenance, developed a method whereby this class of work is placed more nearly on a production basis. As shown by W. C. L. Eglin and F. C. Ralston in our last issue, such a plan accomplishes three main purposes: (1) The separation of all the details of maintaining plant equipment from those of its operation; (2) the establishment of uniform standards and methods of maintenance and inspection; (3) the development of specialists in the work of overhauling and repairing plant equipment.

From the results of more than five years' experience with this plan it has been demonstrated that a centralized maintenance section can handle the work efficiently and at a low cost. Another and one of the most commendable features is that the plan can be enlarged by simple expansion to any degree required by the growth of the system it serves, adhering to the fundamental principles upon which it is built.

Electrifying the Steel Mill

A PERUSAL of the report of the Association of Iron and Steel Electrical Engineers, which is presented quite fully in this issue, brings a realization of the magnitude of the work of the electrical engineer in the steel industry. In particular, one is forced to appreciate the wide difference between this special application and the somewhat standardized engineering of older branches of electrical work. This is nowhere better emphasized than in a paper which was presented by K. A. Pauly and is abstracted in this issue and which deals with the electrically driven reversing mill. The question which faces the producer of rolled steel is that of ultimate cost, and for the electrically driven mill to prove its superiority it must meet requirements of economy not in mere power cost but in the manufacture of the finished steel. This, in the last analysis, turns on production, or the question of the tonnage that can be put through the works. Mr. Pauly forcefully points out that electric drive has successfully endured this crucial test.

From the standpoint of electrical equipment the vital factor is the speed at which the successive passes can be kept up. In the final consideration this again is a question of acceleration and of the average speed which can be reached hour in and hour out in rolling the ingots. Incidentally the reliability of the equipment, its staying in service and doing its work all the time determine the portion of working hours in the year during which this speed can be maintained. It is interesting to note that the electric motor has made good in this particular way in steel-mill practice as it has elsewhere. It seems to be the universal experience that a motor-driven machine will stay on the job and work at full output more of the working hours per year than any of its competitors.

Considering the rolling-mill motor in particular, Mr. Pauly shows in some very instructive curves the effect of increased input on increased speed of making the pass. It is, on the whole, surprisingly great, the increase in permissible input paying richly in increased acceleration and resulting tonnage capacity. It is right here that modern American practice has departed widely from the earlier standards so far as there were any. At first the question was whether the electric motor could be made to stand the speed and torque requirements. That question having been answered, the one which now arises is how hard service in this particular the motor will stand. The limit has certainly not yet been reached and yet the performance of a steam-driven mill has been clearly passed.

There has been a considerable variation from early practice. The shunt motor has replaced the earlier compound-wound machine; the auxiliary generators have been built with laminated fields to quicken their response to the control, and all the control mechanism has been speeded up. The result is that the production has been increased accordingly. The electric motor of today is a very different machine from that which was somewhat timidly pushing into the field of general power. Experience in the steel industry shows very plainly that it is not only able to hold its own in continuous service of the most severe character but that it is capable of efforts that bring tonnage output to a new production level. In short, the electric motor is the most facile and convenient drive.



Edwin Wilbur Rice, Jr.

Pioneer, inventor, engineer—for thirty-five years a master mind in molding the engineering development of the industry

BEGINNING his active technical work forty years ago and having been director of the engineering development of the largest electrical manufacturing company in the United States since its inception thirty years ago, E. W. Rice, Jr., has had a very large share in molding the progress of the electrical industry. His faith in the future of the tungsten lamp when its filament was so frail as to make it almost impracticable gave rise to the investigation which resulted in the rugged lamp of today. The larger development both electrically and mechanically of the polyphase motor is coupled with his name. His recognition of the weak point in high-voltage polyphase-current distribution led to a switching system both safe and simple. To his broad view of engineering needs also is due in large measure the present system of alternating-current distribution and its subsequent conversion into direct current through rotary converters. Besides this, he has been to a great extent instrumental in furthering the development of the steam turbine and has followed this field very closely, even in the past few years, in an effort to secure for the electric light and power industry the last degree of plant economy. It was under his direction that the adoption and subsequent development of the Curtis turbine by the General Electric Company took place. Mr. Rice, himself an inventor with more than 100 patents to his credit, has an enviable capacity for encouraging and leading the inventive ability of his subordinates. It is not too much to say that the research laboratory of the General Electric Company—unique in its relation to industrial and advanced scientific progress and well known throughout the world—owed its inception and later development in a high degree to his realization of the value of such an organization.

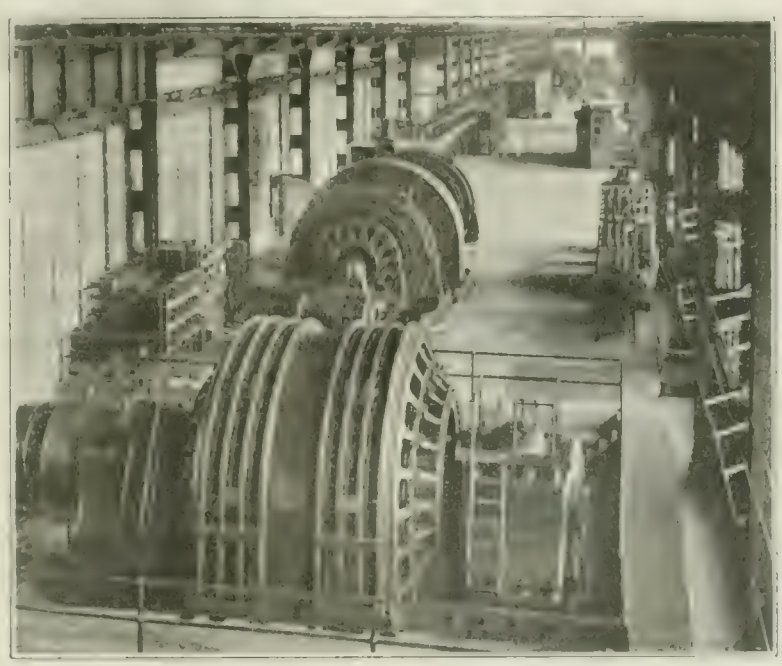
Mr. Rice came into the industry in 1880 upon his graduation from the Philadelphia Central High School as the assistant and confidant of Prof. Elihu Thomson, who had just formed the American Electric Company at New Britain, Conn. When this property was moved to Lynn, Mass., and renamed the Thomson-Houston Electric Company, young Rice was permitted to engage in the work he liked best under the man for whom he had the greatest admiration—experimentation and invention with Professor Thomson. In three years a works superintendent was needed and, not without regret, Mr. Rice accepted this position. As the work expanded and the field grew he grew also, and when this company was consolidated in 1892 with the Edison interests to form the General Electric Company he became technical director of the new company. Four years later he was made a vice-president, and when in 1913 C. A. Coffin retired from the presidency Mr. Rice succeeded him. He was born at La Crosse, Wis., May 6, 1862. In 1917-18 he was president of the A.I.E.E.

Application of Power in Steel Mills

Electric Reversing Mill Drive Compares Favorably with Steam Drive from Tonnage Standpoint—Factors Which Enter Into the Choice Between Overhead and Underground Transmission Systems

APPLICATION of power from the plant to the drive, together with related subjects of education of electricians and standardization of equipment, were specially considered at the fourteenth annual convention of the Association of Iron and Steel Electrical Engineers, held in New York Sept. 20 to Sept. 25.

From the standpoint of production the electric mill has many advantages over the steam mill, chief among which is the extremely small loss due to delays caused by the drive, and because of this an electric mill of the same hourly capacity will exceed the steam mill in monthly or yearly capacity, K. A. Pauly, General Electric Company, asserted in his paper on "The Electric Reversing Mill Considered from the Standpoint of Tonnage." However, the task of the electric mill is not an easy one, since the handicap which it has compared with its competitor (due to the higher moment of inertia of moving parts) must not be overlooked. The results obtained with motor drive, however, compare very favorably with modern steam reversing engines under similar conditions, as shown by the time curves for an electric driven Trumbull mill and a modern steam mill. It will be noted that it is approximately one second after the steel enters the steam mill before the engine has again the speed at which it was running when the steel entered, while with the electric mill there is no drop whatsoever. It is in this respect that the shunt-wound differs from the compound-wound mill motor, the latter dropping its speed as the steel enters, although not to so great an extent as the steam engine. These curves are selected to illustrate the speed characteristics of the two types of drives rather than to indicate record speeds for tonnage.



ELECTRIFICATION OF MILL DRIVES HAS DEVELOPED A PROBLEM OF FIRST MAGNITUDE IN THE STEEL INDUSTRY THAT THE ELECTRICAL ENGINEER IS RAPIDLY SOLVING

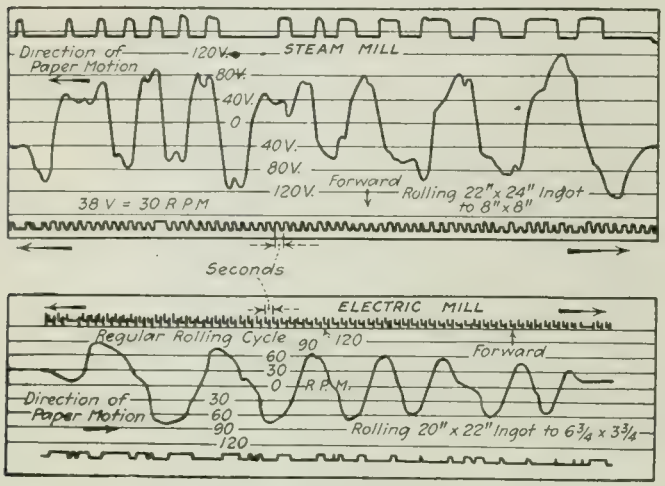
There is, of course, a limit to the capacity of any drive, and the characteristics of electric equipment are such that unless some automatic means is provided for limiting the power of the roll motors a careless operator cannot use the electrical equipment. Current-limit controls have been developed for this purpose, their function being to limit the current taken, and therefore the maximum power developed by the roll motors, to a value which they and their generator can safely carry at frequent intervals. The current-limit setting for the main roll motors therefore is a real indication of the relative peak-load capacity for rolling steel. Coupling these records with the advantages of the electric mill over the steam mill from the standpoint of lower power costs, lower maintenance costs, greater flexibility of control, etc., there is little room for arguments in favor of the steam reversing mill.

Aside from tonnage considerations, electric drive has an important relation to labor conditions, because cleaner working places and less noise result in better satisfied crews, said J. E. Fries, Tennessee Coal, Iron & Railroad Company, in discussing this paper. R. M. Dudley, Ashland Iron & Mining Company, stated that since there is a maximum roll pressure which can be applied to a billet, the procedure in obtaining high tonnages from electric drives is to establish the drive torque required and then lay out the motor installation with this limit in view. As a blooming mill costs approximately $2,000,000 at present prices it would seem that quibbling over about $40,000 in added material in electrical equipment is rather trivial, especially when the effect on tonnage is so great. D. M. Petty, Bethlehem Steel Company, pointed out the advisability of spare parts for quick repair of mill drives. Current values, E. H. Wentz, National Tube Company, held, should be set on the basis of tonnage requirements, thus saving wear and tear on machines and consuming less energy per ton of steel rolled.

Auxiliary Drives as Important from Standpoint of Interruptions as Main Drive

Among the factors influencing the selection and application of motors and control presented by Gordon Fox, of American Steel & Tube Company, were useful work, friction load and inertia. A motor size may be tentatively selected which will cover the work and friction loads and have sufficient margin to handle the inertia load. For a running drive the work and friction load may well comprise 75 to 80 per cent of the motor rating. For a start-stop drive the work and friction loads may be permitted to require about 40 to 60 per cent. Having selected a motor drive, speeds may next be considered. For a running drive the full running speed is the consideration of importance. For a start-stop drive

the ability to accelerate, decelerate, reverse or spot the machine is ordinarily of primary import. For any set of conditions a definite gear ratio exists which will minimize the inertia load and permit most rapid acceleration or deceleration with an available amount of motor torque. To determine this ratio Mr. Stratton



THESE SPEED-TIME CURVES SHOW THE RELATION BETWEEN A STEAM AND AN ELECTRIC DRIVEN MILL

The steam mill, having less inertia of parts, accelerates more quickly but slows down as the billet enters the mill. The motor, however, shows no slackening of speed on this account.

developed the following formula in the *A. I. E. E. Proceedings* of 1915:

$$r = \sqrt{\frac{I_1}{I_2} + \frac{(FR)^2}{T^2}} \pm \frac{FR}{T}$$

In this formula

r = most favorable gear ratio between armature shaft and given shaft of machine.

I_1 = moment of inertia of machine at given shaft.

I_2 = moment of inertia of motor armature (including pinion, coupling or brake wheel) at armature shaft.

FR = torque at given shaft required to overcome combined friction and work loads.

T = motor torque available during the accelerating period at motor shaft.

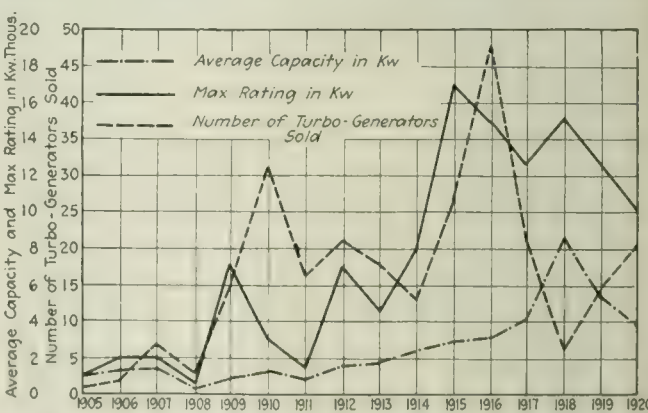
The item $\pm FR/T$ may be omitted if a drive is to be considered in which acceleration and deceleration are of equal importance. When quick acceleration is most desirable the item $+ FR/T$ should be used. For drives where quick stop is desired the item $- FR/T$ should be inserted. Having selected a gear ratio, it is possible to determine the rate at which the machine may be either brought up to speed or stopped. The calculations are based upon the premise that the torques demanded by friction and work loads are practically constant. Variation in torque demand during the cycle, however, may lead to decided variations in speed. In using variable speed motors it is desirable that counterweighting or other means be employed to balance the torque demand as far as possible, since this relieves the motor of unecessary work. Concerning compound-wound mill-type motors, a motor having a no-load speed not to exceed 150 per cent of full-load speed will meet in the most satisfactory manner the requirements of the majority of these drives. Appendices attached to Mr. Fox's paper gave the derivation of formulas suggested for use in this work. Two examples show the application of methods and the formulas to a mill-table drive.

In discussing this paper W. C. Kennedy stated that it would seem advisable to draw time-distance curves using several gear ratios on the auxiliary drive rather than to substitute in a mathematical formula. The lagre open-type low-speed motor for auxiliary drives is an abomination in the steel industry, declared J. E. Fries. The consideration is the accelerating rather than the ultimate speed. A smaller, higher-speed motor with a larger gear ratio is preferable since the lower inertia in the armature makes acceleration more rapid.

Two main points must be considered in choosing motor sizes, A. W. Deenham observed: (1) Does the machine have sufficient peak capacity to start the load quickly? and (2) is the continuous capacity sufficient to carry the duty cycle continuously?

Many Factors in Selection of Power Distribution Systems

Next to the question of application of drives the question of distribution of energy received considerable attention. D. M. Petty in his paper, "Transmission and Distribution of Power in Industrial Plants," said that unless conditions are very favorable it is rather difficult to justify the expense of an underground distribution system as compared to a properly laid-out overhead system using all the various schemes available for insuring good service to the producing department. While the underground system has some valuable advantages, such as eliminating trouble due to lightning and interference from outside agencies, removing certain hazards to workmen about the plant, still the overhead system, if properly laid out, will effect these advantages and will allow in some ways more flexibility than the underground system. In a duct system the size of conductors is limited not only by handling facilities but on account of heating. As a rule a fault in one phase will disable all three phases and is not easy to repair. Unless the load is well anticipated and extra ducts are provided, it is difficult and expensive to increase the capacity of the system. The overhead transmission



GROWTH OF STEEL MILL POWER IS INDICATED BY THESE CURVES SHOWING THE CAPACITY INSTALLED YEARLY

system not only costs much less than underground systems, but it is easy to increase capacity when the occasion demands, and by using care in selecting the location of towers and supports many of the disadvantages can be reduced to a very low minimum. By using at least two grounded so-called "static wires" above those carrying the power, and by placing lightning arresters at each tapping-off point, or even more often on long lines and at very vital load centers, damage by lightning can be reduced to an almost negligible quantity. By using

properly designed guards, ladders and platforms the hazard to workmen may be reduced to a very low point.

As an important factor in the laying out of a transmission system is the effect of its operation on the cost of the finished product, the question of continuity of service to the consuming unit may be fully as important as the cost per kilowatt-hour, and is far more important than the cost of transmitting power to any other producing unit. Provision should be made to isolate any part of the transmission system on which trouble occurs without seriously disturbing the load on any other part. This may be done automatically or manually, depending on the importance of the load. Mr. Petty considered a number of lay-outs, such as radial feeders, and loop feeders. The first division may be further divided into bus feeders, also known as the tree system, and individual feeders. The tree system, as its name indicates, may have several branches which carry power to load centers and may consist of a single line of relatively large capacity or of more than one line operating in parallel. In this case the two lines can be operated in parallel or independently, and any of the branch circuits may be connected to either line. In the system of loop feeding there are several arrangements, one which is considered very good being known as the ring bus.* The author has also considered the question of line efficiency as related to the cost of a distribution system and has gone into a comparison of central station and industrial distribution.

Split or balance-phase protection does not work out so well if there is trouble on two phases or in the station because the current transformers are in the split phase, declared R. B. Gerhardt, Bethlehem Steel Company, in the discussion of this paper. However, attention was called by Mr. Petty to the fact that the ring-bus system allowed only five tap-off substations as a maximum.

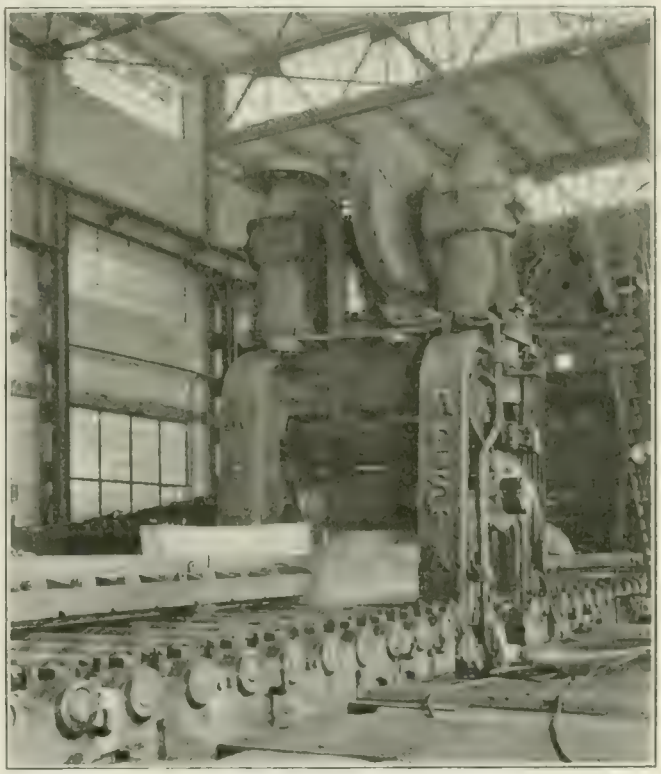
Comparison of Three Methods of Laying Out Underground Transmission

There are three main methods for installing underground conductors for distribution around a steel plant —namely, in a tunnel, in ducts or by burying directly in the earth—A. L. Freret, Tennessee Coal, Iron & Railroad Company, said in his paper on "Underground Transmission." The underground tunnel has advantages over the two other methods for comparatively short distances, where the cables are connecting heavy and very important loads, and where it makes a convenient passage from station to station. Better ventilation, accessibility of conductors, which allows frequent inspection, and ample space for the installation of cables are the chief points of superiority of a tunnel installation. The initial cost, however, is sometimes prohibitive.

In choosing the duct to be used for an underground system of this class it is very important to provide ducts large enough to take care of the largest cable. Some engineers recommend using a duct ½ in. (1.25 cm.) larger than the outer diameter of the cable, but in the event of using many cables of different size it would seem advisable to choose a size of duct which would accommodate the largest size of cable which might be used. In this way in laying out spare conduits any cable could be used that might be required.

There is some difference of opinion in regard to the number of ducts which should be used in one group, but, according to Mr. Freret, twelve or fourteen should be the maximum and if more are required they should be divided into two groups with earth between. Vitrified duct has many characteristics which make it less desirable for distribution systems, he said, than that which is made from fiber. For example, duct of the vitrified class has many joints on account of the short sections, which make it harder to line up properly and is more liable to leakage. Besides, the inside of the duct is apt to have burrs which will injure the lead casing of the cable and the material requires careful handling to prevent breakage. Vitrified duct will also melt under short circuits, sometimes causing injury to other cables or so destroying the duct as to render it unfit for use again unless very expensive repairs are made. Concrete ducts have the greatest arc-resisting qualities.

In the layout of a system the manholes are next in importance to the ducts themselves. Concrete manholes seem preferable to brick, being cheaper to build and



BLOOMING MILLS OF THIS TYPE WITH ELECTRIC DRIVE ARE TURNING OUT TONNAGES COMPARABLE WITH STEAM EQUIPMENT

easier to waterproof. They should be of sufficient size to permit laying the cables along the side walls and to facilitate drawing in, splicing, etc., but should not be so large as to cause too sharp and pronounced bends in the cable when leading it from the duct to the wall.

The author also took up a discussion of insulation for cables, and the conclusion is reached that for plants where continuity of service is important varnished cambric is by far the best insulation for cables and the cheapest for underground work in the long run.

In considering paper-insulated and varnished-cambric-insulated cables the external heat conditions are important, James Farrington, La Belle Iron Works, said, and in case of high external temperatures paper is the better material. Barriers between cables in tunnels are important to localize cable troubles, Albert Hovey, Standard Underground Cable Company, added.

*The double-ring bus system of the Bethlehem Steel Company's plant at Sparrows Point, Md., was described by R. B. Gerhardt in the July 24 issue of the ELECTRICAL WORLD.

T. E. Keating, Westinghouse Electric & Manufacturing Company, presented some of the specific points to be considered in the economic design of a power plant for a steel mill by assuming a hypothetical case and working out the solution. In discussing this paper Gordon Fox, American Steel & Tube Company, stated that as the load on steel plants varied sometimes 4,000 kw. or 5,000 kw. in less than a minute a margin above the regular working steam pressure should be carried in order to take care of these sudden overloads. He said that his company had installed duplicate equipment to take care of the operations which absolutely had to proceed to keep the mill running in case of breakdown of the regular equipment. Walter C. Kennedy concurred with Mr. Fox that several plants should be constructed around the different parts of the mill in order to make use of the waste heat generated in the different locations. Benjamin J. Fernald, Kerr Turbine Company, said that he thought the fixed charges as stated in Mr. Keating's paper were too low and that they would probably run from 20 to 30 per cent, with an average of 25 per cent. He said the cost of money should average about 15 per cent and 10 per cent should be allowed for depreciation. Coal was also higher than $5, the figure given by Mr. Keating, and when insurance is added to this the total cost would be about 25 per cent. Mr. Keating agreed that they might be higher than allowed in his paper, but said that he believed they should not be over 20 per cent.

The processes in a steel plant are of such a nature that delay at any one point in the progression is usually felt all along the line, R. H. Keil asserted in his paper on "Current Limiting Reactance."

Since interruptions to the power supply are just as serious, while they last, as any other delay, it becomes imperative to do everything within reason to assure continuity in the supply of power. Spare generating equipment, double feeders to all important substations, and duplicate buses and switching equipment help, but none of them limits the amount of damage done to equipment during short circuits or other electrical failures either in degree or extent. For this purpose reactance coils have been found very effective in central stations and in some steel-mill power houses.

Need for Educational Courses Felt in Training of Steel-Mill Electricians

Realizing the pressing need of some means of cutting down mill delays and of getting inspectors and operators on the job who can efficiently handle and make repairs to electrical equipment, the educational committee is preparing a textbook and suggests that the electrical superintendent of each steel mill start a class of about twelve men in a six weeks' course of practical instruction in the operation, maintenance and theory of the electrical equipment in their plants. A suggested division by weeks of such a course was as follows:

First Week.—Motors: Types; assembling; relation of poles; interpoles and connections; brush setting; bearings; connections.

Second Week.—Manual Controllers: Types; repairs to segments; repairs to fingers; adjustment of fingers; pressure required; familiarity with connections and spare parts.

Third Week.—Automatic Controllers: Contactors; operation, adjustments; contacts; wiring; overloads; relays; spare parts.

Fourth Week.—Brakes: Types; windings; setting; operation; adjustments; connections and spares.

Fifth Week.—Magnets: Operator's controller; magnet assembling; resistance connections; operation and installation.

Sixth Week.—General: Inspection and repairs to all kinds of electrical apparatus; importance of keeping equipment clean; ordering spare parts.

Necessity for Standardizing Motors, Cranes, Controls and Lighting

Sub-committees of the standardization committee, W. T. Snyder, National Tube Company, chairman, brought suggestions for discussion before the convention for standardizing motors, cranes, control and lighting equipment. Requests for suggestions for standardizing direct-current mill-type motors and induction motors were made by the motor sub-committee, of which D. M. Petty is chairman.

For maintenance where direct-lighting systems are used the committee suggested a schedule showing intervals of cleaning (in days) as follows:

Characteristic of Location	If Units Are Wiped Out*	If Units Are Thoroughly Washed
Very dirty	3	5
Dirty	7	10
Average	15	20
Clean	30	40

*Washing every third or fourth interval assumed.

Discussing standardization of cranes, E. S. Lammers, National Tube Company, chairman of this sub-committee, said that from the viewpoint of duty the various crane ratings now employed in steel-mill practice could be boiled down to a small group of standards that would meet the requirements of all usual crane appliances and eliminate further arbitrary selections. As a whole the committee did not lay stress on standard trolley spans except as a matter of refinement. The greatest need of all is a standard bearing for the different-size shafts. This alone would accomplish much toward reducing the burden and cost of maintenance. The builders now agree on the type, but owing to the lack of co-operation differ on the detail. In conclusion the committee recommended that the steel-mill members of the association and the crane builders be invited to become active members of the Crane Standardization Club of the association, each member to send one official representative, or more, to a monthly meeting for the purpose of discussing and adopting crane standards.

That standardization be continued during the coming year on the simpler forms of magnetic-type controller for cranes and hoists and also for general mill-table service was suggested by F. J. Burd, Cambria Steel Company, chairman of the sub-committee on control standardization. Some of the requirements common to direct-current 220-volt forms of magnetic control, as applied to cranes, mill tables and general reversing service, proposed by the committee as standard were: Control to break both sides of the main circuit every time the motor is cut off the lines; overload relays with electrical reset to be used in both main lines; the number of accelerating points to be as follows: Up to 25 hp., 3 points; up to 75 hp., 4 points; up to 150 hp., 5 points.

Regarding illumination the sub-committee on this subject, Ward Harrison, National Lamp Works, chairman, stated that in conjunction with the bowl-enameled lamp the R. L. M. standard-dome reflector provides a lighting equipment that will meet most requirements of the steel industry.

Industrial Support for Central Stations

In a Message to Business Men They Are Asked to Advocate Higher Rates and Also to Furnish Capital Demands for Power Reaching Emergency Stage Isolated Plants Are Far More Costly than Purchased Energy

By JOHN MILTON McMILLIN
Assistant Manager Bond Department Henry L. Doherty & Company

A HEAD-ON collision has occurred between the rising rental charge for new capital and the regulations which govern "the reasonable rate of return" which capital may earn in a public utility. This condition is of far-reaching effect and has not yet produced all of the complications that it may, but manufacturers who depend largely upon electric power are already beginning to feel it.

How is an electric central station going to continue making plant extensions with capital costing from 10 to 15 per cent net when the public service regulations often assume that about 8 per cent, plus an allowance for depreciation, is the limit which the new capital should be permitted to earn? Who will put up the money and services without the hope of gain, and what has the power company to gain even if it now has the money? How far can the power company go in building extensions out of the reinvestment of its earnings if there is legally required about ten dollars of capital to bring 80 cents of annual net earnings for interest and dividends? Where is the manufacturer going to come out who now, to keep up with his own growth, expects to get increased service from a central power station which has already been fully loaded by the mad scramble for power the last few years in nearly all manufacturing centers? What other solution for this condition can there be than that the power user shall furnish this new capital and also exert his influence toward permitting higher rates for electric service?

Help in answering these questions can only be expected when the users of electric service become better acquainted with some angles of the electric power business which ordinarily are not understood by the general public. However much we may hope that part of the difficulties are only temporary, something must be done now. Already the increasing demands for electric service in certain manufacturing centers have practically reached a condition of emergency.

Central-Station Power by Far the Cheapest

The cost of adequate power cannot be avoided through manufacturers building their own individual plants. There are very many other reasons why this is true in addition to the matter of the bare dollars of original cost. For one thing, the production of power is a specialty which can best be handled by specialists who give their lives to that sole subject. Again, the power station has to be located where it can obtain adequate condensing water, whereas the manufacturer might much better locate his factory at the best site from the point of view of railway facilities and the convenient housing of employees. The production of power in large quantities reduces the cost per unit just as in the production of anything else. In spite of advancing electric rates, there is a greater amount of stability in the public service power item than in almost any other element of cost with which a manufacturer has to reckon.

The big outstanding fact of the case, however, is that the community as a whole and the manufacturers as individuals can obtain power facilities for less capital outlay, in addition to lower operating costs, by working through the central station than by any other means. This is true even if they furnish the whole amount of capital required to enlarge the capacity of the public utility plant. The power load of ten manufacturers each of whom requires 1,000 kw. can be carried by a smaller central station than an aggregate of individual power plants. This is because the central station will only have to reckon with the average load, whereas each individual plant would have to be large enough to carry the maximum, and even then would have no reserve capacity. Still further savings in capital requirements are made possible by the lessened cost of the larger generating machines per unit of capacity. In round figures, the necessary capital to furnish the power requirements of a manufacturer is more than cut in two by having the additional capacity installed in the plant of the public service company. Similar savings in operating economies in the central power station have brought the usual power charges of a public service company down very much below what a manufacturer would have to spend to generate the same power in his own isolated plant, even if he could get the coal. In round figures, this item also is approximately cut in half. Public service regulations require that these charges be reasonable.

Difficulties of the Public Utilities

The most puzzling question in the mind of the average business man is why the public utility companies are so often seen in difficulties trying to raise new capital. He is puzzled to observe it even when earning statements show that a company is making an apparent success. Some light ought to be thrown on that subject at once. One reason is that while the biggest single item of necessary capital in a manufacturing enterprise is usually a talent for trade, the biggest single item of capital required in the electric power business is cash. Another reason is that while the average business man is permitted to earn all he can without any regard to the amount of cash invested in his business, a public utility company, under most of the laws and the spirit of all of them, is permitted only to make net earnings which are definitely measured by the dollars invested in the cost of establishing the business, with the further stipulation that this rate of return shall be very moderate indeed.

Supposing that a public service corporation is permitted to establish rates which will produce net earnings from its operations equivalent to an 8 per cent return on the capital invested in the business, how much is there going to be left for plant extensions after paying even the most moderate dividends and pre-war

interest charges? It must be obvious to any practical man that if such a company were earning $800,000 per annum it might require $10,000,000 of new capital to double the business, and there have been instances recently where the very great demands for electric power have required the doubling of the plant facilities of an electric central station in a year.

Normally, there is a dependable source of a fairly uniform and continuous supply of new capital for such purposes. It is available through the requirements of conservative investors who place part of their savings in the public service business, and further augmented by the investment requirements of banks, insurance companies, estates, etc. These buyers are satisfied with the moderate rate of return afforded by such securities because they recognize the protection afforded their capital through the public service laws and regulations. These regulations, while they do permit only a moderate rate of return, nevertheless usually make that small return more dependably secure than is the case in many other lines of business. But when credit conditions tighten up and investors cease buying securities these sources of new capital vanish and public service plant construction must come to a dead stop. The earnings of the company are wholly inadequate as a rule to finance any appreciable part of capital requirements of a rapidly growing public utility company.

There has been a marked falling off in the amount of investment funds for public utilities during the present year, and during the last six months there has been only the most meager supply of it in comparison with the pressing demands for public utility plant extensions. The owners and operators of such properties in many cases thought at first that this condition would be temporary, but soon found that they could not go on very far through borrowing capital from bankers and others on short-time arrangements. The volume of credit available for such purposes early became an almost negligible factor. Where construction was continued it therefore had to be paid for out of cash reserves. Obviously this last remedy could not be used indefinitely. Thus it has come about that power-plant construction has had to be greatly curtailed for the simple and practical reason that it could not be continued, however much the operators might have believed it to be sound business to go on with the work.

What Can Be Done About It?

Now, how can the man who wants to do something about it help to mend this condition? For one thing he must right about face in regard to his attitude on rates for electric service. Niggardliness on the part of many communities has effectually prevented public service corporations from establishing rates high enough even to produce net earnings equivalent to the meager allowance permitted under public service laws and regulations. Many a public service manager who knows that the earnings of his property are only a half or a third of even the "reasonable rate of return" on the valuation of the property and the business dares not attempt the establishment of the increase in rates necessary to correct this condition. He has been discouraged by the grievous experiences he has heretofore had in collisions with popular ideas of right rates.

Happily this condition is by no means universal. There are communities where a much more broad-minded consideration is given to rate problems. But under the best of conditions the usual attitude is merely a willingness to let the public utility live, not a willingness to see it prosper, and even where this is true your average business man takes rather a passive interest in the situation. He must take a militant attitude.

How the Business Men's Help Will Tell

The aggressive help of business men will very quickly make a great deal of difference. The public service company is naturally the biggest optimist in a town. It has to be, for its investment is absolutely anchored there. Its only hope for the future is the future of the community. It will take heart and find hope with less encouragement than any other business enterprise in the town. Finding itself backed up in a prospective rate increase by the aggressive and militant friendship of the majority of business men, it will generally find some way to manage its affairs so that the growth of the community and its industries need not be retarded for a lack of adequate public service.

Increased rates, however generous, will only solve the problem in part, for to the investor's mind this will merely correct past errors. New capital must be found for enlargements of plant facilities, and plans to find it should be laid right now, for boilers and turbines cannot be supplied in thirty days after the need becomes insistent. The next thing the business man must therefore prepare himself to do is to advance out of his own funds a substantial portion, if not all, of the cost of plant extensions required to handle his increasing business. He can reduce the burden which he will thus have to assume by a prompt and vigorous spirit of co-operation with the public service company in the effort to establish rates for service sufficient to encourage the bondholders and stockholders whose money is already invested.

In providing these advances short-term loans will not solve the problem. A number of power companies have joined with their customers in that temporary expedient during the last few months; but so far as the public service companies are concerned this has been a makeshift and not a policy. Help to finance new extensions on any great scale will very likely have to be obtained through investment in longer-term securities than have heretofore been considered. Very likely it will be a matter of ten-year bonds, or it may have to be managed through preferred-stock subscriptions. An advantage in the latter would lie in the fact that the purchase of junior securities would assist in the sale of bonds to general investors.

Encouragement of the expansion of railway facilities was withheld until the natural inevitable result was congestion of appalling proportions. The present railway capacity now limits commerce like the neck of a bottle. Will practical business men, with that lesson before them, permit a similar result in electric power capacity? Unlike the railroad problem, which required a national willingness to face it, the public utility situation in each individual case can be discussed and acted upon by just the small percentage of citizens in any community who usually mold its public opinion.

The two simple expedients suggested, prompt advances in rates and financial assistance from customers, are both entirely practical. In many manufacturing communities whose industries are growing a panic demand for electric power within the next twelve months is the only apparent alternative.

Features of 37,500-Hp. Water Turbines*

Not Being Handicapped by Competitive Bidding, the Manufacturers of the 35,000-Hp. Niagara Falls Wheels Have Incorporated Ideas Therein That Assure Maximum Reliability and Efficient Operation

THE new 100,000-hp. extension to the plant of the Niagara Falls Power Company, which was considered from the general engineering viewpoint in previous contributions by J. L. Harper, G. R. Shepard, N. R. Gibson and L. S. Bernstein, contains the most powerful hydraulic turbines ever built. Two were furnished by the I. P. Morris department of the William Cramp & Sons Ship & Engine Building Company and one by the Allis-Chalmers Manufacturing Company. As pointed out before, the contracts for these wheels were not placed on a basis of competitive bids, but general dimensions, external appearance, paralleling characteristics and general excellence were specified.

Water Wheel and Generator Considered as Homogeneous Unit

Speed Ring Integral Part of Foundation—Cast-Iron Pit Liner—Guide-Vane Wear Minimized—Governor Is Very Steady and Positive—Hydraucone Regainer Employed

By W. M. White

Manager and Chief Engineer Hydraulic Department Allis-Chalmers Manufacturing Company

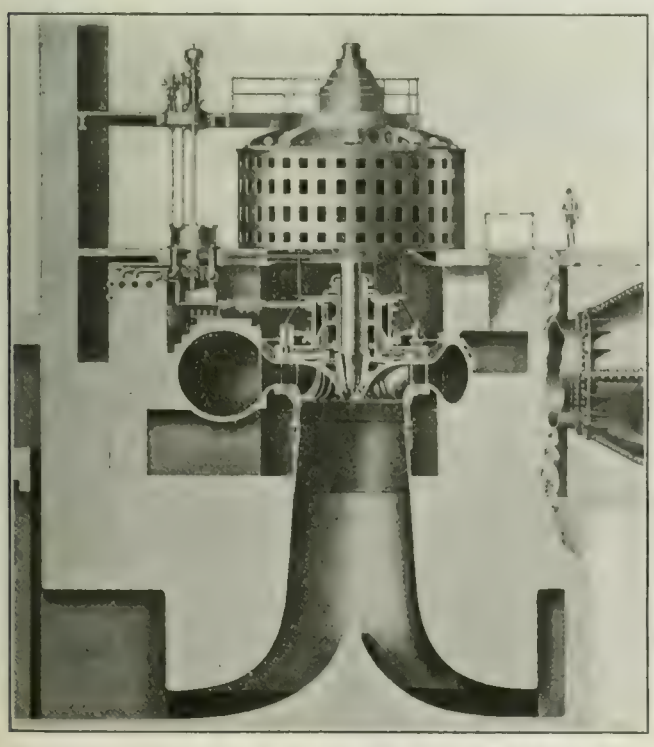
SINCE the design of the entire Allis-Chalmers hydroelectric unit was under the control of a single group of engineers, it was possible to consider the structure properly as a homogeneous unit and correctly to proportion and correlate the various elements. Its most striking features are the form of casing, governor, interconnecting barrel, brake support and draft tube.

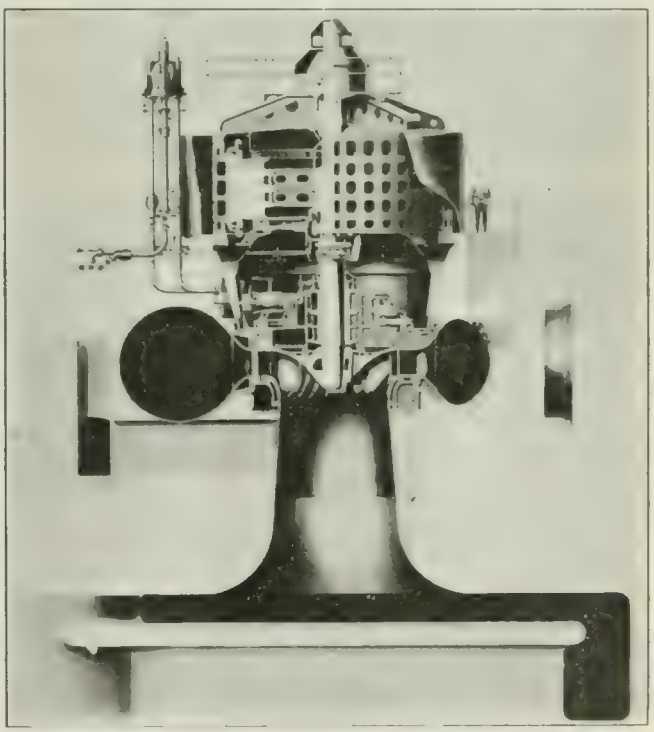
The casing is made up of a multiplicity of conical sections of plate steel of gradually reducing cross-sectional area around the turbine. The plates are riveted to the flanges of a cast-steel speed ring, which forms an integral part of the casing and the foundation of the turbine parts.

Water from the casing to the runner is controlled by means of twenty cast-steel guide vanes. Each vane is operated by a lever through a link attached to the shifting ring on the outside of the turbine and is held in position by two thrust bearings, one supporting the weight and the other resisting the upward hydraulic thrust when the unit is in operation. The thrust bearings are so adjusted that the guide vane is held in a central position between the distributer plates; consequently there is no wear between the ends of the vanes and the distributer plates. Around each vane stem is a stuffing box to prevent water from flowing through the bronze bearings supporting the vane—a specially desirable feature in that silt and sand, which would tend rapidly to wear the main supporting journal, are not carried between the surfaces by leakage. The vane stems are attached to the shifting ring through links so proportioned as to fail before a guide vane or its stem is strained beyond its elastic limit.

The runner is made of gray iron in one casting and is bolted to a cast-iron hub which is keyed to the tapered

*Second installment of a symposium on the 100,000 hp. extension to Station No. 3 of the Niagara Falls Power Company, see Sept. 18, 1920, issue of the Electrical World.





FIGS. 1 AND 2—TWO NEW 37,500-HP. UNITS OF THE NIAGARA FALLS POWER COMPANY

The units were built by different manufacturers (left, I. P. Morris wheel and Westinghouse generator; right, Allis-Chalmers unit) under the same general specifications. Generators are rated at 32,500 kva., 12,000 volts, and the units operate at 150 r.p.m. under 214-ft. head. Two types of draft tubes are shown—the spreading draft tube and hydraucone.

end of the turbine shaft. The turbine guide bearing consists of lignum vitæ fitted into cast-iron blocks having the end grain of the lignum vitæ toward the shaft. The bearing of this unit is 5 ft. (1.5 m.) in length and is made in two portions for convenience in dismantling and ease of handling. The bearing is lubricated by water supplied from the headrace through fine strainers. Connection is also made to the city mains for use of filtered water during times when headrace water contains considerable silt and sand.

A feature of design peculiar to this unit is the cast-iron pit liner forming the turbine pit and transmitting the weight of the generator through this pit liner directly to the speed ring and through the vanes of the speed ring to the foundation. Interalignment of the generator, turbine, etc., is thus permanently insured.

The guide vanes of the turbine are controlled by means of water pressure on two pistons connecting to opposite sides of the shifting ring. This arrangement keeps the governor pipes outside of the turbine chamber and enables the cover plate of the turbine to be removed without disturbing the cylinders and governor piping.

Another interesting feature of design is the governor equipment especially designed for this unit. The position of the stems on the guide vanes is such that the vanes will be in hydraulic balance when about one-third open. They will require considerable force to close or still further open the vanes from that point, but both forces are minimized. With a difference between the sides of the governor pistons equal to an operating pressure of 200 lb. (14 kg. per sq.cm.) and consequently by the usual method of rating governors, the governor of this unit has a capacity of 240,000 ft.-lb. (33,120 kg.-m.). The operating pressure to the cylinders is controlled by means of a four-ported piston valve in the governor stand. This valve is moved axially by varying the pressure on each end of its body by means of another four-ported piston valve, which in turn is moved by a pilot valve. With this arrangement the force exerted upon the flyball mechanism is not sufficient to prevent the flyballs taking up their exact position corresponding to the speed of the unit.

Direct-connected flyballs were used to secure steady, positive and as near frictionless operation as possible. The mechanism consists essentially of a fixed collar clamped around the main turbine shaft and a movable collar held in position and away from the shaft by four sets of ball-bearing toggle joints placed 90 deg. apart.

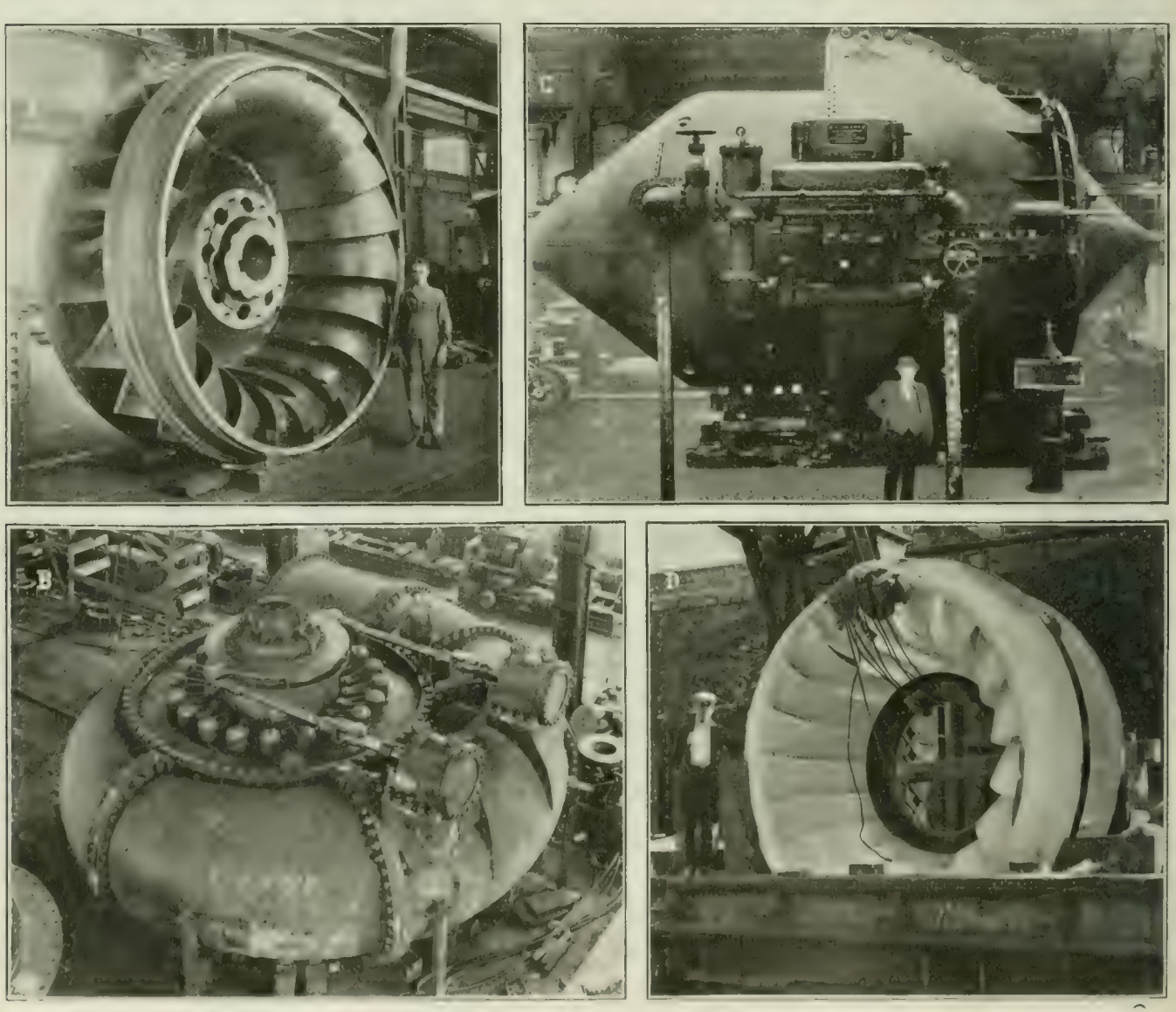


FIG. 5—REPRESENTATIVE VIEWS OF HYDRAULIC UNITS BEFORE ASSEMBLY

(A) and (B), runner and assembled unit of I. P. Morris construction; (C) Johnson valve for control of water in penstocks, and (D) Allis-Chalmers runner.

The governor has been adjusted to close the turbine gates from wide open to completely closed in three seconds of time and to open them from closed to wide-open position in four seconds of time. It is expected that the rise of speed with 40,000 hp. suddenly thrown off the unit will not exceed 25 per cent. The regulation of the unit and the normal load conditions are remarkably steady and positive.

One of the greatest losses in hydraulic turbines is in the energy discharged from the runner. Heretofore efforts have been made to utilize this energy by transforming the velocity into pressure for maintaining below the runner greater vacuum than would normally result from the elevation of the runner above tailwater level. In these units, however, the diameter of the runner is so large compared to the distance from the runner to the tailwater level that it was not feasible to design the draft tube in this manner. Consequently a hydraucone regainer was used. This is a chamber having the general form which the jet of water would take upon striking the impinging surface except that the capacity of the chamber is gradually greater in area in the direction of flow than that required to just close the hydraucone. The radially extending passage also affords a means of regaining for useful effect the whirl of the water as it leaves the runner at partial loads. It is not within the scope of this article to discuss at length the hydraucone, but a discussion of it will appear soon in one of the engineering journals.

Two Water Wheels for Generators of Different Make

Cast-Iron Casing Affords Smooth Contour, Resists Corrosion and Supports Unit—Load-Spreading Draft Tube Reduces Vibration and Improves Efficiency—Grease Gun for Lubrication

BY LEWIS F. MOODY
Assistant to Vice-President and Consulting Engineer William Cramp & Sons Ship & Engine Building Company

THE I. P. Morris turbines are of the vertical-shaft, single-runner type, having cast-iron volute casings embedded in the concrete of the power-house substructure. Particular care was taken to provide an efficient water passage at every point. Owing to the construction of the turbine casing of cast iron, it has been possible to preserve smooth surface contours for the internal surfaces of the casing and to avoid all local disturbances in the flow due to abrupt changes of direction or irregular surfaces. The casing is stayed across the distributer by a cast-steel speed ring, the vanes of which line up with alternate guide vanes when the latter are in the position corresponding to maximum efficiency. After passing through the runner, the water enters a straight conical draft tube of cast iron built in sections. From the lower end of the cast-iron section of draft tube the remainder of the tube is molded in the concrete substructure.

The draft tube is of a new type, the "spreading draft tube," the design of which has been carefully calculated and verified by many tests of experimental models both under conditions of smooth stream-line flow and under the actual conditions of flow experienced when the discharge is received from a runner. In the design of this tube it has been the object to turn the water as smoothly as possible along paths of gradual curvature from the vertical to the horizontal direction and to preserve symmetry about the turbine axis to a point where the velocity has been reduced to so low a value that only a small amount of velocity head remains in the water. Care has been taken to maintain a gradual decrease in the velocity by properly varying the transverse area of

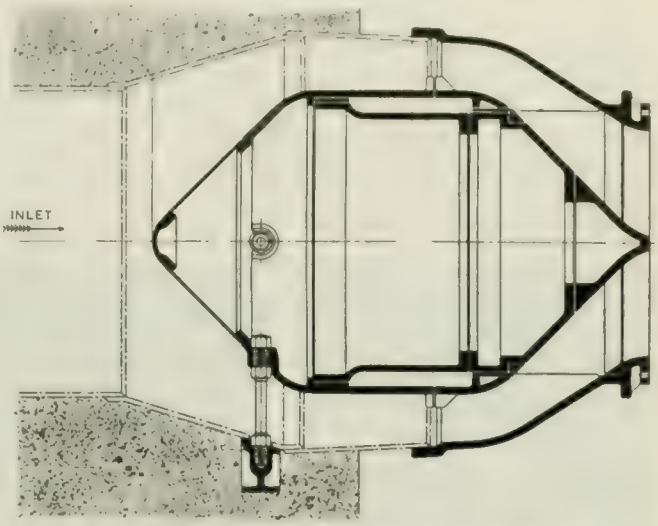


FIG. 1—LARGEST PENSTOCK VALVE IN WORLD

A Johnson hydraulic valve measuring 17 ft. x 24 ft. over all is installed at the bottom of each penstock close to the entrance to the wheel casing. The valves are balanced needle-type valves, having a movable plunger sliding in an internal cylinder. The plunger is of differential form, providing two operating chambers which are alternately exhausted to the air to move the plunger, the hydraulic pressure in the penstock furnishing the sole actuating force. Local or remote control can be used. The valve stroke may be set for any time up to a minimum of thirty seconds for a complete stroke in either direction. The valve can also be set to close automatically in case of a serious break in the wheel casing.

the passage at all points in the tube, in order under all conditions of operation to avoid the formation of eddies or disturbances which may cause severe vibration of the water column in the penstock and turbine.

Another advantage of the form of tube used is the ability of such a draft tube to regain the energy of whirling components of velocity in the water leaving the runner. This property of the tube is of value in increasing the efficiency under part-gate and over-gate conditions and in increasing the margin of power beyond the point of maximum efficiency of the turbine. Preliminary tests of the turbine indicate that both advantages have been realized, and in actual operation the unit is remarkably free from vibration at all gate openings.

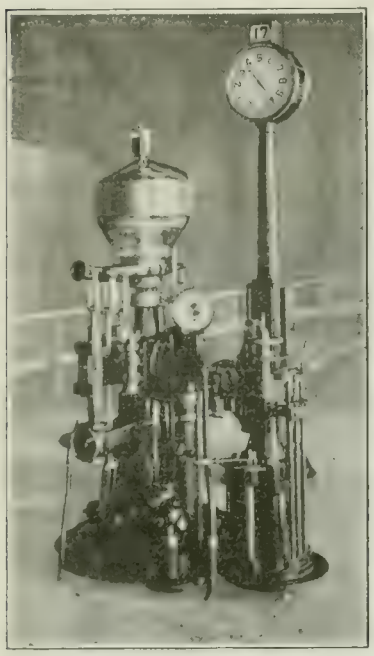
The turbine runners are of cast iron, each one being in one piece. The specific speed of the runners is 158 metric or 35.5 in the foot-pound system. At normal discharge the corrected velocity of the water leaving the runner and entering the draft tube is 21.3 ft. (6.4 m.) per second, corresponding to a velocity head of 7 ft. (2.1 m.), or 3.3 per cent of the effective head on the turbine.

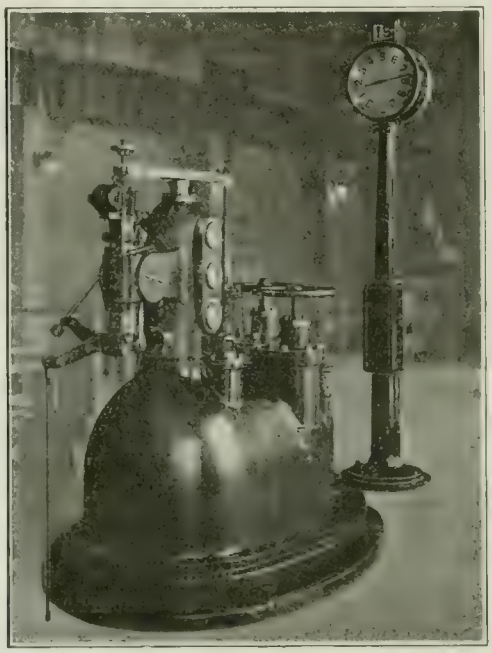
Although the most valuable feature of the new draft tube is probably the elimination of vibration just mentioned, it is also estimated that this tube will improve the efficiency over that which could be obtained with tubes containing elbows by from 0.3 per cent to 0.4 per cent in the efficiency of the entire turbine under conditions of normal gate operation. The same type of draft tube when applied to turbines of high specific speed would, of course, be capable of producing much

greater increases in efficiency than is possible in these turbines, which are of moderate specific speed. The final discharge velocity from the draft tube at normal gate is approximately 5 ft. (1.5 m.) per second, corresponding to a velocity head of 0.175 per cent of the effective head on the turbine.

Mechanical Features

The use of a cast-iron casing, although involving a somewhat increased cost as compared with the use of plate steel, furnishes a superior design in the following respects: The casing is absolutely rigid and can be embedded in the concrete so as to form a part of the substructure, and it can be relied upon to transmit the loads imposed upon it without distortion. The resistance of cast iron to corrosion insures a long life for the casing. Furthermore, there is no likelihood of local points of weakness being developed. The casings were subjected to hydrostatic pressure tests in the shops up to 120 lb. per square inch, which is well in excess of any pressure to which the casings can be subjected in operation during a quick gate closure resulting in water hammer.





FIGS. 7 AND 8—GOVERNOR MECHANISM FOR I. P. MORRIS AND ALLIS-CHALMERS WHEELS

The levers and other parts of the vane-actuating mechanism are made sufficiently strong so that failure of any portion should be an unusual occurrence even when trash becomes lodged between two guide vanes and the entire governor power is concentrated on two vanes. Renewable breaking links are provided to protect the mechanism in case undue load should occur. The operating ring is supported on a ball bearing and is turned by two cylinders which are bolted to brackets cast on the turbine casing, thus making the entire operating mechanism self-contained with the turbine.

For the lubrication of the operating gear, the Taylor system of lubrication is used, consisting of a central grease gun supplying a system of piping leading to each individual bearing. Admission of grease or oil can be controlled to each bearing individually by turning a separate cock at each bearing, the lubricant being forced into the bearing by air pressure admitted to the grease gun. The grease gun consists of a vertical cylinder and piston which can be filled with grease or heavy oil below the piston and air from the powerhouse pressure system admitted above the piston.

To relieve thrust above and reduce leakage around the runner multiple or labyrinth runner seals are used consisting of a series of contractions interposed in the path of the leakage water, alternating with enlargements in which the velocity of the leakage flow produces eddies and reduces the quantity escaping. This provision, although affecting only a small percentage of the total energy when the turbine is new, will be of material advantage in preventing a serious deterioration in efficiency after the unit has been some time in operation. The leakage above the runner passes through a cored space in the turbine head cover and is vented through the runner hub, discharging into the center of the draft tube.

The main shaft of the turbine has a lignum-vitæ guide bearing in the turbine-head cover, the bearing shell being split both horizontally and vertically to facilitate its removal. Acting upon the lower face of the generator rotor are brakes consisting of a series of shoes actuated by air plungers. The operation of the brake is controlled from a cock on the hand-control stand.

In order to avoid running a number of large governor pipes from the operating cylinders up to the gallery, with a consequent increase in the length of fluid column between the governor and the cylinders, resulting in increased inertia of this fluid column, the main governor valves are separate from the governor and placed on the level of the generator-room floor so that they are immediately above the operating cylinders. The Taylor control system is used with these units. This involves the use of fluid-operated plunger valves of the Johnson type, by the operation of which the operating cylinders can be connected to either the governor or the hand-control system. All of the valves for shifting from governor to hand control and back again are controlled by a single lever mounted on the governor stand on the gallery.

The separate hand control provided in addition to the governor contains separate valves and restoring mechanism by which the turbine gates can be operated through the pressure system, the gates being automatically maintained in any position corresponding to the setting of the handwheel. By this means the unit can be operated on hand control with the governor and all of its valves thrown out of operation and made available for inspection and repair. A clutch is provided by which the governor head may be put out of operation without shutting down the unit so that all parts can be made accessible.

Among the members of the Cramp company's organization who have been responsible for the design of this turbine installation may be mentioned H. Birchard Taylor, vice-president; John Overn, Jr., Manager I. P. Morris Department; Frank H. Rogers, hydraulic engineer, and R. E. Brunswick Sharp, assistant hydraulic engineer.

Reconnecting Two-Phase Induction Motors

(With Supplement)

Tables and Winding Diagrams Give Information Necessary for Connecting Two-Pole to Twelve-Pole Motors — Complete Data on Connecting Coils in Unequal Groups

By A. C. ROE

Detroit Service Department Westinghouse Electric & Manufacturing Company

WITH the information given in the accompanying tables and winding diagrams (see supplement) any motor-repair man should be able to connect two-pole to twelve-pole two-phase induction motors for any speed or voltage. The data and charts have been based on years of practical experience and refer to the majority of problems encountered, not to the exceptional ones. Similar tables and diagrams for three-phase motors were published in the ELECTRICAL WORLD for July 24, 1920.

From the charts it can readily be determined for what voltages and speeds it is practicable to connect any motor containing from 12 to 240 coils. If coils cannot be evenly divided between groups, the charts indicate how the coils may be divided and still get satisfactory results. The winding diagrams are grouped according to the number of poles in the winding. Both tables and diagrams apply to lap windings only.

There are one voltage table, one master grouping chart and six sub-charts. The voltage table indicates what changes should be made in connections to obtain certain voltage changes. This table is best explained by an example which has been taken as follows: Suppose it is desirable to raise the voltage of a motor connected four-parallel from 110 volts to 220 volts, what connection must be used? First, the desired voltage must be expressed in percentage of the original voltage, and in this case it is 200 per cent. Then, starting at the four-parallel line in the left-hand column, this line is followed to the right until the figure 200 is reached. Directly above 200 is given the desired connection, which is two-parallel. The table is used similarly for lowering a motor voltage. Where a blank space occurs the change is impossible with two-pole to twelve-pole machines. Even if this table indicates that a winding is possible, the grouping charts may indicate otherwise and must consequently be the final guide. When reconnecting, the voltage of a motor should not be raised so high that there is danger of the insulation failing.

MAKING CHANGES IN SPEED

Changes of speed may be obtained in an induction motor only by changing the number of poles. The synchronous speed corresponding to the number of poles is shown at the extreme left of the master chart for 25-cycle and 60-cycle motors. The highest speed at which a rotor may be run is limited by the mechanical strength of the rotor. On the other hand a considerable reduction in speed results in decreased horsepower and power factor.

After the type of winding and the number of poles desired is known, the coils must be connected in groups (if not already properly connected) and the groups must be connected together according to the type of winding. The grouping charts and the winding diagrams will assist in doing this.

The master chart contains one vertical column indicating the number of poles in the winding, another vertical column indicating the type of winding (series, parallel, etc.) and a horizontal column at the top indicating the total number of coils in the winding. Where the total number of coils can be divided evenly among each group the main chart will show the proper number of coils per group directly under the total number of coils and opposite the number of poles and type of winding used. When the total number of coils will not divide evenly, however—that is, where there are more coils in some groups than in others—a letter (*K*, *L*, etc.) will appear under the total number of coils and opposite the number of poles and type of winding to be used, indicating that the number of coils per group will have to be obtained from the supplementary table bearing the letter. If the connection desired cannot be efficiently made with the given number of poles and coils a blank space in the main chart will indicate this fact. Where a degree mark (°) appears in the master chart it is an indication that one coil will have to be left dead in each group indicated in the sub-chart by a degree sign (°).

HANDLING SPECIFIC PROBLEM

The method of using the charts can better be explained by assuming some specific conditions. For instance, suppose that a six-parallel winding is desired on a six-pole motor having sixty coils. Looking under the vertical column marked 60 opposite a six-parallel winding, it can be seen that five coils per group will give the desired arrangement. On the other hand, suppose that a two-parallel connection is desired on an eight-pole motor having sixty coils. In the sixty-coil column opposite the eight-pole, two-parallel winding will be found the reference *N*, which indicates that the coil grouping is odd and that the sub-chart *N* must be consulted. By reference to the sub-chart opposite sixty coils it will be found that the following grouping is necessary: 3, 4, 4, 4, 4, 3, 4, 4, etc. Suppose again that with this same eight-pole sixty-coil motor a four-parallel connection is desired. Inspection of the main table shows that sub-chart *N* gives the desired connection.

The connection will be the same as for a two-parallel winding, except that the degree marks would be observed because the master chart has indicated that coils must be killed. In cases where the coil always has to be killed it is indicated by a (—1) sign following the number of coils in the group. For instance, in a two-parallel winding, eight-pole, eighty-six-coil machine Table *N* indicates that the number of coils per group will be 6 — 1, 5, 6 6, 5 5, etc.

Besides helping in rewinding or reconnecting motors these charts are useful in determining which is the best design for any machine. For instance, it can be seen that in a ninety-six-coil motor two, four, six, eight

or twelve-pole connections are possible, and that ten-pole series or two-parallel connections are possible without killing any coils, although an odd grouping is necessary.

It will be noted that the number of coils is used throughout this article in preference to the number of slots. This makes the data apply to all cases irrespective of the number of coils per slot.

Connecting Diagrams

In order to facilitate the use of the connecting diagrams on this supplement they are numbered and lettered uniformly throughout. The numbers outside of the circle indicate the number of the groups which they are opposite. The numbers inside indicate the two ends of each pole-phase group. Where one of these inside numbers is repeated this indicates that the two groups so numbered should be connected together at these points. The numbers are so arranged that when a machine is to be changed to a different connection with the same number of poles the change can be obtained by inspection of the two diagrams corresponding to the two connections. For instance, with a four-pole machine—suppose a change is to be made from a series winding to a two-parallel winding. Starting at the top of the first diagram showing the series winding and proceeding clockwise, the numbering on the coil groups is as follows: On the first diagram of the two-parallel winding, proceeding in the same direction, the lettering is the same until the upper end of group No. 4 is reached, where 5 has been changed to A_1. This means that the jumper which formerly connected around to the right to the other 5 has now been swung around to A_1, in order to make the two-parallel connection. Likewise the jumper from 6 in group No. 5 has been swung around to B_2, and 5 from group No. 3 has been swung around to A_2. By completing these changes the motor is reconnected from a series to a two-parallel winding.

It will be noted that there are two drawings for some types of connections. For instance, there are two series-connected windings for the four-pole machine. The first of these drawings shows what is called a "top-to-bottom" connection and the second a "top-to-top and bottom-to-bottom" connection. These are indicated on the diagram by the letters *T-B* and *T-T*. In the top-to-bottom connection the jumpers connect all like poles, skipping alternate poles. In the top-to-top connection the jumpers pick up adjacent poles. The *top-to-top connection should be used for all odd coil groupings* which are given on the charts. In reconnecting for a different voltage a *T-B* diagram must be used in conjunction with a *T-B* diagram; likewise a *T-T* with a *T-T* diagram.

There is one two-speed winding shown in the six-pole group. The motor may be operated as a six-pole or a twelve-pole machine by making the connections indicated in the footnote at the bottom of the group.

The method of using these diagrams and charts as practiced by the writer is as follows: Instruction is given to the winder as to the number of coils in each group, and if the grouping is odd the instructions are written on paper in the order shown on the chart, as, for instance, 4 4 5 5 4 4 5 5. After the coils have been connected in groups or "stubbed" by the winder, all of the top leads of each group are bent out from the center of the machine and all of the bottom leads are bent in toward the center. The beginning and end of each coil are tagged according to the diagram with metal or fiber tags having numbers corresponding to the numbers indicated on the diagram at the ends of the coil groups. These tags are drilled so that they can be slipped on the leads. After the foreman or head winder has checked the tagging the winder connects the leads by putting a jumper from each number to the corresponding like numbers. If only two tags are removed at once, there is less chance for mistakes. When all the jumpers are on, the motor leads indicated in the diagram by A_1, B_1, A_2, B_2, can be put on, after which the winding may be soldered and the joints insulated, etc.

A feature of the diagrams is that it is not actually necessary to follow the lines as the figures and letters denote which leads are to be connected together. Thus it is not necessary for a man out on the job to have a diagram, provided he has the numbering, which may even be telephoned to him. For instance, for the four-pole series winding the necessary data would be: $\overset{4}{1}$-B_1, $\overset{4}{4}$-A_1, $\overset{5}{6}$-$\overset{5}{3}$, $\overset{4}{5}$-2, 6-1, etc. The first number in each group represents a top lead and the last number a bottom lead (or vice versa), and the number underneath each group designates the number of coils in the group. If the coil grouping is even these numbers underneath are not necessary.

The diagram of the two-speed, three-phase winding shown in the six-pole group in the article printed in the Electrical World for July 24, 1920, should have been accompanied by an explanatory note showing what terminal connections to make for each speed. For a twelve-pole winding *A*, *B* and *C* should be the line terminals and A_1, B_1 and C_1 should be left open. For a six-pole winding A_1, B_1 and C_1 are the line terminals and *A*, *B* and *C* are tied together.

The Real Meaning of Productive Illumination Intensities

Since the Intensity of Light Reaching the Eye Is What Counts, the Coefficient of Reflection of the Work Plays Important Part

By Davis H. Tuck
Electrical Engineer Holophane Glass Company

IN PLANNING illumination systems one is apt to get into a rut regarding the intensity of illumination specified for specific purposes. In general one thinks of 2 foot-candles as low-intensity illumination, 20 foot-candles as high-intensity illumination and 6 foot-candles as average good illumination.

An error of the past—and of the present too—is to pay too much attention to the foot-candle intensity of illumination delivered to the work and to give too little thought to the foot-candle intensity that is reflected from the work to the eye. The reading of the foot-candle meter should be used in conjunction with the coefficient of reflection of the work. The importance of this reflection factor is well shown in the illustration, where one shop requires over ten times the foot-candle meter reading of the other for productive intensity.

The eye fortunately functions almost equally well over a wide range of light intensity. Objects are seen mainly by their difference in brightness or contrast. The eye

can distinguish contrast in adjacent surfaces differing in brightness by somewhat less than 1 per cent, the exact value depending upon the individual and the state of adaptation of the eye. This small difference in brightness of approximately 1 per cent represents the beginning of visibility by contrast and is practically independent of the absolute illumination intensity over a wide range of values. Experimentally this least perceptible difference in brightness is well confirmed and is known as "Fechner's fraction."

The psychological basis of illumination is largely dependent on the limits of absolute illumination between which Fechner's fraction holds true, as after an intensity of illumination is reached where Fechner's fraction applies the eye can see nearly as well under one absolute intensity of illumination as another.

Experimentally it has been found that after the illumination affecting the eye has become 2 foot-candles the eye has attained nearly its full value of sensitiveness. There is a very slow and small gain in eye sensitiveness beyond the absolute illumination value of 2 foot-candles, the eye retaining practically uniform sensitiveness up to illumination intensities far beyond practical values.

Another quality of the eye has an important bearing on practical illumination, *i.e.*, visual acuity, or the capacity of recognizing fine detail. It has been found by experimental tests that visual acuity reaches its normal value at the same point of illumination intensity as Fechner's fraction. That is, above 2 foot-candles the increase in the sensitivity of the eye to distinguish difference in brightness and the ability to distinguish fine detail is very small.

We therefore have a well-proved fundamental law. The eye is practically in full action for seeing when it receives an illumination of 2 foot-candles. This illumination of 2 foot-candles must be received by the eye and is not that which is measured by a foot-candle meter. The readings obtained by a foot-candle meter give a measure of the efficiency of a lighting system but do not tell whether the illumination received by the eye is adequate.

For the illumination which is measured by a foot-candle meter to indicate the critical value of 2 foot-candles available to the eye it must be $E = a/k$, where E is the illumination measured by the foot-candle meter, a is 2 foot-candles and k is the coefficient of reflection of the surface being worked upon.

Assuming the work is being done on white cloth where $k = 0.7$ then for the eye to work to the best advantage the foot-candle meter must read $E = 2/0.07 = 2.86$ foot-candles. Fig. 1 shows a weave room of a mill where this condition is met. The lighting equipment is as follows:

Reflector—Holophane CSI75VF.
Lamp—75-watt, type C, bowl frosted.
Spacing—14 ft. 6 in. x 14 ft. 6 in.
Mounting height above floor—10 ft. 10 in.
Illumination intensity—3 foot-candles.

Inasmuch as a further increase in illumination would not make a corresponding increase in eye sensitivity or visual acuity, the illumination of 3 foot-candles for this particular mill is ample and 3 foot-candles is a productive intensity.

The writer was called upon to inspect a painting room of a motor-car factory, shown in Fig. 2, where the following lighting equipment was used:

Reflector—Holophane 2110VF.
Lamp—100-watt, type C, clear.
Spacing—10 ft. x 10 ft.
Mounting height above floor—10 ft.
Horizontal foot-candle intensity—7.5.
Vertical foot-candle intensity—4.5.

The work is done on the vertical sides of automobile bodies, which are painted black. It was found that k for the black automobile bodies was 0.053 and that, although the foot-candle meter registered 4.5 foot-candles on the vertical sides of the body, the foot-candle value that was actually effective on the eye was 0.24 foot-candles ($4.5 = a/0.053$).

Now, in order to bring this system up to productive illumination it is necessary to increase the illumination on the vertical surface to 38 foot-candles ($E = 2/0.053$).

The object of reviewing the above is to bring out the real meaning of productive illumination. Productive illumination does not necessarily mean very high foot-candle values as measured on a foot-candle meter but means that, taking into account the value k (coefficient of reflection of the work), the illumination actually active on the eye must be not less than 2 foot-candles.

It should be noted that whereas a light-measuring instrument which indicates foot-candle values incident on the work, and not the intensity reaching the eye, is excellent for use in making comparative readings of illumination to measure the light-producing efficiency of an illuminating system, it should be used with discretion in constructive illumination planning.





PRODUCTIVE ILLUMINATION IN THESE TWO FACTORIES REQUIRES WIDELY DIFFERENT FOOT-CANDLE METER READINGS

(1) A weave shed where the work is done on white cloth, using 3 foot-candles as measured with a foot-candle meter (Tremont & Suffolk mills). (2) An automobile painting room where 38 foot-candles is employed. The much higher intensity is required because of the black surface worked upon. (Chevrolet motor-car factory, Tarrytown, N. Y.).

Relation of Lighting Feeders to Watts per Square Foot

Tabulation: to Show Actual Demand Factors and Units per Square Foot Used in Different Classes of Business and Industry

By Victor Tousley

IT IS a rational assumption that the intensity of illumination used in any particular place will be governed by the requirements of the business carried on and not by the number of sockets installed. If the number of sockets provided is relatively small, high-wattage lamps will be used, if large, small-capacity lamps will be provided or many of the sockets will not be used at all. Hence the size of mains required to carry the maximum load for illumination is best determined on the basis of the maximum watts per square foot used in the given line of business. Demand factors in this connection are of little use except in special installations, such as in photographic rooms of engraving firms, for instance.

For power purposes the wattage per square foot, on the other hand, is of little use and applicable to special cases only. But the more information it is possible to gain on the subject of actual power requirements, the better it will be, and hence the following tabulation gives demand factors as well as the wattage per square foot in all cases where this information was obtainable. It was found that in only very few installations were any records kept, and in several lines of business it was necessary to arrange special tests. In many other cases the demand factors given are based on statements of engineers and switchboard attendants. During this investigation it was also found that no two installations in any line of business were nearly enough alike to warrant indiscriminate use at one place of the figures obtained in another. It is for this reason that the maxima, minima and averages obtained in each classification are given.

It is also stated in connection with each group whether the factors given apply to straight lighting, power or mixed loads. The watts per square foot given are all based on rough measurements of outside dimensions of buildings such as one could readily make with a tape line in the field or with a common rule from plans. The effect of all minor irregularities was estimated and no accurate measurement was made. Basements and attics were always counted in.

Apartment Buildings (*Mixed Load*)	Minimum	Maximum	Average
Watts per square foot	0.05	0.30	0.17
Demand factors in per cent	12	59	38

The highest demand factors as well as the highest wattage per square foot are likely to be found in connection with the smaller apartments or where occupants rent rooms.

Clothing Manufacture (*Mixed Load*)	Minimum	Maximum	Average
Watts per square foot	0.61	2.6	1.37
Power load: Demand factors in per cent	82	105	94

Some of the installations investigated include office and storeroom space; others merely the shop.

Very little useful information on cooking installations is at present available. With the exception of cases where the ovens are in continuous use the conductors will probably be of sufficient capacity if they can carry the total connected load for thirty minutes after having carried half their load for an hour before.

Cranes (*Power Load*)	Minimum	Maximum	Average
Demand factors in per cent	10	54	27

The high demand factor in this case was obtained from three ore bridges unloading a vessel and all three working steadily. The minimum record was obtained in a railway shop.

Department Stores (*Mixed Load*)	Minimum	Maximum	Average
Watts per square foot	1.02	1.54	1.28
Demand factors in per cent	37	56	46

The watts per square foot and demand factors were not obtained from the same installations. In some of the stores elevators were not electric. In less pretentious neighborhoods brilliant lighting effects are not much sought after and showcase lighting is kept at a minimum.

Elevators, Passenger (*Power Load Only*)	Minimum	Maximum	Average
Demand factors in per cent	32	68	45
Foundries (*Mixed Load*)			
Demand factors in per cent	36	50	48
Garages, Public			
Demand factors in per cent	19	56	34

In large private garages the peak load is often purposely kept low and much below the average of public garages.

Hospitals (*Mixed Load*)	Minimum	Maximum	Average
Watts per square foot	0.23	0.45	0.33
Hotels (*Mixed Load*)			
Watts per square foot	0.45	1.75	0.90
Hotels (*Lighting Only*)			
Watts per square foot	0.17	0.45	0.28

The maximum for mixed load in this case was found in a small club house heavily motored for laundry and ventilation purposes.

Machine Shops, Jobbing (*Power Load*)	Minimum	Maximum	Average
Demand factors in per cent	25	40	33

These figures refer to shops in which jobbing is done, and all of them include crane service. Machine shops engaged in general manufacture of standard parts are classed with "Manufacturing."

Manufacturing, General (*Lighting Only*)	Minimum	Maximum	Average
Watts per square foot	0.27	1.25	0.48
Power: Demand factors in per cent	27	79	48
Mixed load: Demand factors in per cent	20	66	48
Office Buildings (*Mixed Load*)			
Watts per square foot	0.68	1.20	0.85
Packing Houses (*Power Load*)			
Demand factors in per cent	60	68	64
Printing (*Mixed Load*)			
Watts per square foot	0.58	1.20	0.85
Demand factors in per cent	38	70	45

Some printing establishments include office and storage space as well as engraving and composing rooms; some have only the printing machinery.

Rented Buildings (*Mixed Load*)	Minimum	Maximum	Average
Watts per square foot	0.30	1.65	0.96

Buildings here referred to are occupied by small tenants carrying on various lines of business.

Tanneries (*Mixed Load*)	Minimum	Maximum	Average
Demand factors in per cent	40	62	50

In some of these tanneries the manufacture of gloves and other leather products is carried on.

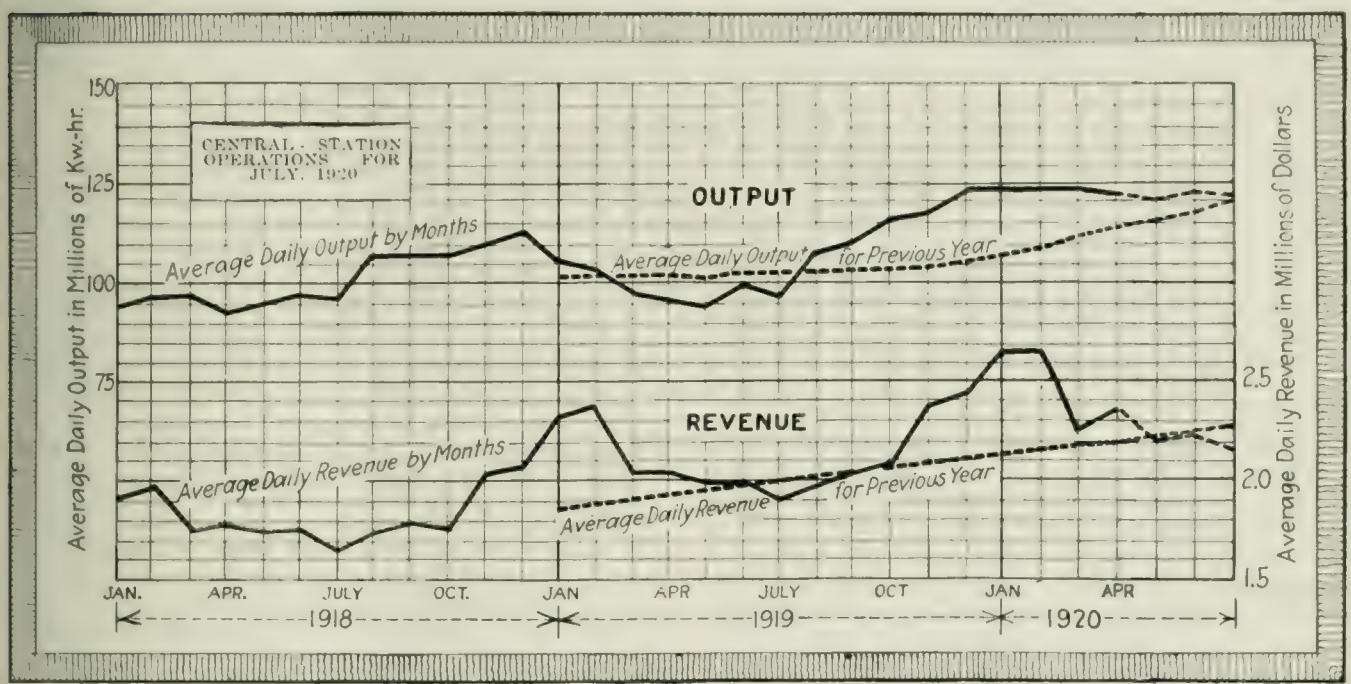
With theaters the watts per square foot in the auditorium usually equals 1.25. This equals about 7.5

watts per seat. In large houses a stage capacity of about 100,000 watts is probably the highest ever called for. Electric signs and lobby illumination have a demand factor of 100 per cent. The general mains supplying the whole installation should have a carrying capacity equal to the demands of auditorium, lobby, signs and dressing rooms for one hour and the stage capacity in addition for about fifteen minutes. The full stage capacity is sometimes on for five or ten minutes before the curtain rises and the auditorium lights are cut off. This will, of course, occur only in the event that a show opens with its maximum illumination.

	Minimum	Maximum	Average
WAREHOUSES (*Lighting Load Only*)			
Watts per square foot	0.03	0.11	0.07
WHOLESALE HOUSES (*Mixed Load*)			
Watts per square foot	0.19	0.93	0.41

This classification does not include wholesale dry goods houses. In some wholesale houses quite a great amount of power is used.

Midsummer Operations Increase



UNUSUAL stability in midsummer central-station operations is indicated from returns received by the ELECTRICAL WORLD for the month of July. Prior to this year energy production has in general shown a decided drop during the summer months as compared with that of the previous winter season, but the output for the month of July of this year in the country considered as a whole was only 72,000,000 kw.-hr., or 1.8 per cent, below that recorded in December, 1919. In 1918 the midsummer production was larger than that of the previous winter, owing entirely to abnormal requirements. The gross revenue during July that year was, however, 10.1 per cent less than that recorded in December, clearly indicating the large loss in revenue during the summer months due to decreased demand for energy for lighting.

During July curtailment of production in many lines was reported, especially in the textile and related industries. This resulted in odd-time work and in some cases complete shut-downs, and, taken in connection with the continued poor transportation conditions, is naturally reflected in a slightly decreased energy demand under that of June in every section of the country except the South Central States and the Mountain-Pacific Section. Factory operations in New England during July decreased slightly under those of June, and a consequent slight falling off in power demand is reflected by the central-station returns from that section. The question of transportation was still a dominating influence in the North Atlantic and North Central States. The iron and steel industry was espe-

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE MONTHS

	Percentage of Installed Ratings Represented	Revenue from the Sale of Energy			Percentage of Installed Ratings Represented	Kw.-Hr. Output		
		1919 Thousands	1918 Thousands	Per Cent Increase		1919 Thousands	1918 Thousands	Per Cent Increase
Aug.	54	$32,756	$29,006	13 0	54	1,801,836	1,793,706	0 5
Sept.	53	32,344	28,336	14 0	53	1,761,582	1,695,862	4 3
Oct.	55	35,492	30,077	18 0	60	2,175,636	1,987,004	9 0
Nov.	53	37,439	31,927	17 2	58	2,055,428	1,895,693	8 2
Dec.	59	44,125	37,978	16 0	65	2,509,571	2,270,833	10 0
		1920	1919			1920	1919	
Jan.	57	46,614	39,002	19.8	67	2,581,096	2,186,732	18 0
Feb.	63	45,881	37,502	22.1	69	2,494,764	1,986,493	25 3
Mar.	65	46,155	36,840	25 0	70	2,698,890	2,103,587	28 0
April	65	45,547	36,541	24 5	70	2,603,692	2,098,559	24 1
May*	65	43,888	35,512	23 4	70	2,631,560	2,179,916	21 2
June†	66	44,313	35,525	24 7	71	2,621,123	2,182,337	20 0
July‡	66	44,312	35,779	23 6	71	2,688,280	2,261,839	18 8

*Includes estimates for thirteen companies representing 0.5 per cent of the total installed rating of all central stations.
†Includes estimates for 14 companies, representing 7.9 per cent of the total installed rating of all central stations.
‡Includes estimates for eighty-four companies, representing 19.2 per cent of the total installed rating of all central stations.

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

	Month	Percentage of Installed Ratings Represented	New England States			Percentage of Installed Ratings Represented	Atlantic States			Percentage of Installed Ratings Represented	North Central States			Percentage of Installed Ratings Represented	South Central States			Percentage of Installed Ratings Represented	Pacific and Mountain States		
			1919 Thousands	1918 Thousands	Per Cent Increase		1919 Thousands	1918 Thousands	Per Cent Increase		1919 Thousands	1918 Thousands	Per Cent Increase		1919 Thousands	1918 Thousands	Per Cent Increase		1919 Thousands	1918 Thousands	Per Cent Increase
REVENUE	Aug.	74	$4,225	$3,693	14.4	57	$12,174	$10,995	11.1	47	$9,295	$7,924	15 8	39	$1,647	$1,385	18.4	61	$5,415	$5,009	8.5
	Sept.	73	4,019	3,536	13 6	53	11,429	10,069	13 5	46	9,671	8,278	16 6	38	1,724	1,488	16.0	63	5,501	4,965	10.9
	Oct.	72	4,127	3,453	19 1	53	12,684	10,822	16.9	52	11,401	9,484	20 2	38	1,840	1,519	21.1	62	5,440	4,799	13.9
	Nov.	71	4,432	3,800	16.2	56	14,738	12,761	15.7	44	10,541	8,689	21 2	39	2,063	1,694	21.8	63	5,665	4,983	13.9
	Dec.	73	4,908	4,254	15.1	57	15,926	13,806	15.8	49	11,660	9,833	18.3	44	2,496	2,070	20.0	77	9,135	8,015	14.2
			1920	1919			1920	1919			1920	1919			1920	1919			1920	1919	
	Jan.	78	5,635	4,718	19 8	59	17,659	14,625	20.9	51	12,885	10,799	19.6	53	3,047	2,538	19.9	75	7,388	6,322	16.1
	Feb.	82	5,354	4,368	22.1	61	17,245	14,343	20.4	55	13,191	10,403	26.0	53	2,949	2,360	24.7	79	7,142	6,028	18.3
	Mar.	82	5,136	4,044	27 0	63	17,696	14,299	23.7	57	13,270	10,469	26 5	54	2,910	2,287	27 8	79	7,143	5,741	24 2
	April.	82	5,087	3,943	29 0	64	17,700	14,383	23 5	57	12,690	10,042	26.9	54	2,952	2,181	35 2	79	7,118	5,992	19.2
	May	82	4,897	3,741	30 1	64	16,624	13,631	21.9	57	12,471	9,853	26.8	54	2,829	2,140	32 0	79	7,067	6,147	15.1
	June.	82	4,903	3,778	30.0	65	16,450	13,469	22.1	57	12,411	9,753	27.4	54	2,849	2,127	33.9	79	7,700	6,398	20.5
	July.	82	5,016	3,892	28.9	65	16,808	13,432	25.1	57	12,721	9,828	29.2	54	2,740	2,198	24.5	79	8,023	6,429	24.5
KW.-HR OUTPUT			1919	1918			1919	1918			1919	1918			1919	1918			1919	1918	
	Aug.	74	161,431	153,266	5 1	57	640,616	662,120	-3.2	47	496,745	460,360	8.0	39	58,991	53,231	10.2	61	444,026	464,729	-4.2
	Sept.	73	153,837	146,209	4 5	53	610,254	610,179	0.1	46	515,519	463,929	11.5	38	58,316	54,838	6.3	63	423,656	420,707	0.5
	Oct.	72	162,859	142,326	14 4	53	694,584	659,859	5.3	67	815,284	709,665	15 3	38	67,155	56,742	18.5	62	435,754	418,412	4.1
	Nov.	71	153,171	140,240	9.2	56	724,667	707,347	2 4	60	686,486	597,855	14.9	39	68,352	59,507	14.7	63	422,812	390,744	8.2
	Dec.	73	180,493	152,304	18 0	58	803,165	733,222	8.9	67	825,313	713,959	15.8	44	88,658	73,728	20.1	77	611,942	597,620	2.5
			1920	1919			1920	1919			1920	1919			1920	1919			1920	1919	
	Jan.	78	207,158	159,773	29.8	60	853,057	717,303	19.2	69	841,841	731,758	15 2	56	140,736	117,677	19.9	75	538,304	460,221	16.2
	Feb.	82	187,264	148,103	26 2	62	809,865	672,836	20 1	73	858,939	663,523	29.4	56	130.473	98,098	33.0	79	508,223	403,933	26.1
	Mar.	82	198,603	148,512	33 7	64	897,327	711,828	26 0	74	913,659	711,761	28 1	56	137,306	102,545	33 6	79	551,995	428,941	28.6
	April.	82	187,174	144,922	29 1	65	883,264	701,778	25.9	74	857,467	687,751	24 7	56	135,140	99,877	35 2	79	540,647	464,231	16.7
	May	82	188,566	148,186	27 5	65	854,631	711,276	20 0	74	862,127	700,095	23 5	56	137,779	98,815	39 2	79	588,457	521,544	12.6
	June.	82	187,526	150,073	25.0	66	861,411	722,782	19.3	74	852,016	686,921	24.2	56	132,733	99,660	33.2	79	587,437	522,901	12.2
	July.	82	191,880	159,265	20.4	66	877,841	712,450	23.2	74	853,230	729,843	16.9	56	139,363	106,389	30.9	79	626,265	553,892	13.1

cially affected, it being estimated that 2,000,000 tons of this product was tied up in the hands of the producers. Steel mills were working on schedules dependent upon the arrival of raw materials, but few were able to work at capacity. Coal-mining operations in Pennsylvania and West Virginia were only about 50 per cent of normal, while in Ohio, Indiana and Illinois they were still lower. Manufacturing centers, such as Rochester and Philadelphia, however, reported transportation conditions slightly improved, and this probably accounts for the fact that the average daily energy output in the Atlantic States in July was only 630,000 kw.-hr. less than during June.

The North Central States reported a general slowing down in manufacturing. The automobile and allied industries were especially affected, large numbers of men being laid off in this class of manufacturing plants. Moreover, the breakdown of a 45,000-kw. unit in Detroit resulted in a curtailment of output for that section. This decreased industrial activity is reflected in a loss of 1,180,000 kw.-hr. in average daily energy demand under that of June.

Labor shortage hindered maximum operations in most of the mining regions of the Mountain States. The Pacific Coast States reported the usual prosperous conditions, especially in the Northwest. The entire Mountain-Pacific section reported an energy output of 793,000,000 kw.-hr. for July, which is virtually the same as was recorded in December, 1919, the record month for the country. The average daily output for the month exceeded that of June by 820,000 kw.-hr.

The stability of the central-station industry in this section is indicated by the fact that at no time during the present year have the monthly operations shown a decrease over the preceding month. No other section of the country can show such a consistent growth during the past half of the present year.

Estimates That Water-Power Development Will Save a Billion Dollars a Year

A SURVEY of the resources and development of water power in the United States has been issued by the Guaranty Trust Company of New York in which the statement is made that probably the most significant achievement in the field of American industry in the post-war industrial readjustment is to be the development on a large scale of the nation's vast water-power resources. With the revival of normal industrial activity by the recently belligerent nations, the company points out, competition in the world's markets will become increasingly severe. Economy in the application of power to the production and transportation of goods will in large part measure the competitive ability of the various nations. As emphasis is more and more placed upon cheapness of power resources, coal and iron alone henceforth will not be such decisive factors in measuring the potential industrial capacity of nations. Water power will have a new significance as a national asset. It is estimated the United States has the means for effecting a saving of its energy supply well in excess of a billion dollars a year. This can be effected only through a fuller utilization of the nation's water-power resources.

The Guaranty Trust Company's survey gives figures compiled by the United States Geological Survey on coal deposits, petroleum production and actual and potential water-power development and sums up the chief provisions of the federal water-power law. Stating that the need for water-power development is a matter of relative economy rather than of an actual shortage of solid fuel in the United States, it declares that "it is in the possible reduction of the proportionate reliance of the industries and the transportation systems upon bituminous coal for energy that water-power development promises the greatest economies."

Readers' Views and Comments

Destruction of Conduit Laid in Cinders

To the Editor of the ELECTRICAL WORLD:

SIR: A subject of vast importance to electrical engineers, as well as to construction companies and building owners, has recently arisen in this city. In the course of building an additional story to one of our largest buildings it was necessary to remove a portion of the original roof. It consisted of a 6-in. layer of cinders, 7 in. of concrete and several layers of roofing paper, which had been thoroughly tarred. The cinder layer was in direct contact with the electric conduits at the time of construction eight years ago. When exposed it was found that the galvanized conduit had been entirely destroyed in many places by the action of the sulphuric acid and other destructive agencies in the cinders. This condition would have made it impossible to remove the wires from the conduits for purpose of renewal or repairs.

Architects who examined the roof said they had never seen such complete destruction of conduit before. The remedy for the trouble would be a grouting of cement wholly surrounding the conduit when it is installed. The roof beams and channels had been protected by concrete and were saved from the destructive action of the cinders.

ISRAEL LOVETT.
Omaha, Neb. City Electrician.

A Fine Point in Electrical Jurisprudence

To the Editor of the ELECTRICAL WORLD:

SIR: The Alabama courts, as noted the other week in your "Recent Court Decisions," have refused to permit the recovery of damages in the case of a workman killed because of receiving an electric shock through an imperfectly insulated lamp wire. It was proved to the satisfaction of the courts that the charge could not have been more than 120 volts, and this the courts agreed with the electrical experts was not a fatal voltage even though the victim was perspiring and standing on a damp board. None the less the man was dead, and in refusing to apply the time-honored legal doctrine of *res ipsa loquitur* (the thing speaks for itself) a complexion was given to the case that were it a less serious matter would savor of comic opera. The man was a negro, and counsel for the plaintiff advanced the idea that negroes are more susceptible to electric shock than whites. More plausibly, the man died from a cessation of heart action due not to the actual shock but to fright. Admitting this hypothesis, was the verdict a right one? If the equipment had been in perfect order and he had been frightened to death by some mistaken notion of danger, clearly the company would not have been to blame; but where a shock, however slight, is actually received because of a fault in the equipment and death ensues is it not poor public policy for the company responsible for the defect to take refuge in a theory that to every layman will appear glaringly contradicted by the facts?

FRANK W. CHASE.
Brooklyn, N. Y.

Babcock & Wilcox Oil-Burning Furnace

To the Editor of the ELECTRICAL WORLD:

SIR: In your issue of Aug. 14, in the article "Considerations in the Burning of Fuel Oil," page 328, the Babcock & Wilcox oil-burning furnace was described in some detail. No mention was made of the fact that this furnace is patented and is installed in boilers manufactured by this company only. We shall be glad if you can mention this fact in your paper, as otherwise we are fearful that persons unfamiliar with this fact might install such furnaces, in which event it would be necessary for us to protect our patents.

A. G. PRATT.
Vice-President Babcock & Wilcox Company.
New York City.

Co-ordinating the Work of Scientist and Engineer

To the Editor of the ELECTRICAL WORLD:

SIR: In terms of research we must account for many of the spectacular successes of our industries. Not as a fad, a merely temporary trend, has it aroused popular interest, but as the tried and proved method of many large corporations and the more helpful government bureaus. With the achievements of research methods in electricity and chemistry, in medicine and agriculture, we were all somewhat familiar before the war. The wide variety of problems which then arose has emphasized the national importance of scientific research.

Our National Research Council, born in wartime, is now "carrying on" as a peace-time organization for the encouragement and guidance of industrial research. Manufacturers and even producers, like cotton and raisin growers, are hastening to organize laboratories in which to study their particular problems. They are besieging our universities for graduates with higher degrees who are skilled researchers in pure science, although they may be correspondingly ignorant of industrial processes.

What contribution do such men promise which places them on an equality with many of us who have years of technical experience? While we were learning to make things go under practical conditions, they were learning to question the hidden operations of nature, to divide the uncut atom, and to count its electrons. A difference in kind of training and of work makes competition impossible and co-operation essential. You cannot have a race between an engineer who is interested in locating and utilizing oil deposits and a scientist who is interested in how hydro-carbons are formed and how to crack their molecules. Perhaps, more than in training, these pure scientists are contributing in their point of view. They seek first a knowledge of nature, feeling sure that all the material advantages and practical applications will be added. A widening of the boundaries of human knowledge is their aim, and their chief joy is in discovery. For others they leave the equal joy of exploiting the newly opened territory. Of course, years may elapse between discovery and utilization, as was true in the case of electromagnetic waves, predicted by Maxwell, experimentally detected by Hertz, and adapted to human needs by Marconi. No one questions the importance of each contribution in this sequence, but how many picture the possibilities of rapid progress when scientist and engineer are in a co-ordinating organization?

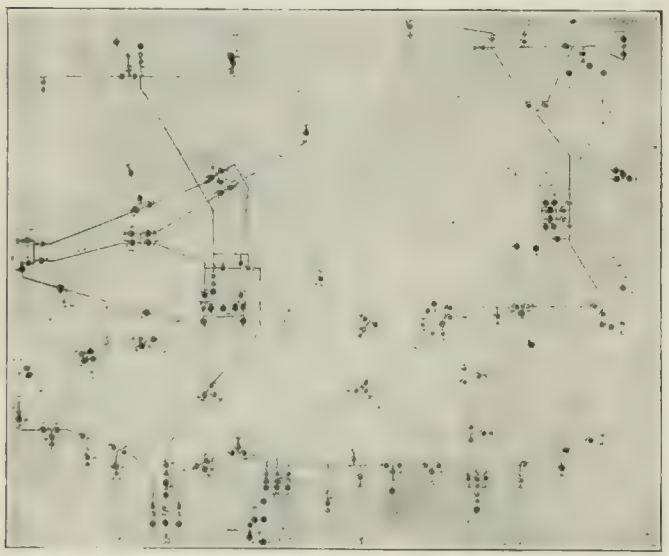
New York City. JOHN MILLS.

Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Dispatcher's Board That Facilitates Switch Changes

A SYSTEM operator's board arranged so the plugs indicating closed switches may be pushed through the board with a pencil, thereby permitting light from lamps mounted in the rear to shine through and indicate open switches, has been designed by the Consumers' Power Company of Jackson, Mich. The board illustrated



SMALL DRAWER BENEATH BOARD CATCHES PLUGS USED FOR INDICATING CLOSED SWITCHES ON THIS BOARD

is mounted above the dispatcher's telephone desk within easy reach, so that changes may be made upon it without the dispatcher leaving his seat. The plugs used are of rubber and are made to fit easily in the holes representing the switches. When the plugs are pushed through the board they fall into a trough at the bottom, from which they are recovered for use again at some future time.

F. W. POLLOCK,
Load Dispatcher.

Consumers' Power Company,
Jackson, Mich.

Economizers Save Seven per Cent of Total Heat

SEVEN per cent of the B.t.u. obtained was returned to the feed water by economizers during a month's run of the new 62,500-kva. West End station of the Union Gas & Electric Company, Cincinnati, Ohio, and an over-all efficiency of 18.46 per cent from fuel to switchboard was realized. The average fuel consumption was 18,500 B.t.u. per kilowatt-hour, using equipment consisting of two 31,250-kva. turbines and eight 12,250-sq.ft. (1,130-sq.m.) Babcock & Wilcox boilers with Sturtevant economizers. During the run the maximum demand was 52,000 kw. and the load factor 54 per cent. The coal as fired had 12,500 B.t.u. per lb. (1,425 cal. per kg.), 1.48 lb. (0.67 kg.) per kilowatt-hour being fired.

With condenser losses of 53.48 per cent of the total heat the turbine showed an efficiency of 26.6 per cent.

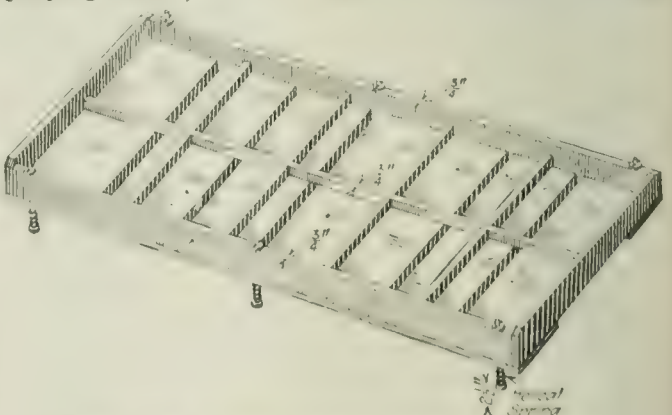
DISTRIBUTION OF HEAT LOSSES IN WEST END (CINCINNATI) STATION

	Per Cent	B.t.u.
Boiler-Room Losses		
Combustible in ash	5	925
Radiation and leakage	1	185
Stack	16	2,960
Gross boiler-room losses	22	4,070
Gain by economizers	7	1,295
Net boiler-room losses	15	2,775
Auxiliary losses:		
Steam storage loco, after crediting exhaust	0.22	40
Steam heating and auxiliaries	8.40	1,550
Turbine losses:		
Friction and windage	2.40	450
Condenser cooling water	53.48	9,850
Returned to condensate	.....	50
Generator losses:		
Electrical	0.84	155
Electrically driven auxiliaries and steam used for same	1.16	215
Total of all losses	81.54	15,085
Over-all thermal efficiency	18.46	.....

The coal contained 11.8 per cent ash, and the residue from the furnaces had 27.2 per cent combustible; thus the loss in the ash was 5.0 per cent. A third turbine and bank of boiler is now being installed and a fourth unit is on order. The plant is designed for firing with either coal or gas.

Spring Rack Prevents Damage to Meters in Automobile

TO PREVENT changes in the calibration of meters when they are transported in an automobile, an Eastern utility uses the platform shown in the accompanying sketch, which is mounted on springs so that



SPRINGS ON RACK PREVENT DAMAGE TO METERS WHILE IN AUTOMOBILE

the meters do not get the full force of jars transmitted through the car. This platform is made long enough just to slide into a Ford truck back of the seat, the legs resting on the floor of the car. It accommodates two

rows of meters, seven in a row. Two ⅜-in. (1-cm.) boards running lengthwise are fastened to the bottom of the side pieces. These boards support wide slats forming the bottom of the rack. The meters are supported by these slats and are separated by partitions of ⅜-in. (2-cm.) wood running lengthwise and across the rack. The spaces between the separators are left ⅛ in. (3 mm.) larger than the back of the meters.

The frame is supported by six springs, loose, on ⅜-in. brass tubes, the latter being screwed into nuts to give a flat surface on the floor. The springs are similar to those on screen doors, but must not be too stiff or their purpose will be defeated. Washers are placed on top and bottom of the frame where the tubes pass through, and tube, spring and frame are held by a cotter pin.

The rack should be made light, since the meters will furnish the weight necessary to hold the frame down.

Hartford, Conn. T. T. THOMAS

Operation of Auto-Transformers to Avoid Trouble

AUTO-TRANSFORMERS used to interconnect two systems are usually connected Y in order to realize the maximum economy over a straight transformer. Unless provided with a delta-connected secondary, such an auto-transformer is subject to triple-frequency voltage between terminals and ground owing to the suppression of the third-harmonic exciting current. If the transformer is of the three-phase core type, this triple-frequency voltage is greatly reduced by the high reluctance thereby inserted in the flux path. Hence three-phase, three-legged core-type construction is strongly recommended for Y-connected auto-transformers without delta secondary. There is very little danger if the auto-transformer neutral is connected to the generator neutral. If the neutral of either system is grounded, a solid ground on the neutral of the auto-transformer will provide a source of third-harmonic exciting current and reduce the liability of trouble from triple-frequency voltage between line and ground. However, this may cause trouble from telephone interference and should not be depended upon for protection unless the system ground is thoroughly reliable and cannot be tripped off.

For the protection of the low-voltage system against abnormal electrostatic stresses in case of a dead ground on one phase of the high-voltage system at or near the auto-transformer, a solid ground on the neutral of the auto-transformer has generally been recommended where there is much difference in potential between the two systems. If the systems contain appreciable electrostatic capacitance to ground, any triple-frequency voltage between line and ground will cause third-harmonic charging currents, which react on the triple-frequency emfs., intensifying them.

Leaving the auto-transformer neutral isolated does not reduce triple-frequency voltages, if such exist, but does prevent their amplification through the line capacitance; however, it exposes the lower-voltage system to electrostatic stresses from grounds on the high-voltage system. Under certain conditions dangerous voltages may be built up. Particularly should the following conditions be avoided:

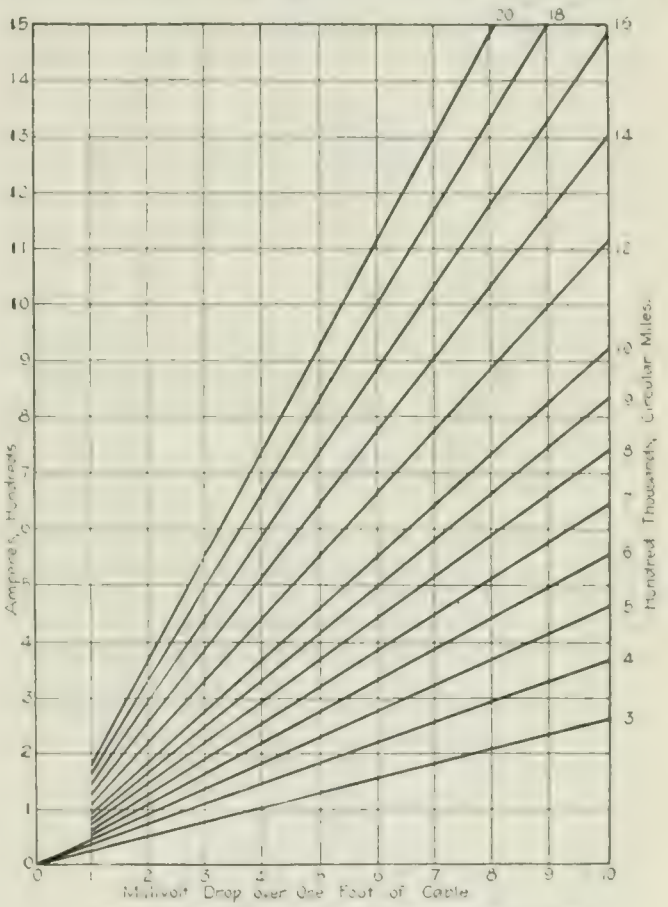
1. An auto-transformer made up of single-phase units or a three-phase shell-type machine without delta secondary.

2. The use of no other grounds on either high- or low-tension systems when the auto-transformer neutrals alone are grounded or the latter are not connected to the generator neutrals.

ROBERT TREAT,
Engineer Power and Mining Department.
General Electric Company,
Schenectady, N. Y.

Current Determined by Voltage Drop in 1 Ft. of Cable

MEASUREMENT of the current flowing in a cable can be determined by taking voltmeter readings and referring them to the accompanying chart. This is accomplished without opening the circuit and thereby shutting down the apparatus to which the cable is



VOLTAGE DROP DETERMINES CURRENT IN CABLE

supplying power by the use of two sharp steel or brass points driven through the insulation of the cable 1 ft. (30 cm.) apart. This distance must be carefully measured, for upon that depends the accuracy of the result.

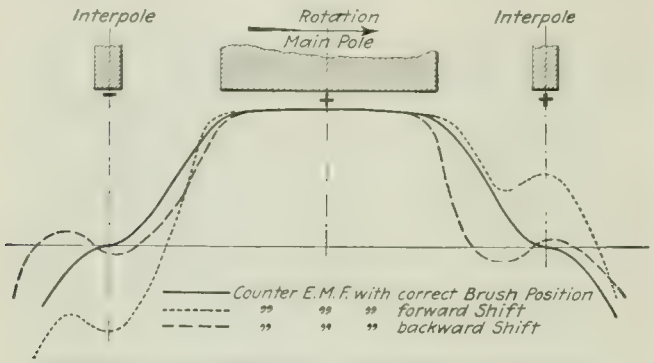
The drop in potential across the distance is then read on the milli-voltmeter. The current flowing is found by reference to the curves shown. By picking off on the curve corresponding to the size of the cable the voltage drop just determined the current is easily found. For example, suppose that a drop of 6.3 mv. was found over a foot of 500,000-circ.mil cable. By reference to the curve for this size we find the current to be 294 amp. In the absence of this curve one can easily find the current by reference to a copper-wire table giving the resistance of 1 ft. of the cable and multiplying this by the reading of the instrument in volts.

Industrial Applications

The Economical Utilization of Electrical Energy
in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

Wrong Brush Position Changes Speed of Interpole Motor

INCORRECT brush position on an interpole motor shows up as sparking and speed variation with load. On a non-reversing motor without interpoles operators are accustomed to give the brushes a backward lead, and they are likely to try the same procedure on interpole



EFFECT ON COUNTER-EMF. OF SHIFTING BRUSH ON INTERPOLE MOTOR

motors, which inevitably causes trouble for the following reasons: The interpole in a motor is always of the same polarity as the main pole next behind it. Backward brush shift causes the interpole to act on the armature coil after it has passed the brush, so that the interpole merely acts in opposition to the next main pole and reduces the total flux cut by the coil. This weakening of the field results in a lower counter-emf. being generated so that the motor tends to run faster.

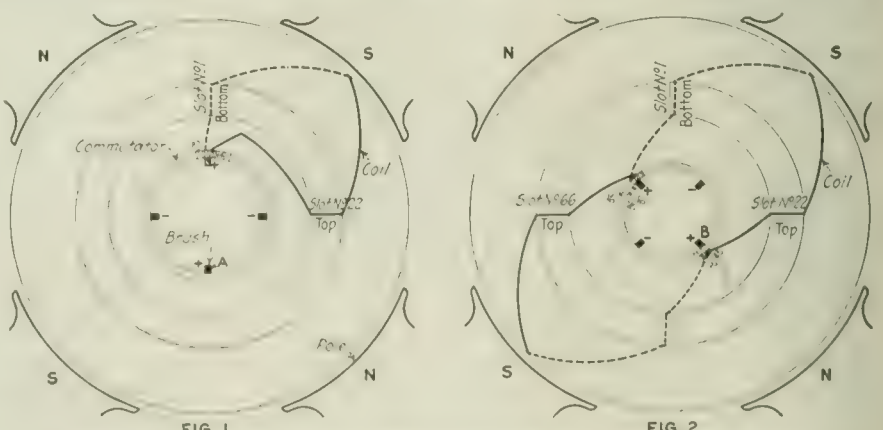
With forward brush shift the effect is the opposite. In this case the interpole acts upon the armature coil before it has passed the brush, so that its magnetic flux is added to the flux of the same polarity from the pole behind it, thus increasing the total flux and counter-emf. generated, tending to slow the speed of the machine.

By the same manner of reasoning it may be seen that interpoles which are too strong have an effect similar to back shift of brush and tend to make the motor speed up as load is applied. Weak interpoles act in the same manner as forward shift of the brushes and cause the speed of the motor to drop with load. To reverse an interpole motor the shunt and the main series fields (if it is compounded) may be reversed simultaneously, or else the armature and interpole circuit may be reversed. If the interpole strength is correct and the brush position is right, an interpole motor will run very close to the same speed at all loads and will run at the same speed in both directions of rotation.

JAMES DIXON.
Reliance Electric & Engineering Company,
Cleveland, Ohio.

Oil on Brush Holder Causes Commutation Trouble

OIL accumulating on the lower brush and holder of a 10-hp. motor in an Eastern factory was recently the cause of the brush sticking and consequent bad commutation and brush and commutator trouble. The oil would accumulate on the brush and holder and become gummy, thus causing the brush to stick. On investigation it was found that the lower brush was directly below the motor shaft and exactly between two poles. Thus oil would tend to run to this brush s it was the lowest point on the brush-holder rings, and besides the draft from the rotating armature was strongest between the two poles and tended to draw oil in toward the machine onto the brush. It was found that the armature coil was constructed (Fig. 1) so that one of the leads came straight out of the slot to the commutator bar, while the other lead of the same coil was brought practically quarter way around the armature to the next adjacent commutator bar. In order to change the position of the brushes it was necessary to change the shape of the leads from the armature coil, as shown in Fig. 2, so that the throw of the leads is symmetrical with the center line of the coil. This located the brushes 45 deg. from the original position and directly behind the poles of the machine so that they would not be greatly influenced by the draft. Since this change the motor has been in service for more than a year and no trouble from accumulation of oil on the brush holder has been experienced.

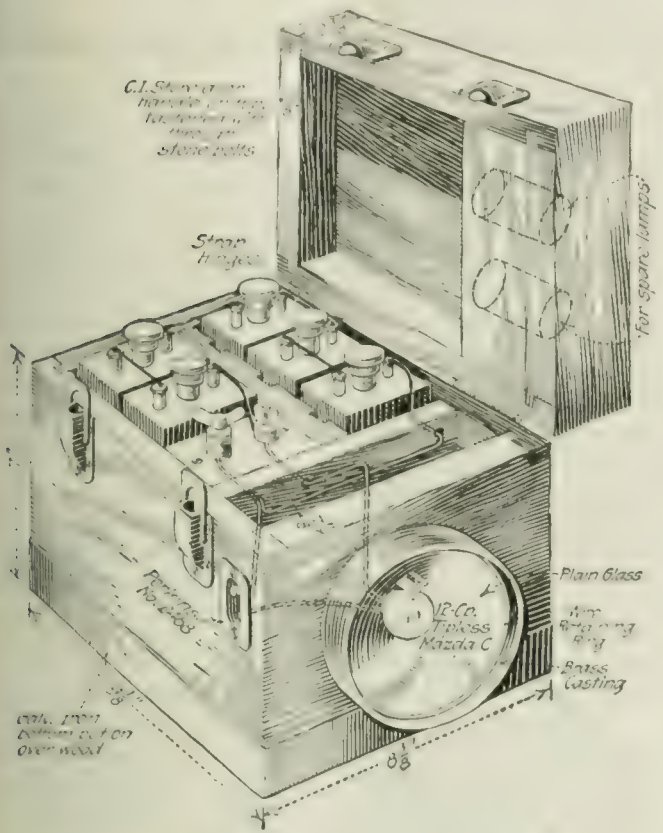


CHANGE MADE TO PREVENT ACCUMULATION OF OIL ON LOWEST BRUSH

Bronx, N. Y. C. A. JOHNSON.

Portable Storage Battery Lamp for Very Damp Locations

PORTABLE storage-battery lamps suitable for use in any damp location, such as mines, etc., have been built by the city engineer's office in San Francisco. The lamp consists of a wooden box containing five



LAMP MADE TO USE WHERE A GREAT DEAL OF MOISTURE IS PRESENT

storage cells and a 12-c.p. lamp attached to the box with a spun-metal reflector coated with white enamel. The cells were the Edison storage battery M-20, 12-amp.-hr. motor-cycle type with rubber insulation. After about a year's service from twelve of these lights it was found that the rubber-insulated cell was likely to give trouble. The boxes were sometimes tipped over and filled with water, and unless they were properly washed out and dried after such an accident, electrolysis made holes in the metal cell containers.

Accordingly, twenty-four lamps having the same type of cells were built, but without soft-rubber insulation. Hard-rubber buttons attached to the cells were used to hold the latter in grooves cut in the sides and partitions of the box. These lamps were provided with an automobile type of push-button switch mounted so as to be operated from the outside of the box. Binding posts of dissimilar character, which will fit only corresponding wire terminals, are used in charging. The dissimilarity of the terminals on the charging cord insures proper polarity. At first small motor-generator sets were used for this charging, but it was later found more desirable to connect the cells directly to the direct-current circuit in series with resistance units and a rheostat so that the current could be regulated to a strength of 2½ amp. for different numbers of cells connected in series. With this arrangement the charging of the cells is very simple and requires no expert attention.

The lamps are ordinarily used for three days' work without recharging. The set complete weighs 18 lb. (8 kg.), which is rather heavy, but it was thought worth while to make the box out of full 1-in. (2.5-cm.) material and to reinforce it as much as possible so that it would stand a great deal of abuse.

Floodlights for Buildings and Yards of Manufacturing Plants

THE method of floodlighting areas around the No. 1 nitrate plant at Sheffield, Ala., during the war period might well be employed for illuminating night construction work on other projects. The main portion of the plant, which included all the buildings with the exception of the Spring Creek pump house, the permanent community and the ammonium-nitrate buildings, was surrounded with a 7 ft. (2.1 m.) wire fence, and for guarding purposes the exterior of this fence was lighted by means of special-design flood-lighting projectors. These projectors were mounted approximately 10 ft. to 12 ft. (3 m. to 3.6 m.) above the ground and extended outside the fence a distance of about 4 ft. (1.2 m.). Each projector was fitted with a 400-watt lamp supplied by a series transformer on the pole having a winding on the secondary to produce 110 volts and a 6.6-amp. primary winding supplied from a constant-current transformer in the power house. A pole line was built around the property just inside the fence. A two-pin cross-arm carrying a No. 6 wire supplied the constant-current circuit. The projectors were spaced approximately 350 ft. (107 m.) apart, and each was equipped with a series of concentric and semi-circular plates which prevented rays getting inside the fence.

The idea was to leave no part of the outside of the fence unilluminated. The territory inside the fence would be comparatively dark so that the patrolling guards could not be seen. This system was supplied from a 10-kva., 2,300-volt, 6.6-amp. constant-current transformer operating independently of the street-lighting transformers.

Each building or small group of buildings was surrounded by an additional fence similar to the exterior fence, and standard 500-watt and 1,000-watt projectors were mounted on the buildings, illuminating the entire surrounding area. The projectors were pointed in such a way that the light directly around the walls and inside the fence would be less intense than the illumination on the fence. This was easily done by proper selection and location of projectors. In this manner the gas plant and the gas tanks were illuminated by means of projectors supplied from a constant-potential circuit operated by a single steel-inclosed switch in the gas house. Similarly the floodlighting on the machine shop was operated by a single switch inside the building. The process building was also surrounded by a fence and floodlights were placed on each side at a height of 50 ft. (15 m.), giving a good distribution for this purpose. Where buildings were close together, of course it was possible so to locate projectors as to cover the entire space between them without duplication.

C. D. GRAY AND E. HAGENLOCHER.
J. G. White Engineering Corporation,
New York.

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

Vancouver Appliance Sales Continue at High Rate

DURING the month of July six outside sales agents in the Vancouver district of the British Columbia Electric Railway Company made 1,478 calls and sold appliances of the value of $4,798.54. These appliances represented a load of 536 kw. and included six electric ranges. The total sales of the company during the month were 498 appliances, of which 222 were flatirons, 89 were electric grills and 50 were small cooking stoves. The British Columbia Electric Association, which is being formed among jobbers, contractor-dealers, retailers and central-station men, is expected to increase the sale of appliances in British Columbia materially.

Why Utilities Must Engage in a Good-Will Campaign

By George F. Oxley
Director of Publicity National Electric Light Association

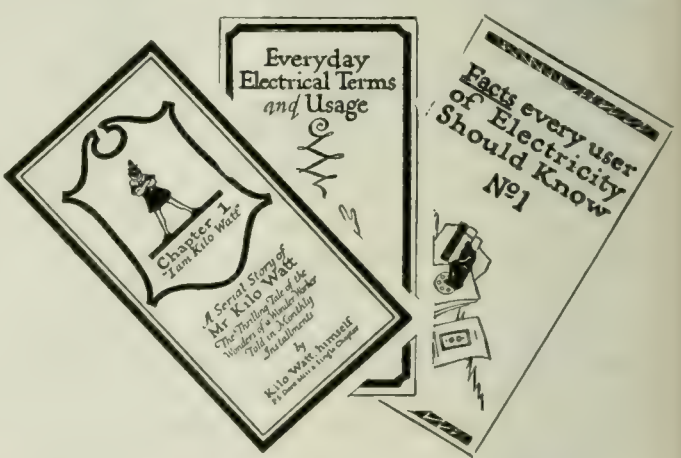
SERVICE, efficient and immediately available whenever, wherever and in the fullest measure demanded, and at the lowest cost compatible with true efficiency, is the aim of the electric light and power industry. The electric utility executive has for his goal the maintenance of efficient twenty-four-hour service and the prompt extension of that service to all who desire it, at a price which will pay the cost of construction, maintenance and operation and yield to investors in his company's securities a fair return on their investments.

Everything possible has been done to this end by the electric light and power industry, as evidenced by the fact that during the ten years preceding the war the companies' charge per unit of service gradually was reduced an average of 25 per cent by the practice of economies and the fullest utilization of inventions and advances in science. In this the companies were assisted also by the greater use of electric service by the public. During the last five or six years increased costs have made necessary a slight upward trend of rates, but in far smaller ratio.

In the face of the greatest use ever made of existing plant equipment and transmission systems, an unprecedented demand for electric service exists throughout the country. Present users require more service, thousands of manufactories are insistent in their demands for service, as are rural communities also, so that at present the demand for electrical energy is approximately one-third greater than the available supply. In addition, fourteen million homes remain to be wired, exclusive of the four hundred thousand new homes which housing experts assert must be built at once.

Obviously, with so great an over-demand, an absolute necessity exists for increasing the output. To obtain the money necessary for this development, the industry must enter the money market in competition with national, state and municipal securities and with the securities of industries which have been enjoying an era of unprecedented prosperity. Therefore the electric light and power industry is compelled to pay interest rates and premiums considerably in excess of those paid by other securities, except industrials, in spite of the fact that the industry is basically as sound as the governments which regulate it. The very regulation that insures this soundness has militated against selling these securities at par because of unavoidable delay in raising rates sufficiently.

More than one million investors in electric light and power securities are interested in these facts from the viewpoint of the return upon their investment. Every user of electric light or power is interested in them



PUBLICITY FOLDERS USED IN CAMPAIGN TO INTEREST PUBLIC IN ELECTRICAL UTILITIES

from the viewpoint of the rates he must pay for service. The electric light and power industry has no source of income other than that collected in payment for service. If by reason of the fact that its rates are not sufficient to insure its securities selling at par value in competition with other securities, the industry must purchase the use of money at a discount, in which case a larger amount of securities would have to be sold. Interest must be paid upon the additional amount of securities sold, and that interest can come from only one source, the earnings of the company, which, after all, are governed by the rates charged the public for service. This same principle is true in every financial transaction of an electric light and power company. Any exorbitant tax imposed by the will of the people must be paid back by the people in the form of rates for service. If damage is done to the property of the company, that damage must be paid for and repairs made at the expense of the people using service. When

employees receive higher wages or the cost of coal increases the users of electrical service must pay.

This, then, is the situation of the electric light and power industry at present. Its service is in great demand. It must extend and expand its distribution systems and plants. To do this it must have money. To secure money it must have higher rates. To have higher rates it must have the sympathetic understanding and good will of the public. To have that the public must realize that its interests are one with the industry's.

It is with a full realization of these fundamental facts that the National Electric Light Association has inaugurated a good-will campaign, which it is hoped and expected will be the largest campaign of its kind ever undertaken by the industry. Through the medium of its "Kilo Watt" campaign, more than one million homes will be reached every month with a message, first, regarding the uses of electricity and on terminology of the electrical industry, and later regarding the problems of finance and operation. Through the public press and other popular magazines articles directed toward the same end already are appearing and will continue to appear during the year's campaign. Manufacturers of electrical machinery, equipment and appliances will devote a large part of their advertising space in national advertising mediums and in the smaller magazines and local newspapers to co-operation in this campaign. The Investment Bankers' Association of America is co-operating in the campaign and has prepared a series of pamphlets which will go out to at least five hundred thousand electrical industry security holders each month.

The sole purpose of the campaign is to endeavor to impress upon the public the fact that it is vitally interested in the electric light and power industry, just as the industry is vitally interested in the prosperity of the nation as a whole and as individual companies are interested in the prosperity of the communities they serve. When the public appreciates that the "capitalists" owning the electric light and power industry are in reality more than one million citizens of the United States, and when the public realizes that it can obtain cheaper and more efficient service by granting proper rates to the electric light and power industry—that is, rates which will permit the greatest possible development of the industry at the lowest possible cost—then the purpose of the campaign will have been served.

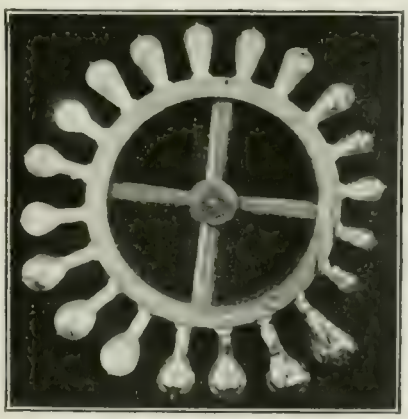
Power Rates Should Be Placed on Competitive Basis

POWER service is a competitive business rather than a public utility service, and central stations should therefore be allowed to make as much profit as they can out of their sale of power to large industrial concerns, according to Morse Dell Plain, vice-president and general manager of the Northern Indiana Gas & Electric Company and president of the Indiana Electric Light Association. In discussing this subject at the last convention of the association Mr. Dell Plain said that it would be to the advantage of the public at large if the central stations were allowed to charge as much for power service as the traffic would bear. The state public service commissions were instituted to regulate non-competitive service, but the power business that the utilities are now securing is strictly competitive with isolated-plant service, and in many instances it has been the central station rather than the power customer that needed the protection. When an industry is making large profits by the use of central-station energy there is no good reason why the utility should not make a good profit on the energy.

At the same convention E. I. Lewis, chairman of the Public Service Commission of Indiana, said "The central stations should advocate a high power rate in order that they may be in a position to supply reliable service and be able to keep ahead of the requirements of their growing communities. The public should be as anxious as the companies to have this condition prevail because adequate and reliable central-station service is the best asset a community can have. Continuous operation of public utility services which are supported by indirect taxation (rates) is more vital to the life and prosperity of a community than the public institutions and services for which the people are directly taxed." To illustrate his point, Mr. Lewis classed water, electricity, gas, street railways, telephone and interurbans among the services for which the public is taxed indirectly, and police, libraries, parks, schools, fire departments and courts as public services which are supported by direct taxation.

Time Saved in Selling Lamps

SINCE lamp manufacturers have adopted the practice of wrapping individual lamps in paper cartons and twisting the ends together, it has been difficult to show lamps to retail customers without considerable loss of time. In addition to the time lost unwrapping and rewrapping the carton, stocks frequently become mixed and disordered because of lamps being replaced on the wrong shelves.



WHEEL FOR DISPLAYING LAMPS

These difficulties have been overcome in the offices of the East St. Louis Light & Power Company by a lamp wheel as shown in the illustration. The wheel is 20 in. (51 cm.) in diameter and wide enough to permit a General Electric No. 3/0 receptacle to be countersunk into it. Twenty of these receptacles are mounted on the rim of the wheel. One side of each receptacle is wired to a common point inside the hub and the other side is connected to a segment of a device similar to a commutator. Energy is supplied to the wheel by means of brushes, and the brush on the commutator is wide enough to light two lamps at one time. The wiring and electrical connections are concealed in the wheel, and its support is mounted on the wall at a point convenient to the lamp counter. The lamps placed in the receptacles range in size from 10 watts to 100 watts of the types most frequently sold. Any individual lamp or two adjacent lamps can be lighted as desired. With these arrangements the comparative size, style and brilliancy of lamps can easily be shown to a customer and the order filled directly from stock.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generation, Transmission and Distribution

Factors in the Design of Large Boiler Plants—Part I.—J. GRADY ROLLOW.—A discussion of principal factors affecting equipment of boiler plants of large capacity. The following are said to be the points concerning which the engineer must have information in successfully designing boiler plants: (1) Character of the fuel to be used; (2) location of the plant with respect to fuel supply; (3) character of the water to be used as boiler feed; (4) size and character of the load to be carried; (5) distribution and use of steam; (6) cost and class of available labor and location of plant with respect to labor markets; (7) cost of fuel; (8) climatic conditions and altitude; (9) importance of the time element in getting plant either partially or wholly in operation; (10) local laws governing design and manufacture of pressure vessels, issuance of smoke, workmen's compensation acts, etc.; (11) the return expected on the capital invested; (12) permanence; (13) value of real estate.—*Electrical Review*, Aug. 21, 1920.

Developments in Power Plants and Generating Stations.—ALFRED STILL.—This is the third article of a series in which the author reviews the general tendencies in power-plant design, both hydro-electric and steam-electric.—*Electrical Review*, Aug. 21, 1920.

The Emmet Mercury Boiler.—The purpose of the mercury boiler and turbine is to make use of the high boiling point of mercury, 677 deg. Fahr. (360 deg. C.), its condensing point being 28 in. (711 mm.) vacuum and 465 deg. Fahr. (240 deg. C.). The exhaust from the mercury turbine is condensed in a form of surface condenser. The heat given out by the condensing mercury vapor makes steam of the cooling water, and this steam may be used to drive another turbine or for any other purpose for which steam may be required. The chief difficulties seem to be the large amount of mercury needed and the danger of leaks, as the mercury vapor is very poisonous. The mercury vapor is passed to the mercury turbine at about 10 lb. (0.7 kg. per sq.cm.) gage pressure. On account of the high temperature of the mercury in the boiler the flue gases leaving the tube are too hot to be passed directly to the stack. Therefore they are passed over a mercury preheater, over the steam superheater and finally over the feed-water heater or economizer. Mr. Emmet is said to believe that by the addition of the mercury device to a good modern power station, with an increase of 15 per cent in the amount of fuel used, the same amount of steam can be supplied to the steam turbines as under present conditions, and the mercury turbine will generate power equal to about 66 per cent of the power generated by the steam turbines. The experimental equipment was in operation for a short time last summer with over 1,000-kw. load on the mercury turbine, and its operation showed that the economies predicted were fully realized.—*Power*, Aug. 3, 1920.

Electrical Characteristics of the Suspension Insulator.—II.—F. W. PEEK, JR.—The author states that the old method of basing everything on electrical tests should be abandoned. Severe electrical tests are often harmful. An electrical, mechanical and porosity uniformity test should be established, in which a small percentage of the product is tested to destruction from day to day. For the very high voltages that are at present being considered greater reliability may in many respects be anticipated than for the lower-voltage lines. The lightning arc-over voltage and dielectric strength will be relatively higher and induced lightning voltages, sufficient to cause arc-over, will be less than now occur on low-voltage lines. Increasing the number of units in series also decreases the probability of complete string failure. Uneven distribution of voltage on the strings becomes more serious at the higher voltages because of the high stress on the unit near the line. This may be corrected by shielding, which prevents excessive corona on the line end units and tends to direct the power arc away from the string. The maximum unit stress on a 220-kv. shield string can be made less than on a 100-kv. non-shielded string.—*Journal A. I. E. E.*, July, 1920.

Traction

New Electric Locomotives.—The electric locomotives of the Gotthard and the Burgdorf-Thun are described in this article. The locomotives of the Gotthard railway, constructed by Brown, Boveri & Company, are for single-phase current, 15,000 volts, 16⅔ cycles. The body of the locomotive is supported by two trucks, each of which is provided with two series-connected motors, and the two groups of motors are fed in parallel. The regulation of the motors is obtained by changing the feeding pressure between 237 volts and 1,325 volts, with eighteen intervals, which is attained by means of suitable tappings in the secondary of the transformer. This is oil-cooled and rated at 1,730 kva. The two trolleys are of the pantograph shape. A small auxiliary group furnishing direct current, provided with accumulators, is employed for maneuvering the controller, for lighting, etc. The locomotives are provided with Westinghouse air and hand brakes; moreover, the motors can work as electric brakes for avoiding the formation of metallic dust from blocks and wheels, which has a serious effect on the motor windings. The locomotives for fast trains can develop a tractive effort of 300 tons upon an up-grade of 26 per 1,000 at 35 km. and 50 km. an hour; those for slow trains give the same effort at 50 km. an hour and an effort of 430 tons at 35 km. an hour. The new locomotives of the Burgdorf-Thun railway are for three-phase current, 750 volts, 40 cycles. The trolleys are of the bow type. The locomotive body is supported upon two trucks, each provided with a motor. To obtain four speeds the stators are provided with two independent windings, one giving

twelve and the other eight poles. The number of poles generated by each winding can be reduced to one-half by a star-delta connection. The rotors are short-circuited. Transformers with suitable tappings are used for starting the motors. The four wheels of each truck are coupled by two connecting rods. These are energized at their central points by two cranks, which receive their movement from an auxiliary shaft connected to the motor through a couple of gears of ratio one to six. The weight of the locomotive is 43.8 tons; the maximum weight of the train 200 tons.—*Science Abstracts, Section B,* July 30, 1920.

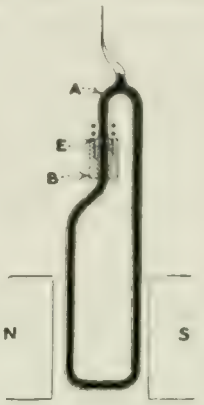
Installations, Systems and Appliances

Design of Contacts for Switches and Busbars.—W. HÖPP.—Extensive experimental researches on contact resistance between copper surfaces have led the author to a number of rules and relations important for proper design of contact surfaces. The current-carrying capacity of a contact is limited by the temperature rise, since at high temperature the losses rapidly increase from oxidation. Above a certain critical current very high temperatures are rapidly attained which tend to destroy the springs and necessitate frequent overhauling. These temperature phenomena are illustrated in a number of diagrams. The contact resistance between copper electrodes for practical cases was found to be almost entirely independent of the contact surface, being expressed as $R = \rho/P$, where P is the total contact pressure in kilograms and ρ is a constant, varying from 280 to 400 microhms per kilogram, for clean, solid contact pieces of copper, and taking values between 70 and 100 microhms per kilogram for similar contacts with tinned surfaces. The condition of a contact may easily be checked up at any time by measuring the drop for a given current. As an average for ordinary copper contacts the author suggests this formula: Drop in millivolts $= 0.5J/P$, J being the current in amperes. If a higher drop is found, either the contacts are very dirty or else the springs have given out so that the pressure no longer has the estimated value. In clamping two pieces of busbar together the contact resistance will add to the copper resistance, but the latter will tend to decrease, since the bar has twice the section in the overlap. Therefore it is possible to design the overlap so as to give the same total resistance as a solid bar of the given dimensions. Assuming an average screw-clamp pressure of 100 kg. per square centimeter, the author finds the necessary overlap to be independent of the thickness of the busbar and gives for all cases the overlap = 25 mm. (1 in.).—*Elektrotechnische Zeitschrift,* March 11 and 18, 1920.

Electrophysics and Magnetism

Magnetic Properties of Iron Alloys.—The series of articles on the relation of magnetic properties and electric conductivity of iron to its percentage of carbon, aluminum, silicon and manganese, etc., published by Gumlish and Goerens in the *Elektrotechnische Zeitschrift,* June 26 to July 24, and referred to in these columns on Feb. 14, is reprinted almost in full in the *Revue Générale d'Electricité* of May 1, 1920.

The Benedicks Thermo-Galvanic Effect.—GOUINEAU.—Some time ago (in *Comptes Rendus,* Vol. 166, 1920, p. 812), in the face of much scepticism, Carl Benedicks announced the discovery of a fourth thermo-galvanic effect having much the same relation to the Thomson effect as has the ordinary thermo-electric effect to the Peltier effect. According to Benedicks thermo-electromotive forces may arise in a perfectly homogeneous circuit of pure mercury, if the temperature distribution is unsymmetrical. The present author describes an experiment which seems to substantiate Benedicks' theories. Gouineau built a little galvanometer with a



APPARATUS TO DEMONSTRATE THE BENEDICKS THERMO-GALVANIC EFFECT

moving coil made up of mercury in a glass tube, as shown in the figure. At E the tube is drawn down to 0.1 mm. inside diameter. The mercury is heated electrically by a resistance spiral above E, while the lower part is kept cool by a protecting sleeve B of asbestos. Using a field strength of 2,000 gausses, deflections of 500 mm. were observed at 1,500 mm. scale distance, indicating that the sharp temperature gradient gives rise to an unbalanced electromotive force. The deflections changed direction when the field was reversed, and for zero field there was only 1 mm. or 2 mm. deflection.—*Comptes Rendus,* June 28, 1920.

Miscellaneous

The Problem of the World's Supply of Energy.—SVANTE AUGUST ARRHENIUS.—The writer deals with the general subject of the gradual exhaustion of coal supply and the question of substitute sources of energy when this is gone. He states that the United States is best off in the matter of coal, which should suffice for some 2,000 years, but England is in the worst position in this respect, with supply for less than 200 years. He also estimates that the coal in Germany will last for 1,000 years. The table gives water power resources of various nations and is attributed to Koehn and Keplan.

Continent	Horsepower in Millions	Horsepower per Inhabitant
Asia	236	0.27
Africa	160	0.14
North America	160	0.17
South America	94	5.25
Europe	65	0.13
Australia	30	3.75
Total	745	0.45 (average)

Country	Horsepower in Millions	Horsepower per Inhabitant
Canada	26	4
United States	100	1
Iceland	2	22
Norway	13	5.2
Sweden	6.7	1.2
Finland	2.6	0.8
Balkan Countries	10	0.6
Switzerland	1.5	0.4
Spain	5.2	0.26
Italy	5.5	0.15
France	6.0	0.15
Austria-Hungary	6.2	0.12
Germany	1.43	0.02
Great Britain	1.0	0.02
Russia	3.0	0.02

The writer also discusses the possibility of utilizing solar radiation.—*London Engineer,* Aug. 6, 1920.

News in Brief

Summary of Market Conditions and of Recent and Approaching Happenings of Importance to the Industry

MODIFICATION of the Interstate Commerce Commission's service order No. 16, giving to public utilities the right to use assigned cars for their daily requirements, is being sought on the allegation that the order is being abused owing to the failure of the railroads to use due precautions in its observance.

A DETAILED outline of the program of the super-power survey was made by W. S. Murray, the engineer in charge at the first meeting of the advisory board. Herbert Hoover will represent the coal-mining industry on the board. The possibility of including the water powers of Maine was discussed.

A MERGER of the Marconi Wireless Telegraph Company of Canada and the wireless interests of the Canadian General Electric Company has just been announced, following the similar merger between the American Marconi Company and the wireless interests of the General Electric Company.

A CONTRACT for two 40,000-hp. hydraulic turbines and all generating equipment for the Fall River station No. 1 of the Pit River development has been let by the Pacific Gas & Electric Company of California.

MANY electric light and power companies are ordering large turbo-generators, the business being about equally divided between units above and units below 30,000 kw. rating.

CIRCUIT breakers rated at 1,500,000 kva. are to be installed in the Hell Gate station of the United Electric Light & Power Company, New York, to the number of 120. They are said to be the heaviest ever designed for 13,200-volt service.

AUTHORITATIVE announcement has been made that the Mexican government plans to purchase the extensive holdings of the Mexican Light & Power Company and the Mexican Tramways, Ltd., including the great hydro-electric plant at Necaxa, on which $12,000,000 gold was expended.

APPLICATIONS for licenses covering as much as 4,000,000 hp. will have been filed with the Federal Power Commission before Jan. 1, it is estimated. This will mean that an appropriation for the expenses of the commission much greater than the $100,000 carried by the bill must be made.

A STUDY into the physiological effects of direct and alternating current may be made a part of the Bureau of Standards' program next year.

PRICES of electrical material are reported as holding steady in all districts except New England, despite the general downward tendency on many commodities. A quiet market, however, prevails in most sections. Some lines in the Northwest are moving well. Disastrous forest fires have occurred on the Pacific Coast, and the high freight rates to the East have led several large lumber mills in the Northwest to threaten to close. The Alabama coal strike has affected adversely the fuel supply of the South. The transportation system generally is much better and stocks are more nearly normal, but except in the South construction of buildings is no more active.

GRADUAL rather than sharp price recessions have made their appearance among New England jobbers' quotations in response to improved deliveries and the desire to reduce surplus stocks or to avoid excessive accumulation.

ELECTRICAL engineering is being taught by the United States to 571 disabled former soldiers, and engineering of all kinds to 2,387.

PROPAGANDA to amend the water-power act in a way that will make the national parks absolutely safe is being carried on by the American Civic Association and the National Park Association. Such an amendment will be pushed by Senator Jones, the chairman of the Senate committee concerned.

WORCESTER, Mass., has held the largest electrical show in its history, the exhibition being entirely a local affair.

PLANS for the municipal operation of the light and power plant at Ash Grove, Mo., near St. Louis, have been formulated by the City Council. The city has an option on equipment of the present system, owned by W. R. B. Turner of Malden, Mo.

CHAIRMEN of the various sections of the Associated Manufacturers of Electrical Supplies have been elected for the ensuing year.

CONSUMERS buying energy from Doherty properties in Ohio at Massillon, Warren and Mansfield have aided in financing plant extensions.

ISSUES of 8 per cent preferred stock are announced by two large central-station companies. The total of bond and stock issues of such companies for September was more than $26,000,000. Very few short-term securities were offered.

A RECOMMENDATION that the inductive interference rules enforced in California be adopted by the public service commissions of other states was made by the inductive interference committee of the Technical Section of the N. E. L. A.

PRESIDENT BERRESFORD of the A. I. E. E. and President Insull of the N. E. L. A. addressed the Public Utilities Section of the National Safety Council at Chicago.

THE REPORT of the Bureau of Standards on its investigation of electrolysis conditions in St. Louis will be completed soon after the end of the investigations being made in Cleveland by the research sub-committee of the American Committee on Electrolysis, in which work the bureau is actively participating.

AFTER having inspected the electrification of railroads in the West, the Dutch commission on railroad electrification visited Washington. The commission was particularly interested in electrolysis and inductive interference.

BRITISH manufacturers and traders are, according to the Guaranty Trust Company of New York, determined to recapture the foreign trade that they lost to Germany before the war and to this end are both perfecting British trade interests in foreign lands and organizing industry more closely at home.

PROSPECTS for the lamp season are reported excellent and sales in 1920 are expected to surpass those in 1919 anywhere from 25 to 30 per cent.

MOTOR-DRIVEN appliances to the number of 2,000,000, it is estimated, will be produced in 1920, washing machines, ironing machines, dishwashers, vacuum cleaners, sewing machines and refrigerators being included.

ELECTRIC jobbers are finding household devices less profitable to handle than formerly, according to the views brought out at the meeting of the Electrical Supply Jobbers' Association at Chicago.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Modification of Utility Coal Priority Order Being Pressed

STRONG pressure is being exerted to obtain a further modification of the Interstate Commerce Commission's service order No. 16, which gives public utilities the right to use assigned cars for their daily requirements. It is claimed that the public utility order is being greatly abused, and admission is made that some abuses did occur under service order No. 9, which was the predecessor of No. 16. In fact, George W. Elliott, in charge of the Washington office of the National Committee on Gas and Electric Service, recommended the change which was made in order No. 16. In the latter order the utilities entitled to assigned cars are described closely. It is being alleged that the new order has had no effect on abuses and that the number of cars assigned to public utilities is increasing rapidly.

Mr. Elliott is of the opinion that the new order is entirely fair and should not be modified, even in lake territories. Owing to the length of time that is required for a new order to permeate to all employees of the railroad some time is required before restrictions become effective. While there may have been a continuance of some of the abuses of the old order during the first week that the new order was issued, Mr. Elliott believes that a marked decrease in the number of assigned cars going to public utilities will soon be noted.

Super-Power Zone Advisory Board Meets for First Time

INTENSE interest was manifest at the first meeting of the advisory board of the super-power survey, held in New York on Sept. 24. W. S. Murray, engineer in charge of the survey, had the opportunity to present to the board for the first time a general outline of his program with charts and to present his engineering staff as a whole.

It was announced that Herbert Hoover has accepted service on the board and will represent the coal-mining industry.

The object of the super-power system, Mr. Murray told the board, is the allocation of the amount of power waste and the recommendation of a regional plant by which it will be eliminated. Within the region covered by the system he estimated that there is a total of 17,000,000 hp. capacity, of which 10,000,000 hp. is in industries and electric public utilities and 7,000,000 hp. in steam railways. He then told how such a system would help transportation by greatly reducing coal haulage, increasing the average load factor from 15 per cent to about 50 per cent and saving 30,000,000 tons of coal annually due to a better steam consumption. Mr. Murray emphatically stated that he thought the entity and franchise rights of existing public utilities should be preserved and that the super-power system should in no way be considered competitive.

Charles L. Edgar, president of the Edison Electric Illuminating Company of Boston, voiced the opinion of all the other members of the board by saying that the super-power system must simply carry on on a larger scale the work that had already been started by the central stations. Mr. Edgar mentioned that he felt that the proper place for big power plants was not in the large cities.

A number of constructive suggestions were offered the engineering staff by different members of the advisory board. The work is going rapidly, and the members of the staff have now perfected plans for the ultimate co-ordination of the many phases of the work.

Need of Federal Power Commission for Larger Appropriation

APPLICATIONS for licenses covering as much as 4,000,000 hp. will have been filed with the Federal Power Commission before Jan. 1, it is estimated. This will mean that the commission will be called upon to handle in one year more water-power work than has been handled by the Departments of Agriculture, War and the Interior in the past fifteen years. An expenditure of approximately $250,000 annually has been necessitated for the work on water power done by those three departments. Therefore, it is pointed out, the Federal Power Commission must have greatly in excess of $100,000, its present appropriation. While it is virtually certain that Congress will promptly remedy the defect in the present law which prevents the use of any of the appropriation for the employment of an office force, it is recognized that difficulties will be encountered.

Manufacturers' Association Announces Fall Meetings

REGULAR fall meetings of the sections of the Associated Manufacturers of Electrical Supplies will be held during the week commencing Monday, Oct. 18, at the association rooms in New York City. The hours and specific dates for these meetings will be announced later. A meeting of the board of governors was held on Sept. 24. The board is outlining an additional line of activities and several new sections are contemplated.

At the meetings of the various sections held during the summer the following section chairmen were elected to serve for the ensuing year:

Air Circuit Breakers. — G. A. Burnham, Condit Electric Manufacturing Company, Boston, Mass.

Attachment Plugs.—A. H. Fleet, Cutler-Hammer Manufacturing Company, Milwaukee, Wis.

Armored Conductor and Metallic Flexible Conduit.—G. F.

Holly, Youngstown Sheet & Tube Company, Youngstown, Ohio.

Carbon.—J. F. Kerlin, Corliss Carbon Company, Bradford, Pa.

Electrical Porcelain.—J. E. Way, R Thomas & Sons Company, New York City.

Fan Motors.—Clinton Stark. Sprague Electric Works, New York City.

Fuses.—C. A. Bates, Bryant Electric Company, Bridgeport, Conn.

Heating Appliances.—F. D. Goode, Cutler-Hammer Manufacturing Company, Milwaukee, Wis.

Industrial Lighting Fixtures.—W D. Steele, Benjamin Electric Manufacturing Company, Chicago, Ill.

Knife Switches.—J. H. Trumbull, Trumbull Electric Manufacturing Company, Plainville, Conn

Lamp Receptacles and Sockets.—H. R. Sargent, General Electric Company, Schenectady, N. Y.

Line Material.—Louis McCarthy, the Macallen Company, Boston, Mass.

Metal Molding.—C. E. Corrigan, National Metal Molding Company, Pittsburgh, Pa.

Molded or Formed Insulation.—Joseph Rockhill, General Insulate Company. Brooklyn, N. Y.

Non-Metallic Conduit.—Russel Dart, Alphaduct Company, Jersey City, N. J.

Outlet Boxes.—G. H. Sicard, Pratt-Chuck Company, Frankfort, N. Y.

Panelboards and Switchboards.—C. E. Wilson, Sprague Electric Works, New York City.

Signaling Apparatus.—T. W. Ness, Holtzer-Cabot Electric Company, Boston, Mass.

Snap Switches.—S. P. Williams, Hart & Hegeman Manufacturing Company, Hartford, Conn.

Wire and Cable.—Le Roy Clark, Safety Insulated Wire & Cable Company, New York City.

Rigid Conduit.—C. E. Corrigan, National Metal Molding Company, Pittsburgh, Pa.

No Very Short-Term Utility Financing Reported in September

ELECTRIC light and power public utility financing for September shows a total of $26,524,000. Ten million of the September total is in preferred stock at 8 per cent—$6,000,000 of the Philadelphia Electric Company and $4,000,000 of the Cleveland Electric Illuminating Company. Among the bond issues the shortest term is a five-year issue of $1,000,000 by the Puget Sound Power & Light Company which yields 8 per cent. The others are either ten-year or fifteen-year issues with two exceptions. One of these, $1,500,000 in gold bonds of the Northern States Power Company, falls due in 1941; the other, $2,304,000 in first mortgage bonds of the Kentucky & West Virginia Power Company, is to run for thirty years. This is in line with the tendency toward longer-term issues that has prevailed in the last few months. With the longer terms, however, there is no decline in interest rates. The average yield for September is as high as it has been this year. The issues are:

Company	Amount of Issue	Period
Hartford Electric Light Co	$5,000,000	10-year
Phila Electric Co	6,000,000	
Milwaukee Electric Railway & Light Co	1,090,000	10-year
Puget Sound Power & Light Co	1,000,000	5-year
Brooklyn Edison Company, Inc	2,000,000	10-year dated Jan. 1, '20
Kentucky & West Virginia Power Co	2,304,000	30-year
Cleveland Electric Illuminating Co	4,000,000	
Consumers' Power Co	2,500,000	15-year
Northern States Power Co	1,500,000	25-year due Apr 1, 1941
Scranton Electric Co	1,000,000	10-year
Monde Electric Co	130,000	10-year

Class of Security	Rate of Interest	Per Cent Yield	Offered at
Gold notes	7	7½	95.62
Preferred stock	8	8	25 (par)
Sinking fund equipment trust gold certificates	8	8	par
Gold coupon notes	8	8	par
General mortgage gold bonds	7	7½	93
First mortgage gold bonds	7	7½	91.5
Preferred stock	8	8	par
General and refunding mortgage gold bonds	7	8	91.25
First and refunding mortgage gold bonds	6	7 40	85
Secured gold bonds	8	8 06	99 50
Secured gold notes	8	8½	98½

California Inductive Interference Rules Recommended as Basis

RECOMMENDATION that the California rules be adopted as a basis by the North Dakota Utilities Commission, and that wherever possible rules similar to those of California be adopted by all other state commissions in dealing with the inductive interference problem, was made by the inductive interference committee of the Technical Section of the N. E. L. A. at its Chicago meeting last week.

The safety committee meeting at the same time recommended that the *National Safety Code*, 1920 edition, be adopted by state commissions in preference to the adoption of individual state codes. It was pointed out by the committee that in so doing, state commissions could protect themselves and the local companies by the customary "saving clauses" and that the adoption of these rules would place them in actual practice so that the practical observation of their working during the coming year would form a basis for desired changes.

Berresford Declares Combination of Fire and Safety Codes Impracticable

PRESIDENTS of the two largest electrical associations, Martin J. Insull of the National Electric Light Association and A. W. Berresford of the American Institute of Electrical Engineers, addressed the members of the Public Utilities Section of the National Safety Council at a luncheon at Milwaukee, Wis., on Tuesday during the ninth annual convention, which was in session Monday to Friday of this week. Speaking from a personal viewpoint and not officially, Mr. Berresford called attention to the dangers of code making without proper consideration of the fundamentals involved or proper consultation with those whose standing gives them authority to speak for the industries involved It was his opinion that the proposed combination of the fire and electrical safety codes is commercially impracticable as the fire code deals fundamentally with commercial hazards, elimination of which is a question determined largely by cost, while the safety code deals with life hazards, where cost is not a prime factor.

Mr. Insull pointed out how safety work can interest employees in utility management problems. He expressed the belief that much of the labor unrest is an expression of a desire for recognition and that the day is not far distant when employee participation in management must be expected. Sympathy with commissions in their handling of utility problems and confidence in their fairness and that of the public were expressed.

The sessions of the Public Utilities Section occupied Tuesday and Wednesday mornings, and papers dealing with hazards in line, underground and power-plant construction were presented.

North Dakota Commission Adopts Overhead-Line Rules

AT A meeting of the Railroad Commissioners at Bismarck, N. D., on Sept. 13-14, it was decided to adopt the National Electrical Safety Code for North Dakota in so far as it affects overhead-line construction. The 1920 edition with its revisions will be used in preference to the 1916 edition. It is reported that the commission has adopted the California inductive interference rules also, because under an existing state law rules had to be adopted within a definite time, and the California rules were taken as the best available.

Central-Station Companies Are Again Issuing Preferred Stock

TWO large issues of 8 per cent cumulative preferred stock have just been put on the market by electrical supply companies. The Cleveland Electric Illuminating Company offers $4,000,000, and the Philadelphia Electric Company offers $6,000,000 of an authorized issue of $15,000,000, both at par.

The Mobile (Ala.) Electric Company advertises an issue of ten-year bond-secured 8 per cent gold notes to the amount of $130,000, convertible into 7 per cent preferred stock of the company, at 97 and dividends for the stock and at par and interest for the notes.

Two bond issues by central-station companies are also announced. The Consumers' Power Company, operating in lower Michigan, offers $2,500,000 fifteen-year 7 per cent gold bonds at 91½ and interest to yield more than 8 per cent. The Scranton Electric Company offers $1,000,000 of ten-year 8 per cent gold bonds at 99½ and interest.

Many Companies Ordering Large Compound Turbo-Generators

THE Westinghouse Electric & Manufacturing Company announces that it has received within the past three months orders from electric light and power companies for more than 500,000 hp. of turbo-generators.

Among these orders are the following:

Cheswick Power Company, Pittsburgh, Pa., one compound unit of 60,000 kw., which will be one of the largest engines ever built.

Narragansett Electric Lighting Company, Providence, R. I., one compound unit of 45,000 kw.

United Electric Light & Power Company, New York, two compound units of 35,000 kw. each.

Brooklyn (N. Y.) Edison Company, two single units of 25,000 kw. each.

United Electric Company, Springfield, Mass., a single unit of 25,000 kw.

Commonwealth Edison Company, Chicago, one compound unit of 35,000 kw.

Havana (Cuba) Electric Railway Company, two single units of 25,000 kw. each.

Commenting on the sale of these large steam turbines, E. H. Sniffin, manager of the power department, Westinghouse Electric & Manufacturing Company, pointed out that the business in large turbine units was about equally divided, as to number, between units of over 30,000 kw. and units of under 30,000 kw. rating. Owing to the reliability of the multi-cylinder type, he stated, it is believed that it eliminates many problems of design which would occur, owing to the physical dimensions, with the single cylinder in these very large sizes. From the present knowledge of design it appears, according to Mr. Sniffin, that this will continue to be the case for some time to come, but, of course, definite prediction cannot be made on account of the rapid development in the industry.

Ohio Consumers Finance Plant Extensions

HIGH interest rates of the present time have caused several utilities in Ohio to seek aid in financing plant extensions from their larger consumers, such as manufacturing plants in need of additional power supplies. The Massillon (Ohio) Electric & Gas Company extended its plant by the addition of a turbine and boilers at a cost of approximately $250,000, of which $200,000 was financed by the consumers at 6 per cent on a five-year basis. The Trumbull Public Service Company, Warren, Ohio, obtained approximately $300,000 from its consumers, and the Richland Public Service Company, Mansfield, Ohio, obtained $200,000, both of these transactions being upon substantially the same terms as those obtained at Massillon. These are Doherty companies.

Two 40,000 Hp. Waterwheels Ordered by Pacific Gas & Electric

CONTRACT has just been let by the Pacific Gas & Electric Company for two 40,000-hp. single-runner, vertical-shaft hydraulic turbines and all generating equipment for the Fall River station No. 1 of its Pit River development in California. These units will operate on a 425-ft. (139.5-m.) head, and will have the largest rating of all waterwheels in the United States. The rest of the generating equipment consists of two 35,000-kva. waterwheel generators for 90 per cent lagging power factor, three-phase, 60 cycles, 11,000 volts, 257 r.p.m., with direct-connected exciters, and one 225-kw. motor-generator set. Allis-Chalmers will supply all the generating equipment, which represents an investment of about $1,000,000, while Westinghouse will supply the seven transformers, which are single-phase, 16,667-kva., oil-insulated, water-cooled, outdoor type, wound for 127,000 volts high-tension and star-connected for 220,000 volts.

Propaganda to Amend Water-Power Bill So as to Protect National Parks

THE American Civic Association has joined the National Park Association in sending out statements to the effect that since the passage of the water-power act "no single square foot of national park, reservation, or even cemetery, is safe from the claims of the power promoter if it has on it a drop of water."

The Federal Power Commission announced immediately upon its organization that no applications would be granted for projects in the national parks. It is well known that Senator Jones, the chairman of the Senate committee having jurisdiction over such matters, is pledged to do all in his power to have the act amended at the next session so as to exclude from its purview any national parks. It is regarded as probable, however, that the amendment will carry a provision for a resurvey of the national parks looking to the exclusion from their boundaries of such areas as do not possess scenic value.

N. E. L. A. Hydraulic Power Committee Formally Organized

THE new hydraulic power committee which was established at the Pasadena convention of the National Electric Light Association was formally organized during the convention of the Northwest Electric Light and Power Association at Spokane on Sept. 8. Markham Cheever of the Utah Power & Light Company of Salt Lake City is the chairman. In order not to conflict with any other committees of technical societies or to duplicate their work, this new N. E. L. A. committee will concern itself with the operating features of hydraulic turbines, etc., exclusively.

Circuit Breakers Rated at 1,500,000 Kva.

THE heaviest circuit breakers ever designed for 13,200-volt service will be installed by the United Electric Light & Power Company, New York, in its Hell Gate Station. There will be 120 of these solenoid-operated type "04" Westinghouse circuit breakers having an interrupting rating of 58,000 amp. at the arc, or 1,500,000 kva. The normal rating is 3,000 amp. The disconnecting switches are gang-operated and their operating mechanisms are interlocked with the oil-breaker mechanism, so that the disconnecting switches cannot be moved unless the breaker is not in operating position, thus assuring safety to operators.

These oil circuit breakers are unique in that the phase elements will be in separate rooms approximately 30 ft. (9 m.) apart, with the operating mechanism on the floor above, thereby preventing the possibility of a busbar short circuit and minimizing the effects of a ground.

Utility Securities Show Improvement During Past Week

THAT utility securities have shown improvement during the past week is the opinion of D. C. Johnson, utility expert of the National City Company. Although it is improbable that the cost of financing will decrease in the near future, it would seem that the maximum has been reached.

"Utilities," said Mr. Johnson, "are recognizing that high interest rates will prevail for some years, and as a result there is more of a tendency to issue longer term securities, that is, from ten-year to twenty-year maturities. Short-term notes and debentures which must be refunded at the end of two or three years cost the utilities from 8.5 to 10 per cent and even higher, while it is now possible for a utility of the first grade to issue ten-year to twenty-year securities on an 8 to 9 per cent basis. The advantage of the longer term securities is obvious, and as they are callable at a relatively small premium the companies can readily refinance an issue."

Eastern Jobbers Discuss Conditions in Appliance Market

GOOD attendance of members and a comprehensive program of timely interest marked the meeting of the Atlantic Division of the Electrical Supply Jobbers' Association in Philadelphia on Sept. 23. How the growth and development of electrical heating devices have become possible through the use of alloyed metals covered by the Marsh patent was told by C. A. Payne of the General Electric Company.

The advertising plan of the publicity committee, which was explained in the ELECTRICAL WORLD last week, was presented by A. A. Gray, publicity counsel. Ways in which the manufacturer can co-operate to increase the stock turnover of his distributers were discussed by W. B. Pierce of the Edison Electric Appliance Company. That the present market situation is changing from a sellers' to a buyers' market was the opinion of Raymond Marsh of the Syracuse Washing Machine Corporation in talking on the merchandising of electrical clothes-washing machines and the outlook.

T. H. West, Philadelphia Electric Company, pointed out that business is passing through a period of readjustment due to overexpansion of credit and advocated present conservatism in making increases in capacity.

Jobbers' Volume of Business 60 per Cent Above That of Last Year

COST of doing business was the principal subject discussed at the regular meeting of the Central Division of the Electrical Supply Jobbers' Association held in Chicago on Sept. 24. Thirty-six members reported on the volume of business for the first eight months of this year compared with the same period last year and every one showed an increase, the smallest being 24 per cent, the largest 117 per cent and the average 64.68 per cent. Since the first of the year, however, inventories and accounts receivable have increased while gross profits have decreased.

The necessity for prompt collections at the present time was emphasized in an address by W. S. Bissell of the F. Bissell Company, Toledo, Ohio.

A very full discussion on the cost of marketing motor-driven household devices was led by F. D. Van Winkle of the Post-Glover Electric Company, Cincinnati, Ohio.

Empire State Gas and Electric Association Meets at Utica Oct. 7-8

FOR its sixteenth annual convention, which will be held at the Hotel Utica, Utica, N. Y., on Oct. 7 and 8, the Empire State Gas and Electric Association has prepared the following program:

THURSDAY, OCT. 7

Morning—Address of President Horace L. Mann; "Selling in a Small Community," by H. K. Stein, superintendent Genesee Light & Power Company, Batavia, N. Y.; "Importance of Meter Testing," by F. J. Murmann, superintendent of meters Westchester Lighting Company, Mount Vernon, N. Y.; "Service Charge Rate," by A. Parshall, consulting engineer, Rochester, N. Y.

Afternoon—"Financing Utility Properties," by R. M. Searle, president Rochester (N. Y.) Gas & Electric Corporation; "Consumers' Viewpoint," by G. I. Vincent, engineer Syracuse (N. Y.) Lighting Company; "Newspaper Viewpoint," by George M. Smith, managing editor New York *Tribune*.

FRIDAY, OCT. 8

Morning—"Coal Situation," by G. N. Snider, coal traffic manager New York Central Railroad; "Office Location, Arrangement and Upkeep," by S. J. Magee, vice-president Associated Gas & Electric Company, New York City; "Office Work in a Small Company," by Paul B. Murphy, treasurer Potsdam (N. Y.) Electric Light & Power Company; election of officers.

An entertainment program has been arranged, including a dinner on Thursday evening and golf and an automobile trip on Friday afternoon.

Straight Rate Better than Combination, in Opinion of Michigan Company

CONTENDING that a straight rate based on the kilowatt-hours consumed is better understood by its consumers than the combination rate based on connected load plus an energy charge now in effect, the Consumers' Power Company has applied to the Grand Rapids (Mich.) City Commission for a change in rates. The 8-cent straight rate asked will give an increased return in addition to simplifying the schedule. Other rates under consideration involve changes in the present combination rate.

Electrical Engineering Taught by Nation to 571 Disabled Ex-Service Men

A TOTAL of 571 disabled ex-service men are taking courses in electrical engineering at the expense of the Federal Board for Vocational Education. These courses are being pursued in a number of schools teaching electrical engineering in each section of the country. The institutions used for the education of these former soldiers include nine schools in Massachusetts, five in New York City, five at other points in New York, twelve in Pennsylvania, six in Ohio, six in Illinois, three in Indiana, three in Tennessee, three in Michigan, three in Iowa, three in Kansas, three in Missouri, three in Colorado, ten in California and three in Oklahoma. In addition one or two schools in the following states have been designated: New Hampshire, Vermont, New Jersey, Connecticut, District of Columbia, Maryland, Virginia, Georgia, North Carolina, Alabama, Mississippi, Louisiana, Kentucky, Wisconsin, Nebraska, Minnesota, Montana, New Mexico, Utah, Arizona, Oregon, Washington and Texas. In all the Federal Board for Vocational Education has 2,387 persons taking engineering courses.

Federal Ownership Program of Mexico Causes Surprise

FOREIGN investment interests in Mexico express much surprise at the authoritative announcement which has just come from the capital to the effect that the Mexican government plans to purchase the extensive holdings of the Mexican Light & Power Company and the Mexican Tramways, Ltd., including the great hydro-electric plant at Necaxa. It is stated that an inventory of these properties has just been made and that the proposed purchase price has been practically agreed upon by the interests involved. The making public of the government's plans to acquire these holdings was all the more of a surprise, coming, as it did, upon the heels of an authentic statement that the Mexican Tramways, Ltd., had under consideration plans for resuming construction work upon its two proposed interurban electric lines, one to run from the city of Mexico to Puebla, 130 miles, and the other from the city of Mexico to Toluca, 45 miles. More than $12,000,000 gold was expended in the building of dams for the storage of water in the mountains, the installation of a hydro-electric plant of 200,000 hp. and the construction of transmission lines from Necaxa to the city of Mexico, Puebla and El Oro. How much money in addition to this was invested in the lighting system and street railways of the capital and Puebla is not publicly known. The Mexican Light & Power Company and the Mexican Tramways, Ltd., are owned by a British syndicate.

It is the purpose of the Mexican government to finance these pending transactions by issuing bonds, which will be retired from the profits of the companies. The details of how this financing is to be accomplished are lacking, however, in the preliminary announcement of pending negotiations.

Merger of Canadian General Electric and Marconi Radio Interests

ANNOUNCEMENT was made at Montreal on Sept. 16 of the merger of the Marconi Wireless Telegraph Company of Canada, Ltd., with the wireless interests of the Canadian General Electric Company. Directors of the latter company, including Senator Nicholls, Sir William MacKenzie and A. E. Dyment of Toronto, have been elected to the board of the Marconi company, which now has the following directors: Frederic Nicholls, president; William Marconi, A. E. Dyment and Robert Bickerdike, vice-presidents; Sir William MacKenzie, Godfrey C. Isaacs, G. M. Bosworth, C. G. Greenshields, and A. H. Morse, managing director. Plans involved in the reorganization call for an increase in the authorized capital of the company to provide additional working funds and for the acquisition of valuable patents controlled by the Canadian General Electric Company.

This merger follows upon the similar merger effected some months ago in the United States between the American Marconi Company and the wireless interests of the General Electric Company, the consolidated company being known as the Radio Corporation of America. The Canadian allied interests were not included in the American merger because the Canadian patents of General Electric wireless equipments are owned in Canada by the Canadian General Electric Company, Ltd., which is a separate corporation not under the control of the American General Electric Company.

Staff of Society for Electrical Development Holds Weekly Conferences



IN ORDER to insure close co-operation between the different departments of the Society for Electrical Development and to co-ordinate its efforts with a view to securing the maximum results, a weekly conference is held by the members of the staff who are responsible for the various activities. At these conferences the work of the society is planned. If the plans are for any extensive activity, they are submitted to the executive committee for approval.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Reasonable Rates for Street Lighting.—Annual rates per lamp for electric street lighting of $23 for 80-cp. lamps and $40.25 for 250-cp. lamps have been declared by the Missouri Public Service Commission to be reasonable charges in the city of Liberty, upon comparison with the rates in other localities.

Extensions to Municipal Plants in New Jersey.—Municipal plants do not, under the New Jersey statutes, the Board of Public Utility Commissioners has declared, require the consent of the commission for additions and extensions not made in contemplation of the supplying of service outside of the limits of the municipality.

Increase in Rates Must Be Earned.—In denying an application for increased gas rates made by the Central Illinois Public Service Company, the Illinois Public Utilities Commission declared that such a company, although not earning a fair return, is not entitled to retain an increase in rates where the increase was granted solely upon the condition that the utility would improve the service rendered and where it had not made a reasonable effort to comply with the requirements as to service nor made any attempt to show why service had not been improved.

Reparation for Rates Alleged to Have Been Excessive.—Application was filed before the Pennsylvania Public Service Commission by the borough of Tyrone asking that the Home Electric Light & Steam Heating Company be made to refund alleged excessive charges made before a modification of its rates by the commission. The commission held that the claim for damages was predicated upon a tariff under which the utility did not derive adequate revenue, the readjustment having been made to obtain a better distribution of the burden, and that therefore no reparation could be ordered in spite of the cancellation of the schedule about which complaint was made.

Arkansas Corporation Commission Approves Return of 7.4 per Cent.—Granting an application from the Rogers Light & Water Company for an advance in electric rates, the Arkansas Corporation Commission asserted that a reproduction value based on a ten-year average of costs previous to 1920 was more equitable than a valuation based on prevailing prices, that a 7.4 per cent return on the investment in a combined water and electric plant met with its approval, and that in the belief of the commission the first duty of a utility is to render service and the only way in which a utlity can render adequate service is to obtain a sufficient rate.

Refusal to Permit Rates to Vary with Cost.—The New Jersey Board of Public Utility Commissioners has refused in a gas-company rate case to approve a charge varying with the cost of the product, upon the ground that the resulting uncertainty to the consumer as to the price to be charged would make it impracticable and probably cause much confusion and annoyance.

Distinction Between Night and Continuous Electric Service.—Asked by the Virginia Western Power Company to prescribe the character of service to be rendered by it in the city of Clifton Forge, the Virginia State Corporation Commission refused, holding that the city itself should decide upon the kind of service. The commission asserted its possession of power to prescribe the rates for twenty-four-hour service rendered by the electric company, although the latter's franchise definitely fixes rates for service from sunset to sunrise, since continuous service is essentially different and distinct from night service and cannot be considered as having been embraced within the terms of the franchise. The city, however, could not be compelled to accept such service against its wishes where the franchise granted by it to the company provided for service from sunset to sunrise only.

Abnormal Conditions in Relation to Extensions.—A real estate company having complained that the Union Electric Light & Power Company of St. Louis had refused to make extensions to its property, the Missouri Public Service Commission, in view of the abnormal financial conditions confronting utilities, approved an arrangement by which the utility would finance the extension to each of three residences concerned up to $50 and the consumer would deposit with the utility the amount of the estimated excess cost thereof subject to the following rebates: (1) A refund of one-half the monthly bills for service up to the full amount of the "normal costs," provided such refunds within the first forty-eight months of service equal said normal costs; or (2) a refund up to the total consumer deposit under (a) a guaranty by the consumer that the annual revenue therefrom shall equal 40 per cent of the actual cost, whereupon that portion of the annual revenue in excess of 20 per cent shall be refunded until the total amount of the deposit has been refunded, the company deducting any deficiency in annual guaranteed revenue from the consumer's deposit, or (b) a refund of $30 for each new resident or commercial lighting consumer and $150 for each new commercial power consumer secured on the extension within the first five years after its completion.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Contributory Negligence Not a Factor Where Lineman Climbs Rotten Pole in Course of Duty.—The Supreme Court of Missouri has held, in State ex rel. City of St. Joseph, that the lower court was not in error in instructing that a lineman who was injured when he climbed a rotten pole on orders from his foreman was not guilty of contributory negligence, and that inasmuch as the condition of the pole was or with ordinary care could have been known to the city or the foreman, negligence on their part was established. (223 S. W. 671.)*

State and Municipal Functions.—While, according to the Supreme Court of Appeals of West Virginia, in City of Charleston vs. Public Service Commission, there may be circumstances under which a state may, in matters of proprietary right as distinguished from those phases of the police power relating to the public safety, health and morals, authorize a municipality to establish by inviolable contract the conditions and rates governing rendition of service by a public service corporation for a definite term not grossly unreasonable in duration, yet since the inevitable result of such a contract is to foreclose the right to exercise an important government function, the authority so to restrict state power must clearly appear and any doubt must be resolved in favor of the continuance of the power. (103 S. E. 673.)

Right to Construct Tunnel at Niagara Sustained.—In an action brought by the Hydraulic Power Company of Niagara Falls against two manufacturing companies which sought to restrain the construction under their properties of a tunnel to convey and utilize waste waters which had previously been used by the defendants for generating electricity, the Supreme Court of New York held that the right to build such a tunnel, acquired in 1900, had not been lost by laches because construction was not started until 1914, and that the defendants having accepted the benefits of the agreement for fourteen years could not by refusing to file objection to the plans or to enter into arbitration concerning them prevent the building of the tunnel, the provision for arbitration on objection being merely incidental and not such as to interfere with the performance of the substantive part of the agreement. (183 N. Y. S. 373.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Energy Consumption in Italy.—The total consumption of electrical energy in Italy for 1918-19 was 3,743,285,194 kw.-hr., as compared with a total of 2,311,930,347 kw.-hr. five years previously.

Electrification of Brazilian Railroads.—A report made by the United States Consul at Rio de Janeiro says that a credit of about $11,000,000 has been authorized by the Brazilian government to cover the cost of changing the railroad system from steam to electricity on the state-owned suburban lines from Rio de Janeiro to Deodoro, Barra do Pirahy, Santa Cruz, Paracomby and Maritima. Plans for the prolongation of some or all lines to the center of the city are also under way.

Adelaide, Australia, Turns to Water Power.—Two plans to derive electrical energy from water power are now under consideration by the South Australian government for application to the city of Adelaide. One plan is to harness the water power from the Square Waterhole, 37 miles from Adelaide, and the second is to use the water of the Myponga River. By taking the water underground from the Square Waterhole and retaining it in a storage basin it is calculated that 21,000 hp. could be obtained all the year round. The other project is expected to provide 42,000 hp., which would be sufficient to supply electricity to all the tramways, the suburban railways, the Islington workshops and for lighting and industrial purposes in the metropolitan area. The cost of the two schemes is put at £1,000,000.

United States Supplies India with Equipment.—The Andira Valley Power Supply Company of India, which is establishing two large central stations at Bhivpuri and Mahin, 90 miles inland from Bombay, has purchased 207 carloads of electrical equipment from the General Electric Company. Shipments have covered an extended period, says the *Schenectady Works News*, 100 carloads having been sent from Schenectady, thirty-five from Pittsfield and twelve from Lynn. Sixty carloads of transformer oil were also included. The largest items were three alternators having a total weight of 580,000 lb., five condensers with a combined weight of 160,000 lb. and two motor-generator sets. The total weight of the shipment was 80,000 tons. Some of the heaviest lifts between Bombay and the destination will be made by means of elephants. The shippers had to take into account the rainy season of India, where from May to September 240 inches of rain frequently falls, making heavy transportation impossible. The assembling of this power station equipment will consume months.

East African Water Power.—The government of Uganda, British East Africa, will grant a concession for the right to develop a portion of the Ripon Falls, near Jinja, for the purpose of generating and distributing electricity for lighting and power in the surrounding district. The Ripon Falls are the outlet from Victoria Nyanza to the Upper Nile, forming one of the sources to the River Nile proper. They are three in number, and the river at the point of the falls is about three-quarters of a mile wide. The average quantity of water passing over the falls is about 20,000 cu.ft. a second.

Progress on Queenston-Chippawa Power Canal.—Reviewing the progress made by the Hydro-Electric Power Commission of Ontario in the construction of the Queenston-Chippawa power canal in connection with its Niagara developments, the *Canadian Engineer* reports the situation to be as follows: The excavation for the forebay has been completed; approximately half of the total excavation necessary for the entire work has been finished; the power-house site has been cleared and excavations for foundations have begun; the construction railway from Queenston has been built and is in operation, and three of the concrete-arch bridges to span the canal have been constructed. Two million dollars' worth of additional construction equipment has been purchased in the last year. It is confidently expected that power from this plant will be delivered before the end of 1921.

Chapter of Accidents Due to Careless Construction.—Because, apparently, of careless construction and lack of adequate inspection of power and telephone lines, one fatality and many accidents were caused near Caro, Mich., recently by a short circuit of which *Telephony* gives an account. The trouble started through the contact of a 2,000-volt line of the Caro Light & Power Company with the limb of a tree. The wires burned in two and the dangling ends dropped onto the lines of two telephone companies which were directly beneath them. Five miles further along the wires of one of these telephone companies were crossed with the wires of a third telephone company because a farm-service branch wire had been allowed to sag upon them. The 2,000 volts from the power line burned off the insulation of this drop line and set fire to a farmhouse connected with it. A young man passing in an automobile endeavored to extinguish the fire and was killed by the telephone wire, which he attacked with a broom, falling upon him, and his father in trying to rescue him was severely hurt. Meanwhile numerous telephone subscribers had received shocks and operators of local exchanges had been driven from their switchboards.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Electric Club of Chicago.—This club has resumed its meetings for the fall and winter season, meeting on Tuesdays.

Florida Ice and Public Utilities Association.—The next regular meeting of this association will be held at Miami on Nov. 15 and 16, partly in conjunction with the meeting of the Southeastern Geographic Division, N. E. L. A.

Philadelphia Section, A. I. and S. E. E.—The first meeting of the new association year of this section will be held tonight (Oct. 2), when J. R. Penman of the Reading (Pa.) Iron Company will give an address on "Electrical Features of Mechanical Puddling."

Water-Power League of America.—This association will convene at Washington, D. C., on Oct. 7 and 8 for the purpose of affording "an opportunity to the several states that are interested in water power development to have their representatives come in contact with the Federal Power Commission that there may be evolved a workable program which will co-ordinate the activities in those states with that of the federal government."

St. Louis Electrical Board of Trade.—The officers, chairman and members of standing committees of the St. Louis Electrical Board of Trade for the coming year were presented to the members of that organization on Sept. 14 at a banquet held at the American Annex Hotel. The officers presented were President C. E. Michel, First Vice-President H. N. Goodell, Second Vice-President H. D. McBride, Treasurer Frank B. Adams and Secretary E. J. Spencer.

Coming Meetings of Electrical and Other Technical Societies

Illuminating Engineering Society—Cleveland, Oct. 4-7. (For program see issue of Aug. 14, page 370.)

National Association of Electrical Contractors and Dealers—Baltimore, Oct. 4-9. (For program see issue of Sept. 25, page 655.)

Electric Furnace Association—Columbus, Ohio, Oct. 6.

American Electric Railway Association—Atlantic City, N. J., Oct. 11-15.

National Association of Electrical Inspectors—Philadelphia, Pa., Oct. 12-13.

British Columbia Association of Electrical Contractors and Dealers—Vancouver, B. C., Oct. 13.

International Association of Municipal Electricians—New Orleans, Oct. [illegible].

Association of Railway Electrical Engineers—[illegible]

Electrical Supply Jobbers' Association—Cleveland, date in November to be fixed.

American Engineering Council—Washington, D. C., Nov. 18-20. (For program see issue of Nov. [illegible].)

Electric Power Club—Hot Springs, Va., Nov. 15-18.

Southeastern Geographic Division, N. E. L. A.—Miami, Nov. 15-20.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

J. B. Harvey, the newly elected president of the Nebraska Section of the National Electric Light Association, has been prominent in Nebraska utility work for a number of years. He started in 1902-1904 as a telephone lineman, rising to a superintendency. In 1904 he entered the State University at Lincoln, graduating in 1909 after completing the electrical engineering course and taking a post-graduate course in mechanical engineering. He was in the employ of the street-railway company in Omaha during his summer vacations and after his graduation superintended the erection of its new



J. B. HARVEY

power house, and he was electrical engineer for that company when he left to organize the Aurora Electric Company at Aurora, Neb. This project was financed locally, and Mr. Harvey built the plant and system, which was merged in 1913 with the Continental Gas & Electric Company. He remained with the new company as manager of the Nebraska group, which consisted of Aurora, York and Beatrice. In 1918 Mr. Harvey as vice-president and F. H. Brooks as general manager took charge of the entire group, which now comprises eighty-seven towns in Nebraska and Iowa and the electric and gas property at Brandon, Manitoba. Mr. Harvey has organized the Public Service Company as the operating company of the group and also the Electric Transmission Company, which built the first transmission line in Nebraska. Mr. Harvey has been the vice-president of the Nebraska Section of the National Electric Light Association, and has brought a typical Western spirit of progress into the work.

Charles S. Ruffner, vice-president of the American Institute of Electrical Engineers and vice-president of the North American Company, New York, has been appointed chairman of the traction and transportation committee of the American Institute of Electrical Engineers, succeeding W. S. Murray.

F. V. Magalhaes, superintendent of the meter and test departments of the New York Edison Company, has been appointed chairman of the instruments and measurements committee of the American Institute of Electrical Engineers, succeeding S. G. Rhodes.

Charles E. Patterson, comptroller of the General Electric Company since 1913, has been elected vice-president in charge of accounting. Mr. Patterson was previously associated with the New York Central Railroad and the American Locomotive Company. For nearly twenty-five years he has had wide experience in accounting. He aided in the development of the Interstate Commerce Commission's accounting system for railways and was appointed chairman of the standing committee of the Electrical Manufacturers' Council, which evolved the standard accounting cost system for the electrical manufacturing industry—a system which received the approval of the Federal Trade Commission and has been generally adopted by electrical manufacturing companies. As secretary to one of the officials of the New York Central, Mr. Patterson began the study of accounting which led to his elevation to the position of assistant comptroller. In 1901 he became comptroller of the American Locomotive Company. In 1909 he joined the General Electric Company for the purpose of introducing a modern accounting system. In 1913 he was elected comptroller of the General Electric Company. His present



C. E. PATTERSON

responsibilities include supervision of credit and collections and the financial relations with subsidiary companies. Mr. Patterson was born in New York City in 1866 and was graduated from Princeton University.

George E. Lewis, the president-elect of the Michigan Section of the National Electric Light Association, is a graduate of the engineering department of the University of Michigan. During 1909 he was associated with the S. Morgan Smith Company at York, Pa. In 1910 he went to Ann Arbor, Mich., with the Eastern Michigan Edison Company as local superintendent. He was advanced to the position of division superintendent in 1912 and in 1915 became superintendent of hydraulic plants of the Detroit Edison Company. He is also associated with Gardner S. Williams, consulting engineer, as electrical



G. E. LEWIS

engineer. He is a member of the American Institute of Electrical Engineers and a past chairman of the Detroit-Ann Arbor Section of the Institute. Mr. Lewis has been active in Michigan association affairs, being the first vice-president for 1919-20.

Russell G. Carter has been promoted to superintendent of the Belfast district of the Penobscot Bay Electric Company, Bucksport, Me., succeeding H. K. Brodgett, who has been transferred to the Rockland district for the same company.

Markham Cheever, chief engineer and general superintendent of the Utah Power & Light Company, has been appointed chairman of the new hydraulic power committee of the National Electric Light Association, which is largely a Western committee and will be active in the interests of hydro-electric developments. Mr. Cheever was born at Ann Arbor, Mich., May 19, 1880, and was graduated from the engineering department of the University of Michigan in 1903. In that year he joined the engineering staff of the Ontario Power Company at Niagara Falls, which was actively engaged in construction work. In 1906 he became associated with the Telluride Power Company in the San Juan district of Colorado; then, after a short period in Idaho, he went to Utah, where he has been connected with the Utah Power & Light Company on engineering work since 1912.

Trade and Market Conditions

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

Price Guarantee Question to Be Threshed Out

INSTANCES multiply where jobbers and dealers who are inclined to buy conservatively in lines where prices are high have asked electrical manufacturers for guarantees against declining markets. A case in point has just come to notice in the West where jobbers are not buying certain electric appliances because they expect prices to fall. They are requesting that the manufacturers protect them against a drop in price. In the East the practice is also growing. Only a month ago a large electrical manufacturing company announced that it would guarantee its jobbers against price declines for a period of sixty days after the purchase of goods.

This is interesting in view of the action of the Federal Trade Commission in calling for a hearing on the subject of price guarantees, to be held in Washington on Oct. 5. The commission received so many complaints relative to guaranteed prices that it decided to hold a "trade practice submittal" on the matter. The latter is an informal hearing which all those in an industry or groups of interested industries may attend to discuss the merits and demerits of business practices against which complaints have been made to the commission. The findings of the meeting are generally taken as the expression of the trade in the matter under consideration.

In this case the objection against guaranteeing prices seems to be that it is said to sustain prices unnaturally. Once a manufacturer has guaranteed a certain price he is naturally loath to reduce its level. When this occurs on articles where the element of monopoly is a factor, or where several manufacturers are acting in concert, it is held to be an infringement of the Lever act against profiteering. There are many who uphold the practice, however, on the grounds that it is a legitimate regulation of a firm's own business.

The Federal Trade Commission as a preliminary to considering the matter recently sent out 2,000 questionnaires to ascertain the views of purchasers, manufacturers, and retail and wholesale dealers, representing more than fifty major lines of industry. Included among these was the electrical industry. The general returns from the questionnaires showed that 250 of those replying favored the practice of giving price guarantees, while 150 answers were opposed. A large number of replies were received with noncommittal or qualified opinions.

Lamp Sales of 1920 Expected to Surpass 1919 from 25 to 30 per Cent

PROSPECTS for a good lamp season this fall are excellent, according to information received from the leading lamp producers. Sales thus far this year have been greatly in excess of other seasons, it is reported, and a still greater volume of business is expected to materialize from now on. One of the large manufacturers of lamps says the demand this season has constantly been in excess of the company's ability to turn out goods and that the sales billed thus far have been 50 per cent in excess of last year. Another manufacturer found demand 25 per cent ahead of the estimated figures for the first four months of 1920, while the next four months have closely followed predicted sales. This company expects fall business to follow the estimated sales curve which is placed about 20 to 30 per cent higher than 1919. To supply this demand, conditions are not so favorable. Factory stocks are either very low or else short on certain sizes. One company has a fairly good stock of "B" lamps, both in warehouses and with jobbers and dealers. On the "C" type, on the other hand, production in this instance has been running considerably below the current demand and no new stock has accumulated. This manufacturer expects its jobbers to be short on these lamps, but is hopeful of increasing production sufficiently to clean up unfilled orders by the first of the year. Another producer reports that in spite of its own low level of lamp stocks the supplies of its distributers are in good shape. Miniature lamps seem to be in good supply both at the factory and with jobbers. Shipments of these are made from stock up to two days' time, according to a leading maker, and miniature-lamp agents are even over-stocked in some cases. Shipments of large lamps not in stock can generally be made in from two to six weeks except on "type C" lamps. Deliveries of these are slower in some cases, one manufacturer being from two to three months behind on orders.

Raw material is not causing any great difficulty at present, it is said, except on some of the minor items. No trouble is being experienced with labor either, though one of the large producing interests recently reported great difficulty in obtaining sufficient skilled workmen. Cancellations are said to be negligible at present. Production is proceeding at a brisk rate. In nearly all cases the output seems to be well up to normal, and one manufacturer is turning out 30 per cent more lamps than last year. Collection conditions are good in this line. The average time of paying bills ranges from thirty to thirty-five days.

British Manufacturers Endeavoring to Regain World Trade

BRITISH manufacturers and traders are determined to recapture the trade won from them in pre-war days by the Germans and to strengthen their hold in foreign markets, according to a report issued by the Guaranty Trust Company of New York. This end is to be accomplished in two ways—first by the perfecting and enlarging of British trade interests in foreign countries, and secondly by the closer organization and consolidation of industry at home. The latter method is intended to bring about better methods of production and sales.

The foreign trade department of the British government formed in 1918, and known as the Department of Overseas Trade, has, it is stated, given particular attention to the need of closer association among manufacturers as a means of strengthening British trade. The committee on electrical trade of the foreign trade department, investigating the condition of the electrical industry after the war, laid particular stress on this matter in its report. The committee said: "Only by the creation of strong combinations will it be possible for Great Britain to compete with the great foreign corporations, which not only manufacture but undertake comprehensive contracts, make powerful financial alliances, and thus exert in every direction greater influence than is possible in the case of any individual firm." Similar views were expressed of the iron and steel and the engineering trades.

A committee of the British Board of Trade, investigating the export trade of the country with the object of devising methods to meet the severe commercial competition that

was anticipated after the war, also recommended in February, 1918, that electrical manufacturers among others should form a common selling organization by the extension and consolidation of existing associations, the organization to be divided into groups handling specific products. That the danger of uncontrolled monopolies and combines is also recognized, however, is evident in the recommendations of the committee on industrial and commercial policy. This committee stated that it would be desirable to institute in the United Kingdom machinery for the investigation of the operation of monopolies, trusts and combines similar to the commissions and other tribunals created for that purpose in the United States.

A typical example of the method by which the British plan to recapture their overseas trade, according to the report of the Guaranty Trust Company of New York, is the organization known as the British Trade Corporation, incorporated in 1917, with an authorized capital of £10,000,000, of which £2,000,000 is fully paid up. Since its incorporation this company has facilitated the export of goods of many millions of pounds value.

In conjunction with the London and Westminster, Lloyd's and the National Provincial banks, the British Trade Corporation formed the South Russia Banking Agency. It also has an investment in the Portuguese Trade Corporation, which was specially started to compete with German interests. Another subsidiary is the Anglo-Brazilian Commercial and Agency Company, which has opened branch houses in Brazil, especially at places where German influence in the past was strongest. Another undertaking in which the British Trade Corporation has invested is the Levant Company, Ltd., which seems to have a promising future as the representative of British influence in the Near East. In this connection the British Trade Corporation has acquired the entire capital stock of the National Bank of Turkey.

Output of Motor-Driven Appliances in 1920 Estimated at 2,000,000 Units

DURING the past year or two the growth in sales of motor-driven household appliances has been very large, and as a result considerable interest has been manifest in statistics of sales in this field, which includes washing machines, ironing machines, dishwashers, vacuum cleaners, electric sewing machines and electric refrigerators. Estimates of the volume of business done in these fields naturally differ somewhat. According to an article by Bernard Lester, in the September issue of the *Circle*, house organ of Westinghouse Electric & Manufacturing Company, the total sales in these six classes of appliances will amount to approximately $170,000,000 during 1920. This estimate is based upon the retail selling price. The business is divided about as follows:

	No. of Units	Retail Price
Washing machines	800,000	$100,000,000
Ironing machines	50,000	7,500,000
Dishwashers	20,000	2,200,000
Vacuum cleaners	1,000,000	53,000,000
Electric refrigerators	10,000	3,250,000
Electric sewing machine	75,000	4,500,000
Total	1,955,000	$170,450,000

An interesting feature of the article is a chart showing the growth by years in the sales of motor-driven appliances. No longer ago than 1916 the total number of electric vacuum cleaners sold yearly was only 100,000. In 1917 the figures advanced to 175,000 and they rose to 750,000 in 1919. The estimate for 1920 is 1,000,000 cleaners. The growth of electric washing machine sales has been quite as rapid. In 1916 only 150,000 of these machines were sold and this number advanced to 475,000 in 1919. The total for this year should reach 800,000, it is stated. The remaining fields are as yet practically undeveloped. Sales of electric sewing machines of any considerable amount date back only to 1915. Total sales for 1920 are estimated at but 100,000 machines. Electric ironing machines, dishwashers and refrigerators can trace their commercial growth only as far back as 1916. Annual sales of ironing machines have as yet reached a total of only about 50,000, and of dishwashers and refrigerators considerably less than 25,000. A large growth of business in these appliances is anticipated.

Canada Turns Out $30,000,000 of Electrical Apparatus

INFORMATION recently published by the Dominion Bureau of Statistics at Ottawa, Canada, would indicate that the manufacture of electrical apparatus has reached important proportions in that country. The requirements of the various electrical plants are now being more largely supplied by the Canadian manufacturers, although imports are still very large, according to a preliminary report issued by the Bureau of Statistics containing figures compiled for the year 1918. Since that date there is little doubt that considerable progress has been made by electrical manufacturers in meeting the demands made upon them in connection with the numerous developments of water power which are now under way throughout the Dominion. In 1918 there were sixty-eight plants engaged in the manufacture of electrical apparatus. The total capitalization of the industry was $43,285,405 and 8,863 persons were employed. The selling value of the articles produced at the works during that year is given as follows:

Dynamos, generators and converters	$1,503,443
Transformers	2,291,874
Switchboards, panelboards and cabinets	990,898
Motors of all kinds	2,727,673
Storage batteries	212,624
Primary batteries	1,397,635
Incandescent lamps	1,924,745
Sockets, receptacles, bases, etc.	415,855
Lighting fixtures	311,844
Telegraph apparatus	71,230
Telephone transmitters	50,000
Telephone receivers	95,000
Interior telephone systems	444,000
Telephone central switchboards	750,000
Private telephone exchange boards	110,000
Insulated wire and cable	5,154,984
All other electrical machinery	1,738,085
Carbons	1,362,666
All other miscellaneous products	8,492,843
Total value	$30,045,399

Exports of electrical apparatus by Canadian manufacturers during the past fiscal year ended March 31, 1920, amounted to only $301,932 (of which $159,788 was for batteries, telephone and telegraph apparatus and $142,144 for electrical apparatus not otherwise provided for), which total is a decrease from $2,167,545 in 1918-19 and $2,166,961 in the previous year.

Need of Co-operation Among Jobbers

AFTER being long handicapped by depleted stocks, electrical jobbers are now confronted with the problem of handling steadily increasing inventories at a time when most merchants, manufacturers and bankers believe that stocks should be reduced. This is very difficult for jobbers to accomplish, however, because manufacturers are catching up with back orders, freight is being handled more expeditiously, and many contractors, dealers and industrial customers have canceled orders which jobbers had already made arrangements to fill.

Jobbers themselves have canceled some orders, it is true, but a number of manufacturers who sell through jobbers state that they have had a smaller percentage of business canceled than have their competitors who sell direct to dealers and consumers through agents.

In a number of places electrical supply jobbers have been trying to solve the problem of uneven stocks by exchanging with competitors. This method has been found to work out well for more than one reason. It helps the one to protect his customers with an adequate supply of materials which otherwise he would be short on. It helps the other to reduce his stock to a sane level, thereby making his financial position more desirable. Moreover, it helps to prevent dumping of excess stocks and so badly disarranging the market when there is no sound economic reason.

Metal Market Situation

Business in the copper market continues dull. There is not enough demand to establish a firm basis for prices and as a result quotations are but nominal. Producers are shading prices as low as 18.50, it is reported. A drop of 1 cent per pound is noted on copper wire base. In the outside market sales are also light. Second hands are offering holdings at 18 cents for nearby shipment and from ¼ to ½ cent higher for delivery through November and December. A sharp break in the London market forced standard spot copper down £3¼ the past week.

Incoming shipments of foreign lead continue to feature that market. The "official" price at New York has been dropped ¼ cent per pound. The scrap metals market is virtually stagnant. Weakness in copper prices and lack of demand caused lower quotations on old copper and brass, while prices on scrap zinc and lead also receded.

NEW YORK METAL MARKET PRICES

	—September 21—	—September 28—
Copper	£ s d	£ s d
London, standard spot	87 0 0	93 10 0
	Cents per Pound	Cents per Pound
Prime Lake	18 50-18 62½	18 50-18 62½
Electrolytic	18 75	18 50-18 75
Casting	17 75	17 62½
Wirebase	22 50-23.00	21.50-22 00
Lead, trust price	8.50	8 00
Antimony	7.12½	7.12½
Nickel, ingot	43 00	43.00
Sheet zinc, f o b smelter	12 50	12.50
Zinc, spot	8 12½	7 75- 8.00
Tin	44 50	43 50
Aluminum, 98 to 99 per cent	35.10	35.10

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	15 50-15 75	15 25-15 50
Brass, heavy	9 00- 9 25	8 50- 9 00
Brass, light	7 00- 7 25	6 50- 7 00
Lead, heavy	7 00- 7 25	6 50- 6 75
Zinc, old scrap	5 00- 5 25	4 50- 5 00

THE WEEK
IN TRADE

IN SPITE of the general downward price tendency on many commodities, prices of electrical material are reported as holding steady in all districts except New England, where weakness in several items is noted.

Quietness is still the prevailing feature of the electrical market in most sections. New England reports brisk trade, however, and in the Northwest a few lines are moving more briskly. The remainder of the country is apparently resting on its oars awaiting price developments. Jobbers on the West Coast fear the result which price reductions in the automobile industry and other lines may have upon business. In the Northwest several large lumber mills are expected to close as a result of transcontinental carriers refusing to modify freight rates upon lumber shipped to the East. The Pacific Coast reports the occurrence of several disastrous fires. In the South a shortage of fuel threatens as a result of the strike of Alabama coal mines.

The transportation situation is very greatly relieved. Stocks are returning to normal and shortages are being reduced. Some complaint is still heard regarding the supply of motors, outlet boxes and rigid conduit. A good volume of construction work is under way in the South, but building activity in other districts is decidedly off as the result of high labor, scarcity of material and tightness of money.

NEW YORK

Recessions in prices of commodities and materials during the past week have not as yet been reflected in the electrical trade, but the causes of the recessions in the other fields are present in the electrical field. Builders are holding off to watch the progress of the price changes, and this has slowed the usual fall demand, which should be strong at this time. With the expected state housing laws not materializing and without definite statements as to future price policy from the steel mills, building here will be confined necessarily to small extensions. Steel products, such as conduit, have further tightened owing to the embargo on carload or less lots of freight from Pittsburgh. Credits and collections show no material change. Transportation is generally slowly improving. Shipments of poles and crossarms from the Pacific Coast are beginning to come through.

Weatherproof Wire.—Base price remains at 28 cents with delivery fair. Foreign demand depends on settlement of exchange.

Line Material.—The usual fall demand is not up to standard. More shipments are coming through than orders require. Insulator orders are taken on long-term delivery, as filling depends largely on transportation.

Poles and Cross-Arms.—Stocks of poles are not improving. Supplies of cross-arms are better, but demand is light. The only price changes have been the addition of the increased freight rates.

Small Motors.—Demand is weak and stocks are being held down.

Rigid Conduit.—Uncertainty of steel costs, poor transportation from Pittsburgh east and the fact that production is far behind have held conduit stocks at a very low point. Black, ½-in., is quoted from $90 to $103 per 1,000 ft.

Flexible Armored Conductor.—Stocks are plentiful, with prices ranging from $85 to $95 per 1,000 ft.

Household Appliances.—Demand is falling off in most lines, such as heaters, vacuum cleaners, dishwashers and hollow ware. Some jobbers report increased washing-machine sales.

Schedule Material.—The market generally is tight with only a few items such as pull sockets good. The Benjamin Electric Manufacturing Company has increased prices on porcelain sockets, including its copper-cap line, from 12 to 38 per cent, averaging 25 per cent.

Dry Cells.—Since the recent advance in price there has been a noticeable increase in sales of bell-ringing transformers for house service.

CHICAGO

While business in general seems to be in a state of flux due to price decreases in many lines, everything in the electrical line is holding steady. The conservative basis of electrical prices and of the merchandising methods established in this line has justified itself by preserving the industry from the nervousness and excitement suffered by others.

Little or no reflection of the current unrest has been felt by dealers or jobbers in this section, and no demands for price cutting have been heard. Orders and inquiries have maintained their steady pace. Shipments from manufacturers are coming in steadily and stocks are gradually returning to normal. In every way trade seems to be progressing in a normal manner. This does not mean that no price reductions are to be expected. As raw material and production costs decrease through the general price recession the prices of finished products are expected to decline in the electrical trade. Manufacturers and jobbers in this district, however, have not been making a profit sufficiently large to occasion price cutting until such cuts are justified by reduced costs.

During the past few days there have been some instances of intended price increases being canceled. Manufacturers feel that while the contemplated increases are justified immediate relief may be in sight and that it is best to give customers the benefit of the doubt until costs in the near future may be seen more clearly.

Wire.—With copper prices slightly off and with cotton and other insulating materials declining, the outlook is for lower prices on both bare and covered wire. It is too soon for any change to be recorded yet, and demand is steady at old prices.

Fractional Motors.—Production is said to be exceeding market consumption by some 20,000 units per week, which seems to discount the possibility of any price advance. The Emerson Electric Manufacturing Company announces that prices will be withdrawn at the expiration of existing fan motor contracts on Sept. 31. What the new prices will be is not yet known.

Heating Devices.—Jobbers' and retailers' sales are above the September average. Stock conditions are improved in these devices. Local demand for heaters, particularly of the single-unit type, is quite heavy. Jobbers anticipate their best seasonal record this fall and winter.

Household Appliances.—Much talk has been heard recently about threatened increases in washer and vacuum-cleaner prices. If the present lower trend in raw material cost prevails the increases will probably be averted. Local and rural demand in this district is being maintained surprisingly well.

BOSTON

Jobbers report that trade continues brisk. Deliveries are improving except on rigid conduit and motors. Prices have weakened on flexible-armored conductor, porcelain knobs and tubes, rubber-covered wire and floor lamps. Collections show some improvement, but are closely watched. In manufacturing circles labor engaged on electrical products continues to function more satisfactorily than for some time. Wiremen in the Boston district, however, have requested a flat increase in their hourly rate from $1.50 to $2, making a normal day's pay $12. It is unlikely that the employing contractors will concede any such increase.

Jobbers' stocks are being well maintained by the receipt of long-deferred rail shipments. Building and engineering contracts in New England for the first three weeks in September totaled $15,661,000, compared with $17,302,000 for the same period last year. The high cost of labor and the unwillingness of men in many trades to work intensively, combined with scarcity of building materials, has slowed down many new building projects.

Rubber-Covered Wire.—In 5,000-ft. lots No. 14 is quoted as low as $10.75 to $10.85 per 1,000 ft., with special prices on large orders of 25,000 ft. or over. Stocks are plentiful with fair demand.

Weatherproof Wire.—Current buying is around 31 cents per pound, with six to eight weeks' delivery from the factory. Stocks are low.

Tubes.—Prices are easier, 3-in. tubes being quoted at $11.35 per 1,000 in. barrel lots, net. "Nail-it" knobs are also lower, a representative price being $34.65 per 1,000 in barrel lots. The arrival of long-deferred consignments is a factor in these quotations.

Flexible-Armored Conductor.—The price tendency is downward under close competition. In coil lots up to 1,000 ft. the price is about $110 per 1,000 ft., and about $100 in larger quantities. Stocks are substantial, with a medium demand.

Rigid Conduit.—Supplies are short and such small stocks as exist are very spotty. Quotations from jobbers' stocks are following card 45 pretty closely, but on mill shipments price at time of delivery is quoted. No trouble is encountered in disposing of any canceled orders left on hand. Little is heard as to price reductions, and in some quarters further advances are regarded as likely.

Motors.—The outlook for shorter deliveries is not good. Three-phase motors of 1 hp. to 10 hp. are quoted on about forty weeks' delivery by one leading house, and on sizes of 15 hp. to 100 hp., twenty-four weeks are quoted. Small direct-current motors are hard to obtain, and the second-hand market is constantly being scoured for "casuals." Prices are firm.

Radiators.—For the moment jobbers are well stocked against the fall demand, but it is doubtful whether a shortage can be avoided when cold weather arrives. One large manufacturer is but a few days behind orders because of foresighted production last summer. Prices are firm, list less 25 per cent being quoted to dealers on lots of six, with 5 to 10 per cent more off on lots of thirty.

Non-Metallic Flexible Conduit.—Despite a heavy demand no shortage is reported. Prices are steady, the $\frac{3}{32}$-in. size selling for $33.50 per 1,000 ft. in 5,000-ft. lots and the $\frac{1}{4}$-in. size for $35 to $36.

Floor Lamps.—Price cutting is under way in retail circles, owing to the accumulation of stocks.

ATLANTA

Conditions throughout the cotton belt have been very satisfactory for cotton picking, and ginning has got under way. Business for the past fortnight has been somewhat quiet as compared with August but will be considerably accelerated as soon as the new cotton crop goes on the market. Ready funds in the rural districts at the present time are very low. The recent break in lumber prices has stimulated building activities, and permits for Atlanta through Sept. 22 are valued at $980,000, an amount double that for the same period in August. Most of this construction is of the commercial and moderate dwelling class, no large office buildings or industrial plants being included.

Jobbers report considerable improvement in the transportation situation. The most noticeable feature is the great reduction in the number of lost shipments, a situation that caused no little trouble in the late spring and summer. The strike of the coal miners in Alabama bids fair to cause an acute shortage of fuel for both industrial and domestic purposes unless the difficulties between miners and operators are very quickly adjusted.

The announcement of the governor of the Sixth Federal Reserve District Bank that the Reserve banks would continue to rediscount warehouse paper to provide for the orderly handling of the cotton crop has done much to lend a more optimistic tone to rural districts. Collections, however, continue tight and credit extensions have been cut approximately 50 per cent.

Knife Switches.—The inroads made by safety switches on sales are very noticeable. All sizes with the exception of 30-amp., 60-amp. and 100-amp., two-wire and three-wire types, are moving very slowly. Stocks are reported in good condition with shipments above the average. Prices, $50 to $200 lots, 30-amp., two-wire, 96 cents; 60-amp., two-wire, $1.62; 100-amp., two-wire, $3.30.

Schedule Material.—Recent receipts have enabled most jobbers to make good headway in filling back orders and accumulating fair stocks. Porcelain has shown an encouraging improvement and is coming through more satisfactorily than for some time past. Orders on all lines of schedule material show a tendency to slow up.

Bells, Buzzers and Annunciators.—A price advance of 25 per cent in the line of specialties is announced. The entire line shows an excellent demand in spite of this increase. While present stocks are fair, unsatisfactory shipments are causing considerable depletion in the more popular articles.

Poles.—Improvement in transportation is responsible for better deliveries of poles. Demand is very brisk. A 30-ft. Western red cedar, butt-treated pole is quoted at $15.20; 35-ft., $23.90, f.o.b. Atlanta; Southern white cedar, one-half the above price. The latter type of pole is showing unusual activity because of the big difference in price.

Cross-Arms.—A large increase in orders has been reported the last two weeks, the principal gain being on orders for standard arms. Stocks of fir arms are somewhat shot up and spotty, while shipments continue only fair. Stocks of pine arms are very badly depleted. Prices, fir arms, less than 1,000 linear ft., two-pin, 3-ft., 79 cents; four-pin, 4-ft., $1.09; N.E.L.A. arms, two-pin, 3-ft., $1.18; four-pin, 5½-ft., $1.78.

ST. LOUIS

The past week has been a continuation of the quiet that has prevailed in electrical circles during September. Some jobbers report that so far as new business is concerned it has been the poorest week experienced in some time. Other jobbers are not so pessimistic, but at the present rate September's volume of business will be considerably below that for August. Distributers attribute much of this quiet to

the psychological effect of the country-wide price reductions. They look for greatly improved business after the election in November. Neither manufacturers nor jobbers in this section are expecting price decreases in electrical lines.

Jobbers' stocks are in good condition except on a few lines such as holiday toys and magnet wire. Good transportation conditions in this territory are having their effect on supplies. Retail sales have been slow the past week. The fall business in heating devices has not developed as yet, but dealers look for the first touch of cold weather to improve demand. Collections remain slow and are being pushed.

Building in St. Louis proper is almost at a standstill, both for industrial and residence purposes, and very little construction work is expected until spring. Home building in suburban territory is more active and electrical contractors are getting a number of smaller jobs in adjacent district.

Poles.—Jobbers report a good stock at base points but are having some difficulty in obtaining cars for shipment. Where cars can be secured deliveries of any sized order can be made. Demand at present is good and is coming more from railroads than from utilities. The latter are buying just enough to cover winter requirements and to finish construction jobs under way. Base prices at mill quoted here range from $11.35 on a Western cedar 8-in., 40-ft. pole to $20 on a Northern white cedar 8-in. 40-ft. pole. Prices are net plus freight from base.

Fuses.—Jobbers report a good demand, especially for the renewable type. Stocks of both renewable and standard fuses are good. Prices show an upward tendency, "Economy" fuses having advanced 27 per cent in packages of 200.

Sockets.—Stocks are large owing to small demand and recent large shipments from manufacturers. The dearth of fixture business, caused by cessation of building, is responsible for the slow demand. Pulls are quoted at 51 cents, keys at 28 cents and keyless at 26 cents, net, in case lots.

Holiday Toys.—Most jobbers in this district have decided not to handle this line at all. As a result there is practically no stock here. Retailers are buying direct in most cases and have placed good orders. Deliveries are not being made as yet.

Meters.—Stocks of the house type are decidedly spotty. Demand from central stations is good because of the large amount of house remodeling and wiring going on. Factories are promising deliveries about the first of the year. By the time building construction becomes normal jobbers' stocks will be built up.

SEATTLE—PORTLAND

With the exception of a noticeable increase in the movement of socket devices, certain heating appliances and lamps, sales are light and indications are they will remain so for a considerable period. Residence construction is maintaining a comparatively even level, but commercial building is very quiet. Apparently there will be no immediate readjustment of lumber rates from the Northwest to Eastern destinations, according to traffic officials of the transcontinental railroads. As a result it is reported that many important mills in both Oregon and Washington will close. Orders for lumber are slackening off.

Business in the Portland district continues good. Production is improving owing more to the increased facilities of manufacturers than to the decrease in demand. The shortage of meters continues and no immediate relief is in sight. Jobbers state that the pole-line material and the loom shortage have been relieved. Recent receipt of several cars of washing machines and electric ranges has also replenished stocks. Wire is in good shape at present, but stocks of steel boxes and covers are short and no relief is in sight. Contractors report fair business. Competition is keen on larger work. Collections are still slow. Dealers report exceptionally good business.

SAN FRANCISCO

Conditions remain about the same with good average business. There is increased expectancy of a serious change in the near future, however, since the recent dropping of automobile prices. Large contractors are working full crews. There is an especially good amount of marine work. The smaller contractors, on the other hand, are finding that there are fewer small jobs on which to figure and so are working only a few men.

There have been a number of disastrous fires in California this year, several small towns having been practically wiped out. A recent fire in Sacramento destroyed the entire season's fruit pack of the California Packing Company. The loss is estimated at $4,000,000.

Batteries.—Stocks and deliveries are good, but demand is being hit by many factors. Considerable missionary work is devoted to the sale of packed combinations of batteries.

Sewing Machines.—Supply is far in excess of the demand. The price advances made during the past three months bringing vibrating machines to more than $60 and rotary machines to more than $80 are undoubtedly justified but have killed demand.

Radiators.—Advance orders taken last winter are being filled. The Westinghouse Electric & Manufacturing Company has notified such dealers that their future delivery orders will be filled immediately because of threatened price advances and probable shortage of stock.

Electric Ranges.—The Pacific Gas & Electric Company has issued a schedule which provides that its agents will sell ranges and water heaters at published list prices, with fixed additions for installation. The new range rate is 3½ cents per kilowatt-hour for the first 180 kw.-hr. and 2 cents thereafter on a two-meter schedule, or else a sliding scale that enables the average household to reach the 2-cent rate about 30 kw.-hr. sooner on a single meter for all the house service.

SALT LAKE CITY—DENVER

Prices of electrical merchandise remain high, with little or no sign of a downward tendency. Jobbers and distributers are watching the market keenly for any intimation of a drop as a possible effect of the recent changes in price on certain commodities. So far there is nothing on which to base a forecast. The money market remains in a static condition. The scarcity of capital is seriously hampering building operations. There is little activity in the mining industry, and this condition is reflected in a lessened demand for electrical merchandise in several important lines. There is some tendency on the part of dealers to look to the Christmas trade to boost sales. Otherwise there is little change in the general market status. Consumer demand is at a low ebb in most sections.

Radiant Heaters.—The chilly weather that has prevailed during the past few days has created quite a demand. Prevailing retail prices are from $11 to $12.50.

Rigid Conduit.—Demand is healthy, but the supply is exceedingly low. An embargo at the Eastern factories affecting particularly the Intermountain region has created a serious scarcity. The embargo was called off for two weeks following the freight-rate increase, but for some reason it is now in force again.

Porcelain.—Stocks are low. Jobbers cannot begin to meet the demand. It is reported that several manufactures of sockets, receptacles, and switches have purchased their own porcelain factories. Distributers in this section expect relief as a result of this emergency measure.

Line Material.—Stocks are low in spite of the little building now in progress.

Lamp Cord.—One of the largest jobbers in the intermountain region is not promising delivery under ten months.

Hollow Ware.—Little activity is shown, though this is normally the beginning of the fall season. From now up to Christmas consumer demand is expected to increase. Stocks are generally plentiful. A scarcity is noted in the cheaper grades of percolators.

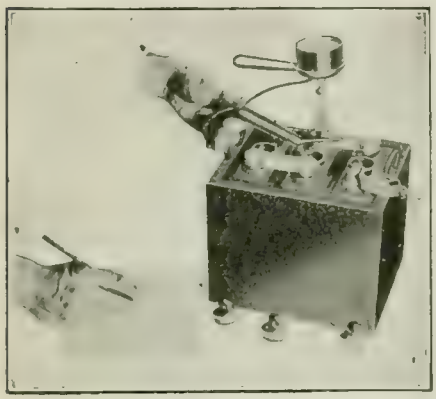
Cable.—Deliveries are requiring from four to five months.

NEW APPARATUS & APPLIANCES

A Record of Latest Developments
and Improvements in Manufacturers' Products
Used in the Electrical Field

Volt Reader for Testing Batteries

The principal uses of the "Cadmovolt" reader, brought out by the Service Station Supply Company, 30 East

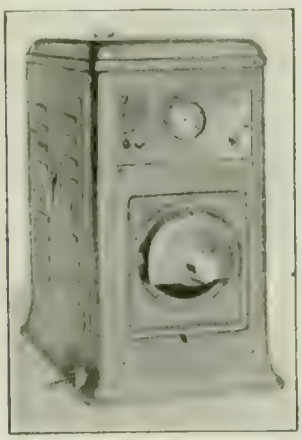


DETERMINES CONDITION OF BATTERY PLATES

Larned Street, Chicago, are: Voltage test of cells on charge or discharge, cadmium test to determine the state of charge of either or both groups of positive and negative plates, and polarity test to insure proper assembly and direction of charging current. The instrument has two reading scales, one for cadmium and another for voltage. No readjustments are necessary when changing from one test to the other.

Farm-Lighting Unit

The removable control case, containing all the electric control and safety appliances, is the distinctive feature of



COMPLETELY INCLOSED AUTOMATIC FARM-LIGHTING UNIT

the lighting and power unit manufactured by the Linderman Steel & Machine Company, Dayton, Ohio. Three types of the unit are made, each of 1 kw. capacity. In the 32-volt semi-automatic model the engine is started by pressing a button and stops when the batteries are charged. In the full-automatic model the engine starts and stops automatically. The 110-volt full-automatic unit has no storage batteries. Power is generated only as needed, the turning on of a light or power switch starting the engine automatically.

Bus Switch Has Removable Insulator

To enable quick replacement of a defective or broken insulator, the Delta Star Electric Company, Chicago, has designed an easily assembled bus-type disconnecting switch. By inserting a wrench in the opening of each end block the holding bolts can be backed off, the insulator removed and a new one quickly inserted. This is accomplished without removing the switch proper from the bus structure.

Plug Fuse

A plug fuse equipped with a zinc cap to avoid the use of brass or aluminum has been developed by the Killark Electric Manufacturing Company,



METAL PARTS ARE SPUN ONTO THE PORCELAIN

3940 Easton Avenue, St. Louis, Mo. Contact is made between the friable element and the shell in the porcelain.

Notes on Recent Appliances

Rheostat for Wireless

A radio rheostat has been brought out by the Clapp-Eastham Company, Cambridge, Mass.

Lamp Socket

A socket which keeps lighted after the switch is turned off has been developed by the Lite-a-While Socket Company, Minneapolis, Minn.

Refrigerating Unit for Home Use

The Balsa Refrigerator Corporation, 149 West Thirty-sixth Street, New York City, successor to the Frigidor Corporation, is offering a self-contained refrigerator unit for home use, known as the "Frigidor."

Unit Light and Power Plant for Farm Use

As a supplement to its 1,200-watt plants, the Perfection Storage Battery Company, Fortieth St. and Rhodes Ave., Chicago, has developed its model "SAR" 1.5-kw. plant, designed to operate a milking machine or other heavy power-consuming device which would overload the ordinary plant. The engine develops 4 hp. and the plant is designed to carry seventy 16-cp. lights.

Changes in Mazda Lamps

Changes in the bulb construction of certain Mazda lamps are announced by the Edison Lamp Works of Gen-

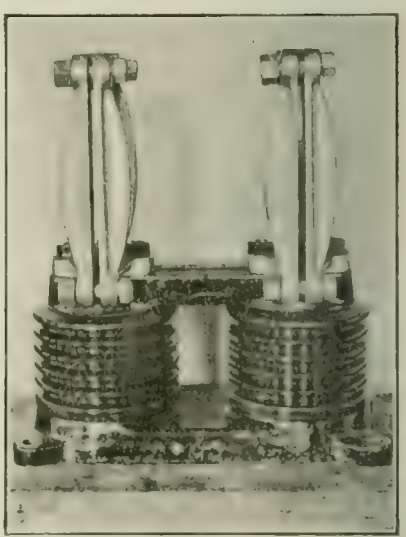


NEW TYPE BULB

eral Electric Company, Harrison, N. J. The 23-watt S-19 street railway lamp will be superseded by an S-17 bulb, which is a smaller type. The diameter of the old bulb is 2⅜ in. and the over-all height 5¼ in., while the new type is 2⅜ in. in diameter and 4⅜ in. in height.

Heavy-Duty Bus Support

Two porcelain insulators used on a single cast-iron base to carry the extra loads involved in heavy buses are the feature of a new unit bus support brought out by the Lewis & Roth Cor-



ARRANGEMENT OF CLAMPS FOR VERTICAL BUSBARS FOR ALTERNATING CURRENT

poration, Philadelphia. Different forms of clamps are made for holding horizontal or vertical arrangements of busbars.

MANUFACTURERS' ACTIVITIES

Record of Changes Affecting Sales and Distribution Together with Trade Personals and Notes on Foreign Trade, Jobbers' News and New Trade Literature

THE VARNEY ELECTRIC COMPANY store, First Street, Evansville, Ind. was damaged by fire Aug. 18. The flames spread to the three-story building adjoining occupied by the Andrew Jackson Company as a factory. Both buildings were partly destroyed and smoke and water did considerable damage to the stocks. The total loss of both companies is approximately $75,000.

THE INTERNATIONAL ELECTRIC COMPANY, Indianapolis, Ind., has obtained a ten-year lease on a large five-story block at 217-219 McCrea Street, Indianapolis. After the building is remodeled the company will remove there from its present location in the Century Building. The new building will increase the floor space to five times the former area. Young Moore is general manager.

THE IDEAL ELECTRIC & MANUFACTURING COMPANY, Mansfield, Ohio, has started on a building program which will double its plant capacity. A five-year development program of the company contemplates the erection of ten modern factory buildings, and twenty-four acres of land has been purchased for this purpose. The foundations are already in for building No. 2, which will be a machine shop, 160 ft. x 425 ft. As soon as this is finished it is planned to proceed with the other buildings.

THE WHS MANUFACTURING COMPANY, Indianapolis, Ind., recently incorporated with a capital stock of $300,000 by Clyde E. Walling, John H. Higgins and W. H. Siegel, is planning the construction of a plant in Indianapolis to manufacture electrical devices.

RALPH J. PATTERSON, formerly commercial manager Twin-State Gas & Electric Company, Boston, Mass., has been appointed commercial representative of the Walker & Pratt Manufacturing Company, Watertown, Mass., with special responsibilities in electric range development work. Mr. Patterson was earlier with the Central Maine Power Company, where he conducted development work in the design of water-heating equipment.

A. A. LOEFFLER has recently been appointed by the Doehler Die-Casting Company, Brooklyn, N. Y., as its Detroit representative, succeeding F. C. Seeger, who will now represent the company on the Pacific Coast with headquarters in San Francisco.

THE WAGNER ELECTRIC MANUFACTURING COMPANY, St. Louis, has removed its Salt Lake City office to 59 West Broadway and opened a service station at that address. The branch is in charge of L. Brandenburger.

THE AMERICAN STEAM CONVEYOR CORPORATION, Chicago, announces a change in its corporate name to the "Conveyors' Corporation of America." The company manufactures steam-jet conveyors, trolley carriers, bearing sheaves and other conveyor supplies. A large and completely equipped machine shop, to which foundry facilities will be added, has been acquired at South Bend, Ind.

THE NATIONAL LAMP WORKS of General Electric Company, Nela Park, Cleveland, Ohio, held a conference of jobbers' representatives at Nela Park on Sept. 13, 14 and 15 to study proper industrial lighting methods. The National Lamp Works is holding its second yearly contest between factories in an effort to increase production and eliminate "shrinkage." The contest, which is distinct for the large and miniature lamp divisions, is called the "ballot-box battle" and will last through September, October and November. Each factory will be known by the name of a state. The factory managers become candidates for "president of the lamp states" and are credited bi-monthly with a certain number of votes based on their factory's showing in production and shrinkage. The system is carried down through the organization, which is divided into two "political parties." Minor contests are held for "mayor," "governor," etc.

THE ROLLER-SMITH COMPANY, 233 Broadway, New York, announces the appointment of the Mountain States Machinery Company, 1710 Glenarm Street, Denver, Col., as its agent in the states of Colorado, Wyoming and New Mexico. The Mountain States Machinery Company (successors to the Vaughan Machinery Company) will handle, in addition to the Roller-Smith lines, the products of many other important concerns, such as the Crocker-Wheeler Company, Maloney Electric Company, Cutler-Hammer Manufacturing Company and Terry Steam Turbine Company.

THE M. E. AUSTIN COMPANY 700 Jackson Boulevard, Chicago, Ill., has a new building under construction at 108 South Desplaines Street, Chicago, to cost with site, $250,000. The building will be three stories in height and have a floor space of 30,000 sq.ft.

AMERICAN MANUFACTURERS' EXPORT ASSOCIATION TO MEET. — The eleventh annual convention of the American Manufacturers' Export Association will be held at the Waldorf-Astoria, New York, Thursday, Oct. 14. The convention will be limited to a one day's session. The theme of the convention will be the part American manufacturers must take to secure permanent world trade.

THE EMERSON ELECTRIC MANUFACTURING COMPANY, St. Louis, announces that with the expiration of Emerson motor fan contracts this month all prices quoted have been withdrawn and that new prices will not be available for about sixty days.

THE R. H. BEAUMONT COMPANY, 319 Arch Street, Philadelphia, has recently opened an office at 230 Fifth Avenue, Pittsburgh, which will be in charge of Thomas Widdaps.

Supply Jobbers' Notes

THE REPUBLIC ELECTRIC COMPANY, Davenport, Iowa, has installed a $100,000 stock in its headquarters, 120 East Front Street, and expects to cover a large field in this territory. It handles electrical appliances of all kinds. J. S. Kimmel is president, A. M. Butler secretary-treasurer and T. H. Harris general manager.

Foreign Trade Notes

ELECTRICAL HOUSEBOAT TO MAKE AN EDUCATIONAL TOUR THROUGH CHINA.—The Western Electric Company is to take the electrical idea to the millions of Chinese by means of a houseboat containing all of the latest labor-saving devices now found in American homes. This boat will begin touring the rivers and canals of China this winter and will emphasize the value of farm-light plants. The boat is scheduled to make a trip of about 5,000 miles in a territory populated by more than a hundred million Chinese, most of whom are absolute strangers to anything electrical. It will carry a complete line of household devices, including motor-driven sewing machines, vacuum cleaners, irons, washing machines and the labor-saving electrical apparatus which American farmers are now using. A staff of expert demonstrators will make the trip and show how easily electricity may be introduced locally by means of the farm-light plants. With the introduction of local lighting plants one of China's greatest businesses in the way of study and development will be relieved. It is realized that only the wealthier classes will be able to purchase the electrical apparatus, but the great number of retainers on their estates should profit indirectly. Western Electric representatives report that since their introduction in 1917 there has been an altogether unexpected demand for electrical sewing machines and flatirons from the natives of Canton, Shanghai and the other coastal towns. Washing machines and [illegible] of the other larger types of electrical apparatus are also coming into favor.

HOLLAND INDUSTRIES FAIR. The fifth industries fair to be held in Utrecht, Holland, Sept. 6-16, 1921, will be of international character as all foreign manufactures and products will be admitted. The general secretary is at Vredenburg, Utrecht.



JOBBERS' REPRESENTATIVES CONFERENCE, NELA PARK

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A commercial agent in Italy (No. 33,747) desires to purchase and secure an agency for electric fixtures.

An importer in Holland (No. 33,753) desires to secure an agency for electrical fittings.

A firm in France (No. 33,756) desires to secure an agency for electrical equipment and motors.

A firm of electrical machinery dealers in The Netherlands (No. 33,757) desires to purchase small three-phase, 220-volt, alternating-current motors.

Trade Publications

ARC WELDING.—The Ohio Brass Company, Mansfield, Ohio, has issued a booklet covering equipment and instructions for electric arc welding.

SINGLE-PHASE CONSTANT-SPEED MOTORS.—The Advance Electric Company, St. Louis, Mo., is distributing bulletin No. 16, describing its type WS single-phase, constant-speed interchangeable, 110-volt or 220-volt motors, rated from ⅛ hp. to 7½ hp..

STORAGE BATTERIES. — The Electric Storage Battery Company, Philadelphia, has issued bulletin No. 179, to describe its new type of storage batteries for mine and industrial locomotives.

LAMP HANGERS.—The Thompson Electric Company, 226 St. Clair Avenue, Cleveland, Ohio, has issued a bulletin covering its safety disconnecting hanger for incandescent lamps.

STEEL-MILL CONTROL.—The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has issued a new illustrated booklet describing its line of steel-mill control apparatus.

FUSES. — The Efficiency Electric Company, East Palestine, Ohio, has issued a leaflet describing its line of refillable plug fuses.

ELECTRICAL SPECIALTIES. — The Anderson Electric & Equipment Company, 154 Whiting Street, Chicago, has issued a complete catalog No. 3, covering electric lighting, automotive, laboratory and dental apparatus.

FACTORY CALLING SYSTEM. — The Klaxon Company, Bloomfield, N. J., has issued a new catalog on its "Klaxocater" factory calling system.

MILL DRIVES. — The General Electric Company, Schenectady, N. Y., has issued bulletin No. 41,000 C, to supersede No. 41,000 B. It covers main roll drives for steel, copper and similar mills.

MOTORS.—The Emerson Electric Manufacturing Company, St. Louis, Mo., has issued motor price and data book No. 50.

New Incorporations

THE L. BRUN COMPANY, Cleveland, Ohio, has been incorporated by Louis Brun, Charles D. Benson, Jr., Clarence N. Gilles and M. Glore. The company is capitalized at $25,000 and proposes to manufacture and deal in all kinds of electrical fixtures and appliances.

THE GIANT BATTERY COMPANY, Commercial Bank Building, Houston, Tex., has been incorporated with a capital stock of $22,000 to manufacture storage batteries. The officers are: C. C. Rouse, president; Ralph Neuhaus, treasurer, and L. S. Holmes, manager.

THE BAILEY ELECTRIC SUPPLY COMPANY, New York City, has been chartered with a capital stock of $250,000 by H. Hammersly, H. Rothstein and L. D. Bailey, 1025 East Sixteenth Street, Brooklyn, N. Y.

THE ACKURATE RUBBER COMPANY, INC., 253 Broadway, New York, has been incorporated to manufacture insulating tapes, compounds and like specialties. Willard C. Candee is president and C. V. Ackerman secretary and treasurer.

THE SOMERVILLE (TEX.) LIGHT, WATER & ICE COMPANY has been incorporated with a capital stock of $50,000. The incorporators are Hugh Hamilton, R. W. Harlock and Paul Freeman.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

POULTNEY, VT.—The S. S. Sherman Milling Company contemplates immediate installation of equipment for electric operation of its entire plant. Electric power will be supplied by the Vermont Hydro-Electric Company.

CHELSEA, MASS.—Bids will be received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., until October 6 for alterations and additions to the lighting system at the Naval Hospital.

Middle Atlantic States

MARCY, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, until October 6 for electric generator set and underground electric service connections at the Utica State Hospital (Marcy Division).

ROOSEVELT, N. Y.—At a special meeting of the Town Board a resolution was passed providing for a change from gas to electric street lights.

TROY, N. Y.—The Ford Motor Company, Bouelvard and Woodward Street, Detroit, Mich., contemplates the erection of a power house on Green Island, to develop 6,000 hp., at a cost of $2,000,000. Stone & Webster, 120 Broadway, New York City, are engineers.

NEWARK, N. J.—The erection of a new power house and automobile service building at the chemical works of Riches-Piver & Company, 226 Hillside Avenue, Hillside, in connection with a factory extension, is contemplated. The capital stock of the company was recently increased from $125,000 to $500,000.

NEWARK, N. J. — The erection of a power plant at the works of the American Brake & Shoe Company, Avenue R, is contemplated. The cost is estimated at about $25,000.

NEWARK, N. J.—The Amalgamated Dye Stuff & Chemical Company plans to erect a new power house at its plant on Plum Point Lane.

ALLENTOWN, PA. — Bids will be received by Malcolm W. Cross, Mayor, Room 301, Central Fire and Police Station, until October 11 for furnishing and installing one 750-hp. steam turbine with reduction gears, one 12,000,000-gal. centrifugal pumping unit, one 500-hp. alternating current motor, one three-stage, 7,000,000-gal. pump, etc.

FRANKLIN, PA.—The Franklin Quality Refining Company, Atlantic Avenue and Erie Railroad Street, contemplates the erection of a power house to cost about $80,000.

JUNIATA, PA.—The McAllisterville Electric Company of McAllisterville, recently organized, has applied for state charter and permission to establish and operate an electric plant in certain districts of Juniata County.

PHILADELPHIA, PA. — The Wilkes-Barre Light Company is to be reorganized. It is planned by the new company to dispose of the present machinery at its plant and install new equipment to furnish 3,000 kw.

PHILADELPHIA, PA.—Plans are under way for the erection of a power house for the Carver File Company, 3231 Frankford Street.

RIDDLESBURG, PA. — The Broad Top Power Company, it is understood, contemplates the erection of a power plant to cost about $600,000.

BALTIMORE, MD.—It is reported that the Consolidated Gas, Electric Light & Power Company of Baltimore will soon receive bids for the construction of the first unit of its proposed power plant at Dundalk.

WASHINGTON, D. C.—Bids will be received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., until October 6 for underground electric light and power distributing system. For further information address above. (Specification 4286.)

WASHINGTON, D.C.—Bids will be received by the Bureau of Yards and Docks, Navy Department, until October 15 for the erection of a power house, 69 ft. x 81 ft., together with several other buildings, at the Bellevue Naval Experimental and Research Laboratory.

North Central States

LEBANON, IND. — The Indestructible Wheel Company contemplates the erection of a power house in connection with its proposed new plant to cost about $50,000.

NEWBURG, IND.—The county commissioners have granted a franchise to the Newburg Light & Water Company of Newburg to extend its lines to the Epworth Coal Mine.

KANSAS CITY, MO.—The Kansas City Power & Light Company is having estimates prepared, preliminary to financing additions to its plant and lines. Plans include the sinking of a condenser well and enlargement of the building proper to provide for a 20,000-kw. or possibly a 30,000-kw. turbo-generator, for which $2,500,000 will be required. An additional $2,000,000 will be required for extensions of the existing transmission systems to be made next year. J. F. Porter is president.

ST. LOUIS, MO.—The erection of an engine and power house to cost about $30,000 is contemplated by the Gerst Brothers Packing Company, 3823 Lucky Street.

KINDRED, N. D.—At a special election bonds to the amount of $15,000 were voted for the erection of an electric light plant in this city.

MAYVILLE, N. D.—The erection of a power plant in Mayville to cost about $20,000 is contemplated. Owner's name is withheld. Arthur Devor, 486 Endicott Building, St. Paul, Minn., is architect.

HIGHMORE, S. D.—The matter of making extensive improvements to the municipal electric light and power plant is under consideration by the City Council.

McCUNE, KAN.—The city officials contemplate the erection of two miles of 66,000-volt transmission lines for the municipal light plant.

OSAWATOMIE, KAN.—Plans are under way by the Black & Veatch Engineering Company, Mutual Building, Kansas City, Mo., for the erection of an addition to the municipal electric light and power plants. Improvements include the installation of a generating unit, construction of a dam, etc. Estimated cost is $85,000.

WICHITA, KAN. — Arrangements have been completed to provide electric lights and power for Goddard and Garden Plain, and permission has been granted by the board of county commissioners for the construction of high-tension lines from Wichita to the two towns.

Southern States

GAINESVILLE, FLA.—Improvements to the electric light and water plants are contemplated at a cost of about $30,000. Plans include the installation of an engine and generator, switchboard and accessories, motor-generating set, etc.

BIRMINGHAM, ALA.—The Corona Coal Company contemplates the installation of a 200-kva. rotary converter and a 100-hp. hoist, also the erection of an 8-mile, 13,000-volt transmission line. L. M. Adler is general manager.

ANDERSON, ARK.—The National Manganese Ore Company, 1069 Fletcher Build

ing, Indianapolis, Ind., contemplates the erection of a hydro-electric plant across Lafferty Creek to develop 100 hp. The cost is estimated at $60,000

EL DORADO, ARK.—Petition has been made to the City Council by S. R. Morgan & Company, Little Rock, for permission to erect an electric power line from its plant at Cargile to the El Dorado Ice & Coal Company, which is owned by Morgan interests.

BRADFORD, OKLA. — The installation of an electric light plant is contemplated. Address W. H. Hayes.

TULSA, OKLA. — The Sand Springs Light, Heat & Power Company contemplates the erection of a 10-mile high-tension transmission line from the Sand Springs power house to Tulsa. Charles Page, at Sand Springs, is president.

DALLAS, TEX.—Bids will soon be received by Herbert M. Greene Company, architect, North Texas Building, for the erection of a twelve story office building for the Security National Bank, Commonwealth Building, and an eight story addition on the existing building, to cost about $1,000,000. Plans include an individual power plant.

DICKINSON, TEX.—The installation of a lighting system in Dickinson is contemplated.

MORAN, TEX. — The Albany Light & Stone Quarry Company of Albany plans to extend its power transmission line to Moran and install a lighting system at that place. Arrangements are also being made for the erection of waterworks to cost about $90,000.

SAN ANGELO, TEX.—The San Angelo Water, Light & Power Company plans to install additional equipment at its plant at this place. Improvements to its power transmission system to Miles, Rowena, Ballinger and Winters are also contemplated.

Pacific and Mountain States

BURNS, ORE.—Louis C. Kelsey, consulting engineer, 22½ North Twentieth Street, Portland, has submitted to the City Council estimates which call for $300,000 for the erection of the proposed municipal light and water plant.

PORTLAND, ORE. — The Eastern & Western Lumber Company, foot of Twenty-first Street, North, has plans under way for the erection of a power plant to cost about $25,000

MERCED, CAL.—The construction of an electric plant on Chowchilla Road near Merced is being planned for by the San Joaquin Light & Power Corporation of Fresno at a cost of about $100,000

SACRAMENTO, CAL.—Improvements to the lighting system in the business district of Oak Park are under consideration. Carl Beaton is city electrician.

TERRA BELLA, CAL. — Plans for the purchase of electrically operated pumping machinery, motors, etc., for installation at the new wells to be established in the Terra Bella Irrigation District have been approved by the board of directors.

OGDEN, UTAH.—The Utah Power & Light Company contemplates the extension of light system to the city of Morgan.

PROVO, UTAH.—A new company, to be known as the Goshen Bay Irrigation Company, is being organized for irrigation and drainage purposes. Plans include the installation of electrically operated pumping plants and drainage systems.

ROUNDUP, MONT. — The City Council has voted to issue $56,000 in bonds for improvements including ornamental street-lighting system

DENVER, COL.—According to information received by Walter B. Lowry, manager of improvements and parks, additions to the ornamental street-lighting system, to cost about $20,000, are under consideration by business men and property owners.

Canada

GRAND FALLS, N. B. — The New Brunswick Electric Power Commission proposes to construct a large power plant at Grand Falls, in addition to the power developments at Shogomoc and Musquash. C. O. Foss of St. John is chief engineer.

VYONDA, SASK. — The Town Council contemplates the erection of an electric light plant to cost about $12,000. J. Currie is secretary and treasurer.

Miscellaneous

PANAMA.—Bids will be received at the office of the General Purchasing Officer Panama Canal, Washington, D. C., until October 12 for furnishing copper cable, conduits, switchboard cords, fuse cutouts, renewable fuses, motors, motor-generator sets, panelboards, etc. (Circular 1407.)

1,342,398. ELECTRODE FOR SEARCHLIGHTS AND METHODS OF MAKING THE SAME; Elmer A. Sperry, Brooklyn, N. Y. App. filed July 15, 1916. Core and shell baked simultaneously.

1,342,399. WIRELESS SIGNALING APPARATUS; Roy A. Weagant, Roselle, N. J. App. filed Feb. 1, 1916. For receiving, relaying or amplifying impulses.

1,342,409. STARTING AND GENERATING SYSTEM; William A. Turbayne, Niagara Falls, N. Y. App. filed April 11, 1918. Automobile storage-battery starter.

1,349,391. CONTROL SYSTEM FOR ELECTRIC FURNACES; Frank Thornton, Jr., Mansfield, Ohio. App. filed March 19, 1919. Changes transformer taps.

1,349,400. BELL-RINGING MECHANISM; Herman A. Wende, Buffalo, N. Y. App. filed June 22, 1914. For operating chimes

1,349,405. ELECTRIC-TRAIN WIRE COUPLING; Thomas R. Brown, Sparkill, N. Y. App. filed March 6, 1917. Rotary motion produced for cleaning contacts.

1,349,483. LAMP FIXTURE; Frank Yokel, Pittsburgh, Pa. App. filed Feb. 19, 1917. Simple design.

1,352,408. COMMUTATOR BRUSH; William C. Hood, Chicago, Ill. App. filed Oct. 28, 1918. Has wiping action across commutator.

(Issued Sept. 21, 1920)

11,950 (reissue). ELECTRICAL SWITCH DEVICE; William F. Hessel, New York, N. Y. App. filed March 11, 1919. Plug for extension lights.

1,353,115. DEVICE FOR VARYING ELECTRICAL COUPLING; Lewis M. Clement, Newark, N. J. App. filed June 20, 1918. Radio.

1,353,154. BATTERY-PLATE SUPPORT; Edward M. Duffey, Kansas City, Mo. App. filed April 12, 1920. For securely attaching plate.

1,353,185. ELECTRICAL SWITCHING SYSTEM; William M. Scott, Tredyffrin Township, Chester County, Pa. App. filed Sept. 6, 1918. Electrolytic.

1,353,194. ELECTROLYTIC APPARATUS; Cecil M. Walter, Four Oaks, Birmingham, England. App. filed June 12, 1919. For treatment of tinned articles.

1,353,257. ELECTRIC COMBINATION LOCK; Adolph Z. Mample, St. Paul, Minn. App. filed Aug. 29, 1919. For automobiles, etc.

1,353,269. WINDING MACHINE; Philip F. Rhoades, New York, N. Y. App. filed May 3, 1919. For coil winding.

1,353,300. SEMI-AUTOMATIC TELEPHONE SYSTEM; George A. Yanochowski, Chicago, Ill. App. filed July 25, 1917. Improvements.

Record of Electrical Patents

Notes on United States Patents

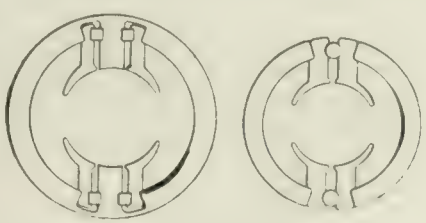
1,353,319. ELECTRIC REGULATION; John L. Creveling, White Plains, New York. App. filed Nov. 1, 1916. To regulate generator automatically.

1,353,332. FILLING APPARATUS FOR ELECTROLYTIC CELLS; Joseph H. Fischer, Milwaukee, Wis. App. filed Dec. 8, 1919. For producing oxygen.

1,353,348. PORTABLE HAND LAMP; Harry M. Koretzky, Brooklyn, N. Y. App. filed June 18, 1919. New reflector and socket.

1,353,401. CONTROLLING MEANS FOR ELECTROMAGNETIC FEED-REEL BRAKES; Henry V. James, Radlett, England. App. filed Aug. 13. 1918. For printing presses, etc.

1,353,410. SUBMARINE DETECTOR; George M. Marshall, Lake Francis, Manitoba, Canada. App. filed Jan. 3, 1918. Audible or visible signal.



No. 1,353,658. Dynamo-Electric Machine

1,353,433. MULTI-SOCKET SWITCH; Raymond D. Smith, Boston, Mass. App. filed Oct. 27, 1916. Accommodates plurality of plugs.

1,353,464. TELEGRAPH REPEATING SYSTEM; Augustus J. Eaves, New York, N. Y. App. filed Nov. 12, 1919. Half-duplex methods.

1,353,471. ELECTRIC IRON; Joseph A. Guyer, Marion, Ind. App. filed March 24, 1919. Readily taken apart

1,353,517. IMPULSE-CONTROLLING SYSTEM; Henry P. Clausen, Mount Vernon, N. Y. App. filed Aug. 19, 1918. Automatic telephone.

1,353,566. SAFETY SPARK GAP FOR MAGNETOS; Alfred C. De Lorme, East Orange, N. J. App. filed Dec. 1, 1916. Adjustable.

1,353,597. SPARK PLUG; Donald W. Lang, and Arthur D. Vaughn, Eldred, Pa. App. filed May 19, 1919. Adjustable gap.

1,353,601. TELEPHONE SYSTEM; James L. McQuarrie, Montclair, N. J. App. filed Dec. 27, 1918. Automatic.

1,353,612. TELEPHONE-EXCHANGE SYSTEM; Frank N. Reeves, Newark, N. J. App. filed Sept. 30, 1918. Automatic.

1,353,637. REPEATER CIRCUIT; George Crisson, Hoboken, N. J. App. filed Dec. 23, 1918. For telephones.

1,353,657. SPARK-PLUG INTENSIFIER; Richard E. Hildebrans, Chicago, Ill. App. filed Jan. 29, 1917. Auxiliary gap.

1,353,658. DYNAMO-ELECTRIC MACHINE; Jaroslaw K. Kostko, St. Louis, Mo. App. filed Dec. 18, 1916. Laminated yoke and poles.

1,353,665. TEMPERATURE CONTROLLER; Albert N. Otis, Schenectady, N. Y. App. filed July 18, 1918. For melting pots.

1,353,673. AUTOMATIC TELEPHONE SYSTEM; Henry Symes, Dunedin, New Zealand. App. filed Nov. 9, 1916. Coin and subscriber system.

1,353,684. WELDING MACHINE; Robert E. Wagner and Wesley E. Laird, Pittsfield, Mass. App. filed April 9, 1919. Has long stroke.

1,353,690. ELECTRIC PLUG; Arthur Agnew, West Somerville, Mass. App. filed Nov. 3, 1919. Non-screwing.

1,353,691. VOLTAGE REGULATOR FOR ALTERNATING-CURRENT GENERATORS; Fred H. Winter, Schenectady, N. Y. App. filed March 1, 1919. To deliver current at different frequencies to induction motors.

1,353,693. MAGNETIC DEFLECTOR FOR ELECTRIC ARCS IN LAMPS, SEARCHLIGHTS AND THE LIKE; John P. Yorke, Westminster, London, England. App. filed June 25, 1918. Maintains arc position.

1,353,698. COMBINED CARRIER AND RADIO SYSTEM; Herman A. Affel, Brooklyn, N. Y. App. filed Sept. 30, 1919. Plurality of signals simultaneously transmitted.

1,353,711. ELECTRIC WELDING AND REACTOR; Sven R. Bergman, Nahant, Mass. App. filed June 25, 1920. Adjustable current.

1,353,735. ANTENNA STRUCTURE; Lloyd Espenschield, Hollis, N. Y. App. filed Sept. 26, 1919. Broad band filter.

Directory of Electrical Associations

Printed in the First Issue of Each Month

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Brooklyn Edison Coal Case

AN INDICTMENT for conspiracy and violation of the Lever act has been found by the federal grand jury against the Brooklyn Edison Company and some of its executives. The company is charged with making improper use of its permits for priority deliveries of coal and with knowingly paying excessive rates for coal, which it is said to be hoarding. We have no desire to prejudge the case or to detract from the seriousness of the charge. The good name of a public utility and the integrity of men of high standing in the industry are called into question, and it is only fair that judgment be held in abeyance until the court has passed on the case. Formidable as every legal document appears, the probabilities are that the charges when sifted will be found to be groundless so far as the company and its officials are concerned.

Present-Day Profits

IN FACING demands for readjustment downward every manufacturer is forced to analyze anew his cost of production. Those who have profited by the unusual conditions brought about by the war must be content with a fair return and increase their turnover, while those who have suffered by unusual increases in the cost of materials and labor with a restricted output must be allowed to build back to the previous basis of profit. This means that prices in some lines will decrease and those in others increase until the distribution of labor and materials has righted itself under the law of supply and demand. Every electrical manufacturer, every wholesaler and every other agency associated with the production and distribution of products used by the electrical industry is placed on the defensive in the analysis of profits. Every executive, therefore, must do two things: Sharpen his pencil and refigure his costs on an economic basis, then resell to his customers on his existing price schedule or a changed price schedule in the light of legitimate manufacturing costs and legitimate profits. If every manufacturer in his marketing plans will make this a definite part of his program, the price adjustments in industry will be gradual and the individual manufacturer's position will be strengthened.

Future Public Utility Executives

EVEN though other industries offer higher initial remuneration to men who have just been graduated from technical schools, they will do well to consider the possibilities of the future in public utility work. When this country entered the world war the influx of technically trained men to this field practically ceased, and since then other industries have been able to offer such large salaries that the central stations have not been able to compete successfully for their share of the annual crop of engineering graduates. The public utility companies have been able to get along so far with the aid of the older technical men in their organizations, but this situation cannot continue for a long period, since it is from this group of employees that the future executive must be recruited. Consequently the central-station industry offers an attractive starting ground for young technically trained men, with the opportunities better now than next year, just as they should be better next year than the year following.

Civil Engineers Would Block Federation

THE civil engineers have submitted the question of joining the Federation of American Engineering Societies to their membership by letter ballot. Accompanying the ballot are two letters, one for and the other against joining the federation. The former is a conservative, sane and safe declaration. In the latter the claim is made that because the federation is not perfected the new body can never function properly. The real objection of the A. S. C. E., however, is to be found in this statement: "Should the society join the federation, it would, in the estimation of the public, cease to function as the leading engineering organization, as it has done for sixty-eight years." The reasoning sounds familiar. We recall when the Engineering Societies Building was erected and the Engineering Foundation formed that the same objection was raised. The civil engineers would not join because they had a home of their own and they were afraid of losing their identity. When later it was found that aloofness brought isolation they applied for admission. Who, then, are leaders? Those who do things, those who build! Leadership connotes action, not reaction, and those who would aspire to it must be constructive. The federation to be of value must include all engineers and the "civils" must do their part to make it an effective organization.

Principles of Sound Utility Financing

TWO opposite motives rend the breast of the average citizen when he has money in large or small amounts to invest—the gambler's impulse, so hardly suppressed by frail humanity, to strike for large profits at whatever risk and the prudent man's desire for an assured return on a stable property. Few electric utility managers, we think, could be found to dispute the assertion made by H. M. Addinsell, in the paper on "Central-Station Financing," part of which we print this week, that the day of possible large speculative profits in the securities of public service companies is past. It departed with the nation-wide acceptance of the principle of regulation by public service commis-

sions. With its departure the way was cleared for universal recognition of the facts on which Mr. Addinsell lays stress—that these companies are, in his own words, "an indispensable and permanent part of the economic structure of the communities they serve," and that their stock and bonds partake and will increasingly partake of the nature of quasi-municipal securities. As such it is self-evident that public utility issues offer a particularly attractive investment to the small buyer, always provided that they give a rate of return enough higher than that borne by national, state and municipal bonds to place them, from his point of view, firmly on the middle ground between government securities with their low interest and those of corporations engaged in private and competitive enterprises with their uncertain features. Mr. Addinsell, who speaks as an investment banker, points out that it is on this class of buyers, in addition to their own customers and neighbors, that public utilities now depend; he explains why this fact makes necessary in mortgage bonds certain limiting clauses seemingly uncalled for; he dwells on the difference between the old form of sinking fund and the new, and he makes a conservative statement concerning the proper ratio of debt to capitalization and of earnings to bond interest, placing both at two to one. His paper deserves the careful attention of central-station executives.

Illumination Design Involves More than Geometry

THE foot-candle meter has put in the hands of the engineer a most convenient and satisfactory method for checking results in illumination. No one who has not used the instrument can half appreciate the facility with which approximate results may be reached. In the current issue Messrs. Samuels and von Dannenberg give the results of a study of illumination design in which the foot-candle meter measurements play a somewhat unusual part.

The particularly interesting feature of the study is in the treatment of semi-indirect and indirect lighting where the equivalent foot-candle curve for a single fixture is obtained photometrically with the fixture *in situ* and the results then applied in the same general way as if the case were one of direct illumination. One can even go further and obtain an equivalent polar curve by the same method. The author's general method of design is that of point-by-point integration simplified by tables. To those accustomed to work in terms of light flux the method may not appeal, but as a check on very approximate calculation the method explained may often prove valuable. If any one prefers working from curves rather than from tables, curves can be found in our issue of June 19, 1920, covering substantially the same ground.

It would be exceedingly interesting for the illuminating engineer to take some typical installation, compute the illumination by several of the methods in common use, and finally to compare results with the photometric measurements within the area illuminated. The result, however, might not be altogether conclusive, since as a matter of fact the geometry of the illumination is so small a factor in the substantial application of the art. It takes the facility of the slide rule plus the wisdom of the serpent to lay out a thoroughly successful system under any conditions other than the most conventional. Physiology and psychology play their parts in the problem to an extent that the tyro fails to grasp and which frequently puzzles the adept. Questions of shadow, of direction and of relative brilliancy of surfaces are sometimes so important as to overshadow most other considerations, and after these are judiciously dealt with there still remains what our psychological friends call the "affective" factors, which now and then prove to be dominant. The mere question of tint is far from negligible, quite aside from theorizing as to the coefficients of reflection, and in anything except the baldest kind of industrial lighting illumination as an art overshadows illumination as a science.

Boiler-Room Instruments Essential to Economy

AS THE art of developing electric power has progressed the necessity of tracing the energy through to the busbars has been more and more appreciated as a check on efficient operation. The thoroughness with which all the transformations and losses of energy can be watched today is put well in evidence by papers like that of R. E. Dillon, which was published Sept. 25, setting forth the apparatus which is actually in advantageous use. The bigger the station the larger the amount at stake and the bigger the investment justified in auxiliary testing apparatus. To generalize the whole problem for the benefit of all classes of stations, big and little, one must begin to classify things according to their relative importance from a dollars-and-cents standpoint.

First of all, it is absolutely necessary to keep track of the coal put into and the energy taken out of the plant. The integrating watt-hour meter and the coal scales may therefore be regarded as imperative requirements. Of these the coal scales are the more often neglected. It is not necessary that the weighing apparatus should be continuous and automatic, but it is of the utmost value that the amount of coal per hour as well as per day should be estimated with considerable accuracy.

To obtain the largest number of kilowatt-hours per B.t.u. it is essential to study the losses along the route from the coal pile to the busbars. In this analysis the facilities for studying the efficiencies of conversion of coal energy to steam energy have too long been neglected, but it is encouraging to see a tendency toward the use of more measuring devices in the boiler room. The fundamental factor required is the evaporation of the boiler reduced to standard conditions per pound of coal fired reduced to combustible. This figure establishes the gross boiler efficiency. The steam meter should be combined with measurements of steam temperature, and the water measure of course with its own measure of temperature. Any failure of proper evaporation means trouble with furnace or boiler. The flue-gas temperature and the CO_2 recorder help to locate the cause. When the combustion is good as indicated by the latter, the former gives some very suggestive information as to condition of the boiler surfaces. It is unfortunate, however, that the continuous CO_2 recorder, which furnishes very valuable information, is, generally speaking, a somewhat delicate piece of apparatus and none too responsive to changes, resulting from rapidly changing firing conditions.

Such in the rough are the data up to the prime mover. Then one can start back from the generator,

in which the losses, being small, can be estimated very closely, and detect any failure of the prime mover to utilize its steam properly. At this point come the measurements on the condensing equipment. All these data can be obtained in a large plant without great difficulty or forbidding expense.

Utility Rates and the Bonus System

APPLICATION of the fundamental principles of the bonus system to the rates for the service rendered by a public utility is as logical in its conception as is their application to the pay of a riveter. A riveter of ordinary skill and ordinary health is thought to be worth a definite wage at the start, but if he climbs above the ordinary level by increasing his skill and carefully looking after his health, so that he can work more quickly and energetically, he is rightly entitled to proportionately increased pay. He knows this when he starts the week's work, and on pay day his efficiency has been calculated and he receives his pay without argument. His employer is satisfied, for although he has paid more total wages in the period, he has obtained service in full measure and he has made more money.

Few public utilities are rewarded adequately for more than ordinary efficiency, yet what is more reasonable than that a set basis be arrived at upon which they shall receive ordinary returns and that, exceeding this, they shall be rewarded in proportion? At present they do not know with any degree of certainty whether it will be reward or penalty that any twelve-month period will bring. If a highly efficient service is rendered because of the foresight of their managements and the skill of their workers, they have no positive knowledge that there will be sufficient revenue to pay the wages that such foresight and skill demand elsewhere. And if they do show such a revenue and something over, experience has shown that more often than not the entire additional pay is returned to their employer—the public. Electric service is a modern institution and its control and regulation must become modern. The utilities and the public are entitled to know in advance what the rewards for efficiency or the penalties for carelessness will be.

Efficient Use of Oil Fuel

THAT the use of fuel oil promotes boiler and furnace efficiency when skillfully carried out is pretty well established, but the exemplification made in the article beginning on page 730 is a particularly encouraging one from the practical standpoint. In the plant referred to the proper relation between oil and air pressures—the two variables in operation—was determined for the whole range of capacity by analysis of combustion gases. With these facts as guide no difficulty was experienced in maintaining complete and smokeless combustion, and it proved possible to hold the boilers up to nearly 300 per cent of their nominal rating while still maintaining extremely high efficiency. In fact, the efficiency was held above 80 per cent from normal load up to 293 per cent of the rating, a very extraordinary figure for a boiler and furnace working under even the most favorable conditions. The tables of performance given show the details of the situation and how extraordinarily good was the combustion.

No correction is observed for the energy required to heat the oil to the 230 deg. Fahr. at which it reaches the boilers, or for that necessary to work the pressure pumps which feed the oil to the burners. This, of course, is not a factor of the boiler efficiency as such, any more than is the power required to work the ordinary auxiliaries, but it is a net loss which has to be evaluated in considering the economic results.

One interesting fact brought out in the tests was that the absorption of heat by the boiler was altogether too complete to obtain superheat with the superheater arrangement originally designed for coal-burning conditions. Obviously the moral is that in order to get adequate superheating in passing to oil fuel one must plan accordingly. The new burners seem to have made possible a distinguished success in the intensive and most thorough combustion obtained through their agency, and the result should give encouragement to the use of oil in other plants where forcing boilers becomes necessary and where oil can be obtained at a reasonable figure. However, these results should not be considered justification for widespread substitutions for coal.

Community Has Prior Rights on Highways

STRICT enforcement of rights derived from prior occupation of highways as between public utilities may result in actual detriment to the community. This is a thought that those engaged in solving the problems developed by the use of the highways by utilities must keep in mind. Highways exist for public convenience, and public needs have always dictated the manner of their use. It is not many years since restrictions that now appear absurd were placed on the use of highways by automobiles because the horse-drawn vehicle was dominant. Today the restrictions that exist are designed to maintain the most advantageous use of highways by all kinds of conveyances. That horse-drawn vehicles have superior because prior rights no sensible man would maintain, since to apply such a rule would result in serious injury to the community.

The same principle that has governed the development of vehicular use applies to the use made by public utilities. The question at issue between utilities is not one as to the rights of two parties but one concerning the rights of three parties, the third party having provided the highway for its own convenience and not for the convenience of individuals. In any question of priority of rights on highways the public alone holds priority, and the rights of utilities will hold only so far as they do not prove detrimental to public interest. An interesting example of the manner in which this principle works out is the existing tendency observable where rural distribution lines are being demanded. The tendency in the past has been to penalize distribution lines for interference with ground-return telephone circuits.

With the constantly growing realization of the value of central-station service has come the realization that such penalization is a bar to obtaining the desired service. The result is the collapse of attempts to protect obsolete telephone practice at the expense of another utility. The interested public has discovered that its prior rights demand a better treatment of the problem.



James Gilbert White

An engineer of international reputation who early recognized the commercial possibilities of electricity and who has developed a great organization to finance, to build and to operate

THIRTY years or more ago, when the commercial use of electricity was in its infancy, it required unusual courage for engineers to try out new ideas, but those who dared and were successful have been well rewarded. Among these is J. G. White. His wide vision, added to his natural ability as an organizer and builder, has made for him an enviable position in the field of public utilities. When the electric street railway was being urged as the successor to the horse-drawn car Mr. White was one of its most active supporters. In 1895 he built the road which was to set the standard for modern interurban electric traction systems. This was a high-speed line from Buffalo to Niagara Falls, and so far as can be learned it was the first to use the four-motor equipment with series-multiple control. To him is given the credit for demonstrating in a practical installation the effectiveness of the three-wire principle with 220 volts on each side. This successful demonstration was made early in his career at Kearney, Neb.

It was really the Buffalo-Niagara Falls installation, which included the building of a transmission line with what was then a record capacity—5,000 hp.—that brought Mr. White into engineering prominence. Since then commissions have come to him from every part of the world. A compilation of the projects with which he or his company have been associated includes thirty-one hydro-electric developments and fifty-five steam-power plants with a combined ultimate capacity of 1,060,915 hp., seventy-one traction systems having a total mileage of 1,768, twenty-four transmission systems with a total mileage of 1,399, besides much other work.

Mr. White was born Aug. 29, 1861, at Milroy Pa., and at the age of twenty was graduated in the arts course from the Pennsylvania State College. He then took up engineering at Lehigh and later at Cornell, from which institution in 1885 he received the degree of doctor of philosophy, having specialized in electricity. During the next two years he was instructor in physics in the University of Nebraska, and in 1887 with others joined in organizing the Western Engineering Company, which three years later was sold to the Edison-United Manufacturing Company, with which he was associated for a short time. He resigned to develop an engineering business under his own name. This business has expanded into one of international scope and includes a utility management division and an engineering division, each now conducted by a separate subsidiary corporation. This success of Mr. White in public utility management and operation probably is due more than anything else to two qualities not often manifest in the same individual, his financial ability and his constant recognition of the necessity for having and holding the public good will.

Designing Direct and Indirect Illumination

(Copyrighted, 1920)

Practical Method of Determining Illumination in a Given Plane for Either Direct or Indirect Fixtures and an Original Scheme of Calculating Foot-Candle in One Horizontal Plane from Values Obtained in Another

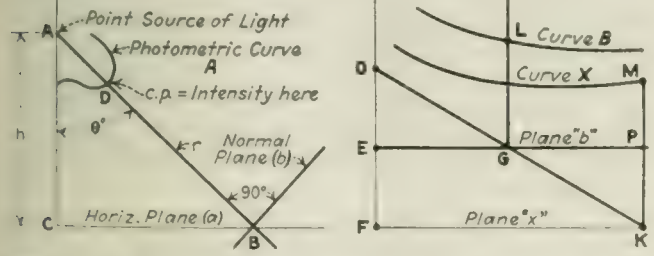
By M. M. SAMUELS and C. O. von DANNENBERG
Electrical Division J. G. White Engineering Corporation

SINCE the introduction of the foot-candle meter means have been placed in the layman's hands whereby he can easily check a lighting installation as to its distribution and efficiency. Therefore it is no longer sufficient for the lighting engineer to determine the types and spacings of fixtures for a particular installation by rough assumptions and practical guesses.

While the problem of predetermination is comparatively simple where direct reflectors are used, it becomes intricate and very difficult for indirect or semi-indirect fixtures. Even with direct reflectors, however, accurate methods are not yet sufficiently used and some of the practical short cuts which simplify the problem and save a great deal of tedious and monotonous detail figuring are not appreciated. Short cuts developed by the authors are therefore outlined here and some new practical methods are suggested which the authors have worked out for the predetermination of indirect or semi-indirect illumination.

The well-known fundamental law upon which all lighting estimates and measurements are based will be briefly stated as an introduction to the subject. In Fig. 1 *A* represents a point source of light. If on a light beam *AB* at an angle θ to the perpendicular at a distance of one foot from light point *A* the photometer reads *cp.* candlepower, then the illumination on a plane *b* which is perpendicular to the beam *AB* at a point *B* where the beam strikes the plane *b* is $cp./(AB)^2$ foot-candles. If the distance *AB* is termed *r*, then the illuminations on plane *b* at point *B* is $cp./r^2$.

On the horizontal plane *a* the illumination at the same point *B* is then $(cp./r^2)\cos\theta = (cp.\cos^3\theta)h^2$, where *h* is vertical distance from light point *A* to plane *a*. The term $(\cos^3\theta)h^2$ is commonly known as the "multiplier," and its values for all horizontal and vertical distances within practical working limits have been worked up in the form of tables which may be found in "Railway



FIGS. 1 AND 2 — METHOD OF DEVELOPING FOOT-CANDLE CURVE FOR A CERTAIN PLANE FROM THAT FOR ANOTHER

Illumination on plane *b* at *B* equals $cp./r^2$; on plane *a* at *B* it is $(cp.\cos^3\theta) \div r^2$.

Electrical Engineers' Handbook," by C. W. Bender, as well as in the bulletins of the engineering department of the National Lamp Works of the General Electric Company. The angles for various horizontal and vertical distances may be found in the same sources. I. W. Gross has replaced these tables by curves which serve the same purpose. (See ELECTRICAL WORLD, June, 19, 1920.) The experience of the writers, however, is that the tables are much handier than the curves.

For non-transparent metal reflectors the manufacturers generally furnish "real" polar curves, which are determined in the laboratory by photometer readings

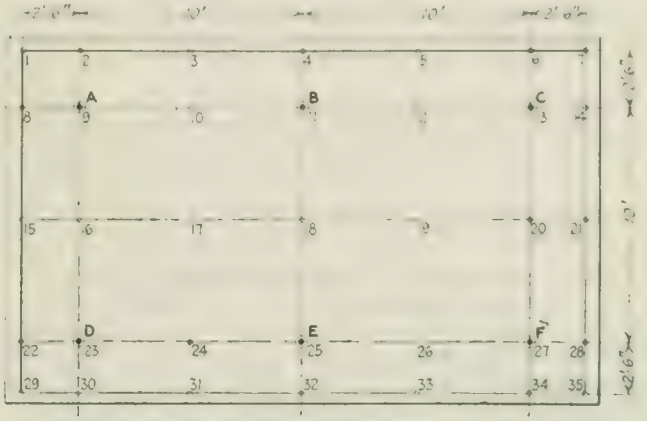


FIG. 3—TYPICAL DISTRIBUTION OF FIXTURES IN A ROOM

and which give the candlepowers for the particular shade and a particular size of lamp as a function of the angles which the particular light beams form with the vertical. The candlepower values given in these polar curves (curves *A* in Figs. 1 and 4), having been derived by actual photometric measurements, may be considered as equivalent to integrations over the full surface of the reflector and are used as if the light, instead of coming to each point from all points on the reflecting surface, actually came from a point source which is located approximately in the center of the lamp filament and which may be called for practical purposes the focus of the fixture.

USUAL PROCEDURE FOR DIRECT REFLECTORS

If a design is required for an illumination by direct reflectors, the procedure is as follows: A certain type of reflector with a given polar curve is assumed. The experienced illuminating engineer will easily select by experience the reflector which will approximately meet his requirements. A certain spacing of the fixtures as well as a suitable elevation is next assumed, also by experience. Then a certain number of points (1, 2, 3, etc., in Fig. 3) are selected for the purpose of determining the illumination.

In order to determine the illumination, for instance, at a point 1 in Fig. 3, the horizontal and vertical focal distance must be measured from point 1 to fixture *A*. For each horizontal and vertical distance the angle θ is found from the appropriate table or curves. For this particular angle θ, the candlepower value (cp.) is taken from the polar curve "*A*" in Fig. 1 or Fig. 4 and multiplied by the multiplier, which may be obtained from the tables or curves, the product giving the illumination in foot-candles at point 1 on the particular horizontal plane illuminated from fixture *A* only and assuming that all

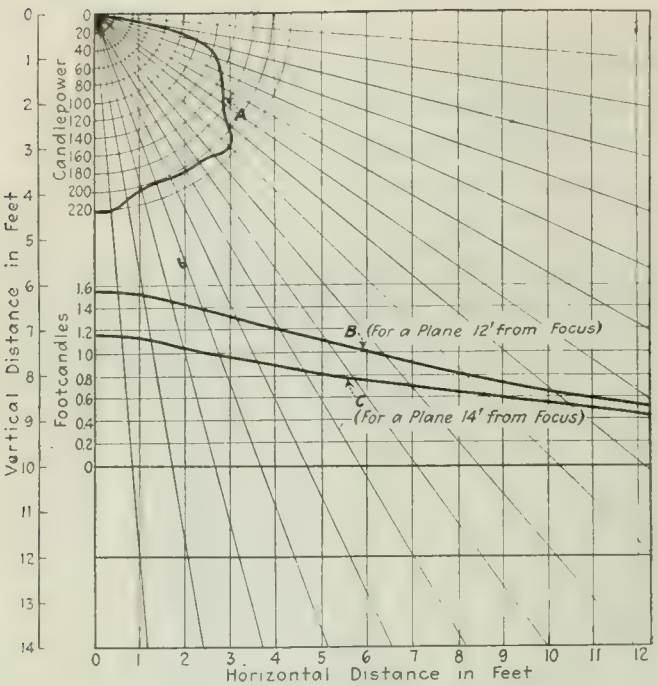


FIG. 4—FOOT-CANDLE CURVES FOR DIFFERENT PLANES DEVELOPED FOR A SPECIFIC DIRECT REFLECTOR

other fixtures *B*, *C*, *D*, etc., are not working. Then the same procedure is repeated for point 1 with every one of the other fixtures, *B*, *C*, *D*, etc., thus obtaining the foot-candles at 1 for each of the fixtures when all other fixtures are not working. The addition of all these foot-candle values gives the actual total foot-candles at point 1 when all fixtures are working at the same time.

The same procedure must be repeated for all other points 2, 3, 4, 5, etc. The more points used the more accurate is the analysis.

The procedure which is generally used by those engineers who desire to estimate illumination correctly is very tiresome and can be considerably simplified by the method which follows:

SIMPLIFYING CALCULATIONS FOR DIRECT FIXTURES

In the majority of cases all fixtures in a room will be of the same type and will be suspended at the same vertical distance from the plane of illumination. Table I may, therefore, be calculated for the particular fixture for various horizontal distances from the fixture and the given vertical distance from same. Curve *C* in Fig. 4 may then be plotted, and the foot-candle values for each point from each fixture in foot-candles can then be taken from this curve by simply reading the foot-candle values for the respective horizontal distances. This curve *C* can be kept on file and used in the future at any time when the same fixture is used at the same elevation, even though the spacing may be different, without the necessity of any tables or calculations.

TABLE I—VERTICAL DISTANCE FROM PLANE OF ILLUMINATION 12 FT.

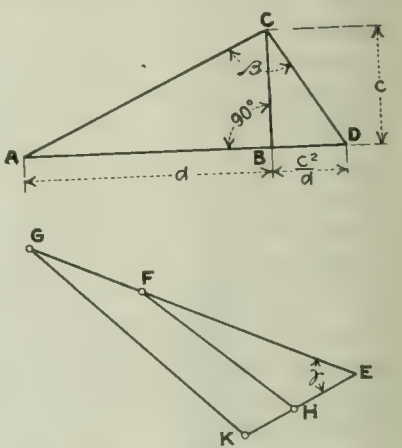
X—From Bender's tables; Y—From Bender's tables; Z—from curve *A*; W—Y Z. foot-candles.

Horizontal Distances	X Angle	Y Multiplier	Z Cp	W F C
0	0	0 00694	224	1 55
1	4° 46′	0 00687	222	1 53
2	9° 28′	0 00668	216	1 44
3	14° 2′	0 00634	206	1 31
4	18° 26′	0 00593	204	1 21
5	22° 37′	0 00546	204	1 11
6	26° 34′	0 00497	204	1 01
7	30° 15′	0 00448	204	0 92
8	33° 42′	0 00400	204	0 82
9	36° 52′	0 00356	206	0 73
10	39° 48′	0 00315	209	0 66
11	42° 31′	0 00278	213	0 59
12	45° 0′	0 00246	214	0 53

A graphic method for plotting curve *C* from curve *A* was developed by Dr. Robert Böker (see *Elektrotechnische Zeitschrift*, Jan. 8, 1920, page 25.) This method might be used should no tables be available, but its application is extremely tedious as well as cumbersome, and its practical utility is doubtful when the N. E. L. A. tables are available.

But even for cases when the same fixture is used at a new elevation the authors have devised a method to obtain curves for any elevation if a curve is already available for a given elevation.

In Fig. 2 let *B* be a curve already developed for a certain fixture for a horizontal plane *b*, having a vertical distance *OE* from focus *O*; it is desired to develop a similar curve *X* for another plane *x* having a vertical distance *OF* from focus *O*. On any radius *OK* let *OG* = *c* in feet and *OK* = *d* in feet. Furthermore, let *GL* = *a* = foot-candles at point *G* on plane *b* and *PM* = *x* = foot-candles at point *K* on plane *x*; then $x = (c^2/d^2)\ a$.



FIGS. 5 AND 6—GRAPHIC METHOD FOR CONSTRUCTING FOOT-CANDLE CURVES FOR DIFFERENT PLANES

Thus a number of radii may be drawn from *O*, the values *d*, *c* and *a* scaled, and thus the values *x* calculated and curve *X* plotted.

In Fig. 4 curve *B* was plotted by first calculating the values in Table I. Curve *C* was then developed from curve *B* by applying the method just described. Particular attention must be called to the fact that the relation between curves *B* and *X* (Fig. 2) given above is for the same light beam and not for the same horizontal distance from the fixture. Thus the value *x* = *PM* is developed for a horizontal distance *FK* from the value *a* = *GL*, which is for a horizontal distance *EG*, for the reason that both points *G* and *K* are on the same light beam and only for a horizontal distance of *O* is the light beam in the perpendicular (*OE* and *OF*).

Curve *X* has also been derived from curve *B* graphically, without any calculation whatever, by Ford Kurtz of the J. G. White Engineering Corporation.

Referring to Fig. 2, and letting *c* = *OK* and *d* = *OG*, it will be noted that

$$a : x = 1/c^2 : 1/d^2$$

or $$x/a = c^2/d^2 = (c^2/d)\ (1/d)$$

or $$(x/c^2)/d = a/d.$$

In Fig. 5 make *AB* = *d*, then draw the perpendicular *BC*, making *ABC* = 90 deg. and *BC* = *c*. Then connect *A* with *C* and erect at *C* a perpendicular on *AC*, making β = 90 deg.; then $BD = c^2/d$.

Then draw any angle (γ in Fig. 6), and make *EF* = *d* and *FG* = *a*. Then make $EH = c^2/d$, taken from Fig. 5. Connect *F* with *H* and draw a line through *G* parallel to *FH* and intersecting continuation of *EH* at *K*. Then *HK* = *x*.

From curves *C* and *B* in Fig. 4 it is easy to work up

Table II, giving total foot-candles for each of the points 1, 2, 3, etc., with all fixtures *A*, *B*, *C*, *D*, etc., working in a room shown in Fig. 2. In the particular case illustrated the values are given for two different planes of illumination, one 12 ft. (3.6 m.) below the focus of the fixture, derived from curve *B*, and the other 14 ft. (4.2 m.) below the focus of the fixture, derived from curve *C* (Fig. 4).

With the values obtained from Table II, it is now possible to plot curves giving the actual distribution of illumination throughout the room on a horizontal plane. Such curves are given in Fig. 8. For some purposes this distribution would be sufficiently satisfactory, whereas for other purposes it would not be uniform enough. It will easily be seen that even though the fixtures are pretty close to the walls the illumination drops off considerably along the wall. Actually the illumination is somewhat more uniform than the curves indicate owing to the reflection of ceilings, walls, etc. If, therefore, a more uniform distribution should be required, it would be necessary either to select a different type of reflector or to install bracket fixtures along the wall to make the necessary corrections in the curves.

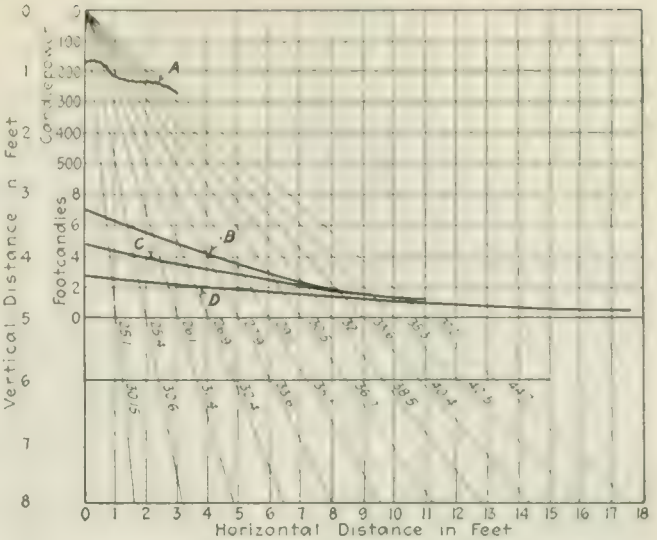


FIG. 8—FOOT-CANDLE CURVES FOR SEMI-INDIRECT FIXTURE

Curve *B* was determined by foot-candle meter readings and curves *A*, *C* and *D* by the authors' method. Curve *A* is referred to as "fictitious polar curve," curves *B*, *C* and *D* are for focal distances of 5, 6 and 7 ft. respectively.

How Method Is Applied to Indirect and Semi-Indirect Reflectors

The above methods cannot be applied directly to indirect or semi-indirect fixtures. Polar curves are generally not furnished for totally indirect fixtures, and even if they were furnished, it would only be possible to use them for the purpose of predetermining the illumination on the ceiling, which in most cases is of very little interest, and it would not be possible to use them for the purpose of predetermining the illumination on a working plane, such as desk plane or lathe plane. For semi-indirect fixtures two polar curves would have to be given, and it would be very difficult even to predetermine the illumination on the ceiling. The fixtures being inverted, the real polar curve which can be obtained by laboratory measurement would naturally also be inverted and would be of no practical use. For this type of illumination it is necessary to obtain by direct measurement the foot-candle curve, similar to curves "*B*" and "*C*" in Fig. 5. Fortunately this has been made possible by the foot-candle meter. It is only necessary to install a single fixture and measure the foot-candles directly at different horizontal distances from the focus but keeping the foot-candle meter at all times on the same horizontal plane.

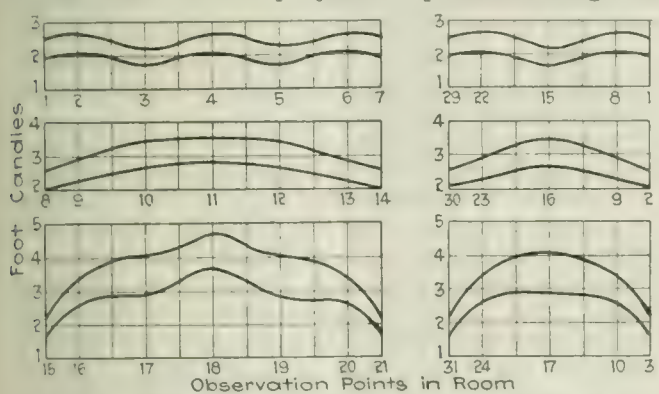


FIG. 7—DISTRIBUTION CURVES DEVELOPED FROM TABLE II

Upper curve of each pair is for plane 12 ft. below lamp, while lower curve is for 14 ft.

But whereas the polar curve for a direct fixture is universal and is independent of the manner in which the fixture is suspended or of the characteristics of the ceiling, the directly determined foot-candle curve for indirect or semi-direct fixtures is applicable only to the particular conditions under which the values were measured which were used to make up the curve.

But for the same ceiling conditions and the same suspension of the fixture the method suggested by the authors and described above can be employed to advantage. If a curve has been determined experimentally for a certain plane of illumination, it is not necessary to make any further tests in order to obtain foot-candle curves for any other planes. The curves for the other planes can be derived from the foot-candle curve determined by experiment by means of the semi-graphic or totally graphic methods described above. Thus curve *B* in Fig 8 was determined by direct reading with the foot-candle meter, for an I. P. Frink fixture No. 551, which is of the semi-indirect type. The focus of the fixture was approximately 24 in. (61 cm.) from the ceiling, and the foot-candle meter

TABLE II—FOOT-CANDLE DATA FOR ROOM SHOWN IN FIG. 3, USING FIXTURE DISTRIBUTION CURVE SHOWN IN FIG. 4

D—Horizontal distance (approximate) of respective points 1, 2, 3, etc., from fixture *A*, *B*, *C*, etc. F_1—Foot-candles at respective points 1, 2, 3, etc., from respective fixtures *A*, *B*, *C*, etc., using curve *B* in Fig. 4. F_2—Same using curve *C* in Fig. 4.

At Points	1			2			3			4			8			9			10			11			15			16		
From Fixtures	D	F_1	F_2	D	F_1	F_2	D	F_1	F_2	D	F_1	F_2	D	F_1	F_2	D	F_1	F_2	D	F_1	F_2	D	F_1	F_2	D	F_1	F_2	D	F_1	F_2
A	3 5	1 3	0 94	2 5	1 3	8 1	0	5 6	1 0	6 0	7 8	10 5	0.6	4 0.5	3	2.5	1.3	8 1 0		1 5	4 1	13	5	1.1	2 0	82	10	0	6 6	0 56	5 6	1 0	0 78	5	1.1	2 0	82
B	12 6	0	6 0	5	10 5	0	6 3	0 53	5 6	1.0	6 0	78	2.5	1.3	8 1.0		12.5	0.6	0.5	10	0.6	6 0	56	5	1.1	2 0	82		1 5	4 1	13	13.5	...		11	0.6	0.5	
C	23				20					15 0	...		10.5	0.6	4 0	53	23			20			15				10	0	6 6	0 56	23			20	6			
D	12 6	0	6 0	5	12 6	0	6	0 5		13 5	...		16	...			10	5 0	6 3	0 53	10	0.6	6 0	56	11	0 6	0 5	14			5 6	1 0	0 78	5	1	1 2	0 82
E	17 7	...	...		0 16					13 5	...		12.5	...			16 0	..		14			11	0.6	0.5		10	0	6 6	0 56	13 5			11	0	6 0	5
F	26				0 24					20 0	...		16 0	...			24.5	..		25			18				14				23 9			20	6			
Total, etc.	..	2 5	1 94		.	2 6	1	2 03		2 1	2 1	56	...	2.6	6 2	06	..	2.6	1	2.03		2.8	6	2.25	.	3.4	4	2.64	....	3 5	2 2	8 1		2	1	2 1.56	..	3.4	4	2 64

was kept on a plane 5 ft. (1.5 m.) below the focus. Curves *C* and *D* were then plotted, by means of the authors' method described above, for planes 6 ft. (1.8 m.) and 8 ft. (2.4 m.) respectively below the focus. Readings by the foot-candle meter on these planes of 6 ft. and 8 ft. proved the curves *C* and *D* to be nearly enough correct for all practical purposes.

From the curves shown in Fig. 8, Table III was

TABLE III—DERIVATION OF CURVE *A* FROM CURVE *B* (FIG. 8)

Distance	Foot-candle	Divisor	Cp.	Distance	Foot-candle	Divisor	Cp.
0	7.0	0.04	175	6	2.85	0.0105	271
1	6.2	0.03771	164	7	2.25	0.00785	287
2	5.5	0.03202	171.5	8	1.8	0.00595	303
3	4.8	0.02522	191	9	1.45	0.00458	316
4	4.15	0.01904	218	10	1.25	0.00358	349
5	3.5	0.01414	248	11	1.15	0.00283	406

developed, which was used for the purpose of plotting the distribution curves shown in Fig. 9 for three different planes for a room shown in Fig. 3. The lamp used was a 200-watt gas-filled tungsten.

It is furthermore possible to develop a curve *A* in Fig. 8 by reversing the method used in connection with Figs. 1 and 4, in which case curves *B* and *C* were

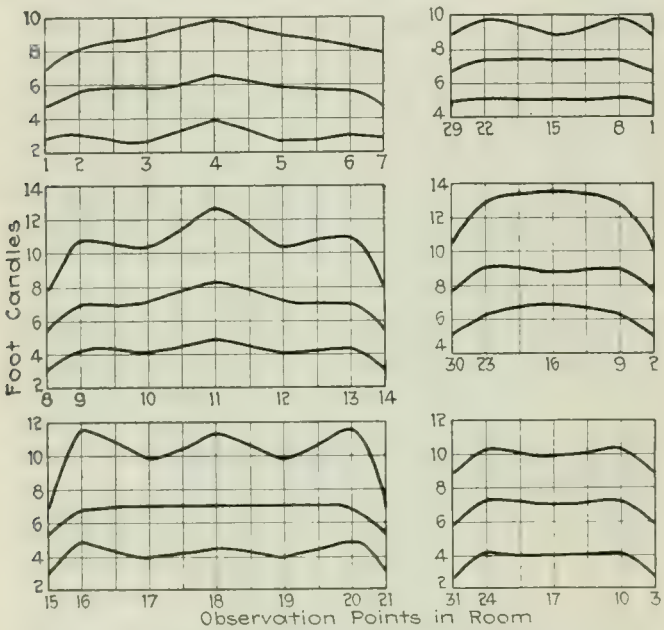


FIG. 9—DISTRIBUTION CURVES FOR ROOM SHOWN IN FIG. 3 EQUIPPED WITH INDIRECT FIXTURES

In each case the upper curve is for a plane 5 ft. below the focus, the next 6 ft. and the lowest 7 ft.

derived from curve *A*. Curve *A* in Fig. 8 can thus similarly be derived from curve *B*. But whereas curve *A* in Fig. 4 is determined in the laboratory by direct photometric measurements, curve *A* in Fig. 8 cannot be so determined. It is a "fictitious" curve and may be termed the "fictitious polar curve" of an indirect or semi-indirect fixture. Once this curve is obtained by the method suggested by the authors, foot-candle curves could easily be derived from it. It could also be used for the purpose of predetermining illumination on vertical planes. Whereas for direct reflectors the actual polar curve represents an integration over the whole area of the reflector, the fictitious polar curve of a totally indirect reflector would represent an integration over the whole ceiling area and the fictitious polar curve for semi-indirect fixtures would represent an integration over the whole ceiling area plus an integration of the direct illumination.

In spite of the fact that indirect illumination has been in general use for some time, it must be admitted that there are very few fixtures on the market for this purpose to satisfy the requirements of the conscientious illuminating engineer. Manufacturers should, therefore, be urged to study the problem more thoroughly than they have hitherto done, and they should be required to furnish with all their indirect or semi-indirect fixtures the respective fictitious polar curves for certain practical ceiling conditions and to develop by research practical factors to apply to different ceiling conditions. When this shall have been done a great deal of time and money will be saved on lighting installations, and the greatly increased uniformity in the distribution of illumination will aid materially in reducing "eye fatigue."

Physical Characteristics of Babbitts

FOUR main reasons were given by T. D. Lynch, research engineer Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., in a paper on "Babbitts and Babbitting" presented before the Pittsburgh Section of the Association of Iron and Steel Electrical Engineers, for the slow progress made toward the adoption of a standard babbitt—first, the lack of standard methods of physical test so as to give comparative results in a reasonably short time; second, the general lack of facilities for the proper control of the temperature of the metal in the babbitting pot as well as lack of care to prevent the admixture of other ingredients; third, the varying conditions of service, such as size of bearing, bore allowance pressure, speed, lubrication, constant and intermittent service, surrounding temperature and vibration; fourth, cost.

The experience of the Westinghouse Electric & Manufacturing Company with tin-base babbitts has resulted in a selection of a composition between that of grades No. 2 and No. 3, having approximately 10 per cent antimony and 5 per cent copper—the remainder tin. This metal flows readily into linings ⅛ in. thick and lighter, while a higher copper content, such as that of No. 3 (a most excellent babbitt) tends to sluggish-

BABBITT SPECIFICATIONS, AMERICAN SOCIETY FOR TESTING MATERIALS

Alloy, Grade No.	Tin, per Cent	Antimony, per Cent	Lead, per Cent	Copper, per Cent	Iron, per Cent, Maximum	Arsenic, per Cent, Maximum	Zinc, per Cent	Aluminum, per Cent
1	91	4½	0.35a	4½	0.08	0.10	None	None
2	89	7½	0.35a	3½	0.08	0.10	None	None
3	83½	8½	0.35a	8½	0.08	0.10	None	None
4	75	12	10	3	0.08	0.15	None	None
5	65	15	18	2	0.08	0.15	None	None
6	20	15	63½	1½	0.08	0.15	None	None
7	10	15	75	0.50a	....	0.20	None	None
8	5	15	80	0.50a	. .	0.20	None	None
9	5	10	85	0.50a	....	0.20	None	None
10	2	15	83	0.50a	....	0.20	None	None
11		15	85	0.50a	.	0.25	None	None
12		10	90	0.50a	.	0.25	None	None

ness when being poured, resulting in the necessity for much thicker linings than ⅛ in. Likewise experience with lead-base babbitts has resulted in a selection of a composition between Nos. 7 and 8, having approximately 14 per cent antimony and 8 per cent tin, with not over 0.5 per cent copper and the remainder lead, resulting in a metal that flows even more readily than the tin-base composition and wears well.

Central-Station Financing*

Viewpoint of Investment Banker—Small Investors Now Buy Greater Part of Utility Bonds—Limitations to Suit Purchaser Proper Ratio of Debt to Capitalization and of Earnings to Interest—Day of Speculative Profits Past

By H. M. ADDINSELL
Harris, Forbes & Company, New York

IT IS obvious that there is no financial or other institution so replete with funds that out of its own resources it can supply the large amount of money constantly required for your great and growing industry. Even if there were, prudence would prevent such an institution putting all its eggs in one basket. The investment banker, if he is wise and expects to continue in business, buys only what he can resell to his clients, the investing public. Just who is the investing public? In this connection the following statement of Carl D. Jackson, chairman of the Wisconsin Railroad Commission, will be of interest:

"The actual ownership of most public utilities is by the people themselves. The first liens on most public utilities are very often owned by trust companies, banks, and largely by insurance companies throughout the United States. Nearly every man carries an insurance policy. The average citizen has a bank account, yet not one citizen out of a hundred realizes that in one form or another his actual savings and insurance and his wife's and children's welfare depend upon the solvency and continued operation of public utilities. There is probably not one in fifty whom we meet on the street who does not own a part of a public utility, whether he knows it or not."

The investing public of today, so far as the bonds or notes of electric service companies are concerned, is different from that of past years. Banks and institutions are generally out of the market for this class of security; large private investors cannot afford to buy them for income-tax reasons, with the result that the large majority of our present sales of public utility bonds are to small investors—the man in the street—with one thousand, two thousand or possibly five thousand dollars to invest. Not only on account of the direct or indirect financial relation are your problems those of the man in the street, but also because of the economic importance of your industry, as the growth and prosperity of the communities you serve are directly affected by the character and extent of the facilities with which you are able to provide them.

Your industry, in common with all others, must face the high cost of the materials and labor that make possible the creation of your product as well as the high rental value of the money you must have to procure such materials and labor. We also know that at the moment the securities of public utility companies do not find the same degree of favor with investors that they once enjoyed. Confidence is returning slowly, and the wary investor must be wooed with an attractive bait if he can be interested at all in public utility bonds. What must this bait be? Prime security, high interest rate and, with the exception of the very choicest issues, a conversion or some similar feature to add also a speculative possibility to the investment.

Theoretically there are three means available to an electric light and power company by which it may obtain additional funds for the additional capital expenditures that are constantly and continuously required—(1) by sales of additional stock; (2) by borrowings, secured by mortgage or note, and (3) by use of surplus earnings. As a matter of practice, however, only the first two methods are available, as even if surplus earnings are temporarily used for new construction, these items go into capital account and are eventually represented by capitalization in the form of either stock or indebtedness. Generally speaking, the means that permit a company in good times and bad to raise the major part of its funds at the most advantageous rate are the sale of its funded obligations, bonds or notes.

From Mr. Addinsell's Paper

The investor does not want a bond issued under a mortgage where the present character of the property or security may be changed by the escrow conditions; hence the limitation eliminating securities as the basis for the issue of future bonds, the limitation regarding the character of physical property that may be made the basis of a future bond issue, and the "disconnected property" and franchise restrictions.

It would perhaps be reasonably conservative to say that no more than three-fourths of the capitalization should be represented by mortgage debt and one-fourth by stock, and a two-thirds and one-third ratio would be even more sound and conservative.

To retain a first-class status in the minds of bond purchasers, a company must show at least a two-for-one earning ratio.

The day of possible large speculative profits in public utility securities is past. With the regulation that exists and the incontrovertible fact that these industries are an indispensable and permanent part of the economic structure of the communities they serve, they are partaking, and I think will partake increasingly, of the nature of quasi-municipal securities.

The solution of all the problems of the electric light and power companies is very simple to express but probably very difficult to achieve. It is simply to arrive at a complete and mutual understanding of one another's problems, which when arrived at will make possible, if approached in a spirit of sympathy and fair play, the equitable adjustment of our relations to one another.

More Flexibility in Present-Day Mortgages

Past mistakes in creating small authorized mortgage issues have been recognized and cured by providing for very large or unlimited authorized issues. A recognition of the lack of flexibility in old mortgages to meet changing market conditions and permit the companies to avail themselves of their prime security under varying market conditions has led to the provision in modern mortgages which permits the issue of bonds thereunder in so-called series, with the right to make the maturity and the face interest rate appropriate to the then existing market conditions. This provision generally includes also the right to refund existing series by the

*Part of a paper read before the Association of Edison Illuminating Companies at New London, Conn., Sept. 13-16, 1920.

issue of a new series. Such mortgages should, however, contain some restriction on the creation of shorter series than any existing series, on the theory that while the creation of a shorter series does not prejudice the intrinsic position of an already outstanding longer one, investors look with disfavor on the possibility of a series of bonds being issued later with a preferential position as far as payment of principal is concerned.

The investor does not want a bond issued under a mortgage where the present character of the property or security may be changed by the escrow conditions; hence the limitation eliminating securities as the basis for the issue of future bonds, the limitation regarding the character of physical property that may be made the basis of a future bond issue, and the "disconnected property" and franchise restrictions. He is also concerned as to his relative lien on the property, the continuation of that relative lien and, in fact, the improvement of it. Out of that has grown the limitation on the acquisition of additional properties carrying prior liens.

We must bear in mind that in these big "series" mortgages we are projecting ourselves far into the future. Of course, we cannot guarantee future management, but we attempt to outline a basis in these mortgages that will confine a possibly unwise management within limitations with respect to the issue of bonds that will preserve the security and integrity of the original situation and which, on the other hand, will not hamper a sound management in availing itself of its prime security to a proper extent in the legitimate future development of the property.

The Old Sinking Fund and the New

In industrial financing it is customary to require amortization of at least a substantial portion of a loan from earnings during the life of the obligation. In old electric light and power mortgages we find sinking funds requiring the paying off of a certain amount of the bonds each year from earnings to accomplish this. But the particular position of public utilities does not justify an insistence upon the retention of this feature in modern mortgages. The investor in your securities must recognize frankly that your business is a permanent and continuing one that forms an important economic part of the life and business of the communities served; in fact, you could not stop doing business if you would. Even if you did, others would take the property on which the bondholder has a mortgage and carry on the business. And your earnings come under public franchises, so you cannot charge rates that would permit you to amortize your borrowings out of earnings. Neither the public nor the public service commissions would permit it. Therefore the straight sinking fund is disappearing and in its place comes the sinking or improvement fund.

The theory of the old sinking fund was, of course, to reduce the debt and thus improve the relation between property and bonds and incidentally create a market from time to time for the bonds. The theory of the sinking or improvement fund is to improve the relation between property and bonds by permitting the company either to expend the funds arising therefrom for additions and extensions to the property, which might otherwise have been made the basis for the issue of bonds, or to retire bonds therewith. This has accomplished the result, although perhaps not quite so definitely and satisfactorily from the standpoint of the bondholder, for it does not give him a definite recurring market nor does it have the same stimulating effect on the market for the bonds.

As I say, the action of the sinking or improvement fund is not so positive and so concrete as that of the sinking fund, and modern thought in investment banking circles is turning toward a requirement for a definite percentage of gross earnings to be expended or appropriated each year for maintenance and depreciation, relying on the action of such a fund to preserve the integrity of the existing property and on the operation of the escrow clauses permitting the issuance of bonds for 75 per cent or 80 per cent of expenditures to improve the relation between property and bonds.

It may be argued that a percentage of gross earnings is not necessarily a scientific or accurate way to arrive at the proper amount that should be expended or appropriated each year for maintenance and depreciation, and that the true basis for such a covenant would be the value of the physical property, taking into consideration the rate of depreciation of the various classes of property involved. This may be correct theoretically, but practically, as far as I know, no one has been able to think out a workable method for applying the principle in a mortgage; that is, a method workable and satisfactory from the standpoint both of the company and of the bondholder. Furthermore, as a practical matter, we all know that the ratio of gross earnings to physical property is apt to remain approximately the same in the average electric light and power company, and in a number of cases that we have figured out the percentage of gross agreed upon for maintenance and depreciation runs surprisingly close to the amounts that would have been required had they been figured on the basis of the actual maintenance and depreciation requirements of the physical property.

In the interest of the public, the stockholders and the bondholders, it is imperative that the property of the companies be at all times kept in good physical condition and capable in every way to give the best of service at minimum cost. Inasmuch as the bondholders are asked to furnish the bulk of the money to create these properties and at the same time are limited to a definitely fixed return materially less than is allowed upon the investment as a whole, it is absolutely necessary that all mortgages should contain adequate and enforceable provisions to insure the making of such repairs, renewals and replacements as may be necessary from time to time to preserve the integrity of their security and keep the property in a high state of operating efficiency.

It has become a matter of practice to permit electric light and power companies to issue additional bonds for 75 per cent or 80 per cent of the cash cost or fair value, whichever is less, for additions and improvements to their property. In the latter case this means that, looking toward the future, you are indorsing the proposition that it is good practice to capitalize these companies on the basis of four-fifths mortgage debt to one-fifth stock. Looking at it from this aspect, I am sure we shall all agree that this is not fundamentally sound and is verging toward the situation of too large a percentage of capitalization being represented by bonds or borrowed money—the same unbalanced condition that caused the past difficulties of many of our steam railroads and also of some of our public utilities.

It would perhaps be reasonably conservative to say that no more than three-fourths of the capitalization should be represented by mortgage debt and one-fourth by stock, and a two-thirds and one-third ratio would be even more sound and conservative. I know that your answer to this proposition will be to point out the difficulties of raising junior money for these properties, especially with the kind of rate regulation that we have had in the past, but here again we should all work for the establishment of the electric light and power industry in the minds of the public and the commissions in such a way that the investor in the equities will feel sure of a reasonable fixed return even if the speculative possibilities are largely eliminated by such regulation.

It has also been customary in the past in the best bond issues to have a requirement that net earnings must be equal to twice the interest on all bonds outstanding, together with those proposed to be issued, as an additional restriction precedent to the issuance of escrow bonds. With the high face interest rates that it is now necessary to pay in order to attract investors, combined with the limitation on earnings imposed by rate-regulating authorities, it has sometimes been recognized that under the special conditions existing at present it is not practicable to insist on the two-for-one ratio, and many new mortgages are being drawn with only a one and three-quarters earnings requirement. Perhaps I should point out that, notwithstanding the reasonableness of a demand on the part of the company for a departure from a two-for-one ratio in view of present high interest rates, it is extremely difficult to market bonds where the showing of earnings is less than two for one, and I should feel that I was remiss in endeavoring to place before you the bondholder's viewpoint if I did not call attention to the fact that to retain a first-class status in the minds of bond purchasers a company must show at least a two-for-one earnings ratio.

I have spoken of the practical difficulties that are encountered at present in marketing equity securities. The single exception thereto, and it is a very important one, appears to be the sale of preferred stocks to employees and customers. The advantages of such sales, aside from the additional source of capital it creates, from the standpoint of both the company and the customer, and the relations of the company to the community in general, are so obvious and so well understood by us all that they do not need further comment. This proceeding, furthermore, is a long stride in the direction of the establishment of a more complete understanding between your companies and the public. I should like also to mention that it would appear to be good business to go one step further and market locally at least a certain proportion of the *common* stock of these companies. Modern thought is that the public interest can be best served by having all corporate stocks without par value. This should greatly benefit public utilities, which, unlike industrial companies, cannot stand still but must be able to sell their stocks under varying market conditions in order to provide for constantly increasing public needs for service.

A problem that modern conditions in your industry is making increasingly more important is the question of financing the great generating stations operated by water power or located at the mouth of coal mines which can turn out a large quantity of energy at low unit costs and provide the needs, at least in part, of one or more companies. These cannot very satisfactorily be financed as construction propositions standing on their own feet. They can best be financed through the construction stage by using the credit of the distributing company or companies that they are designed to supply. It sometimes happens, so large are these generating stations and so great the amount of money required, that a particular company with enormous demands for power finds itself in a position where its earnings will not support a sufficient amount of its own securities to enable it to avail itself of its own sources of financing. A suggestion that has been made in this connection is that in such an event a separate company should be formed with the new generating station as its principal property, the voting stock of which should be owned by the distributing company or companies and the generating station leased in perpetuity to the distributing company on suitable terms, with the option on the part of the distributing property to purchase the power plant at its cost to date. The generating company can then issue its own first mortgage for a suitable term of years with suitable call privileges, which in turn should be guaranteed by the distributing company. Provided the details are satisfactorily worked out, such an arrangement should result in a safe and salable security, although the distributing company would still be faced with the problems of raising the equity money and having in hand at the time of the sale of the generating company securities sufficient funds to insure the completion of the plant.

THE FINAL SOLUTION OF ALL PROBLEMS

My theory is that the solution of all the problems of the electric light and power companies is the same broad solution that is the answer to the economic and industrial problems at present pressing the entire world for answer, and of which the labor problem is an important and conspicuous example. That solution is very simple to express but probably very difficult to achieve. It is simply to arrive at a complete and mutual understanding of one another's problems, which when arrived at will make possible, if approached in a spirit of sympathy and fair play, the equitable adjustment of our relations to one another.

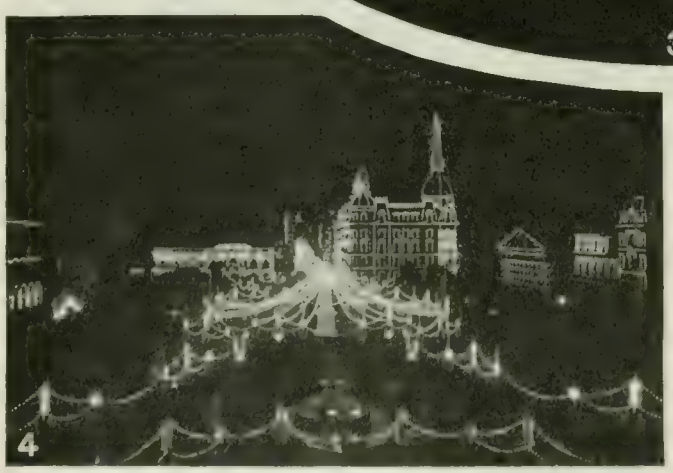
I am not here to discuss the complicated question of what is a fair rate of return, with all its technical and practical complications in the way of valuation, necessary but unproductive investment—hard-earned dollars that have been invested in public utility enterprises and been unproductive for sometimes long periods of time—and what is a fair rate of return under changing conditions, but I will say that we may all just as well face frankly the fact that the day of possible large speculative profits in public utility securities is past. With the regulation that exists and the incontrovertible fact that these industries are an indispensable and permanent part of the economic structure of the communities they serve, they are partaking, and I think will partake increasingly, of the nature of quasi-municipal securities. I look forward to the day when public utility practice and financing will be so standardized and stabilized that the securities of these companies, at first in the larger communities and eventually everywhere, will command a market closely approximating—both as to level and ready marketability—that enjoyed by the obligations of the municipalities themselves.

Special Lighting During National Holiday at Buenos Aires Despite High Fuel Cost


1


2


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4


5

In spite of the difficulties in obtaining coal during the past year, when the price of both coal and wood have been high, Buenos Aires was remarkably successful in carrying out plans for decorative illumination for the national holiday of May 25. The accompanying illustrations Nos. 1, 2 and 4 show various scenes in the Avenue and Plaza de Mayo. No. 3 is the Casa Rosada, corresponding to our "White House," and No. 5 shows the national Congressional building. The special lamps and fixtures were provided by the city, and the electrical utilities of Buenos Aires furnished the energy for their operation.

It is interesting to note that the price of red quebracho, a very hard wood, burned in chunks, with nearly half the fuel value of coal, on April 15, 1920, was $11 per long ton. while coal, during the past year, has ranged from $25 to $30 per long ton. During the war coal reached the nominal price of $70 per ton, but there was none available. It was then, some two years ago, that the practice of burning wheat, corn, bran and sawdust was started.

A representative of the McGraw-Hill Company who fortunately was able to be in the city at that time was astonished to note not only the profusion and magnificence of the lighting throughout the city but also the spirit of enthusiasm of the people who filled the streets and parks.

Electrical Possibilities in South America

Great Opportunities for Water-Power Development—Enormous Cost of Coal—Operating Difficulties and How They Are Overcome

BY VERNE LEROY HAVENS*

SOUTH AMERICA has benefited financially from the turmoil of the past five years. Farm and mine products have been sold at very high prices, and although this has been partly offset by the high costs of imported articles, South Americans have been forced to economize materials and equipment of all sorts for the simple reason that materials were needed by all the industrial nations for their own use. Some countries were so isolated that they could not ship, if they would, and in few cases were ships available for carrying anything not absolutely essential. Hence South American nations have purchased comparatively little and must buy much if only to take care of deferred maintenance. This applies to most things, and very especially to electrical equipment and supplies, railway equipment of all sorts and building material. They must buy for deferred maintenance, but at the same time South America has not fallen behind in its desire for further intensive development, and the work of the past five years and that of the next five years must be done together in the five years to come.

With the exception of southern Chile and certain comparatively isolated sections of Colombia, Venezuela and Peru, South America has no bituminous coal. The anthracite in Peru is about the only deposit known on the continent, and the lignite of southern Brazil, high in ash and sulphur, is virtually the only known coal on the east coast. Normally the railways import coal for locomotives in practically every port. Millions of tons have been required for this purpose.

Today the French mines are out of commission to a large extent. Germany cannot ship for one reason, Great Britain for another, and the United States for still another, in any appreciable quantities. As a matter of fact, the United States, England and Wales, and Australia are called upon to supply a large part of the world with coal, and they cannot do it under existing circumstances. Coal at Rio Janeiro, for example, has not been below $20 a ton since the early days of the war. Suffice it to say that generally the cost has been more at other ports, and although the actual conditions will no doubt improve, it is interesting to know that within recent weeks coal has been delivered at Rio at $35 per ton.

From the Uruguay River, perhaps 300 miles from Buenos Aires, northwest across the Continent, there are enormous possibilities of hydro-electric development. In Brazil there is power in quantities on every river, and there are many rivers.

The one state of São Paulo, Brazil, has an export trade as great as that of the Republic of Mexico, a comparatively large literate population, railways radiating in every direction, burning coal at $25 to $40 a ton or scratching around for wood to burn, and the power possibilities in every neighborhood are simply stupendous. The state is gently mountainous, if one may use such a term, and has an annual rainfall of about 54 in. (137 cm.).

The Paulista Railway has contracted with the General Electric Company to electrify its line, and but a month or so ago there was introduced in the National Congress a bill to authorize the electrification of the Brazil Central Railway from Rio Janeiro to Barra de Pirahy, the mountain section of the line connecting the national capital with the city of São Paulo. The Paulista project will cost about $10,000,000 and the Rio Janeiro-Barra de Pirahy project about $11,000,000, the saving of coal by the latter being calculated to be about $2,500,000 per annum.

There are at least fifteen aluminum transmission lines in the state of São Paulo, and they have large deposits of bauxite ore, which means not a little in their future development.

Brazil has in the water-power region excellent clay for refractories, the largest single deposit of iron in the world—and at the same time perhaps the purest—great deposits of 48 per cent manganese near by, and



MINING WITH POWERFUL ELECTRIC SHOVELS WHICH ARE SAID TO FAR EXCEL THEIR STEAM BROTHERS

a rapidly increasing demand for steel rails for its railways. Manganese-steel rails will no doubt ultimately be used, of a lighter section than those of commercial steel, because of high manganese content. There being no frost, this is possible. This is only one angle of electrical possibilities in this region, as considered in connection with furnace development.

In practically every city on the continent the available power is oversold, and extensions will be unavoidable in the near future. Uruguay is becoming especially interested in the development of the Salto del Uruguay, and Buenos Aires is even casting longing eyes on the water power at Iguassu, 500 miles away, for use to supplant coal for light and power in that city of 1,800,000 people, as well as for its suburban railways.

Chile, Peru and Ecuador are all interesting themselves in railway electrification. One has no conception of what lack of fuel means to a country or how a coal shortage will worry an engineer unless he has been "up against" those conditions.

Buenos Aires has some coal today but still burns a great quantity of wood. During the war the coal theoretically reached $70 a ton—only there was none to

*Editor of *Ingeniería Internacional*, the international engineering journal printed in Spanish by the McGraw-Hill Company. Mr Havens has just returned from a three months' visit in various parts of South America, where he discussed conditions with men closely allied with achievement there. Prior to his association with the McGraw-Hill Company he was engaged in Latin-American countries and Spain for more than fifteen years.

be had. The city was lighted with wood and wheat and corn and bran. A small 50-kw. plant in central Argentina, owned by a company having similar interests in Cordoba, Junin and elsewhere, was actually producing light and power by burning bran and hay. There is no prospect of coal very soon at any reasonable price, and people are afraid to trust to imported fuel. Longer transmission distances are noted often nowadays, and there is no reason apparent why the electrification of every important railway in South America not in a great desert or prairie district should not take place within a comparatively short time.

Among the minor electrical problems noted in various places, notably on the west coast in Peru and Chile, but also on the east coast, is that of insulators installed near the sea. The sea mist, bearing salt and various other ingredients, drifts in and dampens the insulators. Then light breezes blow and mix fine dust with the salt film, and the final result is an arc across the insulators. In certain localities, notably Lima, the insulators must be designed for a voltage notably higher than that which the line actually carries.

Another interesting fact was noted in Rio Janeiro. Experience there has been that the crowding together of many cable conduits has interfered with ventilation and the cables have become overheated. The vaults were tightly closed and the imprisoned air became intensely hot. With the burning of a cable the manhole cover would be lifted and the whole vault apparently burst into flames. The old practice, first developed by telephone companies and followed by those installing low-voltage cables, of putting all the conduits in one trench has been abandoned, and the lines are now separated. It is said that now almost no difficulties arise. It is a matter of record that the Rio Janeiro Tramway, Light & Power Company has virtually no electrical troubles, and what would normally be considered a simple delay in New York would be a scandal in Rio. The electrical department is supervised by E. A. Sturgis.

Another interesting experience was met in viewing the remains of the Valparaiso tramways on March 11. They were owned by German interests which had not made any repairs since 1914, and the service did not impress any one very favorably. Owing to a minor quarrel, the bottled annoyance of several years broke out, and the mob certainly spilled vials of wrath on the tramcars. Rioters tramped from one street to another all over town, and wherever a car was found it was torn apart and burned.

Now the citizens have no trolley cars, but they ride on drays and carts, or they walk, and apparently they are happy over it. The unfortunate outcome was the result of years of quarreling, and it is doubtful whether new interests could be induced to re-establish the service at the old fares of 1 cent and 2 cents for second and first class.

Unusual Efficiencies with Oil Fuel

Using Fuel Oil with Mechanical Atomizers, the Savannah Electric Company Has Obtained Boiler Efficiencies of 80 per Cent with 300 per Cent Boiler Rating—Normal Operation of 250 per Cent Rating

By JOSEPH POPE and FRANK G. PHILO,
Division of Construction and Engineering, Stone & Webster, Inc.

DURING the latter part of 1919 the Savannah (Ga.) Electric Company and the Blackstone Valley Gas & Electric Company of Pawtucket, R. I., which had previously burned coal exclusively in their power plants, entered into contracts for fuel oil. Under the Blackstone Valley oil contract deliveries were not scheduled to begin until the summer of 1920, so the reconstruction of the Pawtucket plant of that company, which is to be converted to oil burning, is still under way. The Savannah installation was completed early in the present year.

The Savannah oil-burning installation at its Riverside plant has now been in operation seven months and the results throughout have been extremely gratifying. The furnace design has met all requirements, and tests, the results of which are given in the accompanying tabulation and also partly indicated in the curves, show that the high efficiency obtained at the boiler rating is maintained to a remarkable degree at extreme overloads.

Since the adoption of fuel oil the boilers have been operated normally at about 250 per cent of their rated capacity and there has been no instance of tube trouble throughout the seven months of operation, although the boiler-feed water is by no means entirely free from solid impurities. All indications are that general maintenance will be low. Operation has been found extremely simple. Only two conditions require adjustment at the furnace, oil pressure and draft, and it has been possible to schedule these conditions and their adjustments so accurately that the every-day operating performance closely approximates the best test results.

EXISTING FORMS OF OIL-BURNING EQUIPMENT WERE INADEQUATE FOR THIS INSTALLATION

Load conditions at the power stations of both the Savannah and Blackstone Valley companies required the development of high boiler outputs and made high efficiencies at these outputs extremely desirable. While the steam-atomizing type of burner, which had been used exclusively in all the larger oil-burning power plants of this country, gives excellent results at about the builder's rating of the boiler and a little above, the efficiency falls off rapidly at the higher overloads, and the extreme overloads demanded of the Savannah and Pawtucket boiler plants would have been impossible of attainment in the usual form of furnace.

The mechanical atomizing type of oil burner offered promising possibilities, but the type which had been in use for marine service had not shown as high efficiency commercially as the steam-atomizing burner. Furthermore, the boiler ratings obtainable per burner were considerably lower. Fortunately a new type which could be operated at high rating had been developed by

the Babcock & Wilcox Company about the time the conversion of the Savannah and Pawtucket plants to fuel oil was under consideration. The performance of this burner was investigated.

With the new type of burner a specially designed orifice disk or tip is employed, in which the oil is led to a central circular perforation through tangential grooves and thus attains a violent rotary motion as it is projected through the orifice. The resulting spray takes the form of a widely diverging cone of extremely fine mist. The burner proper is set in the furnace wall at the center of an air register so designed as to impart a whirling motion to the entering air. It was found that this construction gives extremely thorough atomization and an intimate admixture of air and oil which

pumped by a motor-driven Kinney pump to a similar service tank at the Indian Street station (another plant of the Savannah company), several hundred feet away and at a higher level. In the service tanks the oil is heated to about 100 deg. Fahr. It is then pumped to the burners through high-pressure heaters. At the Riverside station the oil reaches the burners at about 230 deg. Fahr. and at pressures varying up to about 210 lb. (14.7 kg), dependent upon the rating desired. The high-pressure oil pumps and heaters are housed in a separate fireproof room constructed within the station. Forced draft is supplied by turbine and motor-driven fans.

A single size of burner tip fulfills all requirements of normal operation. The proper relation between oil and

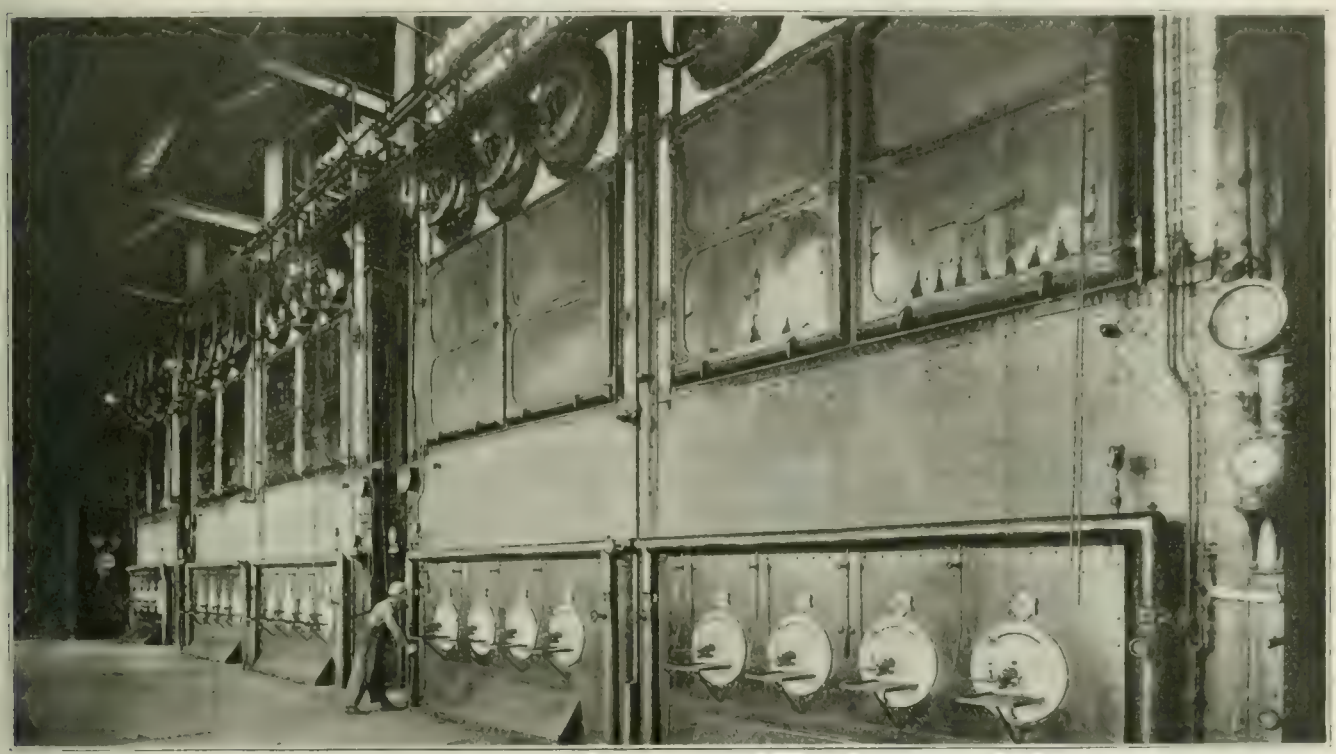


FIG. 1—HIGH EFFICIENCIES AT FORCED BOILER RATINGS HAVE BEEN OBTAINED IN THIS FUEL-OIL INSTALLATION AT THE RIVERSIDE STATION OF THE SAVANNAH ELECTRIC COMPANY

are particularly desirable. The flame starts close up to the burner tip and is practically noiseless. The rate of combustion is controlled by the temperature and pressure of the oil. The size of orifice in the burner tip also determines the rating, but burner tips can be obtained in various sizes and are interchangeable, the largest size having a normal capacity of about 1,400 lb. (635 kg.) oil per hour, at 200 lb. (14 kg.) pressure. Because of these advantages it was decided to equip the plants mentioned with these burners.

Since the Riverside boilers were originally equipped with stokers for bituminous coal the stokers were removed and four oil burners installed under each boiler. As shown, the lower part of the furnace front is covered by a steel-plate blast box, in which are set the registers and burners and through which the forced draft is supplied.

Fuel oil is received at the above-ground steel tank storage at Riverside by pipe line direct from the supply station of the oil company. From the Riverside storage oil may be fed by gravity to a two-compartment underground service tank for use at the Riverside station, or

air pressures throughout the capacity range was determined by analysis of the combustion gases and is maintained by varying the air and oil pressures in direct proportion. No adjustment of air registers is required so they are set wide open. No difficulty is experienced in maintaining smokeless conditions with varying load at all ratings.

TESTS OF THE NEW INSTALLATION

During May, 1920, a series of tests were conducted on one of the Riverside boilers for the purpose of formulating a proper operating schedule and incidentally to determine the actual efficiency of the installation. To insure constancy of radiation during the test, the boiler in battery with the test boiler was not kept under fire.

For this purpose a separate oil pump and heater were set up and all oil actually weighed as fed to the test boiler. Feed water was measured by two specially calibrated Venturi meters, which were installed in the front and rear feed connections respectively. Since only one feed was used at low ratings, good scale indications

were obtained on the manometers for all desired rates of boiler output. Centrifugal feed pumps were used and the flow was very steady. The tests were of four and five hours' duration, with three to four hours' preliminary operation under test conditions, insuring almost absolute constancy of results throughout the actual test period.

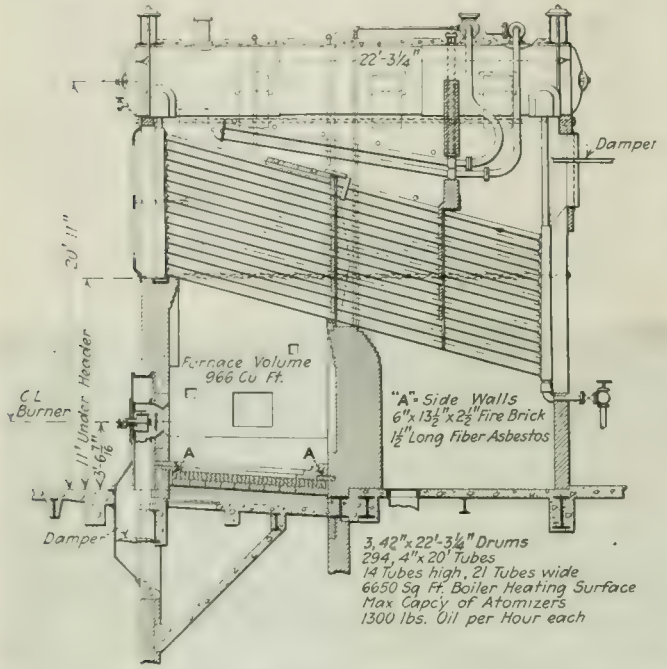


FIG. 2 — SECTIONAL ELEVATION OF 665-HP. BOILER IN WHICH THE COAL-BURNING FURNACE WAS CHANGED TO OIL-BURNING

Results of Tests on the New Equipment

Results of the tests are presented in considerable detail in the accompanying tabulation, and the more important results are emphasized graphically in Fig. 3.

For example, the test at 168 per cent of boiler rating (not shown in the table) indicated an efficiency slightly below the corresponding value on the curve. For this test the percentage of excess air was deliberately increased, because, although no evidence of incomplete combustion had been detected in previous tests, it was feared that the air ratio might possibly have been held too low, permitting the escape of some slight trace of CO. From the test results, however, this had evidently not been the case. In the test following and the one used in plotting the curves the air excess was reduced to the same low figure previously allowed.

During the test at 114 per cent of boiler rating a negative value was obtained for the draft loss through the boiler. At this low rating the chimney effect of the furnace and first pass evidently created a greater pressure reduction at the point of furnace draft measurement than was required to carry the gases through the two remaining passes of the boiler. An interesting observation resulting from the increased furnace efficiency is the effect upon superheater performance. When burning coal the steam was superheated, on the average, about 140 deg. Fahr., and it was necessary to keep constant watch of the condition of boiler heating surfaces to avoid exceeding this figure. With complete combustion, as occurs with the oil-burning installation, and the resulting increased heat absorption by the first pass of the boiler proper, the superheat imparted by the same area of superheater surface is reduced approximately one-half.

The efficiency curve speaks for itself. The values given are gross efficiencies, but any deduction for heat supplied to oil pumps, heaters and forced-draft fans is negligible, as the exhaust steam is fully utilized for heating boiler-feed water.

So far as known there is no other boiler installation giving efficiencies approximating 80 per cent at 300 per cent of boiler ratings.

Stone & Webster, Inc., division of construction and engineering, handled the problem of design and reconstruction of these plants for oil burning.

RESULTS OF TWO OF A SERIES OF TESTS TO DETERMINE THE EFFICIENCY OF MECHANICAL ATOMIZATION OF FUEL OIL

Capacities:		
Rating developed, per cent	113.7	293.3
Hp. developed (B. & W. 665-hp. boilers)	756	1,949
Efficiency:		
Efficiency of boiler, furnace and burners, per cent	82 43	80.15
Evaporative Results:		
Water actually evaporated per lb. oil, lb	14 58	13.74
Equivalent evaporation per lb. oil, lb	15.70	15.22
Barometer, in Hg	29.84	30.02
Length of test, averaged, hours	4	4
Number of burners used	4	4
Grade of oil burners used (Gulf Refining Co.'s Mexican fuel oil; 16.6 deg. Baumé at 60 deg. F.; moisture, 0.8 per cent; flashpoint (closed cup), 181 deg. F.)		
Size of burner tip, drill size	47	28
Average Pressures and Temperatures:		
Steam pressure, lb. gage per sq.in	190.0	201 0
Temperature of superheated steam, deg. Fahr	427.0	483.0
Temperature of saturated steam, deg. Fahr	384.0	388.3
Superheat, deg. Fahr	43.0	94.7
Feed-water temperature at boiler, deg. Fahr	213.5	213.0
Factor of evaporation	1.0766	1.1080
Temperature of exit gases, deg. Fahr	438	566
Temperature of air to burners, deg. Fahr	110	100
Oil pressure at atomizers, lb. per sq.in	210	217
Oil temperature at atomizers, deg. Fahr	238	230
Draft Observations:		
Air pressure at atomizers, in. water	0.37	2.96
Furnace draft, in. water	0.11	0.11
Draft at boiler side of damper, in. water	0.08	0.59
Draft loss through boiler, in. water	0.03	0.48
Draft loss through air registers, in. water	0.48	3.07
Draft loss through boiler and registers, in. water	0.45	3.55
Flue-Gas Analyses—Third Pass:		
Carbon dioxide by volume, per cent	14.30	14.40
Oxygen by volume, per cent	1.60	1.43
Carbon monoxide by volume, per cent	0.00	0.00
Nitrogen by difference, per cent	84.10	84.17
Excess air over theoretical, per cent	14.02	13.3
Weight of Water and Oil:		
Water fed to boiler per hour, actual, lb	24,212	60,720
Water evaporated per hour, equivalent, lb	26,077	67,278
Oil fired per hour, lb	1,661	4,421

Heat Balance:	B.t.u.	Per Cent	B.t.u.	Per Cent
Heat absorbed by boiler	15,226	82.43	14,769	80.15
Loss by imperfect combustion	00	0 00	0 00	0.00
Loss in dry gases of combustion	1,180	6.39	1,665	9 04
Loss due to moisture from hydrogen	1,080	5 85	1,145	6 22
Loss due to moisture in oil	9	0 05	10	0 06
Loss due to moisture in air	21	0.11	32	0 17
Radiation and unaccounted for	955	5.17	806	4 37
Heating value per lb. oil	18,471	100 00	18,427	100.00

Ultimate Analysis of Oil, percentages: Carbon (C), 83 22; hydrogen (H), 10.16; oxygen, (O), 3 64; nitrogen (N), 0 10; sulphur (S), 2.83; sediment, 0 05.

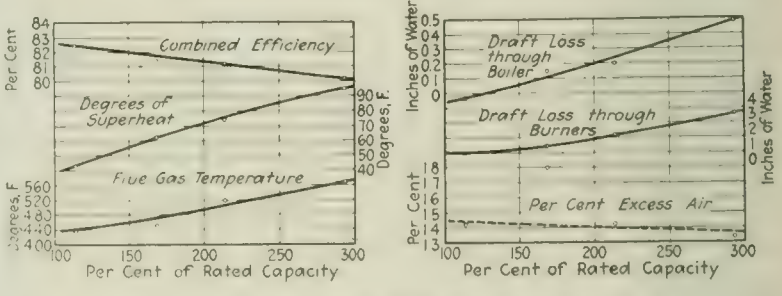


FIG. 3—SOME IMPORTANT RESULTS OBTAINED DURING OIL-BURNING TESTS ARE INDICATED

Generating Plant at the Mouth of Mine—II

Analysis Shows that House Turbine and Electric Drive for Auxiliaries Are Economical — Treatment of Boiler-Feed Water by Evaporator System a New Feature — Recirculation of Condenser Water Is Provided For

By G. G. BELL
Manager Power Generating Department West Penn Power Company, Pittsburgh, Pa.

HOW the West Penn Power Company leased a coal mine that will provide the Springdale station (ultimate rating 300,000 kw.) with fuel for fifty years was emphasized in the Sept. 25 issue of the ELECTRICAL WORLD, which also covered the selection of coal-handling and boiler-room equipment at this plant. In the current number important features of the turbine-room apparatus are analyzed, reserving electrical matters for a later date. A careful study of feed-water heating resulted in the selection of house turbine and electric drive for auxiliaries. The exhaust from this turbine should prove ample for feed-water heating. A low-pressure evaporator system which has been in use in sugar manufacture is here applied to the treatment of boiler make-up water, and experience thus far has been completely

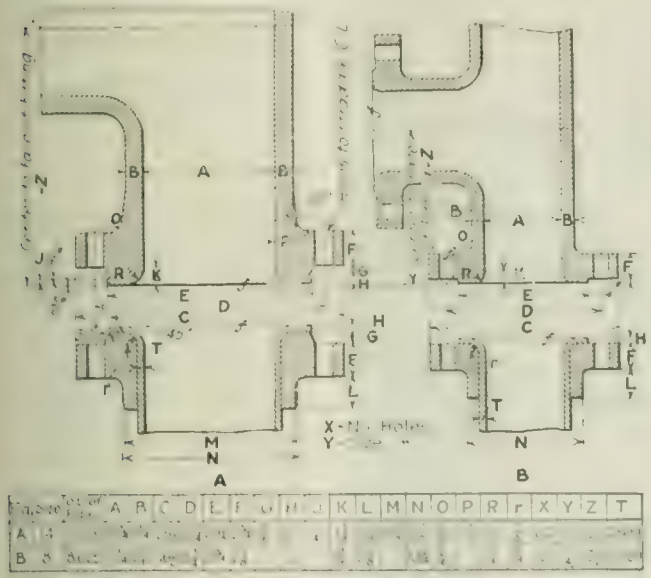


FIG. 8—DETAILS OF 400-LB. (28-KG.) STEAM AND WATER FLANGE AND FITTING

satisfactory. Arrangement has also been made for recirculation of condenser water in case of trouble at the intake from ice or trash.

Turbine Room.—The generating equipment consists of two 25,000-kva. Westinghouse generators, three-phase, 60-cycle, designed for a maximum of 12,000 volts, driven by Westinghouse double-flow turbines.

The condensing equipment was supplied by the Westinghouse company, and consists of a single 32,000-sq.ft. (2,930-sq.m.) condenser per unit, having 1-in. (2.5-cm.) tubes about 20 ft. (6 m.) long. The condensers are hung from the turbine foundation. To take care of the longitudinal expansion of the turbine copper expansion joints are provided between the condensers and the turbines. Large openings are left in the floor in front of the units to light and ventilate the condenser pit. Windows are provided under the turbine-room floor.

There are two motor-driven circulating pumps per unit, each having a capacity of 17,500 gal. (66,200 l.) per minute at the maximum head. Each pump when run by itself will furnish from 60 to 65 per cent of the amount of water that the two pumps together will furnish, on account of the reduced friction head. The condensate pumps are motor-driven and in duplicate, each being of 100 per cent capacity. One Le Blanc air pump of 100 per cent capacity is provided, and two steam air ejectors are provided for use in case of excessive leakage or for breakdown service. Three different sources of water are supplied for the Le Blanc pump—first, directly from the river; second, in case of flood, from a tank in the floor if the discharge pressure on the Le Blanc is higher than it will work under successfully; third, from the circulating system, in case the dam below the plant should fail and the suction head on the pumps should become too large.

As the power for the motor-driven auxiliaries is supplied by a house turbine and the exhaust steam from it is used to heat the feed water, there is an advantage in the Le Blanc pump in that it requires less steam

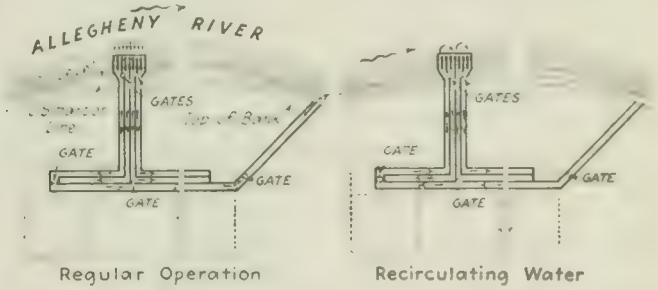


FIG. 9—PATH OF WATER FOR NORMAL OPERATION AND RECIRCULATION OF CONDENSER WATER

than the steam air ejector. However, the cost of the tank and the complication of the piping and floor space required add considerably to the expense of the Le Blanc air pump. There is not much complication in the steam air ejector, provided that the steam is discharged into an open heater. This means a possible difficulty in getting proper air separation. Where jet condensers are used for heaters, as in the Springdale plant, and it is desired to reduce the amount of air in the condensate and make-up to a mininmum, it is necessary to provide a surface condenser, into which the exhaust steam and air from the ejector are discharged. These gases are cooled by the condensate before it enters the heater. The additional cost of this surface condenser and the piping will offset the increased cost of the tank and piping required by the Le Blanc air pump.

The Springdale plant is about half a mile above the Springdale dam. The intake tunnels are placed low enough to insure that the power house will be able to operate in case of failure of the dam, provided that an additional 10 ft. or 12 ft. (3 m. to 3.7 m.) of gravel is dredged away from the intake.

The main intake trouble in the river is from ice and leaves. This is overcome by the installation of rotary

screens and arrangements for recirculating the discharge water, permitting it to be cooled by the ice and recirculating it through the condensing system. A modification of this scheme has been tried out at the Connellsville power station and at one or two other power stations which are subjected to similar trouble, and it has been found very satisfactory wherever tried. They are 6 ft. (1.8 m.) wide and arranged for motor drive, the top of the screens being above the maximum high water mark.

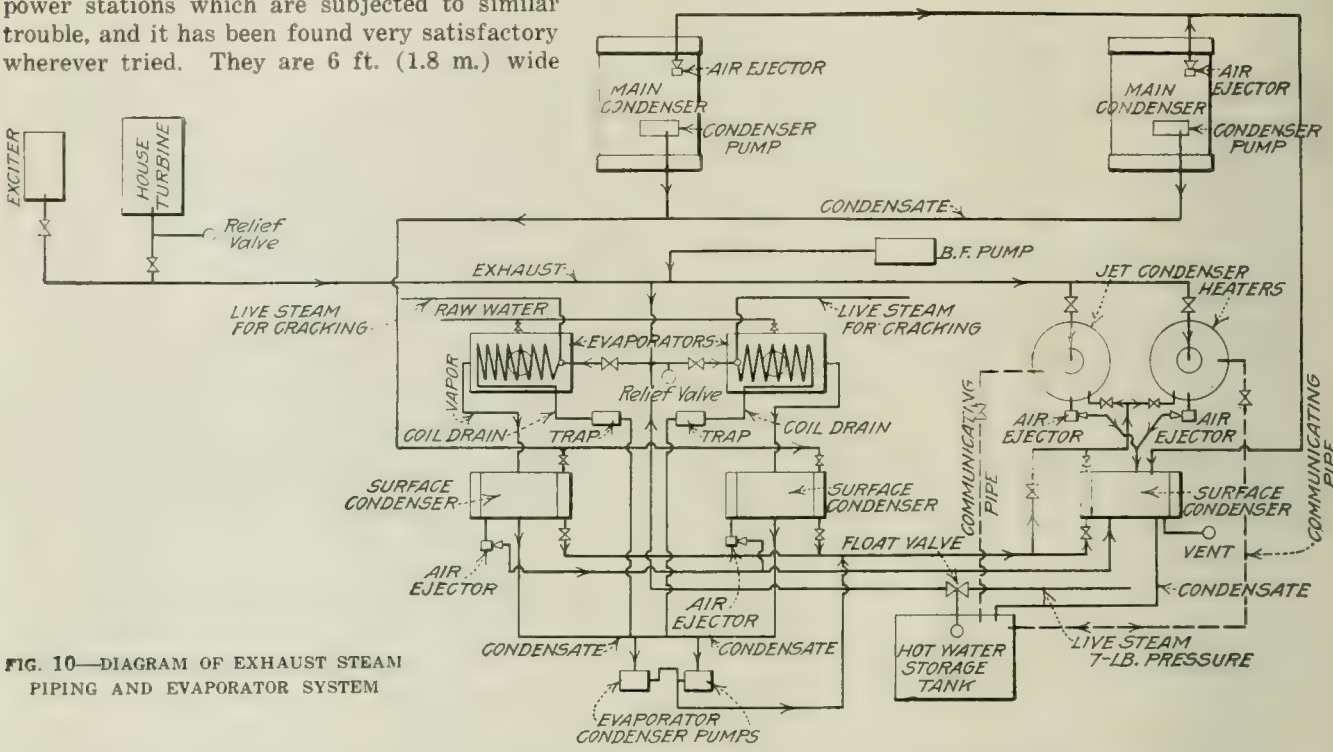


FIG. 10—DIAGRAM OF EXHAUST STEAM PIPING AND EVAPORATOR SYSTEM

Two tunnels supply circulating water to each unit in the power station. One circulating pump on each unit gets its water supply from each of the two tunnels, so either tunnel may be shut down for repairs and still permit of all units being operated at full or nearly full capacity. The double-intake tunnel system and means of recirculating the water also has the advantages of permitting the cleaning of the condensers while in operation. One circulating pump can be shut down and the dirt from the condenser washed through it into the tunnel by a partial reversal of flow in the condensers. All the auxiliaries in the plant, with the exception of one boiler-feed pump and one exciter set, are motor-driven. The station was originally laid out with the intention of putting in dual drives in order to maintain a heat balance. However, an investigation of the relative merits of turbine versus motor drive, using a house turbine to produce the power for the auxiliaries, showed that by adopting the house turbine nineteen turbines ranging in size up to 400 hp. and fourteen reduction gears could be omitted, and that the initial cost was less for the house turbine—that is, when the dual drive for the more important units, such as circulating pumps, had been provided. The house turbine also increases the over-all economy of the station by 2 per cent, as it produces unit energy with from 50 to 60 per cent of the amount of steam that a small turbine would take, considering the increased steam consumption at part load and at reduced speed on the smaller machines. There is at least an equal saving in the capacity of the large turbines which would be required to supply power to the auxiliaries, so that the net station capacity is increased. Taking into account the lower maintenance cost of motors as compared with small turbines and gears, especially considering the high steam temperatures and pressures, which entail special troubles, it seemed that the only logical thing to do was to adopt the house turbine.

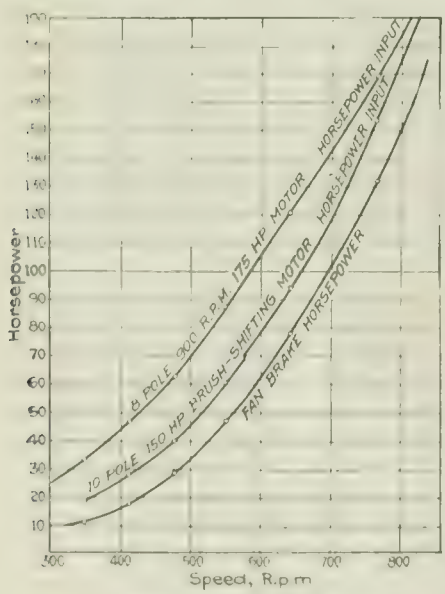


FIG. 11—BRUSH-SHIFTING MOTOR ECONOMY

This type of motor was chosen for the forced-draft fans in the boiler room on account of its high efficiency compared to the slip-ring motor.

In order to heat the condensate to 210 deg. Fahr. (99 deg. C.) it is necessary that about 13 per cent of the condensate be available as exhaust steam. The amount of power consumed by the auxiliaries at the Windsor power station is 5.5 to 6 per cent of the total amount generated, and the amount of power required by the Springdale units should be about the same percentage. But, as the house turbine requires 125 per cent more steam per kilowatt-hour than the large units do, it appears that about the correct amount of exhaust steam is available.

One of the chief sources of trouble to electrically driven auxiliaries is lightning or surges on the line, and it has been customary in some stations to install motors of approximately 50 per cent excess capacity in order that the motors shall not kick off under such conditions. With a house turbine and dual auxiliaries, the

house turbine is connected to one bus, the other bus being connected to the large units through a bank of house service transformers, and where there are duplicate auxiliaries one is connected to each bus. In case of failure of either source of supply the other auxiliary still continues to operate. In case it is desired to keep a uniform feed-water temperature, the house turbine can be run parallel with the main units and the load on the house turbine controlled thermostatically, or load can be transferred by hand from one bus to another in the event that the house turbine is run separately.

The house turbine has also the advantage that in case of a complete station interruption it can be put on the line and be ready for service much more quickly than one of the big units. A motor-driven auxiliary plant has the additional advantage that on account of the elimination of the leaks in steam piping and around the governors on the smaller units the amount of make-up is very much less. Data on this point are limited, but practice in first-class plants seems to indicate that about 2 per cent make-up is required in the motor-driven plant as against 6 per cent in the steam-driven plant. The house turbine unit at Springdale power station is a 2,500-kva., 2,200-volt General Electric turbo-generator.

When the flow in the Allegheny River is very low there are traces of acid. This probably will increase as manufacturing increases up the Allegheny Valley, and manufacturing must extend this way. To take care of the water requirements of the plant a filtering system of 1,000,000 gal. (3,780,000 l.) per day was provided. This water will be used in the low-service system to prevent corrosion of piping through the plant and cooling coils in transformers and turbines. The make-up for the boilers is taken from the same source and is evaporated in two Griscom-Russell horizontal evaporators. These evaporators work between the pressure of the exhaust steam from the house turbine (2 lb. or 0.91 kg.) and a 23½-in. (59.2-cm.) vacuum, which is about the highest vacuum that can be maintained in the evaporator when working at full capacity and using condensate from the main turbo-generators as cooling water. By this arrangement the condensate is heated to about 125 deg. Fahr. (52 deg. C.) in the evaporator condensers, and it is then given a final heating in two Elliott jet condensers.

Both evaporators and jet condensers are provided with Elliott single-stage air exhausters to maintain a vacuum in the evaporator condensers and heater condenser, if desired. The arrangement also serves to extract the air from the make-up and gives a water supply for the boilers that should as nearly as possible eliminate corrosion. This is particularly important where steel economizers are contemplated. As far as is known, this is the first application of the low-pressure evaporator for power-plant purposes, although they have been employed in the sugar and other industries extensively. It has the additional advantage that at the low temperature in the evaporator there is very little tendency to form scale. An evaporator after being in service for a month and a half at a little higher temperature than it will ultimately work under is free from scale, the only foreign matter being a fine powder on the walls and coils. A plant equipped with a low pressure evaporator is about 1 per cent more economical than one with a high pressure evaporator unless the exhaust steam from the high pressure evaporator is bled into the exhaust end of the large turbines. There are, however, objections due to blade erosion and additional automatic stops which are necessary in these designs.



FIG. 12—VIEW OF TURBINE ROOM SHOWING TWO MAIN UNITS IN PLACE

As already mentioned in describing the house turbine, a motor-driven auxiliary plant has a comparatively small amount of make-up. This requires very close supervision of the condensers to see that the leakage is as low as it should be. It was originally contemplated to use the conductivity method to get a continuous record of the amount of condenser leakage, but the conductivity of the Allegheny River water was found to be so low that all of the manufacturers of equipment advised against the use of this method.

The storage tank used in conjunction with the evaporator and storage tank is intended to be kept full. If the water is drawn off below a certain level, steam is automatically admitted to the evaporator coils, the vapor being condensed and pumped directly into the condensate lines. In case there is a vacuum in the jet condenser, the water in the condenser will rise above the level in the tank; similarly, a slight back pressure can be taken care of in the same way.

The Springdale power station was designed and constructed by Sanderson & Porter, in conjunction with the operating organization of the West Penn Power Company.

Hundredth Anniversary of Electromagnetism*

Oersted and Ampère Lived in Age of Discovery

IN CONSIDERING the vast scope of the sciences, the far-reaching ramification of the engineering arts which after one century stand upbuilded upon the discovery of Oersted and Ampère, one cannot but compare the value and lasting worth to mankind of such men with that of the philosophers, theologians and political reformers who during the same epoch announced "fundamental principles" and laid down "basic laws."

Theirs was an epoch of unrest, that of Oersted and Ampère—one of discovery and revolution in all lines of human activity—a renaissance of the intellect, the brushing aside of boundaries and barriers,





geographical and social, of striving for political and mental freedom.

Leaders, revolutionaries, discoverers sprang up in all lands in every realm of activity. It is but natural that an era which brought forth a Hegel, a Rousseau, a Kant, a Bonaparte should have given birth to such minds also as Oersted and Ampère—also enthusiasts unbound by tradition but in touch with the *realities* around them, courageous and diligent seekers after truth.

Not every century has opened a door to such immense realms of practical benefits as these two first entered, piloting the way for us. It may be many centuries before there is discovered a new force, so readily obtainable, so completely governed, and so applicable to the service of mankind, as are these twins electricity and magnetism. Oersted discovered and Ampère instantly appreciated and defined the laws of a force which more than any agent (save fire and steam) has been potent in shaping the civilization of the world. And what this first century has seen is merely a vague outline of the fullness of service which the ensuing ages will derive from the Oersted-Ampère discovery. If our descendants are a grateful race, those two names will grow in luster by each centenary, while those of philosophers and abstract mentalists will perish with each transient generation.

LEE DE FOREST,
De Forest Radio Telephone & Telegraph Company, New York City.

Centennial of the Union of Electricity and Magnetism

WE CELEBRATE this year the hundredth anniversary of the great researches which created the science of electromagnetics. The event which led to that fortunate result, fraught with so many material benefits to the world, are among the most dramatic in the history of science.

Electricity had been recognized since the days of Thales, and frictional electricity had become well known through the experimental researches of many physicists during the eighteenth century. The dawn of the nineteenth century witnessed the discoveries of voltaic electricity. There was no idea, however, that an electric current had any magnetic properties. Magnetism, on the other hand, had been recognized in relation to permanent magnets long before the Christian era.

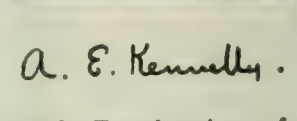
In 1820 Hans Christian Oersted was professor of physics at Copenhagen. He had in his laboratory a battery of voltaic cells and a magnetic needle. He knew that a wire carrying the current in a voltaic circuit becomes heated. The idea occurred to him that a metallic wire, when heated in this way, might disturb a poised magnetic needle. He seems to have had no previous anticipation of the existence of a magnetic field around such a wire. He tried the experiment and found immediately a very marked and definite influence exerted by the wire upon the needle. This was not a thermal effect but a magnetic effect. The needle deflected strongly. There was no need for a microscope or a telescope. There was nothing but the voltaic battery, a piece of bare metallic connecting wire and the magnetic needle. Imagine his surprise and delight. In a few minutes of laboratory investigation the two sciences of electricity and magnetism that had been separate and absolutely distinct in human thought since the night of time were connected and became inter-related. Electromagnetics was born.

The news of this wonderful discovery spread among scientists like fire. Oersted's announcement was dated July 21, 1820, from Copenhagen, in Latin. The announcement reached Prof. André Marie Ampère, at the Ecole Polytechnique in Paris, on Sept. 11.

The news of the discovery stirred Ampère profoundly. He immediately set up a voltaic battery and some magnetic needles to repeat the experiment. Test followed test successfully, and Ampère could scarcely find time to sleep or eat. The French Academy of Sciences was scheduled to meet in Paris on Sept. 18. Within the intervening week Ampère prepared an epoch-making Academy paper, greatly extending the scope of Oersted's wonderful discovery.

With the precision and clarity that





have made French science famous for many centuries, he connected electricity and magnetism so definitely in experiment, in mathematics and in logic that ever since the two sciences have been inseparably associated.

A. E. KENNELLY,
Professor of Electrical Engineering Harvard University and Massachusetts Institute of Technology, Cambridge, Mass.

Letter from Dr. Jewett

In the issue of Sept. 18 the address of Dr. F. B. Jewett was erroneously given as the University of Chicago through the misplacing of type lines in the printing establishment. It is scarcely necessary to state that Dr. Jewett is chief engineer of the Western Electric Company, New York City.

*Other letters expressing appreciation of Ampère and Oersted's discoveries by Francis B. Crocker, Elihu Thomson, F. B. Jewett, R. A. Millikan, Edward L. Nichols, E. B. Rosa, and Carl Hering appeared in the Sept. 18 issue of ELECTRICAL WORLD.

Readers' Views and Comments

Shortage of Instructors

To the Editor of the ELECTRICAL WORLD:

SIR: There is an unprecedented shortage of younger teachers in engineering subjects, a shortage which, in connection with an increased registration of students, makes the situation in many technical schools almost critical. The "want columns" of engineering periodicals witness this shortage. Men in charge of apprenticeship courses in large manufacturing companies are overwhelmed with requests for men from numerous colleges. Inducements such as were unheard of in the pre-war days, when experienced instructors were paid as little as $750 a year, are offered to these "cub" teachers. Senior and even junior students of none too high scholastic standing receive several hundred dollars a year for what help they can give in reading and correcting papers and preparing experiments.

There are at least three reasons for this situation—an unprecedented demand for young engineers in industry, an increased registration of students, necessitating more instructors, and the inability of colleges on account of limited endowment to meet the necessary salary increases. These conditions will undoubtedly become more normal sooner or later, but in the meantime the deans and heads of departments are confronted with the necessity of an immediate solution.

Of course, after the almost insuperable problems of the war, when we were short of everything except trouble, this particular difficulty seems almost too tame to mention. But unless the situation is met wisely and promptly, we may have a generation of engineers with insufficient training just at the time when large projects of all kinds are pending to be executed within the next decade.

Just as many of our war difficulties proved to be blessings in disguise, so it is quite possible that the shortage in junior instructors may lead our more mature educators to reconsider some accepted methods of teaching in the light of modern psychological principles. Is it really necessary, or even desirable, to have recitations in numerous small sections conducted by immature instructors with little practical experience, with hardly any advanced theoretical training and with none of the point of view which comes with responsible professional work? Is it necessary to spend innumerable hours in the laboratory making electrical connections, taking performance curves, and then to spend more long hours at home writing reports? Is it necessary for the student to make detailed drawings of machinery, to compute fantastic dimensions for it, and to leave the school with the comfortable delusion that he "knows all about it"?

The underlying theory of all these methods of instruction which require a large number of young instructors is undoubtedly plausible. It is to give each student closer contact with a teacher, a contact impossible in lecture courses, and thus to clear up the difficulties in the student's mind as they come up. Incidentally the pupil is prodded along all the time and is not allowed to switch himself off at a siding for a rest. Another plausible theory is that through these instructors the student gets a practical training that will spare him embarrassment in the shop and make him immediately useful to his employer. The so-called "practical" instruction also adds to the student's interest, and smaller colleges make a feature of the "practical" nature of their curricula to attract students. All these features of modern instruction in engineering subjects came into vogue as a reaction against the earlier methods, when students were taught in large classes with hardly any textbooks, taking notes after the professors, who usually emphasized the physical and not the practical nature of the subject. There used to be little laboratory and computing work, and term examinations were the only check on the class. The old academic method certainly had its shortcomings, but is the present "kindergarten" method fundamentally very much better?

The technique of instruction is a specialty by itself, and only an expert body, such as the Society for Promotion of Engineering Education, assisted by representatives of the principal industries, is qualified to make a competent recommendation in the present emergency. Such a conference is apparently not in sight, and in the meanwhile I venture my humble opinion that the technical schools cannot go very far wrong by going back to the old-fashioned lecture system, with frequent examinations and reviews to keep the youngsters on the *qui vive*. With this change more weak students and misfits will fall by the roadside early in their scholastic career (and to insure their doing so is really to be charitable toward them), less ground will be covered in a perfunctory way, and less dexterity will be acquired in the laboratory. But as to the ultimate results, say ten years after graduation, we should be perfectly willing to give preference to high-caliber men who listened to mature teachers of national prominence, who had enough time to ponder and digest those lectures and to do some outside reading and reflection, who were not rushed with routine required work, and who thus carried with them the inspiration, the method of attack and the perspective which come only from thoughtful deliberation and association with a mature leader.

V. KARAPETOFF,
Cornell University.

Ithaca, N. Y.

Correction for New England Power Report

To the Editor of the ELECTRICAL WORLD:

SIR: In the writer's abstract of the New England power report, which was published in the Sept. 11 issue of the ELECTRICAL WORLD, two typographical errors appeared on page 526. The figure in the middle of the next to the last paragraph should have been 1,378,000,000 kw.-hr. per annum, instead of 1,378,000 kw.-hr., and similarly in the fourth line from the bottom in the last paragraph on that page the figure should have been 1,496,000,000 kw.-hr., instead of 1,496,000 kw.-hr. In the latter case, however, I believe it is perfectly obvious from the context that this is an incorrect value, and I presume that any one who studies the relation between 323,000 kw. and 1,378,000 kw.-hr. in the preceding paragraph will perceive that three ciphers were omitted here also.

CARROLL H. SHAW.

New York City.

Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Cleaning Condensers Saves One Fireman on Two 3,000-Kw. Turbines

AS A RESULT of thoroughly cleaning the condensers used with two 3,000-kw. turbines one fireman per shift was eliminated besides saving coal and freeing one 500-hp. boiler in the Newark (Ohio) plant of the American Gas & Electric Company. In checking up on the condensers in this plant use was made of Table II, shown below, giving vacuum pressures corresponding

TABLE I—HOW VACUUM WAS INCREASED BY CLEANING CONDENSER TUBES

	Discharge Temperature, Deg. Fahr.	Injection Temperature, Deg. Fahr	Vacuum, In.	Barometer, In.
Before cleaning	89	69	25.75	29.5
After cleaning with hose	87	68	26.75	29.4
After scraping	66	50	28.35	29.54

to different temperatures of discharge water. This table, compiled by the writer, has been found reliable for such checks provided the condensers are of about the proper size for the amount of steam used. There may be some variation from the table with changes in the barometer or when the temperature of the injection water is higher than 80 deg. Fahr. (27 deg. C.), but this variation will not be great.

On an inspection of this plant it was noticed that with a discharge temperature of 89 deg. Fahr. (31.6 deg. C.) the vacuum was only 25.75 in. (655 mm.), while, according to the table, for this temperature the vacuum should be 27.6 in. (702 mm.). This discrepancy of 1.85 in. (47 mm.) indicated trouble in the condensers and therefore each tube was washed out with a hose. As a result the vacuum increased to 26.75 in. (670 mm.)

TABLE II—RELATION BETWEEN TEMPERATURE OF DISCHARGE WATER AND VACUUM IN CONDENSER OPERATING PROPERLY

Temperature of Discharge, Deg. Fahr.	Vacuum, In.	Temperature of Discharge, Deg. Fahr.	Vacuum, In.
68	28.8	93	27.4
72	28.7	99	27.1
79	28.0	104	26.8
84	27.8	108	26.5
89	27.6		

with a discharge temperature of 87 deg. Fahr. (30.5 deg. C.). As this, however, was still below the vacuum given in the table, the tubes were scraped with a standard tube cleaner. After this cleaning the vacuum increased to 28.35 in. (721 mm.) with 66 deg. Fahr. (19 deg. C.) discharge water.

This high vacuum reduced the steam consumption on the turbines to a point where one less boiler took care of the load nicely. After this cleaning one fireman per shift was laid off and one 500-hp. hand-fired boiler was released from service, besides which an appreciable saving in coal was effected. It might be mentioned that each condenser, although connected to a 3,000-kw. turbine, has only 6,000 sq.ft. (560 sq.m.) of surface or 2 sq.ft. (0.19 sq.m.) per kilowatt, which is rather low compared with the average installation of about 2.5 sq.ft. (0.23 sq.m.) per kilowatt.

A. L. PLATT.

Newark, Ohio.

Anchoring a Transmission Line to an Old Chimney

A 33,000-VOLT incoming line is anchored to an old brick chimney of a substation of the Concord (N. H.) Electric Company in somewhat unusual fashion by the structural steel attachment shown in the accompanying halftone. The line is dead-ended on insulators held on an angle-iron framing, taps to the lightning arresters being carried downward through discharge gaps and choke coils and thence run into the building through wall bushings. The upper sets of insulators are carried on 4-in. (10-cm.) angles and the lower set on 2½-in. x ½-in. (6-cm. x 1.2-cm.) strap iron. The transformers are installed with the lightning arresters in the old brick structure, which was formerly a steam generating station. The transformer connections are



CHIMNEY OF OLD STEAM PLANT SUPPORTS INCOMING 33,000-VOLT LINE

run from the upper dead-end terminus of the line (not shown in the photograph) to horizontal leads carried on insulators supported on pipe framing above the roof level, from which drop leads are carried to the transformers within the building.

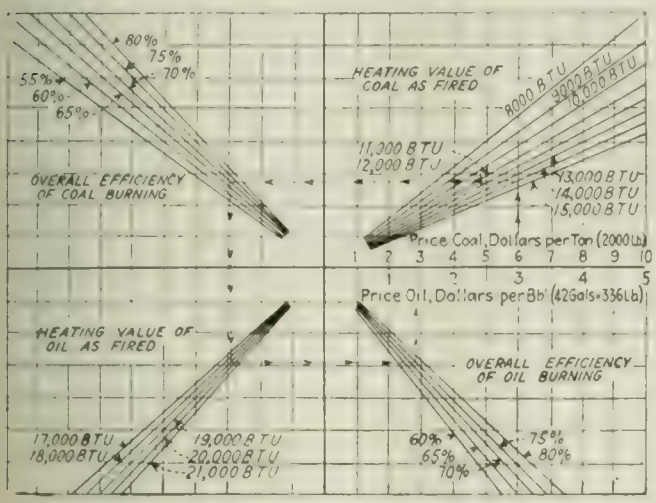
L. J. CHASE, Manager.

Concord Electric Company,

Concord, N. H.

Costs of Coal and Fuel Oil Compared by Chart

THE accompanying chart shows what the price of oil of different grades must be in order to compete with coal of various grades at varying prices. If the cost of coal, its B.t.u. heating value and the over-all efficiency at which it is burned are known, the chart shows how to find the price at which oil will compete, considering the different heating values of the oil and the over-all efficiency which may be obtained with oil burning. The example worked out on the chart shows six-dollar coal of 14,000 B.t.u., burned at 70 per cent over-all efficiency, as comparable with oil at $1.45 a



COMPARATIVE FUEL COSTS OF COAL AND OIL

barrel, 19,000 B.t.u., and used with an over-all efficiency of 75 per cent. This chart takes into account only the cost of the two fuels and does not take into consideration operation costs such as labor, maintenance or the first cost of the plant. It should be noted that the B.t.u. of both the oil and the coal are based on fuel as fired. Taking 18,250 B.t.u. for the heating value of the oil and 14,000 B.t.u. for the corresponding heat content of the coal, we would have to burn 4.56 barrels of oil to equal a ton of coal. This is assuming equal over-all efficiencies.

F. H. DANIELS,
General Manager.
Sanford Riley Stoker Company,
Worcester, Mass.

Cost of Maintaining Equipment in 60,000-Kva. Plant

ITEMIZED maintenance costs of electrical equipment in the steam plant (Station G) referred to in the article "Analyzing Maintenance Costs," on page 613 of the ELECTRICAL WORLD for Sept. 25, are given in the accompanying table.

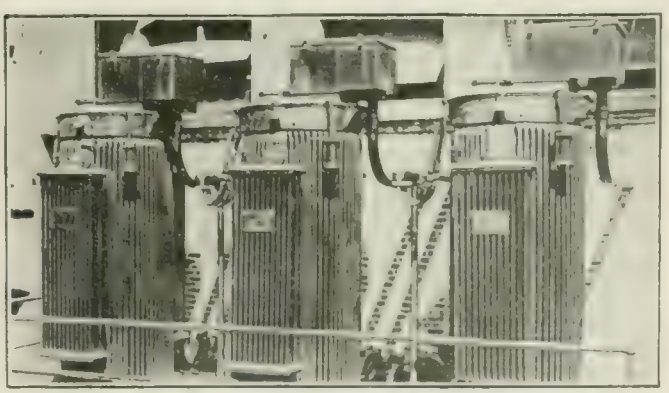
This New England plant was built about nine years ago, and in the last two years, for which the data are given, it has changed from 43,100 kva. to 63,100 kva. in rating. During these two years it has generated 144,844,900 kw.-hr. Switchboard maintenance is seen to be the most expensive item, constituting about 35 per cent of the total electrical repairs, while auxiliary motors take 28 per cent.

The total cost of electrical equipment repairs per kva. of station capacity for the two years was: Generators, $0.038; switchboard, $0.09; batteries, $0.02; motors, $0.074; wiring, $0.041; total, $0.263. Electric plant repairs represented 0.84 per cent of the total station operating expense, and of this small proportion switchboard and wiring maintenance accounted for 0.53 per cent of the total operating expense, other items being smaller. The electrical repair cost per kilowatt-hour manufactured in the two years was only 0.0088 cent. Compared with steam-plant repair expenses the cost of electrical repairs is relatively small, these being only slightly more than $500 per month, against nearly $5,000 per month for steam equipment repair.

MAINTENANCE COST FOR ELECTRIC PLANT EQUIPMENT 1918-1920
STATION RATING VARIED FROM 43,100 TO 63,100 KVA
DOLLARS EXPENDED IN REPAIRS

	Labor					Materials				
	Generators	Switchboards	Batteries	Motor-	Wiring	Generators	Switchboards	Batteries	Motor-	Wiring	Total
1920											
June	214	73	5	83	4	2	272	25	37	0	715
May	44	4	4	55	4	11	41	0	105	0	268
Apr.	23	63	12	58	6	8	10	0	135	0	214
Mar	34	115	3	39	15	0	0	0	7	1	315
Feb	23	92	9	52	54	2	23	12	9	2	278
Jan	19	89	2	52	359	29	60	0	7	6	623
	357	436	35	339	442	52	406	37	300	9	2,413
1919											
Dec	35	32	5	103	109	221	0	0	3	0	508
Nov	17	40	6	79	84	27	60	0	5	1	319
Oct	5	31	4	166	29	4	1	0	268	72	580
Sept.	9	97	2	232	4	28	57	0	245	61	735
Aug	13	50	11	366	42	9	10	0	165	9	675
July	19	86	1	85	25	46	69	8	6	13	358
	98	336	29	1,031	293	335	197	8	692	156	3,175
Year	455	772	64	1,370	735	387	603	45	992	165	5,588
1919											
June	45	149	46	32	4	32	1,549	7	27	5	1,896
May	19	183	89	30	12	32	23	87	0	9	484
Apr.	36	124	70	11	36	326	414	449	365	5	1,836
Mar	61	3	5	82	68	0	0	0	0	55	274
Feb	21	104	0	22	348	2	0	0	0	118	615
Jan.	29	45	0	45	49	6	45	0	0	97	316
	211	608	210	222	517	398	2,031	543	392	289	5,421
1918											
Dec.	36	38	0	37	0	20	27	0	75	86	319
Nov.	52	65	0	82	0	34	3	0	0	55	291
Oct.	47	11	0	71	0	29	1	0	47	57	263
Sept.	33	97	0	59	0	9	19	14	0	9	240
Aug	61	32	0	84	0	5	17	0	0	20	219
July	38	18	0	56	0	25	38	0	11	71	257
	267	261	0	389	0	122	105	14	133	298	1,589
Year	478	869	210	611	517	520	2,136	557	525	587	7,010
Two years	933	1,641	274	1,981	1,252	907	2,739	602	1,517	752	12,598

Transformers Made Weatherproof



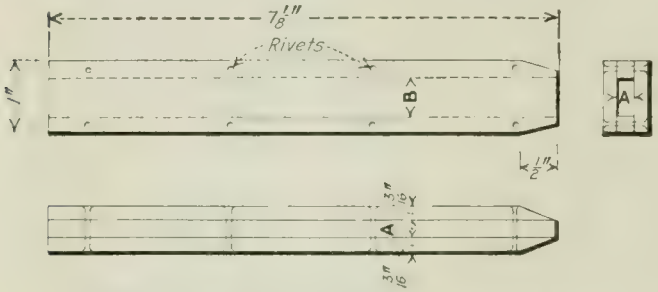
WEATHER protection of this bank of 667-kva. transformers has been accomplished by placing a housing over the high tension bushings. The 2,300-volt cables terminate in end bells which are within the weatherproof boxes mounted on top of the transformers. The 575-volt leads are taken out of the transformers through the regular bushings. The installation is at the Pacific Mills at Lawrence, Mass.

Industrial Applications

The Economical Utilization of Electrical Energy
in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

Device Which Holds Motor Wedges While Driving Them Into Place

MOTOR wedges are easily held in position for driving them into the slots by means of a device developed in a New York repair shop. The drivers are made of five pieces of cold-rolled steel with the front end tapered to permit of working in restricted spaces. When



A LOOSELY FITTING PLUNGER 7¾ IN. LONG FITS INTO THIS WEDGE DRIVER

using the driver the wedge is placed in the chamber with ¼-in. (6 mm.) projecting. The plunger is inserted from the rear and driven by a rawhide mallet. The sizes most used have *A* and *B* dimensions respectively 1/16 in. (1.6 mm.) and 7/16 in. (11.1 mm.), 5/64 in. (1.9 mm.) and 7/16 in. (11.1 mm.), and ⅛ in. (3.1 mm.) and 9/16 in. (14.2 mm.).

C. A. JOHNSON.

Bronx, New York City.

Rewound Motor for Testing Phase Rotation

FOR checking phase rotation an Eastern repair shop rewound a 1½-hp., three-phase, 60-cycle, 220-volt, 1,050-r.p.m. motor to two phase, 440 volts, twenty-four poles, 265 r.p.m., as the lower speed was better for observing rotation and the two-phase connection permitted of testing both two-phase and three-phase lines. To assist further in noting direction of rotation a white arrow was fixed to the end of the shaft and a black disk mounted behind the arrow on the end frame, the direction in which the white arrow slowly revolved in front of the black disk being easily observed.

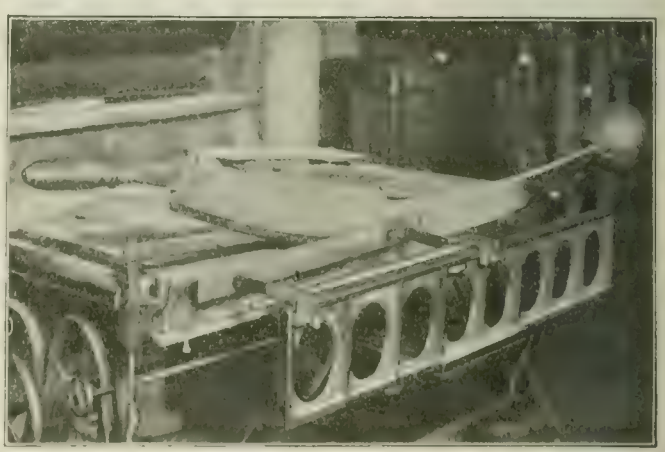
The motor had forty-eight slots and a coil pitch of 1 and 7; it was connected series-star, each coil being wound with twenty turns of two No. 19 single-cotton and enamel-covered wire. The six-pole pitch of 1 and 7 chorded has a chord factor equal to $\sin(7 \times 180/8)/2 = \sin 78° 0' 45'' = 0.9807$. Full-pitch line voltage should be $220/0.981 = 224$ volts per phase, or $224/1.73 = 129$ volts star. This winding will then be good for $(3 \times 129)/2 = 188\frac{1}{2}$ volts for two-phase series connection. The number of turns per coil required for two-phase, 440 volts, twenty-four poles, is $20(440/188.5) \times 24/6 = 186$ turns for full pitch. The turns being increased 9.3 times, the cross-section of copper was decreased in the same proportion, the size nearest correct being No. 25; but as the proper number of turns of No. 25 more than fill the slots, No. 27 was used. As rewound, the motor had forty-eight coils (two-layer winding), pitch 1 and 3, and was connected series, one coil per group, and developed approximately ⅓ hp.

The motor was mounted on top of the testing switchboard with the dial facing the test bench, and four wires were brought down to four plug switches, a fuse being placed on each outside wire between the test motor and the plug. The plugs were arranged A1, A2, B2, B1; for three-phase tests a lug was used at the back of board to connect A2 and B2 together. A 6-ft. (1.8-m.) length of cable is used for each test lead, the male end of the plug switch being attached to one end of the cable and a bull-dog testing-clip to the other end. This phase rotation tester has been in use for about a year and a half and has proved a valuable instrument.

Detroit, Mich. A. C. ROE.

Cutting Fiber to Narrow Widths

TO CUT fiber in very narrow widths the American Electric Service & Maintenance Company, Springfield, Mass., designed the home-made gage illustrated herewith for attachment to a paper cutter. The gage consists of a straight bar, 21 in. long, 1¾ in. high and 3/16-in. wide (44 cm. x 4.5 cm. x 4 mm.), attached to angle pieces which are seated against two sliding blocks arranged to move back and forth as required on the regular stop of the cutter. A ½-in. (1.3 cm.) rod con-



AUXILIARY BAR ON STOP OF PAPER CUTTER ADJUSTABLE FOR CUTTING VERY NARROW STRIPS

nects the sliding blocks and is fitted with a spring to hold the gage in a horizontal position parallel to the face of the cutter. The gage can be fixed in any position along the cutter by set-screw adjustment, and the fiber can be cut to hair widths if desired.

Boston, Mass H. KNOWLES.

Forty-Cycle Motors Operated on 60 Cycles to Utilize Old Equipment

THAT a 40-cycle motor has more desirable characteristics when operating on 60 cycles at the same voltage than a standard 60-cycle motor proved to be true when a central station recently made tests to find out if its service could replace a 40-cycle isolated plant without necessitating the purchase of new motors. Of course in buying new equipment 60-cycle motors are more economical on 60-cycle energy, but this case involved only the utilization of old motors efficiently. The utility had both 25-cycle and 60-cycle service available, and after testing a 40-cycle motor at the same voltage on all three frequencies the isolated plant was shut down, 60-cycle service was installed and smaller pulleys were put on the motors, which have been operating satisfactorily for the past three years.

It might be thought that the power factor would be worse on the higher frequency, but the reverse is actually the case. A 40-cycle motor contains more iron than a standard 60-cycle motor, and with the constant voltage the increase in frequency reduces the magnetizing current, and this results in higher power factor.

The test results showed that on 25 cycles the free running current of the motor was over 125 per cent of the rated full-load current on 40 cycles, while on 60 cycles the free running current was but a little more than one-half that at 40 cycles. Using the tests on 40 cycles as a basis, the 60-cycle results showed 14.5 per cent less free-running watts and the 25-cycle test 136 per cent more. The free-running current on 25 cycles was so high that no full-load test was attempted.

A partial load test was applied long enough to observe some readings, which showed that the motor could not be satisfactorily operated at 25 cycles.

TESTS OF 20-HP., 220-VOLT, THREE-PHASE, 40-CYCLE MOTOR ON 40 CYCLES, 60 CYCLES AND 25 CYCLES

Volts	Amp	Input, Watts	Brake, Hp	Per Cent P F	R p.m.	Remarks
		40 Cycles				
232						Open circuit.
	160					Starting free.
230	21 5	1,660		19	800	Running free.
221 5	30	8,800	11 8	67	790	
221 5	39	12,020	16 1	80	790	
220	46 5	14,920	20	84	780	Brake tests.
218	54	18,005	24 1	88	780	
		60 Cycles				
230						Open circuit.
218	100					Starting free.
228	11 5	1,420		31	1,200	Running free.
230	12	2,420	3 2	50	1,200	
229	19	4,500	6 0	59	1,198	
227 5	22 5	7,000	9 4	78	1,196	
224	33	10,900	13 3	83	1,187	
220	43 5	14,000	18 8	87	1,177	Load obtained through belt-driven generator. Motor operated very well.
217	51	17,230	23 1	90	1,170	
213	60	20,120	26 9	91	1,165	
207	74	24,200	32 4	92	1,157	Short overload test.
		25 Cycles				
231						Open circuit.
202	220					Starting free.
228	64	3,920		15	498	Running free.
225	67	10,800	10 5	30	498	Load obtained through belt-driven generator.

The slip at 23 hp. to 24 hp. was about 2½ per cent on both 40-cycle and 60-cycle service. When the load at 60 cycles was increased to 32.4 hp. the slip increased to about 3½ per cent, but the motor gave no indication of stalling.

The motor used for these tests was a 20-hp., 220-volt, three-phase, 40-cycle, 800-r.p.m. synchronous-speed General Electric type I, form K squirrel-cage motor, with its regular type of compensator.

C. W. LEONARD.
Union Electric Light & Power Company,
St. Louis, Mo.

Blanks for Recording Photometer Tests

FOR conveniently recording data of lamp and reflector tests made for industrial plants the test record sheet here illustrated was devised by the writer, who has found it to be very useful during the past year. It is in the form of a blue-line print (such as can be made in any drafting room) the color and surface of which permit the use of ink for recording the data. It provides spaces for the recording of all information for the distribution and absorption comparisons usually required by the user of accessories.

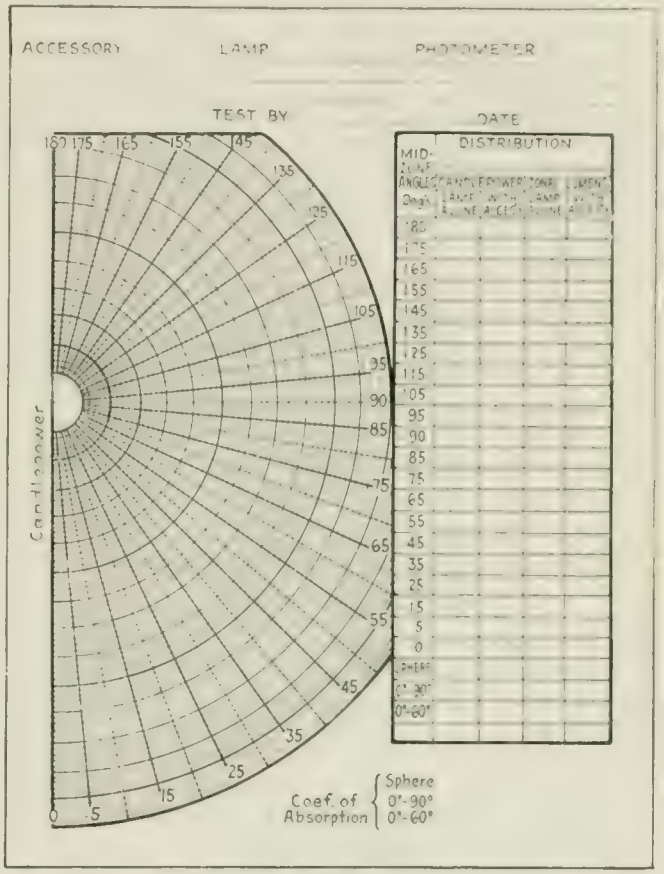


CHART FOR RECORDING PHOTOMETRIC TESTS

Industrial plants are now learning that it is of value to give time and study to the selection of lighting units. Although reflector and lamp manufacturers are striving to standardize the shapes of reflectors, there are a number of things which cause some makes to be better than others. As the best way to determine the performance of lamps in their shades, reflectors or other accessories is by making photometric tests, the purchase of a suitable photometer for making such tests has been shown to be a paying investment where there is an employee available who is capable of making such tests and using the results. As an alternative an illuminating engineer should be retained to test the accessories under consideration and to recommend the selection of that which is most desirable for the application.

Pittsburgh, Pa. D. W. BLAKESLEE.

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

Pacific Gas & Electric Stockholders to Receive Company Magazine

COMMENCING with the current issue, the Pacific Gas & Electric Company, San Francisco, will send its monthly publication, *Pacific Service Magazine*, to all stockholders of the company. In adopting this policy the company is actuated by a desire to do all in its power to establish and maintain an intimate relationship between the stockholder as a part owner in the public utility enterprise and the directors and officers of that enterprise, who are really the servants of the stockholders.

The officers of the Pacific Gas & Electric Company feel that the comparatively slight expense involved in increasing the distribution of the magazine will be more than made up by the value it will be to the company's stockholders, as well as to the company as a whole, in supplying the right kind of information concerning the company's activities and keeping alive the general interest in the company as a public utility.

Development of Utilities Depends on Commissions

THAT adequate development of public utilities and a fair deal for the public and the utility corporations alike depend upon competent regulation by public utility commissions is the attitude of the Pacific Power & Light Company, Portland, Ore. The duties and responsibilities of public utilities are interestingly explained in the current issue of the company's monthly *Bulletin*, which reads in part as follows:

"Regulation of public utility corporations is a most serious and responsible undertaking. The public utility is the vendor of an essential service. It is an important factor in the industrial development of the community it serves. The investment in the public utilities of each state amounts to millions of dollars. It is generally the largest single investment in any community. The kind of service a public utility renders is dependent upon the efficiency and economy of its operation, and the development of its service is determined by the nature and protection of its credit. Public utility statutes vest in commissions of regulation almost unlimited powers of supervision and control. Commissions determine standards of service, classification of accounts, values, rates and return. The service and development of our public utilities are measured by the character and intelligence of the personnel of commissions. The technique of engineering and accounting, operating practices and the economics of production, distribution and finance are the problems of regulation. Their solution requires judgment and learning that are the result of study and experience. The public good of regulation will depend for its success upon those who regulate. It is a question of men and not of laws. The state with the best public utility laws and the least capable commission will not have such good regulation as the state with the worst laws and most capable commission.

"The public does not properly appreciate the importance of a public utility commissionership, and it should come to know the duties and responsibilities of such an office in order that it may be less influenced by the expediencies of practical politics. It should have a dignity and importance in the public mind that will lift it above the strife for partisan advantage. Regulation is correct in principle and can be made right in practice if commissions are efficient in personnel. Commissions must be capable, independent and permanent in order to be efficient, fair and just. There must be knowledge and experience. The term of office should not be governed by the vicissitudes of politics. It is unduly burdensome and unfair to the public and public utility alike to be constantly educating a new commissioner in the problems of the public utility industry in order that political obligations may be discharged or partisan advantage bear fruit. One of the problems of today is to take regulation out of politics and to make commissioners responsible to their judgment of what is fair, just and reasonable, uninfluenced by the rant and cant of the demagogue and the cupidity of the politician."

Better Accounting Methods Necessary

THE prime thing for every utility to know and to let the public know is whether the net income from operations is sufficient, declared J. A. C. Kennedy, general counsel of the Nebraska Power Company, at the recent Omaha convention of the Nebraska Section of the N. E. L. A. To know this, Mr. Kennedy continued, involves thoroughly understanding modern accounting. The ordinary business man, however, has not heretofore sought to master this very important phase of the business. An official of so large a corporation as the Nebraska Telephone Company said that that company had never made money in Nebraska, because it was only in the last few years that its officials had learned how to keep their accounts properly. The greatest error by this company in its earlier years was a neglect to charge annually a sufficient depreciation expense. The result was a colossal increase in the operating expenses when the time came, as it was bound to come, to junk the antiquated switchboards, receivers, etc. Had a proper depreciation charge been annually made in anticipation of this inevitable day of reckoning, the funds would have been at hand with which to replace the obsolete property, instead of the company being compelled to take the necessary funds out of the immediate year's receipts. If such has been

the experience of this great corporation, Mr. Kennedy said, it is certain that many smaller utilities of all kinds have gone along blissfully ignorant of their failure, because of inadequate accounting methods, to charge enough for the service rendered.

If the great value of an adequate accounting system was fully appreciated by every utility company, there would not be a moment's hesitation in adopting such a system. It is the common experience that the installation of an adequate accounting system gives a new tone to a business. It dignifies it and gives the management a distinct pride. This is true because the manager has an accurate monthly picture of all of his company's operations, from a study of which he may not only devise ways and means of improving the financial condition of his company but, in addition, be prompted to devise methods for the improvement of the company's physical condition and its capacity for giving better service. The public is not only interested, therefore, in having such an accounting system as will reflect the actual financial condition of the company, but its interest goes to the improved service that almost inevitably follows the installation of such a system. Furthermore, the speaker held, the demands of the income-tax law and of the regulatory bodies are making accounting more important than it has ever been before, and the men in the electric lighting and power fields who will have the greatest measure of success are those who will give careful attention to the perfection of their accounting systems.

Utility Maintains Customers' Lighting Equipment

NEARLY 37,000 customers' lighting units are being maintained by the Commonwealth Edison Company of Chicago at a fixed rate per lamp per month. Customers' 100-watt to 500-watt lighting fixtures are maintained during the life of the contract for electric service at the rates shown in the table below.

The price charged for the maintenance service includes the original installation of lamps and all renewals thereof except that in the case of signs the customer pays an additional sum for the original installation of lamps and all renewals. In order to obtain this service a customer must contract for the maintenance of all units of 100 watts and over. The company cleans the lamps, globes and reflectors at least once a month, and where special factory conditions require more frequent cleaning it makes a practice of cleaning the lamps twice a month without extra charge. The maintenance does not include repairs or painting of equipment, and the customer is held responsible for any lamps that have been broken or removed from the sockets.

Equipment	Net Monthly Charge per Fixture
200-Watt Mazda "C" store fixture	$0 37
300-Watt Mazda "C" store fixture	0 43
400-Watt Mazda "C" store fixture	0 48
500-Watt Mazda "C" store fixture	0 48
100-Watt Mazda "C" factory fixture	0 26
200-Watt Mazda "C" factory fixture	0 32
300-Watt Mazda "C" factory fixture	0 37
400-Watt Mazda "C" factory fixture	0 42
500-Watt Mazda "C" factory fixture	0 42
	Per Socket
Sectional sign*	0 01½
Panel sign*	0 05
	Per Bracket
300-Watt Mazda "C" exterior bracket	1 20
500-Watt Mazda "C" exterior bracket	1 25
	Per Post †
300-Watt and 500-watt Mazda "C" private street post	1 50

*Minimum charge $6 per year †Including switching.

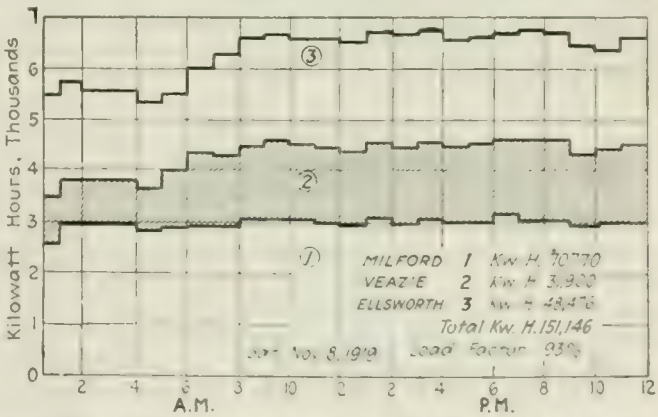
The present form of agreement has been in force since March 1, 1920, and supersedes a previous contract under which lighting units were installed and maintained. About five months after the present maintenance arrangement became effective the company was maintaining 36,840 lighting units exclusive of signs, as shown in the following table:

Inside store fixtures	18,835
Outside bracket fixtures	732
Factory units	16,970
Street posts	303
Total	36,840

Although more inside store fixtures were being maintained than any other type at that time, most of the new contracts taken were for the maintenance of factory fixtures which are expected to exceed the totals of all other fixtures combined. There was an average of about three fixtures to every customer when the above figures were given out, but the number of fixtures per customer is expected to grow with the increase in the number of industrial customers who avail themselves of the maintenance service. Lighting salesmen receive a commission of 25 cents per socket for all maintenance contracts secured.

High Load Factor Results from Long-Hour Business

AN AVERAGE load factor of 85 per cent is obtained regularly on the generating system of the Bangor (Me.) Railway & Electric Company and controlled properties, which supply energy to a varied load in the central Penobscot Valley and adjacent territory. Hydro-electric stations at Milford, Veazie and Ellsworth serve diversified industries, large paper mills, electric railway, and commercial lighting and power business. A typical load curve of an all-day-and-night load factor of 93 per cent is shown herewith, the combined outputs of the various stations from hour to hour being indicated by the broken lines. The individual outputs of the stations are represented by the areas between these lines. The stations were rated as follows at the time the readings were taken: Ellsworth, 2,250 kw.; Milford, 3,200 kw.; Veazie, 1,600 kw. Edward M. Graham is vice-president and general manager of the company.



COMBINED HOURLY LOAD CURVES FOR ALL STATIONS OF BANGOR RAILWAY & ELECTRIC COMPANY'S SYSTEM

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Periodic Self-Excitation in Direct-Current Machinery.—LEYERER.—In experiments with a large turbo-generator with exciter-dynamo an instability was observed that under certain conditions caused a periodic self-excitation of the exciter machine, first in one direction, then in the other, so that the system actually generated alternating current of very low frequency. The rotor of the turbo-generator was connected directly to the exciter, in parallel with the exciter field winding, and a regulating rheostat was inserted in series with the exciter armature. When this rheostat was cut down to minimum resistance the system ran smoothly and the exciter current was stable. At a given resistance value disturbances set in. The current rose slowly and then decreased to zero. After a while the exciter would reverse its polarity, and the same phenomenon repeated itself. When the regulating rheostat was adjusted to still higher resistance values the current reversals became more rapid and the curent amplitude lower, until, above another limiting resistance value, the oscillations ceased altogether and the current remained zero. The author presents a mathematical theory of the phenomenon and shows under what conditions instability and periodic excitation may occur.—*Archiv für Elektrotechnik,* July 8, 1920.

Variable Speed, Shunt-Wound Direct-Current Motors.—An analytical treatment of the design of direct-current shunt motors, with especial reference to flash-over tendencies and iron losses.—London *Electrical Review,* July 23, 1920.

Lamps and Lighting

Development of Electric Sign Lighting.—E. A. MILLS.—The development of electric signs and lighting has followed along two general lines—improvement in lamps and improvement in design and construction. The advent of the drawn-filament 10-watt standard-voltage sign lamp solved all difficulties, and it may be considered the standard lamp at this time. Various types of letters and arrangements of signs are considered by the author by reference to a series of photographs of typical signs.—*Transactions I. E. S.,* Aug. 30, 1920.

The R.L.M. Standard Reflector for Industrial Lighting.—WARD HARRISON.—The writer calls attention to the fact that the R.L.M. specification provides (a) a durable and highly efficient reflecting surface, (b) a contour of reflector which will insure an effective light distribution, and (c) a depth which will cut the filament center off from view at an angle of 72½ deg. from the vertical axis, thus screening the light source to minimize glare. He states that a photometer has been developed with which the reflection factor of porcelain-enameled steel surfaces of a given contour may be indicated by one reading. In explaining the difficulties in using the tungsten gas-filled lamp with various types of reflectors, some information is given regarding the bowl-enameled lamp which has been developed for use in dome reflectors. The enameling is a superficial coating which is applied to the bowl of the lamp and is carried to the point opposite the lowest part of the filament. As regards durability, the author states that it will resist practically any mechanical abrasion it is likely to encounter. Repeated tests have shown it to be proof against deterioration by acid fumes. Because of its smoother surface, this lamp does not collect dirt so readily as a frosted lamp. When used with the R.L.M. dome reflector, the lower part of the lamp becomes virtually a semi-indirect bowl, serving the same purpose as heretofore has been accomplished by the opal cap. In combination with the bowl-enameled lamp the R.L.M. standard dome reflector provides an equipment that will meet the requirements of a large percentage of industrial plants.—*Transactions I. E. S.,* Aug. 30, 1920.

Generation, Transmission and Distribution

Electricity in Spain.—BLUMENTHAL.—This article gives a review of the present development of electrification in Spain and also touches upon some plans which are on foot aiming at the utilization of a considerable part of the 5,000,000 hp. estimated water power available. So far about 900,000 hp. has been assigned on concession, but less than 400,000 hp. had been developed in 1917. Richest in hydraulic power among the Spanish rivers is the Ebro, with 1,130,000 hp. Next comes the Douro with 90,000 hp., the Guadaquivir with 75,000 hp., and the Tajo with 70,000 hp. Statistical data regarding the eight biggest power companies and their present plants are given. The author also discusses the productivity of the Spanish electrical manufacturing industry. The article is evidently meant to advise German interests on the possibilities for selling electrical machinery and supplies in Spain.—*Elektrotechnische Zeitschrift,* April 1, 1920.

Installations, Systems and Appliances

Design of Electrical Installations for Ships.—C. H. WORDINGHAM.—The writer covers briefly questions of generation, distribution and utilization of electricity on shipboard, including the electric propulsion of ships.—London *Electrician,* Sept. 3, 1920.

Portable Oscillograph.—J. W. LEGG.—It is stated that it has become more and more desirable to have a portable commercial oscillograph, extremely compact and light in weight, for work outside of the laboratory. The writer describes such an oscillograph and ascribes to it the following advantages: (1) Special compactness of apparatus; (2) use of an incandescent lamp with special arrangements to obtain very great intrinsic brilliancy; (3) mechanically operated focal-plane shutter; (4) remote-control switch to cause transient to appear at any desired part of the film; (5) trip magnet to

operate remote-control switch and shutter immediately after abnormal voltage is applied to the incandescent lamp; (6) lamp-extinguishing switch to prevent the filament from being destroyed; (7) self-contained storage battery to supply galvanometer field; (8) switch for placing ammeter in galvanometer field or battery-charging circuits; (9) element resistances and control panel for commercial voltages; (10) all the above apparatus mounted in a single case 13 in. x 14 in. x 25 in. (33 cm. x 36 cm. x 63 cm.) over all and weighing but 82 lb. (37 kg.); (11) transformer for 110 volts or 220 volts, 20 cycles to 70 cycles, supply for incandescent-lamp, trip-magnet and induction-motor operation; (12) induction motor with back-gear and step-pulley arrangement for driving photographic drum at uniform speed over a great range of speeds; (13) this oscillograph is arranged in two units, weighing but 135 lb.—*Journal A. I. E. E.*, July, 1920.

Electrophysics and Magnetism

High-Frequency Iron Losses.—THOMAS SPOONER.—Data are presented giving the iron losses for 5-mil, 4 per cent silicon steel sheet for a range of frequencies from 5,000 to 50,000 per second. An approximate separation of hysteresis and eddy current losses is made, showing the result of skin effect on these losses. A method of test is described which if desired could be used over a much wider range of frequencies than those indicated. The source of high-frequency supply was a new type of arc oscillator. The probable accuracy of results is discussed.—*Journal A. I. E. E.*, Sept., 1920.

Some Physical Properties of Nickel-Iron Alloys.—L. R. INGERSOLL.—The specific heats, thermal conductivities, thermo-electric properties and specific resistances have been determined for a series of iron-nickel alloys of exceptional purity and definitely known composition.—*Physical Review*, August, 1920.

Electrochemistry and Batteries

Oxygen from the Air as a Depolarisant.—FÉRY.—Attempts to use oxygen from the surrounding air for the depolarization of galvanic cells so far have met with little success. In Switzerland a ZnC cell with natrium chloride is used a good deal for electric clocks, and in a cell suggested by Rosset ammonium cuprate acts as a depolarizing medium, going over into cuprite, which is again rapidly oxidized by the air. The capacity of these cells, however, is rather limited, since their action depends on normal diffusion in the electrolyte. Furthermore, the zinc is usually exposed to corrosion even when no current is flowing. The author has developed a cell where the zinc is entirely protected from oxidation by being placed on the bottom of the jar. The other electrode is a long vertical cylinder of very pure carbon, standing on a small piece of insulation on top of the zinc plate. The electrolyte is ammonium chloride. Owing to the small distance from carbon to zinc the interior resistance of the cell is small. When the cell gives out current, the lower parts of the carbon electrode will be strongly polarized by hydrogen, but since the upper part of the carbon is submerged in a surface layer rich in oxygen, local currents will form in the carbon. The electrolytic action of these currents will even out the concentration differences and depolarize the cell more rapidly than if the oxygen had to pass from the surface down under the influence of ordinary diffusion.—*Archives des Postes*, June, 1920.

Book Review

WINNING THE PUBLIC. By S. M. Kennedy. New York: McGraw-Hill Book Company, Inc. 168 pages, illustrated. Price $2.50.

Taking as his text in effect St. Peter's injunction "Be courteous," Mr. Kennedy, who is vice-president in charge of public relations and business development of the Southern California Edison Company, in this book preaches a sermon under fifteen chapter headings which is sure not to weary his congregation but to interest, enlighten and stimulate it. Courtesy in all the relations of life is the lubricating oil of our complicated modern civilization, and were it to become extinct the machinery of business would creak and groan and ultimately break down. Every utility executive will admit offhand the great importance of conciliatory methods in dealing with the public. Yet how many of those to whom it falls to select the clerks and minor officials with whom alone most customers come into contact, and who to these customers are themselves the company, have realized that for such posts a cheerful bearing and a natural politeness are qualifications quite as essential as a quick grasp of detail or a good head for figures? And how many of the clerks and minor officials who thus meet the company's customers appreciate the truth that incivility, moroseness and indifference are disqualifications for their jobs quite as real as stupidity or slowness? To the utility executive and the under-official alike who have not quite grasped these facts, as well as to the wiser ones who will like to see their own reasoned practice supported by precept, argument and illustration, Mr. Kennedy's book is warmly to be commended. Written in a racy style, embellished with illustrations which have a direct bearing on the points the author makes, and the text enhanced by many apt quotations from poets great and small on the beauty of kindliness, it leaves little to be said on the topic with which it deals. To read it may not change the cherisher of a chronic grouch into a Chesterfield or a pompous humbug into a Sunny Jim, but it will encourage the habitually courteous to persevere in that spirit and it should check the backsliding of those who by imperceptible degrees are losing their first friendly zest. Moreover, it should bring home to any hitherto doubting utility manager the indisputable truth that arrogance and insolence behind the counter can do more harm to public relations in a week than president and directors can undo in a year.

Mr. Kennedy's book will be particularly interesting to public utility executives because its author is an outstanding national figure in the electrical industry who has the confidence both of his public utility associates and of his public. In matters of public relations he has long been considered an authority because of his clear-cut vision of the needs of the central-station customer. His popular paper "The Man in the Street," in which he pictures the influence of the good will of the general public on the central-station company, has been generally recognized as a classic in the literature of commercial relations. This paper, which has been widely published and circulated in public utilities, is included in the book. Some of the other chapters have been published serially in the *Journal of Electricity* and the ELECTRICAL WORLD.

News in Brief

Summary of Market Conditions and of Recent and Approaching Happenings of Importance to the Industry

WITHDRAWAL of the coal-supply priority accorded to public utilities by the Interstate Commerce Commission is threatened owing to the insistence from the Middle West on augmented shipments through the Great Lakes.

ANNOUNCEMENT is made that the Westinghouse Electric & Manufacturing Company has entered both the manufacturing and the operating branches of wireless telegraphy and telephony and has acquired control of the International Radio Telegraph Company. Guy E. Tripp will be chairman and E. M. Herr president of the reorganized company.

PROHIBITION of sign and display lighting in northern and central California has been extended to Nov. 1 by Power Administrator Butler.

APPEARING before the California Railroad Commission, R. H. Ballard, vice-president of the Southern California Edison Company, advocated that rates be fixed so as to provide a return on future financial obligations incurred in the development of the property.

A VIGOROUS protest against frequent shutdowns has been made by the Merchants and Manufacturers' Association of Washington to the Potomac Electric Power Company.

WORK is now proceeding at full blast on the Wilson Dam, which forms an important link in the Muscle Shoals project. Four thousand men are employed on this dam.

NO ACTION will be taken by the Federal Power Commission on any application related to developments on the St. Lawrence or Niagara River until the chief counsel of the commission has reported on its relationship to such projects.

PROPAGANDA against exportation of surplus power from Maine is making its appearance in the New England press, but little popular interest in the subject has yet developed. Explanations of the meaning of the super-power program at the recent Kineo convention of the New England Geographic Division, N. E. L. A., reached the outside public and helped to counteract the efforts of certain local politicians to make capital out of the interconnection idea.

APPLICATIONS to the Federal Power Commission for licenses made by the Crown-Willamette Paper Company of Oregon and the Pit River Paper Company of California have been permitted to be advertised prior to their completion owing to special circumstances affecting the projects.

WHAT effect widespread price slashing may have on the electrical industry is not yet apparent, but quotations and sales will undoubtedly show its influence. A smaller volume of business is reported from all centers except St. Louis. The lumber industry in the Northwest is in better shape. The strike of electricians on the Pacific Coast is over, and labor conditions generally are better. Collections are slowing up. Stocks in most lines are good, and shipments are in larger volume than many jobbers desire. Building construction continues at a low ebb except in the South and on the Pacific Coast.

THE FAN season just past was highly successful, and the left-over stocks are of small dimensions except in the East, where the summer was unusually cool. An even better fan business is confidently expected next year.

NEW ENGLAND electrical jobbers are doing an annual business of $50,000,000 or more, according to information brought out at the Kineo (Me.) convention of the New England Section, N. E. L. A.

REPORTS from jobbers throughout the country indicate that prices in all sections except New England are holding steady. Of forty manufacturers questioned, twenty-nine are optimistic, three pessimistic and the rest non-committal.

THE BUYING movement is making itself felt in lamp sales in all parts of the country. Supplies are holding up well, and there is little likelihood of shortage.

NEED for an informal organization to act as a "research laboratory of ideas" for the entire electrical industry was expressed at the White Sulphur Springs meeting of the Conference Club, which is to try to function along this line.

FIGURES for July issued by the Geological Survey give a total production of electrical energy in the United States of 3,609,319,000 kw.-hr., of which 1,414,177,000 was produced by water power. Production by water power increased 10 per cent and production by fuels 21 per cent in the first seven months of 1920.

ASSERTING that public utility securities are increasing in favor with investors, G. A. Hoyt of William A. Read & Company, investment bankers, holds that preferred stock issues have advantages over mortgage bonds bearing the same interest.

PUBLIC utility financial problems received consideration by the American Investment Bankers' Association at its ninth annual convention, held this week at Boston.

MERCHANDISING problems were discussed at length by the National Association of Electrical Contractors and Dealers, meeting at Baltimore this week.

INTERIOR lighting, metering and the effects of variations of intensity on the eye were the main subjects before the Cleveland meeting of the Illuminating Engineering Society.

THE LARGEST electrical show ever given in New York City opened on Oct. 6.

REFRACTORIES were discussed by the Electric Furnace Association at its Columbus (Ohio) meeting on Wednesday.

EXPANSION of the *N. E. L. A. Bulletin* and discussion of fewer subjects at the annual conventions of the association are favored by the Commercial Section.

IMPORTANT electrometallurgical and electrochemical papers were presented at the Cleveland convention of the American Electrochemical Society.

BRITISH COLUMBIA electrical men from all branches of the industry have launched a co-operative campaign amid much enthusiasm.

COMMERCIAL executives of the Stone & Webster organization held their pioneer convention this week at Boston.

A FREQUENCY changer rated at 15,000 kva. and said to be the largest in the world has been started in the Battle Creek (Mich.) Elm Street plant of the Consumers' Power Company.

PORTLAND, Me., and other cities in the Pine Tree State are planning to repeal daylight saving on Sunday, Oct. 10, instead of waiting until Oct. 31 to re-establish Eastern standard time.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

California Power Restrictions Extended

ALL POWER companies in northern and central California have been advised by Power Administrator Butler of the California Railroad Commission that his order No. 115, prohibiting the use of sign and display lighting except on Saturdays and Sundays, has been extended to Nov. 1. If there should be rainfall sufficient to relieve the power shortage before that date, the order, it is stated, will be promptly canceled. It is with difficulty that certain relief reservoirs can collect enough water to tide them over peak periods, to say nothing of twenty-four-hour operation.

Large Opportunity Seen for Conference Club Idea

IS THE electrical industry "thinking ahead"? Is there now any machinery of organization by which the leading ideas of the different detail organizations can find expression? Can the Conference Club be organized on a different basis to answer these questions? These were some of the problems discussed at a meeting of the Conference Club at White Sulphur Springs, W. Va., Oct. 1 and 2. President L. K. Comstock called the informal meeting together and outlined the steps that have been taken to forward the Conference Club idea since the Cleveland meeting. He stated that several representative jobbers had agreed to advance the plan and that at the Pasadena convention of the National Electric Light Association several of the central-station leaders expressed their personal interest in the idea of forming an organization which could discuss the problems of the whole industry with relation to the public.

Various members present stated their belief in the opportunity to develop the thought that an informal organization could be formed to give a sense of direction to the broad economic, industrial, commercial and social problems that the electrical industry faces in common with other industries. It was repeatedly emphasized that the proposed organization was not a new plan to direct the policies of individual organizations or of individual groups; that is to say, the manufacturers, central stations, jobbers, interstate constructing contractors, local contractors and dealers must all have their individual policies and individual organizations, but there is an opportunity for the leaders of each group to gather at intervals and discuss the relation of all these organizations to national policies.

As one speaker said, there ought to be an opportunity for some group of men in the industry representing all branches to act as a sort of research laboratory of ideas, thinking ahead for the industry as a whole, not discussing matters in terms of this year's business but of the trend ahead for five, ten and twenty years. As a result of the discussion a committee was appointed to work with the executive committee and formulate a plan of organization that would carry out the ideas expressed.

Brooklyn Edison Officials Explain Alleged Irregularities in Coal Orders

THREE indictments under the Lever act have been found by the New York federal grand jury against the Brooklyn Edison Company, Inc. It is charged that the company in July purchased 50,000 tons of coal in excess of its requirements, and it is alleged that this constitutes hoarding in violation of the act. Another of the indictments charges that the company conspired to use preference permits and priority orders for the transportation of coal to tidewater which it did not intend to consume and which was not consumed by it but diverted to other purposes. The third indictment alleges that the company since October, 1919, conspired to pay unfair and excessive prices for coal purchased from the Adelphia Coal Company, Inc.

The following statements by Matthew S. Sloan, president of the Brooklyn Edison Company, Inc., and Walter F. Wells, vice-president and general manager, which were published in the New York City newspapers on Oct. 5, were confirmed to a representative of the ELECTRICAL WORLD by Mr. Sloan. The statement by Mr. Sloan read:

"Our company learns for the first time that it is a crime under the Lever act for a public utility company to have on hand enough coal to take care of its needs. We have no excuses to make, and are in fact proud of our ability under the present difficult coal conditions to secure enough coal to take care of our daily requirements and to build up an adequate reserve to assure the people of Brooklyn of a constant and uninterrupted supply of electricity.

"Our yearly requirements average 1,500 tons per day. The grand jury was apparently advised that we need only 1,000 tons per day, and acted on that information. We are still in the market for coal, and, despite the indictment, we will continue to purchase coal to keep our bunkers full and build up our reserve to 70,000 tons. We now have approximately 40,000 tons in storage.

"The Edison company has never secured any permit or priority order for the shipment or transportation of coal for, or in connection with, the B. J. Lynch Coal Company, and has not authorized the use of any special permit or priority order for any purpose except to secure coal needed for its own use. It now appears that one of our trusted employees in connivance with the B. J. Lynch Coal Company used the name of the corporation to accomplish the shipment of coal to tidewater. This connivance did not cause any pecuniary loss to the company.

"The company is charged with the purchase of coal from the Adelphia Coal Company from Oct. 22, 1919, at unfair prices. The fact is that no coal has been received from the Adelphia Coal Company except under a contract dated in 1916 and at a price below the market price for coal of a similar grade at the time. Payments by the Edison company to the Adelphia company mentioned in the indictment were for coal delivered and for no other purpose.

"Our company has bought coal at competitive market prices, and we have not paid higher prices for coal than we were forced to pay because of market conditions.

"Our investigation of the charges against this company convinces us that Mr. Wells, our vice-president, is blameless in respect to all matters investigated by the grand jury, and we know of no reason why he should have been mentioned in the indictment."

Walter F. Wells, vice-president and general manager of the Brooklyn Edison Company, in his statement to the newspapers said:

"I know nothing about the transaction with respect to which I am accused, except that in my service as vice-president of the company I know that coal was purchased from the Adelphia company and that the prices were less than similar coal cost us from other sources.

"Neither the company nor myself has had any dealings with the B. J. Lynch company. I was given no hearing by the grand jury on the charges against me, and I welcome the opportunity which a trial of these cases will give me to demonstrate the propriety of my official acts."

Coal Priority Privilege of Public Utilities Threatened

THE priorities accorded to public utilities in the matter of coal supply are again in the balance. In the face of the greatest pressure, the Interstate Commerce Commission is virtually compelled to augment decidedly the amount of coal going up the lakes. The cold weather in the Middle West has had the effect of arousing the people of that section to the point where they no longer will wait for their coal supply. The railroads have found it impossible to meet the lake program. Now they are called upon to furnish a minimum of 2,000 cars daily in addition to those now being used in the distribution of coal in the Middle West. The carriers assert that this is impossible under present conditions.

The commission has given no intimation as to the steps it may take, but it is known that it is considering a modification of the public utility order. Instead of allowing public utilities to have assigned cars, the commission is considering a plan whereby emergency coal will be furnished utilities after the case has been passed upon. There is also under consideration a plan for using all open-top cars for coal movement until the close of navigation on the lakes.

The hearings are behind closed doors. George W. Elliott of the National Committee of Gas and Electric Service, appearing for the public utilities, is understood to have made an extended argument in favor of the modification of the existing service order No. 16.

The hearing was not planned for in advance. The railroads, alarmed by the deficit accumulating on the lake movement, called the operators into conference on Oct. 4. This conference expanded the following day to include most of the interests concerned. On Oct. 6 Division 5 of the commission began executive hearings at which public utilities, coal operators, railroads, steel makers, sand and gravel shippers and others are being heard.

Ballard Advocates New Basis for Electric Rates

APPEARING before the California Railroad Commission at a recent hearing held to fix rates for his company, R. H. Ballard, vice-president of the Southern California Edison Company, advocated a new basis for electric lighting and power rates designed to provide a return, not on the cost of producing the present service, but on the financial obligations that must be incurred in order to carry on the developments that will be required for years to come.

"The inspiration for the financial plan of rate fixing," Mr. Ballard said, "came from public speeches of the presiding commissioner, President Edgerton, who pointed out the imperative need, first, for very large hydro-electric developments in the state and, second, for a system of rate fixing which would not only stabilize rates to consumers but also insure the continuity of reasonable interest and dividends on fair capital to attract still further capital which must now be secured in much larger amounts and at a greater cost than formerly.

"To those who have perhaps inadvertently intimated that the suggested plan is some ruse of the company to fix permanent rates at a time of low earnings, I feel it my duty to draw attention to the fact that the exhibits of the company, now before the commission, include complete statements of earnings for the full years of 1920 and 1921 and, in fact, for five years prior to this period.

"As to the plan itself, it means a large stabilized business on a sound financial basis with the added security of low rates to consumers and a general feeling of co-operation. To the present consumer it means an ample supply of power with good service at rates at least one-third less than those prevailing in Eastern and Middle West communities and with excellent prospects for lower rates from time to time as new developments are completed according to program."

The hearing was adjourned, to be resumed at a later date, when many consuming interests will be heard and the proposed plan discussed.

Underwriters Will Talk to National Electrical Inspectors

THE joint meeting of the Electrical Conference and the National Association of Electrical Inspectors which will be held at the auditorium of the Underwriters' Association of the Middle Department, 316 Walnut Street, Philadelphia, at 10 o'clock next Tuesday morning, will be addressed by A. R. Small and Dana Pierce of the Underwriters' Laboratories, the former speaking on approved devices and the work of the laboratories in general, the latter on some laboratory and inspection problems. Dr. M. G. Lloyd of the Bureau of Standards will talk on "Safety to Life," and W. J. Canada, head of the engineering department of the National Electric Light Association, will explain Rule 15A. Important changes in the National Electrical Code will be announced. In the evening there will be a banquet at the Hotel Adelphia.

Convertible Securities Favored by Investors

UTILITY securities with convertible features have been in active demand recently and some investors are inclined to regard current yields as the maximum. In discussing the present status of such securities O. B. Willcox, vice-president of Bonbright & Company and chairman of the committee on public service securities Investment Bankers' Association, stated to a representative of the ELECTRICAL WORLD that the utilities had found it much easier to sell new issues in this market when they carried some added inducement, especially in the nature of conversion privileges.

"Investors," said Mr. Willcox, "while demanding a high rate of return, are not overlooking the fact that the present rates of interest will not continue indefinitely and the possibility of converting bonds or debentures into preferred stocks yielding 7 to 8 per cent affords a means of continuing a high-yield investment."

Mr. Willcox is also of the opinion that the sales of preferred stock to customers is the best type of financing for the utilities. It has been found to be a very effective and economical means of obtaining funds and customer-stockholders are proving of great value to the electric companies. In addition to this the sale of stock does not increase the debt of the company, but instead builds up a larger equity value back of the mortgage bonds.

Westinghouse Company Enters Wireless Field

THE Westinghouse Electric & Manufacturing Company announced this week its entrance into the manufacturing and the operating branches of wireless telegraphy and telephony. The Westinghouse company's interests in the operating field are the result of its acquisition of the control of the International Radio Telegraph Company. That company, which was founded by R. A. Fessenden, the pioneer investigator in the continuous-wave field, operates and maintains wireless stations on ships and has shore stations at Newport, New London, Brooklyn and Cape May, with others under construction in Maine and Massachusetts. It is perfecting a world-wide service of overseas wireless-telegraph communication and is also active in the development of wireless telephony. The original company (known as International Radio Telegraph Company) has been reorganized to form the International Radio Telegraph Company. The officers are: Guy E. Tripp, chairman; E. M. Herr, president; S. M. Kintner, Calvert Townley and H. P. Davis, vice-presidents, and John V. L. Hogan, manager. All of these are Westinghouse officials except Messrs. Kintner and Hogan, who were president and manager respectively of the older company.

Prior to the war the Westinghouse Electric & Manufacturing Company was not commercially interested in wireless work, but it had devoted a great deal of attention to radio phenomena. During the war, however, it not only carried out extensive researches for the government but also manufactured a large amount of apparatus for military use. A separate factory has now been equipped at East Springfield, Mass., for the manufacture of all types of modern radio apparatus, from the largest transmitting and receiving sets required by transoceanic stations to the small sets used by the amateur. Apparatus will not only be supplied for the well-known land, sea, ship, airplane, military and naval services, but special attention will be paid to the development of new uses, such as for railroads, power companies, mines, lumber camps, ranches and farms, and for inter-works communications of large industries. A staff of research and design engineers has been built up and important fundamental development work is under way.

One of the principal problems of commercial radiotelegraphy is the reduction or elimination of the interference from atmospheric or static electrical disturbances. This phase of the work has been carefully studied by the Westinghouse engineers. The company has exclusive manufacturing and selling rights under the Fessenden patents for the heterodyne method of reception. It also possesses licenses under other important patents, including the Poulsen arc converter system, which is used in long-distance ship and shore stations, notably in the new Lafayette station in France.

New York Electrical Show the Largest Ever Held There

DISPLAYING the development in methods of utilizing electricity in the home, office, store and factory, the thirteenth New York Electrical Show opened on Oct. 6 in the Grand Central Palace. The show occupies three floors of the building, with a total of 151 different exhibitors, making the largest electrical exhibition ever staged in New York.

Of particular interest is the industrial exhibit on the third floor, which is given over to a series of working demonstrations of material-handling equipment, including industrial trucks, conveyors and hoists. Processes of manufacture by electrical apparatus shown in actual operation are furniture making, welding, japanning, heat treating, rivet heating, oil tempering and heating with vacuum furnaces. Complete processes are shown in a bakery, refrigeration plant, battery-charging plant, etc. A special exhibit shows factory lighting, with requirements for safety and highest efficiency.

The remarkable development in household labor-saving devices is indicated by the fact that there are twenty-one different makes of washing machines, eight makes of dishwashers, eleven makes of ironing machines, six iceless refrigerators, three kitchen mixing and beating devices, seventeen vacuum cleaners, twelve ranges and other cooking devices.

The Electrical Show will be open daily from 11 a.m. to 11 p.m. until Oct. 16.

Hydro Projects to Be Advertised Prior to Completion of Applications

THE advertising of the applications for licenses under the water-power act of the Crown-Willamette Paper Company of Oregon and the Pit River Power Company of California, prior to the completion of their respective applications, has been authorized by the Federal Power Commission. In the case of the former company the exception was made because construction is already under way. In the latter case the rule was departed from in order that preliminary construction on a pulp and paper project may begin at an early date. It is desirable to rush the plant to completion in order to relieve the serious paper shortage in California.

Export Association to Meet in New York Oct. 14

FOR the eleventh annual convention of the American Manufacturers' Export Association, which will be held at the Waldorf-Astoria Hotel in New York on Oct. 14, the following program has been prepared:

Morning Session.—Routine business, election of officers and discussions.

Afternoon Session.—Keynote address, "To Obtain Permanent World Trade American Manufacturers Must Now Take a Leading Part Themselves," President W. L. Saunders; address by Dr. R. S. MacElwee, director of the Bureau of Foreign and Domestic Commerce; "Relation of Banking to Export Trade," James S. Alexander, president National Bank of Commerce; address, W. A. Harriman, president American Shipping and Commerce Corporation; "Our International Future," B. C. Forbes, editor *Forbes Magazine;* "Taxation," Otto H. Kuhn, Kuhn, Loeb & Company; "Great Lakes-St. Lawrence Tidewater Project," Julius H. Barnes, United States Wheat Director; "International Chamber of Commerce," John H. Fahey.

Evening, Banquet, 7 o'clock.—Addresses by President W. L. Saunders, Dr. L. S. Rowe, director Pan-American Union; Alfred Reeves, manager National Automobile Chamber of Commerce; Alba B. Johnson, president Railway Business Association, and Dr. Charles Eaton, assistant editor *Leslie's Weekly.*

Investment Bankers See Brighter Outlook for Utility Investments

THAT the public is rapidly coming to appreciate the importance of encouraging the flow of capital into public utilities in order that these may render adequate and expanding service at attractive rates was declared at the ninth annual convention of the Investment Bankers' Association this week in Boston. Special consideration was given to public utilities at a session on Tuesday evening, when O. B. Willcox, chairman of the committee on public service securities, presented a comprehensive report summarizing the trend of public opinion in relation to utility problems and emphasizing the better outlook resulting from popular enlightenment and sound regulation. The demand of the public for improved and expanded service, involving large expenditures of new capital, has brought with it, the report held, due appreciation of the function of credit in public service. The general attitude of the press reflects the growing opinion that the self-interest of the public served demands the payment of rates that will both attract and protect capital, assure a fair return and provide good credit. The report commended the federal water-power legislation, electrical expansion and super-power systems and advocated the local distribution of utility securities, coupled with continuing interest in utility financing by investment bankers.

Declaring that the practice of local utility security distribution is encouraged by bankers, the report went on to say:

> The appreciation by the public and the regulators of the necessity of credit for adequate public service and the examples of the difficulties consequent on insufficient equity financing should promote the adoption of broader schemes for utility financing with such balance of bonds and stocks as compared with property values and earnings as will permit the marketing of stocks sufficient in amount adequately to protect and balance the increasing amounts of bonds issued. There should be more owners and fewer creditors. The ideal utility financial structure should admit of the sale of common stocks, which of course is only possible if those stocks, unsecured by lien or preference, are protected by property values and by earnings sufficient to represent a reasonable business risk, with some expectation of more than ordinary profit.

The principle of the non-par-value stock is now better understood, and the use of such shares is increasing and growing in public favor. It is illogical that a share of stock should be used both as a measure of value and as an evidence of title. The value constantly changes. There is no theory on which all shares of all companies can be made to sell at $100, or any other so-called par value; and if sold at par the shares may appreciate or depreciate in value, and the next issue by the same corporation may have to be sold at a higher or lower rate. On the other hand, the share as an evidence of title always represents an undivided interest in property. Non-par-value shares seem best to meet the requirements for which shares of stock were invented.

Carl D. Jackson, president Wisconsin Railroad Commission, addressed the convention upon the public utility situation, pointing out the growing recognition by the public of fundamental economic considerations bearing upon utility administration and rate making, and touching upon the efforts of regulatory bodies to meet the changed conditions of today by recognizing the necessity of adequate returns to attract capital into the field of public service. The primary importance of service in establishing and maintaining public confidence and approval was set forth. The speaker declared that the time seems near when the public will again have recourse to safe and stable public utility securities for investment. He outlined the financial needs of the utilities in the coming years and urged investment bankers to establish close and permanent relations with utility financing and to co-operate with the regulating commissions in seeking sound and approved methods of meeting the financial needs of such properties. Preferential treatment in the public interest should be accorded utilities by the banking interests as a quasi-public duty. In general, the speaker said, the utilities are weathering the storms of the past few years and are on the road to more prosperous conditions.

A resolution was passed recognizing the necessity for public utility expansion, fuel conservation and electric railway rehabilitation and offering the co-operation of the association to the owners and operators of utilities and regulating officials in laying before the public full information respecting the vital importance of the prompt and continuing expansion of all kinds of utility service. The resolution favored such financial regulation as will predispose the investing public to provide the necessary funds by purchasing sound public utility securities. Copies of this resolution are to be sent to the governors and the regulating authorities of the several states.

Furnace Men Discuss Refractories

MORE than a hundred electric furnace operators and manufacturers of electric furnace products met in Columbus, Ohio, on Wednesday of this week when the Electric Furnace Association assembled to discuss a program consisting of six papers dealing with the refractories required in electric furnaces. R. M. Stull of Columbus emphasized the need of refractories which withstand higher temperatures than those now used in electric furnaces. He suggested some new refractory compounds, but said that to burn them would require electric kilns operating at about 2,200 deg. C., and he did not think that any such kilns had been developed.

Stone & Webster Commercial Agents Convene

COMMERCIAL agents of properties managed by Stone & Webster, Boston, met for the first time in convention this week, sessions being held on Tuesday and Wednesday at the headquarters offices. The program included the following papers or addresses: "Selling Securities of the Local Company Through Its Own Commercial Department," by C. W. Kellogg; "When Are Extensions Profitable?" by G. E. Quinan; "Merchandising Methods," by H. J. Pettengill, Jr.; "The Plot in Newspaper Advertising," by H. A. Lemmon; "Window Dressing and Store Arrangement," by J. T. G. Nichols. A luncheon was scheduled at the Exchange Club, Boston, Tuesday noon, with addresses by E. S. Webster, H. H. Hunt, Russell Robb, Henry G. Bradlee, H. T. Edgar and F. J. Whiting. About fifty commercial agents representing all parts of the country were expected.

Electrochemists Hear About Self-Baking Continuous Electrode

AT THE thirty-eighth general meeting of the American Electrochemical Society, held in Cleveland on Sept. 30, Oct. 1 and 2, there were two technical sessions for the reading and discussion of papers, one being devoted particularly to electrometallurgy and the other to electrochemistry. Among the important electrometallurgical papers were those of M. R. Wolfe and V. de Wysocki on "Heat Losses Through Electrodes of a Six-Ton Heroult Furnace"; M. L. Hartman, A. P. Sullivan and D. E. Allen on "Physical Characteristics of Specialized Refractories—Part III, Electrical Resistivity at High Temperatures"; J. W. Richards on "The Söderberg Electrode: First American Installation," and J. Kelleher on "Some Phenomena Observed in Electric Furnace Arcs." The Söderberg continuous self-baking electrode is an innovation in this country, the first installation being at Anniston, Ala., in an 1,800-kw., three-phase furnace making ferromanganese. The electrodes are 32 in. (80 cm.) in diameter, and the operation of the furnace is continuous as far as electrodes are concerned. The electrochemical papers related primarily to corrosion and the electrodeposition of metals and alloys.

The feature of the convention was the afternoon visit to the Nela Park Laboratories of the General Electric Company. A lecture on industrial lighting was given by Ward Harrison, chairman of the reciprocal relations committee of the Illuminating Engineering Society. This was illustrated by a demonstration of modern industrial lighting. Industrial plants visited included the United States Copper Products Company, where electric furnaces are in use for copper, brass and bronze melting; the National Castings Company, where the Heroult furnace is used for making castings; the Western Reserve Chemical Company, manufacturer of organic chemicals by electrolytic methods; the Ohio Chemical Company, manufacturer of electrolytic gases, and the Guide Motor Lamp Company, electroplating with rotating electrodes.

At a brief business session it was announced that the recent referendum on a resolution approving legislation to make the metric system the exclusive legal system of weights and measures in the United States resulted in a vote of 483 in favor to 107 against, out of a total membership of about 2,000. The board of directors selected Atlantic City as the place for the next meeting in the spring of 1921.

Numerous Rulings Made by Chief Counsel of Federal Power Commission

THE relationship of the Federal Power Commission and the International Joint Commission to power development on the St. Lawrence and Niagara Rivers is to be the subject of a special report by the chief counsel of the Federal Power Commission. Pending this report and its approval no action is to be taken on any application affecting the St. Lawrence or Niagara River.

The Federal Power Commission also has decided that no hearing is to be held prior to the termination of the period of advertisement. Hearings will be arranged, however, within a week or ten days after the expiration of that period if a quorum of the commission can be in attendance and if the necessary information is available.

The chief counsel has been requested by the commission to report on the possible effect of issuing a preliminary permit upon the status of certain lands now within a power reserve but to which the Pit River Power Company claims ownership through purchase from California.

In a report to the commission the chief counsel holds that the authority of the commission does not extend to allotted Indian lands. The report was made in connection with the application of the Washington Power Company for right-of-way that is required by a power transmission line.

The Pacific Gas & Electric Company and the Mount Shasta Power Company applied to the Forest Service for easements for a transmission line under authority of the act of March 4, 1911. The chief counsel of the Federal Power Commission, however, held that the water-power act repeals the portion of the previous act providing for the issuance of such a permit. He held that application must be made to the Federal Power Commission.

Interior Lighting, Metering and Effects on Vision Discussed by I. E. S.

THE application of light to residential, commercial and industrial interiors, means of measurement and the effect on the eye were the subjects that had most consideration in the twenty papers presented at the fourteenth annual convention of the Illuminating Engineering Society at Cleveland, Ohio, held on Monday to Thursday of this week. One evening session held at Nela Park was preceded by a dinner tendered to the members and guests by the National Lamp Works of the General Electric Company.

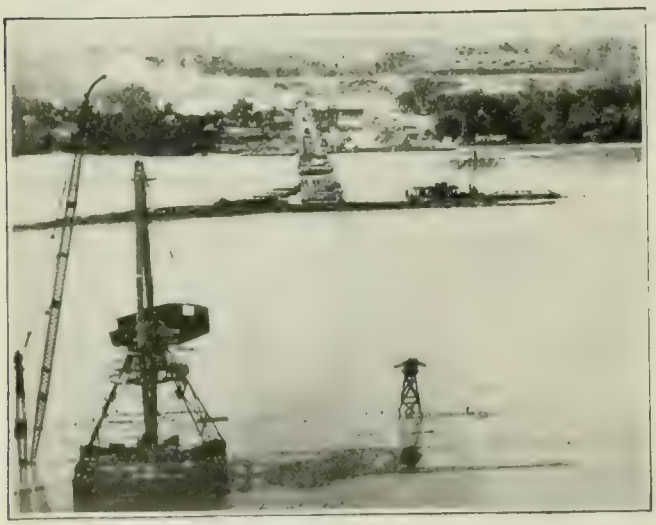
The excellence of the papers presented at the convention was the subject of much favorable comment, but it was generally felt by the members present that the program was too full to permit of its having the consideration and discussion it deserved. Practical plans, including the necessary financing for broadening the scope and increasing the usefulness of the society, were announced in the address of the retiring president, S. E. Doane, who has made arrangements for the society to collect, compile and publish illuminating engineering data for the entire industry. It is intended

that the society shall sell reprints to manufacturers and others at a price which will cover the overhead expense necessary to take care of the program.

Ten of the papers presented at the convention were on subjects pertaining to interior illumination, and four of these record the efforts of central stations to raise the standard of lighting on their customers' premises. Other subjects discussed under this general heading included "Improved Methods for Illuminating Motion-Picture Theaters," by L. A. Jones; "The Lighting of Shoe Factories," by A. L. Powell and J. H. Kurlander; "Recent Applications of Color in Lighting," by A. D. Curtis and J. L. Stair, and "Some Mechanically Difficult Applications of Industrial Lighting," by Samuel G. Hibben. The papers on metering included one by Davis Tuck on the construction of a small portable light meter capable of making accurate measurements. How to make and use a simple portable reflectometer of the absolute type was described by A. H. Taylor. A procedure was worked out by C. H. Sharp and W. F. Little whereby the reflection factor may be measured by an absolute method for any surface whether matte or glossy. A comprehensive paper on the important effects on the eye of variations of intensity was prepared by C. E. Ferree and Gertrude Rand. They found that increased intensities when not accompanied by harmful glare produced a gain in acuity, speed of discrimination, speed of adjustment and in the power to sustain clear seeing.

The annual losses sustained as the result of accidents attributable to poor lighting were estimated by R. E. Simpson to amount to $300,000,000, or more than the present industrial lighting bill of the country. Before the close of the convention the new president, General G. H. Harries, was inducted into office.

Work Again Under Way at Muscle Shoals



AFTER the most unfavorable season ever recorded on the Tennessee River, work has started at full blast on the Wilson Dam at Muscle Shoals. Four thousand men are engaged on the work, which calls for a monthly expenditure of $700,000. Gen. Lansing H. Beach, the chief of engineers, recently visited the Wilson Dam and reports that the power-house cofferdam has been pumped out and that everything looks favorable for rapid progress on the project.

The illustration gives a view from the south or power-house end of the dam, showing the work in a flooded condition on Aug. 19, 1920. This is a very unusual condition for this season of the year on the Tennessee River.

Merchandising Electrical Appliances Has Attention of Contractor-Dealers

AT AN unusually well-attended convention of the National Association of Electrical Contractors and Dealers held this week at the Southern Hotel, Baltimore, Md., special attention was given to the subject of merchandising of electrical appliances and fixtures. A report was presented to the executive committee and approved relating to resale merchandise. While no attempt was made to define the margin of profit, still it was agreed that proper accounting methods would disclose a cost of doing business which would more than offset present discounts and still leave an attractive profit.

At the opening session Thomas A. Whelan, president Fidelity & Deposit Company of Maryland, presented a vivid picture of a nation-wide canvass made a month ago. Mr. Whelan indicated that the present situation is not one to cause pessimism, but he said that unsual care should be exercised by all business men. He showed that there was no shortage of raw materials and also pointed out that the buying public was inclined to forego luxuries. Legitimate business organizations, he asserted, would have no difficulty in obtaining sufficient funds from the banks to help them carry on their business and maintain creditable stocks.

The methods employed by the Society for Electrical Development to help the contractor-dealer in the solution of his problems, especially those pertaining to merchandising, were explained by J. M. Wakeman, general manager of the society.

J. L. Wolf, secretary of the Lighting Fixture Dealers' Society of America, gave some interesting data relating to the proper handling of fixture sales, which brought forth considerable discussion. The opportunity for the contractor to engage in the sale of industrial electrical material was interestingly brought out by J. A. Clark of the Westinghouse Electric & Manufacturing Company, in a paper entitled "Sale of Motors for Industrial Uses." This was followed by an instructive paper by A. L. Abbott of the Electric Construction Company of Minneapolis on "Managing an Electrical Contracting Business."

The remaining hours of the Thursday morning session were given over to a three-fold discussion of what the three national associations, the National Electric Light Association, Supply Jobbers and Associated Manufacturers, are doing to help the electrical contractor-dealer improve retail distribution.

Friday morning was given over to theories of merchandising, with the following program: "A Two-Billion Industry," by H. B. Kirkland; "Harmonizing the Industry," by Samuel A. Chase; "Scientific Merchandising," by W. L. Goodwin, and "Advertising for the Contractor-Dealer," by William A. Thompson, bureau of advertising, American Newspaper Publishers' Association.

An elaborate demonstration of illumination in its industrial application was made Friday afternoon by Ward Harrison of the National Lamp Works of the General Electric Company, Cleveland. In conjunction with this demonstration a paper by R. W. Shenton, "A New Era in Lighting," and one by P. B. Zimmerman, "The Industrial Lighting Market and the Contractor's Part in Selling It," were presented. The local committee had laid out an extensive entertainment program.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Financing the Kerckhoff Project.—The San Joaquin Light & Power Corporation has applied to the California Railroad Commission for authority to issue $2,625,000 of bonds to cover expenditure incurred in constructing the Kerckhoff power project on the San Joaquin River, including the transmission line and necessary substation.

Long-Distance Telephony in Japan.—Work on underground long-distance telephone lines from Tokyo to Osaka and between Tokyo and Hokkaido is to be begun early next year, though it is not expected to be completed for two years. There is already one underground telephone line in service in Japan, that between Osaka and Kobe, a distance of 25 miles.

An Old-Time Dam Disappears.—The Detroit Edison Company recently finished building on the Huron River, near Ann Arbor, Mich., a modern reinforced-concrete spillway to take the place of a timber and stone-filled dam that dated back eighty-eight years, having been built in 1832. This ancient structure had endured to play its small part in hydro-electric development, undreamt of in its early days, but an unusually high flood in 1918 finally put it out of business.

Hydro-electric Development in New Zealand.—The development of the water powers of New Zealand undertaken by the government and by locally elected power boards is making progress. One of the power boards has engaged Hays & Vickerman of Wellington, New Zealand, to proceed at once to design and construct a 12,000-kw. hydro-electric plant at Southland. This project involves the building of 48 miles of double and 48 miles of single 66,000-volt transmission line, some outdoor substations and a primary network involving about 2,000 miles of line.

The Argentine-Brazilian Waterfalls.—The falls of the River Iguazú, on the border of Brazil and Argentina, 800 miles from Buenos Aires, are, according to the secretary of the British legation at that capital, under investigation by the Argentine government with the view of their exploitation for electrical power, and the Brazilian authorities have been asked to co-operate in the work. There are 275 cascades in this portion of the river and one of them has a sheer drop of 213 ft. American engineers are said to have pronounced their development technically feasible, but the financial and engineering factors involved are so formidable that there is no early prospect of the project being undertaken either by public or private enterprise.

Electrical Growth in Kansas City.—Among the cities where rapid industrial growth has made large extensions to the central station necessary is Kansas City, Mo., where it is announced that the Kansas City Power & Light Company is planning to expend $4,500,000 in the coming year. The plans include drilling a second condenser well and building an addition to permit the installation of a 20,000-kw. or 30,000-kw. generator with all auxiliaries, the cost being put at $2,500,000. The remaining $2,000,000 is required for extensions of the transmission system.

Building a Stack in Record-Breaking Time.—A sixth stack has been added to the Connors Creek plant of the Detroit Edison Company in what is held to be remarkable if not unprecedented time. Work on the steel construction began on June 24 and was finished on Aug. 3, twenty days ahead of the scheduled date. Brickwork in the lining of the stack started on Aug. 9 and was completed on Aug. 21, twelve working days, including two Saturdays when work went on for part of the day only. It is estimated that 74,000 bricks were used, an average of 6,700 daily, or 1,340 per man per day. The stack is 240 ft. in height.

Rate Increases Continue.—An increase of ¼ cent to ½ cent per kilowatt-hour in wholesale power rates has been granted to the People's Power Company in Rock Island, Moline and seven other Illinois places served by it. The Nassau Light & Power Company, operating in Glen Cove and Locust Valley, N. Y., and also the Glen Cove Light & Power Company, will be allowed to charge 12 cents a kilowatt-hour for general lighting after Oct. 20, an increase of 3 cents. An advance in light and power rates has been allowed to the Consolidated Light, Heat & Power Company of Huntington, W. Va. Kaysville, Utah, which purchases energy from the Utah Power & Light Company, has increased its rates to citizens from 8 cents to 12 cents a kilowatt-hour, with a minimum charge of $1 instead of 50 cents.

Loud-Speaking Device Heard on Outgoing Ship Without Receiving Apparatus.—When the *Imperator* sailed from New York for Europe a week or two ago the passengers had an exemplification of the power of loud-speaking telephone devices as developed by the Western Electric Company. A call "paging" two of those on board was heard distinctly all over the ship, as were the farewell messages and music that followed it. It was explained that a loud-speaking transmitter had been set up in a tenth-story office window near the waterfront in order to make the experiment, which, in spite of the adverse conditions occasioned by the noise of the city streets, was entirely successful. Still more remarkable results are prophesied. This was the first time that an outgoing ship had been communicated with in this way.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Missouri River Electrical Distributers. The annual meeting of this body, which will be in St. Louis, is scheduled for Oct. 14 and 15.

Chicago Section, American Welding Society.—This section will meet on Tuesday, Oct. 12. It has issued a booklet, the title of which is "Keep the Guess Work Out of Welding."

Cleveland District Section, A. I. and S. E. E.—On Monday next, Oct. 11, this section will listen to a paper on "Troubles of the Electrical Operating Man," by A. W. Mohrman, Trumbull Steel Company, Warren, Ohio.

Yesterday's A. I. E. E. Meetings.—The Providence (R. I.) Engineering Society Section and the Philadelphia Section of the A. I. E. E. met yesterday, automatic substations being considered by the former society and secondary distribution and demand measurements by the latter.

Commonwealth Edison Section, N. E. L. A.—The final meeting of this section for the 1919-1920 season was held on Sept. 12, when the members were addressed by Samuel Insull. The officers elected for the coming season were: Chairman William A. Durgin; vice-chairman, Allen Gatef; treasurer, William A. Fox; secretary, Frank Ashton.

Philadelphia Engineering Meetings.—On Tuesday, Oct. 12, Dr. George K. Burgess will make a luncheon address before the Engineers' Club of Philadelphia on "The Bureau of Standards and Its Engineering Contracts." On Thursday, Oct. 14, the American Society of Heating and Ventilating Engineers will listen to a "Résumé of the Work of the Research Bureau" by Dr. John R. Allen. On Wednesday, Oct. 13, the local section of the American Association of Engineers and on Friday, Oct. 15, that of the Illuminating Engineering Society meet.

Coming Meetings of Electrical and Other Technical Societies

American Electric Railway Association—Atlantic City, N. J., Oct. 11-15.
National Association of Electrical Inspectors—Philadelphia, Pa., Oct. 12-13.
British Columbia Association of Electrical Contractors and Dealers—Vancouver, B. C., Oct. 19.
International Association of Municipal Electricians—New Orleans, Oct. 19-22.
Association of Railway Electrical Engineers—Chicago, Oct. 28-31.
Electrical Supply Jobbers' Association—Cleveland, date in November to be fixed.
American Engineering Council—Washington, D. C., Nov. 18-20. (For program see issue of Sept. 25, page 651.)
Electric Power Club—Hot Springs, Va., Nov. 15-18.
Southeastern Geographic Division, N. E. L. A.—Miami, Fla., Nov. 17-19.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Intelligible Accounts Insisted On.—The Washington Public Service Commission, which claims never to have allowed a rate that would yield a return on watered stock and inflated bond issues, has refused to increase the rates of a water company which had kept its accounts so badly that it was impossible to determine its actual net income.

Assessing Cost of Synchronous Motor-Generator Set.—An electric generating company, the Nevada Public Service Commission recently decided, should furnish free of cost electric energy for a synchronous motor-generator set of a distributing company which is a factor in producing voltage regulation in the vicinity, where complaints had been filed regarding unsatisfactory voltage regulation.

Violation of Commission's Order by Town Official.—A member of the Town Council of Ault, Col., having had his own premises connected with the municipal system despite the commission's order that no new consumers were to be served, and the Farmers' Electric & Power Company having sought to have the town's authorities published for contempt, the Public Utilities Commission found no evidence that these authorities had sanctioned the act of the individual referred to and, censuring the company for failing to follow up its charges, dismissed the complaint.

Co-operation on the Part of Customers of Small Utility Commended.—In granting increased rates to the Bandon Power Company the Oregon Public Service Commission commended the "general spirt of co-operation upon the part of the citizens and residents of Bandon to the end that they may have continued service without undue expense or making it prohibitive to the utility." It was generally agreed, the commission said, by business men and city officials present at the hearing that the power company was cautious in its expenditures and was operating under as economical a basis as possible. A further effort to reduce the peak load was recommended by the commission.

Excessive and Reasonable Rates.—Where increased rates yielding about 5 per cent greater gross revenue will enable an electric utility to meet estimated increased operating expenses, providing 7 per cent for return and 5 per cent for depreciation, proposed increased rates yielding from 16 to 22 per cent additional gross revenue are excessive, the Missouri Public Service Commission declared in passing on applications for increased rates made by three companies under the same ownership in that state. The controlling electric utility, having an estimated property value of $328,000 and serving places of 11,000, 2,300 and 1,300 population, was permitted to charge maximum basic rates of 11½ cents per kilowatt-hour for the community containing the plant and 12½ cents and 13½ cents respectively for the communities served by transmission lines.

Regulation of Non-Continuous Service.—The Missouri Public Service Commission fixed the following rules and rates for an electric utility having property valued at $9,000 and rendering non-continuous service: Service to begin fifteen minutes prior and on cloudy days one hour prior to sunset and to last until 11 p.m. and on Saturday until midnight; monthly rates, 15 cents per kilowatt-hour with a service charge of 50 cents, subject to a minimum charge of $1; street lighting, 60-watt lamps, $1.75; 500-watt lamps, $10; water-pumping service, 70 cents an hour.

Special Rates — Large Consumers with Several Plants.—Any special service which a power company renders to mining or other companies should be paid for as a separate transaction, according to a decision of the Nevada Public Service Commission in a rate complaint made by the Esmeralda Power Company against the Nevada-California Power Company, and should not be included in the terms of a rate schedule. The commission also affirmed that a company has the right to include the meter readings at different locations as one service so as to be entitled to lower rates for greater consumption where the different plants are operated as component parts of one business, but not otherwise.

Changing from Direct to Alternating Current.—Having heard a complaint against the announced intention of the Martinsville Gas & Electric Company to change its electric system from direct to alternating current, the Indiana Public Service Commission decided that, although it had the power to order direct-current service continued, it would not do so in this case as it would burden the consumers with excessive rates. The commission declared that it had no power to award compensation to owners of direct-current motors in case the system is changed to alternating current, but it made suggestions to the effect that the company bear two-thirds of the cost, furnish its consumers with alternating-current appliances at cost and help them in disposing of their old equipment. The company was ordered to continue direct-current service for a reasonable time. The question whether a change from direct current to alternating current should be permitted, the commission said, should be decided upon the broad basis of the efficiency and economy of the system as a whole and the quality of the service that may be rendered with or without the proposed change.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Power to Fix Charge Retained by State.—Power to fix the fare to be received by a street railway or its proprietary companies having been retained by the state in its public utilities act, this power, the Supreme Court of Utah has declared, in Murray City vs. Utah Light & Traction Company, can be exercised whenever the necessity requires despite city ordinances, and such action does not impair the obligation of a contract. (191 Pac. 421.)*

Fraudulent Transfer.—In Creighton Gas, Electric Light & Power Company vs. Jamison, the Supreme Court of Nebraska declared it to be a fraud which no court will permit to allow officers of a corporation who owned all its stock, after having agreed with a third party to transfer the property of the corporation to him, to transfer in the name of the company such property to one of their number between the time of the signing of the contract and the actual transfer of the property. (178 N. W. 830.)

Courts Will Not Interfere with Corporate Management in Absence of Fraud.—In an action brought by the Western Union Telegraph Company against the Public Service Commission of New York for the Second District, the Supreme Court of New York declared that the powers of those intrusted with corporate management are largely discretionary and that the courts will not interfere unless the powers have been illegally and unconscientiously exercised, or unless it be made to appear that the acts were fraudulent or collusive and destructive of the rights of the stockholders. (183 N. Y. S. 659.)

Emergency Rate-Fixing Powers of Commission. — Under the Wisconsin statutes the Supreme Court of that state held, in City of La Crosse vs. Railroad Commission, that the undertaking of an inquest such as is required to establish permanent rates is not necessary to the determination of the existence of an emergency making increased rates essential, the commission having under such conditions the power to act in a summary manner. In such a case its action is not to be overruled unless it appears that it has exceeded its powers or that its acts impose unreasonable or unjustly discriminatory burdens upon the people or the utility. (178 N. W. 867.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

M. C. Osborn, formerly sales manager of the Washington Water Power Company, Spokane, Wash., and past-president of the Northwest Electric Light & Power Association, has associated himself with the Gillespie Eden Corporation as utility representative. Mr. Osborn will be connected with the main office of the company in New York.

Olin H. Landreth has resigned as chief engineer of the Eastern Potash Corporation, New Brunswick, N. J., and opened a consulting engineering office at 156 Fifth Avenue, New York City. He will specialize in power developments, industrial engineering, hydraulic engineering and valuation work. Mr. Landreth will devote a part of his time to the Eastern Potash Corporation as consulting engineer.

C. A. Moore, superintendent of the electrical department of the Cambria Steel Company at Johnstown, Pa., has resigned to become superintendent of the new power plant of the Berwind-White Coal Company at Windber. Mr. Moore entered the employ of the Cambria Steel Company in 1902 and was superintendent of the Franklin plant at Westmont, Pa., until 1917, when he became electrical department superintendent. In his new post he will report to C. W. Parkhurst, now consulting engineer for the Berwind-White Coal Company.

Walter E. Miller has resigned from the staff of the Railroad Commission of Wisconsin, terminating a connection therewith of nearly fourteen years, inclusive of occasional private engagements, to engage in private practice as a consulting engineer. His practice will include investigations and studies of steam and electric railway and public utility problems, especially the valuations of such properties, rate making therefor, reports on efficiency of operation, designing, estimating and supervising construction of new properties and improvements of existing plants. For the present his office will be 413-416 Pioneer Block, Madison, Wis.

F. J. Sill, superintendent of distribution and commercial manager of the companies operated as the New England Power Company system, has resigned. Mr. Sill has been prominent in the development of the New England system during the past ten years and is widely known in central-station and industrial circles. He came to the old Connecticut River Transmission Company from the Brooklyn Rapid Transit Company in 1910, originally having charge of relay and meter work. In March, 1912, Mr. Sill was made superintendent of distribution, and in January, 1919, was placed in charge of the commercial and sales work of the system. At the time of his resignation he also supervised the management of the Fall Mountain Electric Light Company, Bellows Falls, Vt., and of the Gardner (Mass.) Electric Light Company. During the summer Mr. Sill will make his headquarters at 109 South Street, Westboro, Mass., and in the fall expects to re-enter the field of active practice.

Men of the Industry

Changes in Personnel and Position—
Biographical Notes

William C. Lounsbury, who has been elected president of the new Great Lakes Section of the N. E. L. A., is general manager of the Superior (Wis.) Water, Light & Power Company, with which he has been identified for the past fifteen years. Mr. Lounsbury was graduated from the Massachusetts Institute of Technology in 1904 and after spending a few years in practical work in Worcester, Mass ; Washington, D. C.,



W. C. LOUNSBURY

and New York City, he was placed in charge of construction work of the Superior Water, Light & Power Company. In 1912 he was made general superintendent, which position he held until he was appointed general manager in 1918. Mr. Lounsbury has been active in association work in the State of Wisconsin and served as vice-president and president of the Wisconsin Electrical Association.

Prof. Dugald C. Jackson, consulting engineer, Boston, Mass., has been appointed chairman of the standards committee of the American Institute of Electrical Engineers, succeeding L. T. Robinson. In 1907 Professor Jackson was put in charge of the department of electrical engineering of the Massachusetts Institute of Technology. Early in 1918 he was commissioned major in the Engineers' Reserve Corps, and was ordered to France. Professor Jackson is a past-president of the American Institute of Electrical Engineers and of the Society for the Promotion of Engineering Education and a member of other national associations. He has contributed largely to the literature of electrical engineering.

Byron H. Hurd, formerly assistant secretary of the California-Oregon Power Company, has been made acting secretary of that company to succeed J. C. Thompson, who was appointed manager of the Klamath division.

G. A. Sawin, service engineer with the Public Service Electric Company, Newark, N. J., has resigned to become assistant to the manager of the supply department of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. In his new position he will take care of the public utility work of the supply department. Mr. Sawin was graduated from Harvard University in 1901 with the degree of bachelor of science in electrical engineering. He then entered the meter engineering department of the General Electric Company at Lynn, Mass., where he remained seven years, engaged chiefly in the design of alternating-current watt-hour meters. About twelve years ago Mr. Sawin joined the Public Service Electric Company as meter engineer, having charge of the meter department of the company. Later he assumed illumination duties and became meter and illuminating engineer. In his latest position as service engineer his duties consisted of investigating and following every application for power from the time it was made until the customer was connected to the lines. Mr. Sawin is a member of the American Institute of Electrical Engineers, the National Electric Light Association and the Illuminating Engineering Society. He served on the N. E. L. A. meter committee 1909-1912, inclusive, being chairman of the committee during the last three years. He was a member of the committee on metering and service methods of the Association of Edison Illuminating Companies, 1913-1920. He also served on the board of managers for the Illuminating Engineering Society, New York Section, 1920.

Obituary

Lucilius A. Emery, for five years Chief Justice of the Supreme Court of Maine, and a foremost authority upon the legal phases of water-power development, died recently at Hancock Point, at the age of eighty years. Judge Emery contributed a valuable report on the "Legal Phase of the Water-Power Investigation" to the account of the special investigation of water-power resources which was published late in 1918 by the Maine Public Utilities Commission.

S. C. Green, founder and owner of the Green Electric Company of Dallas, Tex., died at his home in Dallas recently. Mr. Green was one of the best known electrical engineers in the Southwest and designed and built many of the electric light plants throughout Texas and Oklahoma. The plants at Antlers, Okla., and Ranger, Tex., are two of the latest.

Trade and Market Conditions

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

Uniform Guarantee Adopted by Washing-Machine Manufacturers

THE American Washing-Machine Manufacturers' Association adopted at its recent meeting a uniform guarantee for the use of all its members. In addition to a one-year guarantee against defects in workmanship or material, provision is made for the free replacement of parts proving defective during the life of the guarantee. Ordinary wear, accident or misuse are expressly excepted. Replacements of defective parts will be made f.o.b. factory, but no local service or repair charges will be allowed. The guarantee does not apply if machines are used for any other than for private-family washings.

Fan Manufacturers Optimistic Over Prospects for 1921

IN SPITE of unfavorable weather causing poor fan sales in some sections of the country, notably the East, manufacturers almost unanimously agree that the season just passed has been on the whole a very successful one. A survey of the fan stocks left over in the hands of dealers and jobbers throughout the country reveals virtually no surplus in the South, medium stocks in the Middle West and a small supply in the Far West.

San Francisco reports that the number of fans left over on the West Coast is comparatively small, as the past season has been an excellent one there. Unusually hot weather in the interior valleys was an important factor. In the Intermountain section sales were very satisfactory. Few fans are left on hand in that territory. St. Louis reports that comparatively small stocks are held over by jobbers and dealers. Orders for ceiling fans were still being received through September at an increase over the season's contract prices. In the Chicago district the number of fans to be carried over is still undetermined as deferred summer weather caused unusual selling through last month. The outlook for clean shelves is now better than a few weeks ago. In Atlanta territory jobbers state that this has been one of the biggest fan years on record. The chief demand was for oscillating desk fans, but there is no surplus stock of any type, it is said. In the East, on the other hand, sales have been disappointing. In the New York district unseasonable weather held demand to a minimum and large stocks have accumulated. Ceiling fans present a notable exception to the general light demand. Cut rate sales have been few, however. In New England the volume of business has also been comparatively poor and substantial stocks remain unsold. A leading jobber will carry over about $7,500 to $10,000 worth of fans.

Manufacturers are extremely optimistic over prospects for next year. One of the leading manufacturers is planning to meet a 25 per cent increase over the 1920 demand and producers generally expect to increase production. The basis of this optimism is said to be the growing use of fans in households which has nowhere near reached its peak. Furthermore, the spread of moving-picture houses and also the number of soda fountains and restaurants which have supplanted vacated saloons throughout the country are expected to provide a large market. Plans are on foot to increase sales further by promoting the use of fans in cold as well as in warm weather for heating purposes.

The outlook for supplying next year's demand is not entirely favorable. Considerable difficulty has been experienced in getting raw material, and though this condition has improved, it will not be 100 per cent on next year's output, according to leading manufacturers. Transportation congestion is another unfavorable factor right now. The use of personal tracers on cars and express shipments is being resorted to in many cases. Manufacturers think it will be long before this situation returns to normal. Reports on labor differ. Several producers are finding a smaller turnover, a larger available supply of labor and a bigger output per man, while others are not meeting such favorable conditions.

Stocks of fans in the hands of manufacturers vary. One representative producer has 20 per cent of this season's output on hand, but many others are absolutely cleaned out. Ceiling fans are the one type of which no producer has a supply. Great emphasis is laid by manufacturers on the need of anticipating orders for 1921. One of the main factors adversely affecting fan sales in the East this year is said to have been the delivery of many orders too late to supply the demand. Fan manufacturers are fearful of similar congestion on deliveries next spring. To avoid this condition, price schedules in many cases are being prepared a month earlier than usual, so that fans normally ordered in January can be contracted for this November or December.

The general price tendency on fans seems to point to higher quotations. Present raw material supplies were ordered last winter when prices were at their peak, so that no reductions can be looked for during 1921 at least, it is generally stated. Early in September fan prices were advanced for 1920 contracts, pending the preparation of 1921 contracts. So far as can be learned no business has been placed for 1921 as yet. One manufacturer had decided to raise prices Oct. 1, but it has not been possible to find out whether or not this higher schedule will go into effect.

Trend of Prices Held Dependent Upon Raw Material

CONSIDERABLE speculation is manifest as to the effect that price cuts in many lines may have upon trade and prices in the electrical industry. As yet it seems there has been no decided reaction. Reports received from jobbers throughout the country indicate that prices in all sections are holding steady except in the East. In the latter district easier quotations are current in several lines as the result of overstocking. The general attitude of the trade just now seems to be one of marking time. On the Pacific Coast, however, electrical jobbers express fear of the effect that general price slashing may have upon business.

In the East the view is expressed in several quarters that conservatism in buying may rule for the next few months. Further than that, while many manufacturers and jobbers will not venture predictions, a very large number seem to feel optimistic over the outlook for 1921. The basis for this is held to be the undersold condition of the electrical market in many lines such as steel material, porcelain, etc., and the existing belief that next spring will see a boom in the building industry.

Several of the large manufacturers point out that the production of electrical material is probably as much dependent upon finished products in other lines as any other class of goods, if not more so. For this reason, though the same basic condition of supply and demand is existent, these

producers hold that lower electrical prices must necessarily come almost last in the scale of economic readjustment. Furthermore, in several lines such as electric fans, producers have contracted for their 1921 raw material months in advance. Labor is an important factor in the production of electrical goods and labor prices remain high. The fact that as yet there has been no general tendency to reduce wages is taken as a hopeful sign by many that demand, and hence production, will continue in strong volume.

On the other hand, prices of bare and insulated wire are said to be softening and lower quotations are not unexpected. This easing off of prices, it is stated, is caused by the factor of lower raw material becoming operative, as cotton and copper prices have eased off. A similar factor governs chances of lower prices on conduit and other steel material. The price trend in this line, according to one of the largest supply jobbing houses in this territory, will depend upon the action which steel mills take in regard to quotations. Others oppose this view, however, on the ground that the market for conduit, outlet boxes, etc., is too largely undersupplied to admit of price cuts. The points upon which all interests apparently agree are a persistent optimism regarding the stability of the industry as a whole and the view that price cuts, if made, will not be so general or in the same proportion as in other lines. The reason advanced for the latter statement is that there has been no profiteering or hysteria of price boosting in electrical material during the past few years.

TONE OF THE TRADE IS OPTIMISTIC

With regard to the general optimism of the trade, an analysis of statements recently received by the ELECTRICAL WORLD from about forty of the largest electrical manufacturers, covering twelve major lines of material, is interesting. Barring several noncommittal replies, only two manufacturers reported an appreciable number of cancellations. These were both in the heating-appliance line, one of them being on ranges. Three others reported a few cancellations. These were on bare wire and industrial reflectors. The number of companies that are finding their supply of raw material much improved outnumbered those that reported no change for the better about two to one. The manufacturers whose output was up to normal or above were in the same proportion. A decidedly better labor situation was reported in three out of four cases. Transportation difficulties were very generally improved. On the other hand, about twice as many manufacturers reported stocks in an unsatisfactory condition as reported that supplies were well built up. An encouraging feature is that producers finding an unslackening demand were in the ratio of two to one. Thirteen manufacturers stated that prices will probably increase, while fifteen thought prices will hold steady and four believed a drop is due. These four opinions covered bare and insulated wire, electric ranges and loom. In twenty-nine of the replies the tone is optimistic, three are pessimistic and the rest are noncommittal.

Guy Wire Again Becoming Available

THE shortage in guy wire seems to have been due in large measure to the number of different types of mills required to make the finished product. Because of better labor supply and improved transportation facilities, however, the shortage is gradually being overcome.

The stranding mills have been held up waiting for supplies from the wire mills, and it seems that the wire mills, on the other hand, have been unable to get a sufficient supply of wire rods to permit them to draw sufficient wire to supply the demand for both wire and strands. Trouble started in the steel mills last fall when the stocks of the stranding and wire mills became depleted, and the demand has been so heavy since that time that they have been unable to build up any reserve stock of raw materials to tide over temporary labor and transportation difficulties.

On the higher grade steel strands, such as high-strength and extra-high-strength strands, the shortage is more acute. Mills are promising thirty-day shipments and even better than this on some kinds and sizes of strand.

Fall Lamp Buying Under Way with Good Local Stocks

REPORTS received from jobbers throughout the country indicate that the fall buying movement is making itself felt appreciably in lamp sales. Supplies are apparently holding up well, and there seems little prospect of a shortage prevailing except perhaps on some of the large-size lamps in certain sections.

The Pacific Coast reports that deliveries on the whole are excellent. Demand is picking up. In the Northwest, too, seasonal buying has started, and it is believed that this season will equal last year. No shortage is expected. In the Southwest sales have been good. Complete stocks are available in most instances except on the large sizes. Lamps of 75 watts to 200 watts, type C, are most difficult to obtain. It may be three months before reserve stocks of these sizes have been built up by all jobbers in that section. Stocks of series lamps for street lighting are spotty and demand is growing.

In the Intermountain section also demand is growing. The new "Mazda" type, C-4, is coming rapidly into favor. Reports from the South indicate the usual seasonal demand. Lamps in all sizes are moving briskly, particularly the 25, 40 and 60-watt sizes, with the 100-watt type C lamp showing increasing popularity. Stocks are in good shape, and the anticipated shortage on certain sizes, it is stated, will not materialize.

In the East prospects for good fall sales are excellent. Jobbers in the New York district are finding an increasingly strong demand. The discontinuance of daylight saving the latter part of this month is expected further to strengthen demand. Stocks are in excellent shape on all sizes and types of lamps. In New England, however, the supply is said to be just about keeping up with the brisk demand, and there is, of course, little opportunity for jobbers to accumulate surplus stocks. It is reported that careful distribution will be needed to supply the trade adequately.

Metal Market Situation

THE undertone of the copper market is weak. Producers have lowered their quotations to 18.50 cents, but this price is merely nominal, as consumers remain out of the market. It is stated that 18.50 cents would probably be shaded as an inducement for large orders. Producers are not pressing to sell, however, as production costs remain unchanged and a better volume of buying is hoped for in November. At present, it is reported, the copper output is being curtailed to guard against the accumulation of stocks further weakening the market. Foreign demand remains light. Freer offerings of copper are available in the outside market. Second hands are quoting 17.75 cents for prompt shipment f.o.b. refinery, while November and December delivery ranges from 18 cents to 18.25 cents.

The price of lead eased off ¼ cent the past week, the leading interest quoting 7.75 cents at New York.

NEW YORK METAL MARKET PRICES

	September 28	October 5
Copper	£ s d	£ s d
London, standard spot	93 10 0	96 7 6
	Cents per Pound	Cents per Pound
Prime Lake	18 50 18 62½	18 50
Electrolytic	18 50 18 75	18 50
Casting	17 62	17 37½
Wire bars	21 50 22 00	21 50 22 00
Lead, trust price	8 00	7 75
Antimony	7 12½	7 00
Nickel, ingot	43 00	43 00
Sheet zinc, f.o.b. smelter	12 50	12 50
Zinc, spot	7 75 8 00	7 65 7 75
Tin	43 50	42 37½
Aluminum, 98 to 99 per cent	35 10	35 10

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper	15 25 15 50	15 00 15 25
Brass, heavy	8.50 9.00	8.00 8.50
Brass, light	6.50 7.00	6.50 7.00
Lead, heavy	6 50 6 75	6 25 6 50
Zinc, old scrap	4 50 5 00	4 50 5 00

THE WEEK
IN TRADE

THE electrical industry appears figuratively to be holding its breath to see the effect which widespread price slashing may have upon electrical quotations and sales. In New England lower prices are reported in half a dozen lines, while in New York territory jobbers are slashing prices almost to cost and canceling orders to avoid overstocking. In the St. Louis district trade has been more active the past week, but all other sections report a quieter volume of business than usual. The demand for radiant heaters is making itself felt strongly in certain sections as the result of sudden cold snaps, and lamp buying is also getting well under way. Farm-lighting plants are moving well in the Northwest. In that section the demoralized lumber industry is finding a stronger demand, and favorable conditions of crop harvesting and fruit picking lend an optimistic tone.

Labor conditions are reported satisfactory. The strike of electricians on the West Coast has been settled. Collections generally are slowing up, apparently due to the present business uncertainty. Stocks are well built up in most lines and shipments are now arriving in too great a volume to suit many jobbers. Building construction is proceeding at a rapid pace in Atlanta territory and on the Pacific Coast but the industry in other sections is rather quiet.

NEW YORK

During the past week a pronounced tendency to shade prices has been felt. In some cases quotations are being made within 2 or 3 per cent of cost with no buyers in the market. The witholding by retail consumers and builders has been reflected to a greater extent to the jobbers who are seeking a market for overstocks in such lines as wire and armored cable. That is, the present is a strong buyer's market, with little trading and generally dull tone. Collections have lengthened to sixty-five days from a normal of thirty to forty days. The volume of business during the past week has ranged from 15 per cent above to 15 per cent less than the average in August, with the expected fall demand still holding off. A few inquiries only have deen reported for Christmas business. Orders on manufacturers are being canceled to prevent overstocking, and jobbers' sales are being made in some cases on a non-cancelable basis. Requests on manufacturers to guarantee prices have thus far been refused. No building is being undertaken, and that supply equipment which is being sold is for alterations or small extensions. The embargo from Pittsburgh has been removed.

Wire.—Large stocks of wire are held by almost all jobbers and the assortment is good. Some jobbers report two, three or four months' stocks. Prices of No. 14 rubber-covered are shading down quotations from $10.50 to $11.50 per 1,000 ft. The movement is very sluggish with orders on factories curtailed or canceled.

Flexible Armored Cable.—Almost all jobbers have quite good stocks and some have undesirably large supplies with a very weak market, typical reports being that the last month's sales have been one-tenth of normal. Some of the smaller manufacturers are reported as going after business at any price. Two wire cable quotations range around $94 per 1,000 ft. in the larger lots to $98 to $100 per 1,000 ft. for small lots.

Rigid Conduit.—Stocks of conduit are spotty with some jobbers entirely out of stock and a very few with a fair supply on hand. Under these conditions quotations naturally are unstable. One-half-inch black in 5,000-ft. lots is quoted at $85 per 1,000 ft., smaller lots at $92 to $94 per 1,000 ft. One-half-inch galvanized is quoted at $100 per 1,000 ft.

Schedule Material.—Stocks are spotty and low, especially in lines where porcelain enters largely into the product. Extensive shading in prices is reported, in some cases quotations are said to be 21 per cent off list. These lines are being most closely watched by both jobbers and retailers.

Heaters.—The cooler weather of the last week has stimulated the sales of heaters slightly. Stocks are fair and prices remain unchanged as yet.

Hollow Ware.—Stocks are reported as being practically depleted in all lines; back orders are over a year old; manufacturers are refusing new orders. Retail sales are restricted, it is claimed, by high prices.

Vacuum Cleaners.—Demand is fair with good stocks and deliveries sufficient to keep stocks up to normal.

Washing Machines.—Sales are good for the time of year. No marked decrease in sales has been felt.

Small Motors.—Stocks are very low and spotty with little demand. Some jobbers have had no deliveries for four or five months and manufacturers are quoting on thirty to forty weeks' delivery.

CHICAGO

The effect of widespread price cutting in other lines is felt in the electrical trade with varying intensity in different branches. As the electrical manufacturer has been very conservative in price increases during the past four years, electrical goods are likely to be the last and the least affected by a shrinkage of value. Since labor is so large a portion of the manufacturing cost, no appreciable reductions are seen until labor costs are cut.

In this district, however, the disposition on the part of buyers is to await developments. Large corporations, municipalities, etc., are still buying in about the same proportion as in the past, but retail trade, dependent wholly on popular opinion, has been sharply reduced. Sales of household appliances are at a standstill, with the sole exception of heaters. These are under heavy demand due to the sharp cold snap Chicago is experiencing. Reduced sales are permitting the building up of jobbers' stocks, and it is not felt that the quiet period will be of sufficient duration to become troublesome.

Labor is becoming plentiful. One of the large jobbers recently received 144 answers to a five line advertisement for warehousemen in which the wage was stated to be 56 cents per hour. This situation is due to the large number of reductions in forces employed by many local plants and by the influx of labor from the automobile centers. The only price reductions noted are on wire, where labor cost is a negligible feature.

Bare Copper Wire.—Following the trend of electrolytic copper some manufacturers are quoting on a 22½-cent base. Current jobber's price on No. 8, in 200-lb. lots, is $22.75 per 100 lb., and on No. 10, $23.

Weatherproof Wire.—Stocks of weatherproof are much improved and factory deliveries are approaching normal. Reduced raw material costs have caused a 2-cent cut. No. 12 triple braid is now quoted by jobbers at 32 cents per lb., and No. 6 triple braid at 29 cents, these quotations being for 500-lb. lots.

Steel-Tape Cable.—An expected advance has apparently been forestalled by reduced costs. Deliveries range from 90 to 120 days. The price of 600-volt solid duplex No. 8 is $205.47 per 1,000 ft., and 2,500-volt solid single No. 6 is $202.73 per 1,000 ft., in 2,000-ft. lots.

Flexible Armored Conductor.—Jobbers' stocks, with slightly reduced demand, are getting in better shape. No price change has been announced. Quotation on No. 14 single-strip, in coil lots, is $110 per 1,000 ft.; in smaller quantities, $120 per 1,000 ft.

Line Hardware.—Recent increases have had little or no effect on demand. Factories are gradually turning out goods in better shape. Some stock is in the hands of jobbers. Deliveries are now requiring sixty days.

Ornamental Iron Poles.—Factories are adding increased freight to old quotations, no fluctuation in price being

anticipated. The material is all fabricated to order and deliveries are good, thirty to forty-five days being quoted.

Ornamental Tops.—Glassware and tops for poles are still very hard to get, from sixty to ninety days being required for delivery. Numerous cases are noted where the poles have been set for some weeks and completion of the job is delayed on account of missing tops.

Hollow Ware.—The market is still undersupplied in spite of greatly reduced demand. Retail trade is at a minimum. The public seems to be looking for a reduction in price, which those familiar with the line say cannot occur.

Household Appliances.—The wave of conservative buying has hit these items pretty hard. It is felt that as soon as the general public realizes that prices are firm business will resume its former stride. Reports are heard of reduced production by some makers.

BOSTON

Price cutting among the smaller jobbing houses within the last few days has led to a general reduction in quotations on fast-moving supplies. Many of the leading wiring materials are off from 6 to 12 per cent. Overstocking, due in part to heavy orders placed in the past and in part to the arrival of long-delayed shipments of material, appears to be responsible for the present movement to dispose of supplies on hand and make payments to manufacturers thereof. Factory prices are holding firm. Among the larger jobbers the present slump is looked upon as temporary. Collections are still unsatisfactory, and the use of acceptances has made its appearance even among very large customers. Deliveries continue to show improvement. Building operations are very unsatisfactory locally as to volume, although some large apartment-house work is being pushed for suburban occupancy. An agreement is announced between employers and factory workers in the Lynn shoe industry as to wages. Labor conditions in the electrical field are fairly good. Wages are being maintained at their present level.

Flexible Armored Conductor.—Prices are off, No. 14 single-strip in 1,000-ft. lots or over selling at $85 per 1,000 ft., compared with $100 last week. Stocks are of liberal size.

Rubber-Covered Wire.—Easier prices, running down to $10 per 1,000 ft., on No. 14 solid slow-burning, in 5,000-ft. lots, are noted. Stocks are equal to current demands.

Weatherproof Wire.—A drop of the base price from 29 cents last week to 27 cents is noted. Shipments are coming in well and the demand is fair.

Bare Copper Wire.—The base price has fallen from 24 cents to 22.5 cents during the past week. The feeling is widespread in the trade, however, that copper is selling at too low a price in the ingot and a later advance would not be surprising.

Non-Metallic Flexible Conduit.—Heavy shipments appear to have upset the market, in view of the somewhat spotty demand. Reductions in the price of cotton do not seem to have reached the electrical manufacturer's raw material as yet sufficiently to lower prices to jobbers. On 3/32-in. loom the price per 1,000 ft. in 5,000-ft. lots is $29, against $33.50 last week. The ½-in. size is quoted at $33, against $35.50 last week. Good stocks are in hand, with moderate demand.

Sockets.—In case lots pulls sell for 45 cents net, compared with 50 cents a week ago. Key sockets are moving at 26 cents, against 28 last week, and keyless have dropped from 26 to 24 cents. The small amount of building work compared with needs of the district is cutting down demand.

Tape.—Prices hold firm, notwithstanding recent reductions in the price of cotton. On ¾-in. black, in 100-lb. lots, a rate of 58 to 60 cents per pound is quoted. There seems to be no shortage of this material.

"Nail-it" Knobs.—Prices are easier, the latest quotation being $32 per 1,000 on lots of 4,000 or more. Heavy shipments have been received.

Rigid Conduit.—This material continues relatively short, though here and there modest orders can be filled from jobbers' stocks. Galvanized pipe is harder to get than black. On ½-in. galvanized $102 per 1,000 ft. is being asked, and on 1-in. galvanized $200. The price of ½-in. black conduit is $96 per 1,000 ft., and on 1-in. black $189.50.

Motors.—Increased manufacturing facilities have brought better stocks of fractional horsepower and small motors into the local market, although nothing like a real surplus appears generally in hand. New makes of motors are bidding strongly for patronage, and the excellent deliveries some of these offer are appealing to the trade.

Washing Machines.—Deliveries are greatly improved. One representative distributer had about three carloads in stock Monday and was quoting $128 per machine, galvanized tank, in lots of six, to legitimate dealers. Interest in ironers is growing.

Vacuum Cleaners.—Good retail stocks are on hand, and the flow between factories and dealers is well maintained.

ATLANTA

Fewer orders to cotton-duck mills from tire manufacturers, together with reduced prices on cotton textile, have caused some of the large mills to postpone proposed extensions and additions. This has caused the orders for electrical material involved to be put off. Jobbers report a reduction in the number of orders received, but this is not causing any uneasiness as it is largely due to the between-season slump in business activities. Trade in Atlanta, however, is still booming, owing to tremendous building operations under way. Building permits for September in Atlanta reached $1,100,000, this being the second largest month of the year. Predictions are that the total will reach $14,000,000 by the end of the year. A great number of moving-picture theaters and commercial buildings are under construction throughout the territory and jobbers report large sales of fixtures and other material for this class of business.

Confusion regarding the policy that banks will pursue in making loans on warehoused cotton is causing some uneasiness in the rural districts. The general opinion seems to indicate that there will be ample funds for the proper and normal moving of the crop. Collections continue somewhat slow, and banks have called on jobbers for a 50 per cent reduction in the amount of paper presented for discount. As the movement of cotton gets under way, however, this condition should improve and the tight money situation be considerably relieved.

Transportation continues to show improvement. All houses report a considerable betterment in the receipt of shipments and fair stocks of nearly all lines of material are either on hand or rolling.

Rigid Conduit.—Good stocks of black are reported by all houses, but galvanized is still scarce. Prices, black, less than 2,500 lb., ½-in., $8.89; ¾-in., $11.80; 1-in., $17.44; galvanized, ½-in., $9.40; ¾-in., $12.49; 1-in., $18.46.

Distributing Transformers.—Slight relief from the acute shortage of this article is noted. Several fair-sized shipments have been received, while others are reported for reasonably prompt delivery in all sizes from 1 to 50 kva.

Flexible Armored Conductor.—While recent shipments have been sufficient to take care of outstanding orders, brisk demand has prevented the accumulation of any stocks. Shipments are coming through more satisfactorily than for some months past.

Pole-Line Hardware.—Price increases averaging 10 to 30 per cent are reported on all lines. Sales are very good with stocks holding up well under the circumstances. Difficulty is experienced in obtaining 26-in. galvanized braces. Price, cross-arm braces, lots of from 100 to 500, 20-in., $16.36; 24-in., $20; 26-in., $21.20.

Wire.—Good stocks of both rubber-covered and weatherproof are on hand. Some slight difficulty is experienced in filling orders for the more popular sizes. Incoming shipments should fill all back orders and permit stocks to accumulate.

Lead-Covered Cable.—Shipments continue satisfactory on the more popular sizes. Local stocks are depleted.

Holiday Goods.—Retail orders are good but no shipments of moment can be made as jobbers have not yet

received their allotments from factories. Hollow ware is available only in sufficient quantities to meet the current demand. Unless shipments in this line greatly increase within the next thirty days, a shortage is predicted.

ST. LOUIS

Trade has become more active during the past week, almost all jobbers report. This is felt to be a hopeful indication of good business conditions this fall. Unseasonably cold weather has helped sales of heating devices considerably. In spite of the better volume of trade the past week most jobbers report that the total business for September will fall short of the total for August, though it is larger than in September of last year.

New business has not been large, but manufacturers are delivering big shipments in many lines and jobbers are applying these on back orders. The number of inquiries during September was exceptionally large, according to some jobbers, in spite of the fact that new business was slow. One jobber reported having 5,000 inquiries during the month.

Stocks are good in most lines and care is being taken to prevent overstocking. This fear of overstocking has caused a number of cancellations on the part of jobbers, who state that they cannot dispose in three months of a year's supply finally shipped to them by manufacturers. The total amount of building construction in St. Louis proper during September was only 25 per cent of the total for September, 1919.

Wire.—Stocks of rubber-covered wire are good, but the supply of weatherproof is spotty. Demand is good, particularly for weatherproof in sizes No. 8 to No. 14. No. 14 rubber-covered is selling for $11.50 per 1,000 ft. in 5,000-ft. lots, and $32.35 per 100 lb. in lots of 1,000 lb. or more.

Rigid Conduit.—The supply of ¾-in. black is better, but the ½-in. size is still short. The stock of larger sizes is good. Demand is reported satisfactory. One-half-inch is quoted at $80 per 1,000 ft. in lots of 5,000 ft. or more, and ¾-in. at $110 per 1,000 ft. in lots of the same size.

Transformers.—Jobbers can supply the demand in the smaller sizes from 10 kva. to 150 kva. Deliveries of larger sizes, however, cannot be made under several months. Smaller transformers range from three to four weeks. Demand is better for the bigger sizes, coming chiefly from industrial plants.

Linemen's Tools.—Stocks are exhausted and the few small shipments to jobbers recently have not been able to cut down back orders appreciably.

Electric Irons.—Good stocks have accumulated for the fall trade. Jobbers are now getting immediate delivery. Shipments are beginning to be made to retailers on orders placed last January for the present fall trade. Retailers report very satisfactory sales.

Washing Machines.—Large stocks are on hand here. Demand is reported as spotty.

Vacuum Cleaners.—Jobbers have good stocks and report a fair demand. Retailers say their sales are satisfactory.

Lamps.—Stocks of series lamps for street lighting are better than a month ago. Demand is still reported active. Demand for other types in all sizes is good and stocks are improving. The 75-watt to 200-watt type C lamps are easier to obtain.

Locust Pins.—Good stocks are on jobbers' shelves. Demand is coming mostly from railroads, though there have been a large number of inquiries from utilities. Current price is $60 per 1,000 in lots of 5,000 or more.

Tape.—Normal supplies are in stock. A steady demand is reported. The ¾-in. black is quoted at 55 cents per pound in large lots.

SEATTLE—PORTLAND

Jobbers in Seattle and contiguous cities report that with the exception of an increasingly heavy movement of farm-lighting plants sales show no particular increase over the several weeks past. The season for farm lighting is at hand, crops are nearly harvested, and farmers have started making needed installations. Demonstrations at state and county fairs are doing much to increase sales. Stocks are in good condition and freight from the East is coming through satisfactorily. This also applies to other stocks with the exception of heavy power apparatus such as motors, generators, etc. These latter items are not moving to any extent. Appliance sales are well sustained, particularly in washing machines, ranges, electric tableware and socket device heaters. Ranges alone in this line are hard to obtain. The lamp season has opened with good sales reported. This only applies to residential types as industrial lamp sales have been very poor. Lamp stocks are in excellent shape.

Prices show no change of importance with the exception of increases made necessary by higher freight rates, ranging from 25 to 33 per cent. September reports from various sections of this district show that favorable crop conditions continue to prevail. Harvesting is proceeding apace and picking of fruit is in progress. The quantity and quality of these products are reported good, but prices are still uncertain and this is causing an underlying note of concern. Heavy railroad buying plus heavy purchasing for water delivery added materially to the new business accepted by West Coast lumber mills during the last week in September. Approximately 40 per cent of the buying was railroad material.

Portland manufacturers and jobbers report that business is continuing in good shape. This is also true of wiring contractors. Electrical dealers state that business is improving materially, with lamps, vacuum cleaners, washing machines and electric heaters showing the greatest activity. Jobbers report that stocks of electrical appliances for the holiday trade are in excellent shape with the two or three exceptions of percolators, toasters and two-disk hot plates.

SAN FRANCISCO

Business is reported quiet except in the southern part of the state, where there is a great deal of building under way, especially in Los Angeles. It is stated that the value of building permits for Los Angeles during the year 1920 will be approximately $50,000,000. The total for September in Los Angeles is $7,231,440, in San Francisco $1,996,612, and in Oakland $798,619. This compares with totals in the same cities for September, 1919, of $2,447,793, $1,231,921 and $574,350, respectively.

The labor situation has been settled by granting demands of the electricians' union. Members are now paid on a basis of $10.50 per day for foremen and $10 per day for workers. It is expected that the power conservation regulations now in force in the bay cities will soon be remitted because of the withdrawal of the irrigation load, especially that required by the rice fields. The steel towers leading from the Caribou project of the Great Western Power Company have been placed and the aluminum cable is rapidly being strung. This power should be available early in 1921. It is predicted that the Pacific Gas & Electric Company's 220,000-volt energy will be brought down from the Pit River about ten months later.

Panelboards.—High labor charges have created a better call for ready-made panelboards from Eastern manufacturers. Additional lines, such as the Benjamin, will be more extensively stocked in the near future.

Rubber-Covered Wires.—Jobbers report that stocks in general are moving very nicely. The endeavor to maintain the complete stocks required by the great distance from the source of supply has resulted in accumulations of some odd quantities.

Schedule Material.—Some complaints are heard because the safety switches shipped from the East do not bear the union label, although this practice is now customary. This is resulting in an intermittent demand for certain cheaper switches complying with state regulations which are made locally and carry the union label.

Dishwashers.—No other feature of the electrical home attracted so much attention as did the electrical dishwasher. Dealers have booked many orders. These are nearly all advance sales, for there are no local stocks at the present time, although November shipments are promised.

NEW APPARATUS & APPLIANCES

A Record of Latest Developments
and Improvements in Manufacturers' Products
Used in the Electrical Field

Time-Limit Automatic Starter

For starting direct-current motors carrying loads which are liable to vary between wide limits and where remote



ACCELERATING FINGERS CLOSE AS THE ARMATURE MOVES UPWARD

control is desired, the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has redesigned its No. 6105 time limit automatic starter to include both larger and smaller sizes than formerly. The new starter is made in capacities ranging from ¼ hp. to 10 hp. at 115 volts and up to 25 hp. at 230 volts and 500 volts. The air dash-pots formerly used are replaced by oil dash-pots.

High-Voltage Bus Support

For 66,000 volts and higher ratings the Delta-Star Electric Company, Chicago, has developed the unit-type rigid



UNITS MAY BE REPLACED WITHOUT CHANGING ENTIRE SUPPORT

support illustrated. This unit is assembled from standard sections, each securely joined together by four bolts, resulting in a support of high mechanical strength and high electrical flashover. This unit-type support is also furnished for underhung conductors of 45 deg. mounting and can be equipped with any of the various buses or conductor fittings of the unit-type design.

Pole-Top Switch

Pin-type insulators used in such a way that they are under compression, wiping contacts of large area and under considerable pressure, arcing horns designed quickly to bring the arc to the ends of the horns and a lever ac-



Open



Closed

ACTION OF SWITCH INDICATED BY CLOSED AND OPEN POSITION

tion that gives positive action are the features of the pole-top switch just placed on the market by the Lewis & Roth Corporation, Philadelphia. At present these switches are being made in 15,000-volt ratings.

Notes on Recent Appliances

Washing Machine

A washing machine of the oscillating type has been developed by the Voss Brothers Manufacturing Company, Davenport, Iowa.

Ozonator

An ozonator for cold storage rooms has been developed by the Ozone Company of America, Milwaukee, Wis.

Regenerative Receiver

A small coupler or receiving transformer, a variometer connected in the grid circuit and a variometer connected in the plate circuit, together with a grid condenser and grid leak, are the features of the new type ZRF wireless receiver placed on the market by the Clapp-Eastham Company, Cambridge, Mass. The panel is of ¼-in.



FOR LONG DISTANCE SHORT-WAVE WORK

bakelite and is 14¾ in. long and 5¾ in. high to match detector and amplifier panels put out by the same company.

Pendent Luminous Heater for Household Use

A 660-watt pendent luminous heater for household use is being offered by Adon Products, Inc., 516 Fifth Avenue, New York City, attachable to any 120-volt alternating or direct-current circuit. The device is tubular in shape, with a perforated metal shell to protect the heating elements and with arrangements for securing baffles and deflecting disks. All outside parts are nickel-plated. Contact parts are insulated with heavy mica.

Bench Drilling Stand

A unit-type bench drill stand on which is to be attached an electric drill, which is adjustable for height and which may be swung from over its base to permit drilling in pieces too large to rest on the bench, has been placed on the market by Black & Decker, Baltimore. The height from bench to top of column is 30 in., the



PUTS ELECTRIC DRILLS TO NEW USE

vertical adjustment of the drill 12 in. the drilling radius 7 in., the vertical feed 4 in. and the net weight 70 lb.

MANUFACTURERS' ACTIVITIES

Record of Changes Affecting Sales and Distribution Together with Trade Personals and Notes on Foreign Trade, Jobbers' News and New Trade Literature

THE NATIONAL FIBRE & INSULATION COMPANY, Yorklyn, Del., manufacturer of electrical insulation products, has filed notice of an increase in capital from $500,000 to $3,000,000 for proposed expansion.

GENERAL ELECTRIC COMPANY, Schenectady, N. Y., has purchased the United Button Company's plant on Grand Street in the Bushwick section of Brooklyn, it is reported. The property contains about 100,000 sq.ft., and costs about $500,000, it is said.

THE WETMORE-SAVAGE COMPANY, 76 Pearl Street, Boston, held its employees' annual outing at Centennial Grove, Essex, Mass., on Sept. 6, 1920. The day was taken up with field events, baseball and clambake.

PENNSYLVANIA ELECTRIC ASSOCIATION, at its annual convention held last month at Bedford Springs, gave its usual exhibit of electrical products. A number of manufacturers had their products on display, making in all a very attractive exhibit.

THE NATIONAL LAMP WORKS of General Electric Company at Nela Park, East Cleveland, Ohio, was judged the best-kept industrial establishment in the country in a recent magazine contest. During the nine years since the plant was established the entire plot has been turned into a park. The exteriors of the buildings have been so designed and the buildings so grouped as to have earned for the plant the name "University of Industry."

THE ARROW ELECTRIC COMPANY, 99 Hawthorne Street, Hartford, Conn., is planning an extensive alteration to its factory building.

THE HURLEY MACHINE COMPANY, Chicago, reports that the eight months ended Aug. 31, 1920, show sales and net profits double those of the corresponding period last year. For 1919 this period showed net sales of $3,163,006 and in 1920 $7,138,456. The net profits after depreciation in this period in 1919 were $580,159 and in 1920 $1,108,241.

PHILIP L. ROSE has been elected treasurer and A. A. Adams, controller of the American Waterworks & Electric Company, New York. Cecil S. Ashdown, vice-president and treasurer, has resigned to join the Remington Typewriter Company.

W. P. MORGAN, JR., formerly connected with the St. Louis office of the Robbins & Myers Company, has joined the sales force of the Chandeysson Electric Company, St. Louis, Mo.

THE YOUNGSTOWN SHEET & TUBE COMPANY, Youngstown, Ohio, held its ninth annual field day on Sept. 6, 1920, at Campbell Park, which has been equipped by the company for the use of its employees for recreational purposes. Field events, baseball and dancing occupied the day.

THE KING WASHING MACHINE CO., Wolcott, Ind., announces the appointment of T. R. Allen as general manager and O. B. Askren as general sales manager of that company.

THE THOMPSON-LEVERING COMPANY, 327 Arch Street, Philadelphia, manufacturer of electrical instruments, a firm which has operated for many years under this name, is to be incorporated under the same name with no change in management or policy. W. J. Thompson, A. J. Levering and D. J. Corcoran are to be officers of the company.

THE HABIRSHAW ELECTRIC CABLE COMPANY, Yonkers, N. Y., and its subsidiaries report net sales for the six months ended June 30, 1920, of $6,064,790 and for the quarter ended on the same date, of $3,406,921. This is an increase during the second quarter of $749,052, or 28 per cent, over the first quarter.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., announces that an arrangement has been made whereby the General Electric Company has acquired a substantial interest in the Locke Insulator Corporation, and the following are the now existing officers and directors: President, Donald Symington; vice-presidents, John F. Symington and F. H. Reagan; treasurer, W. G. Hoffman, Jr.; secretary, J. F. Douty, Jr.; directors, G. E. Emmons, C. W. Appleton, D. R. Bullen, J. W. Upp, George P. Baldwin. This arrangement, the General Electric Company announces, will result in full engineering and research co-operation between the two companies with respect to insulator problems. The Locke company will now produce the Hewlett high-tension transmission insulator, taking advantage of the additional facilities supplied by the completion of its new plant at Baltimore, Md.

THE VICTOR ELECTRIC COMPANY, 116-20 West Thirty-second Street, New York, is arranging for a consolidation of its interests with the X-Ray Supply Company, New York. Edwin W. Kelly is secretary.



PENNSYLVANIA ELECTRIC ASSOCIATION EXHIBIT

Foreign Trade Notes

FABRICANTES ASSOCIADOS DE MAQUINARIA, Havana, Cuba, has been consolidated with the Atlantic Trading Company of that city. The new organization is capitalized at $500,000 and proposes to conduct a distributing business of engineering equipment and electrical supplies. It will represent a limited number of electrical machinery and supply manufacturers. T. C. Ulbricht, president of the company, was formerly one of the officials of the American Steel Company of Cuba, having previously been connected with the Havana Electric Railway, Light & Power Company. H. W. Brooks, vice-president and general manager, was for a number of years connected with the Westinghouse Electric & Manufacturing Company, and during the war was chief of the machinery section, Bureau of Ordnance, U. S. Navy.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washingon, by mentioning the number.

A hotel in Guatemala (No. 33,784) wishes to purchase an intermittent electric sign.

A firm of wholesale dealers in India (No. 33,796) desires to purchase electric fans.

A municipality in the Azores (No. 33,790) asks for bids for the construction and maintenance of a hydro-electric plant. Supply and installation of all electrical and mechanical appliances, machinery and turbines is desired.

Trade Publications

ELECTRIC ARC FURNACE REGULATOR.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued leaflet No. 3,161, covering automatic current regulator for electric arc furnaces with movable electrodes.

MECHANICAL EQUIPMENT.—The Walworth Manufacturing Company, Boston, has issued a foreign export catalog No. 35 in English, Spanish, Portuguese and French, covering its line of valves, fittings and engine specialties.

ELECTRIC BRASS MELTING.—The Acheson Graphite Company, Niagara Falls, N. Y., has recently issued a booklet outlining the advantages of electric furnaces for melting brass.

ELECTRIC HOISTS.—The Sprague Electric Works of the General Electric Company has issued bulletin No. 48,961 on type W, 1-ton to 6 ton, direct and alternating-current, floor-controlled hoists.

SMALL MOTORS.—The Emerson Electric Manufacturing Company, St. Louis, Mo., has issued price and data book No. 50, in which are listed motors up to 2 hp., forge blowers, exhausters, ventilating fan motors and grinding and polishing lathes.

IRON AND STEEL MILL EQUIPMENT.—The General Electric Company, Schenectady, N. Y., has issued bulletin No. 48,951 to supersede bulletin No. 1923. The new bulletin covers the use of electricity in the iron and steel industry.

ELECTRICAL WELDING.—The Electric Welding Company, Brooklyn, N. Y. has issued a new booklet, No. 1,001, covering electric arc welding.

STEAM COIL HEATERS.—The Buffalo Forge Company, Buffalo, N. Y., has recently issued catalog No. 460, describing its complete line of standard coil heaters.

METERING TRANSFORMERS.—The Packard Electric Company, Warren, Ohio, has issued bulletin No. 208, describing its single-phase, two-phase and three-phase potential and current transformers.

BEARINGS.—The Fafnir Bearing Company, New Britain, Conn., has issued a new booklet, No. 20: "Fafnir Ball Bearings for Your Machines."

New Incorporations

THE ELECTRIC APPLIANCE COMPANY, Frederick, Md., has been incorporated by M. A. Pooler, R. Paul Smith and Raymond E. Town. The company is capitalized at $25,000 and proposes to manufacture electric and gas supplies.

THE WALKER MANUFACTURING & SALES COMPANY, Boston, Mass., has been incorporated by Louis J. Walker, Arthur L. Weston and Robert T. Anthony, Hudson, Mass. The company is capitalized at $25,000 and proposes to do an electric welding business.

THE WIZARD ELECTRIC SWEEPER COMPANY, Elyria, Ohio, has been incorporated by H. M. Davies, R. S. Davies, R. E. Cuthbertson, L. N. Webber and C. H. Brown. The company is capitalized at $25,000 and proposes to manufacture a new model electric sweeper.

THE BRANCH ELECTRIC LAMP COMPANY, 173 Mercer Street, Jersey City, N. J., has been formed to manufacture electric lamps. Emanuel D. Bach is promoter of the company.

THE MAIN ELECTRICAL COMPANY of Marshall, Mich., have filed articles of incorporation with a capital stock of $1,000.

THE PORCELAIN INSULATOR CORPORATION, Lima, N. Y., has been incorporated with a capital stock of $250,000 by W. F. Harvey, D. H. Finucane and E. P. Doran, Lima, N. Y.

THE WRIGHT BATTERY COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $1,000,000. The incorporators are M. L. Horty, M. C. Kelly and D. L. Mackey, Wilmington, Del.

THE BOYERTOWN ELECTRICAL SUPPLY COMPANY has been organized by E. M. Yoder, Boyertown, Charles G. McAvoy, Philadelphia, and others to manufacture electrical equipment.

THE RURAL FARM POWER COMPANY, Macon, Ga., has been organized by J. A. Harris, George S. Avant and others to manufacture electrical equipment for farm service.

THE EASTERN ELECTRIC MANUFACTURING COMPANY, Bridgeport, Conn., has been incorporated by E. A. Harry, Milford, Conn.; R. M. Gambino and Frank Flammina, Bridgeport. The company is capitalized at $100,000 and proposes to manufacture electrical devices, etc.

THE PNEUMELECTRIC CORPORATION, Syracuse, N. Y., has been incorporated with $40,000 of preferred stock and 2,000 shares of no par value common stock, by J. L. Wagner, W. S. Timmins and L. P. Smith, to produce electric hoists, punches and drills for coal mines.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

DANVERS, MASS.—Bids will be received by the Commission of Mental Diseases, 36 State House, Boston, until Oct. 14 for the erection of a power plant and equipment at the State Hospital. The cost is estimated at $250,000.

PLAINVILLE, CONN.—Whiting & Davis, silversmiths, contemplate the erection of a factory addition and the installation of electric generators.

Middle Atlantic States

BUFFALO, N. Y.—The National Lamp Works of the General Electric Company, care of F. S. Terry, Nela Park, East Cleveland, Ohio, contemplate the erection of a power house to cost about $200,000. George H. Johnson, Nela Park, East Cleveland, Ohio, is architect.

JAMESTOWN, N. Y.—The Dahlstrom Metallic Door Company contemplates the installation of a 300-hp. synchronous motor-generator set. Changes to the lighting system are also contemplated. J. A. Westman is general manager.

NEW YORK, N. Y.—The Bronx Company, 177th Street and the Bronx River, contemplates the replacement of steam power by electricity and increasing present capacity of substation by 400 kva., the installation of steam turbines in generating plant is also planned. Philip T. Brown is electrical engineer.

PHILADELPHIA, PA.—William Steele & Sons Company, Sixteenth and Arch Streets, has been awarded the contract by the Reyburn Manufacturing Company, Twenty-third and Allegheny Streets, for the construction of several buildings including warehouse, power house, etc. Equipment for power house will be required.

North Central States

CLEVELAND, OHIO.—The Allen Theater Enterprises, R. J. Bulkley, agent, Richmond Street, Toronto, Canada, contemplates the erection of a power plant for a new theater and commercial building. A. M. Allen Company, 1900 Euclid Avenue, is engineer.

BEATTYVILLE, KY.—The Beattyville Light & Power Company has increased its capital from $50,000 to $75,000. Improvements to the plant are contemplated.

BLACKEY, KY.—The Rockhouse Coal Company contemplates the installation of a power plant to cost about $50,000.

COVINGTON, KY.—At the general election the proposal to issue $250,000 in bonds will be submitted to the voters for the installation of a 10,000,000-gal. electric triple-expansion pump at the waterworks. J. M. Louk is superintendent of the waterworks.

HAZARD, KY.—The Hazard Light & Power Company and West Virginia & Kentucky Power Company have consolidated at Lothair, one mile from Hazard. It is planned to construct high-tension transmission lines through the Kentucky River, the Big Sandy River coal fields, etc., and supply nearby towns.

LEE, KY.—The Cumberland-Hazard Coal Company contemplates the installation of a power plant to cost about $75,000. Work will be started at once.

PIKEVILLE, KY.—The Pike Light & Power Company will make immediate improvements to cost about $40,000.

SALLYERSVILLE, KY.—The Sallyersville Light & Power Company has plans under way for the installation of a plant to cost about $25,000. G. W. Ramey is interested.

WASIOTO, KY.—The Wasioto Light & Power Company, recently organized by E. M. Bell and others with a capital of $30,000, contemplates the installation of a plant.

CHICAGO, ILL.—Bids will soon be received by the Charles A. Stevens Company, 33 South Jefferson Street, for the erection of a warehouse, garage and power house to cost about $75,000.

SPARTA, WIS.—The Angelo plant of the Wisconsin-Minnesota Light & Power Company, it is reported, has been destroyed by fire. In order to renew permanent service the company plans to erect a transmission line to La Crosse to be connected with the main transmission system.

SUPERIOR, WIS.—The Great Northern Railroad, 175 East Fourth Street St. Paul, Minn., contemplates the installation of motors for the electric operation of its No. 3 iron ore dock, which is now being rebuilt.

ATWATER, MINN.—An electric light and power company is in the process of organization for the installation of an electric lighting system at this place. Address Edward Feig.

DULUTH, MINN.—The city officials contemplate extensions to the electric lighting system on Central Avenue from Roosevelt to Cody Street and on Grand Avenue from Fifty-fourth to Fifty-ninth Street. P. G. Phillips is commissioner.

NELSON, MINN.—The Nelson Light & Power Company plans to erect a transmission line to Alexandria.

NORTHFIELD, MINN.—Petition has been made to the City Council for the installation of a new street-lighting system in this place. R. H. Moses is city clerk.

TWO HARBORS, MINN.—The Duluth & Iron Range Railroad Company contemplates the installation of a switchboard and the erection of a lead-covered aërial cable (100 lines) from First Avenue to Eleventh Avenue. Plans also include the construction of rural lines to the Silver Creek district and to the St. Louis county line. Cost is estimated at $10,000.

VIKING, MINN.—The installation of an electric lighting system is contemplated by the city officials.

CLINTON, IOWA.—The Clinton Gas & Electric Company contemplates the installation of additional turbines to develop 3,500 kw.

FERTILE, IOWA.—The city officials contemplate the installation of an electric lighting system. J. T. Tallackson is city clerk.

GRESHAM, NEB.—At a recent election bonds for a lighting system were carried.

SIDNEY, NEB.—Bids will be received by I. G. Graybill, Mayor, until Oct. 15 for remodeling present power plant and furnishing one engine, generator, etc.

BURLINGAME, KAN.—The city officials contemplate the erection of a power plant to cost about $70,000. Black & Veatch, 701 Mutual Building, Kansas City, Mo., are engineers.

CLAY CENTER, KAN.—At a recent election bonds to the amount of $80,000 were carried for repairs and equipping the municipal electric light plant.

WELLINGTON, KAN.—Johnson & Benham, consulting engineers, Firestone Building, Kansas City, Mo., have been appointed to prepare plans and supervise the construction of improvements to the electric light plant, including the installation of a turbine, generator, boiler, etc.

Southern States

WILSON, N. C.—The installation of an electric light system to cost about $110,000 is contemplated.

TRION, GA.—The Trion Company, Inc., contemplates the erection of an addition to its power plant. Jackson & Moreland, 387 Washington Street, Boston, Mass., are engineers.

JACKSONVILLE, FLA.—Bids are being received by the City Commission for the erection of a high-tension transmission line to the plant of the Federal Ice Company at Moncrief. The cost is estimated at $13,000. William Edwards, Engineer Building, Jacksonville, is engineer.

JACKSONVILLE, FLA.—Bids will be received by the City Commission until Oct. 15 for furnishing and delivering one 333-kva. oil cooled transformer, 6,600 to 13,200 volts primary, 2,300 volts secondary, 60 cycles, 7,200 alternations, provided with four 2½ per cent full capacity taps in the 13,000 volt winding, or two 5 per cent taps in the 6,600-volt winding. Bidders are also requested to state what allowance will be made for three burned out 300-kva. General Electric water-cooled transformers, 60 cycles, 6,600 volts primary, 2,200 volts secondary.

OKLAHOMA CITY, OKLA. — The Oklahoma Terminal Elevator Company has plans under way for the construction of an elevator building to cost about $600,000. Motors will be installed for electric power. P. L. Jackson is secretary.

AMARILLO, TEX.—An issue of $30,000 in bonds was carried for the installation of an electric fire-alarm system at this place.

BALLINGER, TEX.—The city officials plan to erect an electric light plant and contemplate the purchase of power, lines, poles, machinery, etc.

MEMPHIS, TEX. — The plant of the Texas Gas & Electric Company, recently destroyed by fire, will be rebuilt by F. Miller of Hollis, Okla., who has purchased the franchise and property of the company.

Pacific and Mountain States

OLYMPIA, WASH.—Bids will be received by the State Capitol Commission until Oct. 12 for the installation of a lighting system for the Temple of Justice and the new state office buildings.

HILLSBORO, ORE.—The Federal Telegraph Company, F. H. Barstow, local manager at Portland, contemplates the erection of a wireless station. Plans include a 620-ft. tower to hold six sets of antennas, etc. The cost is estimated at about $200,000.

REDLANDS, CAL. — A committee has been appointed by the South Mesa Water Company of the Yucaipa Valley to investigate and report on the matter of erecting its own power plant.

SAN DIEGO, CAL.—Bids will be received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Oct. 20, for the installation of a fire-alarm system.

BROWNING, MONT. — It is understood that plans are under way for the installation of an electric light plant at the local Indian Agency.

BUFFALO, MONT.—The city officials of Miles City, Terry and Glendive contemplate the erection of a hydro-electric plant at Buffalo Rapids. Joseph C. Leighton of Miles City is interested.

GREAT FALLS, MONT. — The Montana Power Company contemplates the installation of wireless telephone systems, connecting at its eleven plants in the state.

(Issued June 8, 1920)

1,342,525. Web-Tension Brake Mechanism for Printing Presses; Theodore J. Beregh, New York, N. Y. App. filed July 12, 1919. Adjustable.

1,345,502. Switch or Receptacle Box; Krantz, Brooklyn, N. Y. App. filed July 19, 1917. Several switch units combined.

(Issued July 6, 1920)

1,345,489. Hole Closure; Bryson D. Horton, Detroit, Mich. App. filed April 13, 1915. Seals for repeated use in knock-out holes.

1,345,502. Switch or Receptacle Box William Newton, Lynbrook, N. Y. App. filed Nov. 23, 1916. Means for holding.

1,345,503. Switch or Receptacle Box; William J. Newton, Lynbrook, N. Y. App. filed Dec. 5, 1916. Position adjustable in outlet box.

(Issued Sept. 28, 1920)

1,353,852. Safety Mechanism for Elevator-Shaft Doors; Albert J. Rosentreter, Boonton, N. J. App. filed Dec. 17, 1919. Opening door cuts off power.

1,353,869. System of Electrical Distribution; Leonard A. Watson, Brooklyn, N. Y. App. filed Sept. 19, 1919. Car lighting.

1,353,870. System of Electrical Distribution; Leonard A. Watson, Brooklyn, N. Y. App. filed Sept. 19, 1919. For battery and lamp circuit.

1,353,872. Telephone-Exchange System; William C. Weaver, East Orange, N. J. App. filed March 25, 1918. Operator-controlled.

1,353,876. Starting Device for Internal-Combustion Engines; Hans Weichsel, St. Louis, Mo. App. filed May 23, 1919. Insures forward starting.

1,353,883. Dynamo-Electric Machine; Thomas Zimmerman, Niagara Falls, N. Y. App. filed Nov. 12, 1915. Compact.

1,353,935. Electrically Wound and Synchronized Striking Clock; Anton R. Nelson, Susanville, Cal. App. filed March 2, 1917. Uses commercial energy.

1,353,965. Electrically Heated Tool; Frank Kuhn, Lawrence H. Thomas and Jules G. Spiess, Detroit, Mich. App. filed May 27, 1920. Soldering iron.

1,353,972. Electric Heater for Sealing Wax; Arthur J. Ording, Chicago, Ill. App. filed Oct. 3, 1919. For applying wax.

1,353,976. Vacuum-Tube Device; Erwin R. Stoekle, New York, N. Y. App. filed March 20, 1916. High-power.

1,353,983. Phase-Distribution System; Thaddeus F. Baily and Frank T. Cope, Alliance, Ohio. App. filed June 27, 1918. Three-phase current for resistance furnace.

1,353,995. Electrolytic Apparatus; William E. Greenawalt, Denver, Col. App. filed Jan. 7, 1919. Electrolysis of impure copper solutions.

1,354,005. Commutator and Method of Assembling Same; Sebastian N. Sloan, Maumee, Ohio. App. filed March 3, 1917. Improved clamping.

1,354,006. Process of Making Commutators; Sebastian N. Sloan, Toledo, Ohio. App. filed May 2, 1918. Segments clamped between flanges on ends of barrel.

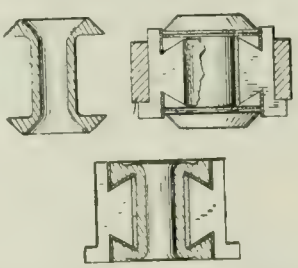
Record of Electrical Patents

Notes on United States Patents

1,354,007. Spool or Holder for Commutators; Charles A. Van Dusen, Toledo, Ohio. App. filed Feb. 24, 1919. One-piece barrel with flanges swaged inwardly to clamp segments.

1,354,020. Telephone System; Harry W. Bryce, Downers Grove, Ill. App. filed Oct. 6, 1915. Manually operated link and trunk circuits.

1,354,030. Signaling Device; Anderson Dilly, Brooklyn, N. Y. App. filed Nov. 4, 1919. Portable flash.



No. 1,354,006. Process of Making Commutators

1,354,051. Call-Registering System; Alben E. Lundell, New York, N. Y. App. filed Sept. 30, 1918. Telephone.

1,354,074. Machinery for Balancing of Unsymmetrical Loads with Polyphase Distribution Nets or Supply Mains; Hidde K. Schrage, Stockholm, Sweden. App. filed Dec. 22, 1919. By a non-synchronous generator.

1,354,086. Storage-Battery Electrode or Plate; Cornelius Ambruster, Roslyn, Pa. App. filed Sept. 4, 1918. Poured end-connecting bar.

1,354,099. Electrical Transmitting and Indicating Apparatus; Edward A. Graham, Brockley, London, England. App. filed June 24, 1919. For transmitting orders, numerical data, etc.

1,354,142. Electrical Protective Device; Benjamin H. Smith, Turtle Creek, Pa. App. filed April 5, 1916. Time-limit relay.

1,354,146. Condenser; Phillips Thomas, Edgewood, Pa. App. filed Feb. 25, 1919. Heavy duty.

1,354,147. Condenser and Method of Making the Same; Phillips Thomas, Edgewood, Pa. App. filed March 7, 1919. High-voltage and low-capacity.

1,354,152. Relay Device; Charles C. Whittaker, Wilkinsburg, Pa. App. filed June 19, 1917. Differentially acting.

1,354,160. Electrical Regulator; Clarence A. Boddie, Pittsburgh, Pa. App. filed March 28, 1917. Holds constant voltage.

1,354,167. Control System; Andrew H. Candee, Pittsburgh, Pa. App. filed Aug. 3, 1917. Mining locomotives.

1,354,168. System of Control; John A. Clarke, Jr., Edgewood Park, Pa. App. filed Oct. 3, 1917. Multiple-unit train.

1,354,173. Motor-Control System; Ray E. De Camp, Wilkinsburg, Pa. App. filed Oct. 6, 1916. For frequent stops and reversals.

1,354,180. Motor-Control System; Adolph A. Gazda, Wilkinsburg, Pa. App. filed Sept. 30, 1916. For frequent stops and reversals.

1,354,188. Control System; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed Feb. 7, 1916. Electric railway.

1,354,229. Telephone Transmitter; George K. Thompson, Maplewood, N. J. App. filed Sept. 21, 1918. High normal resistance.

1,354,234. Holder for Electroplating; Harry M. Blaetz, Philadelphia, Pa. App. filed Jan. 17, 1920. Making lead-molding electrotypes.

1,354,255. Battery-Cell Hydrometer; Percy D. Ivey, Guelph, Ontario, Canada. App. filed April 14, 1919. For cells having opaque walls.

1,354,256. Battery Cell; Percy D. Ivey, Guelph, Ont. App. filed April 14, 1919. Strong walls.

1,354,257. Process for Treating Mineral Oils; Walter Johnson, North Loup, Neb. App. filed April 25, 1916. For cracking crude or mineral oil.

1,354,266. Method of Electrically Welding Steel; John W. Plant, San Mateo, Cal. App. filed April 29, 1919. In neutral atmosphere.

1,354,290. Receiver of Wireless Signals; Ernest E. Frank, Helston, England. App. filed June 19, 1920. Separates waves of close frequencies.

1,354,293. Slug Welding; James H. Gravell, Elkins Park, Pa. App. filed Aug. 20, 1919. Slug readily located in position.

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1,354,323. Battery Hand Lamp; Lorenz Maisel, Madison, Wis. App. filed Aug. 26, 1918. New switch.

1,354,347. Ringing-Tone Circuits; Frank M. Slough, Rochester, N. Y. App. filed Dec. 1, 1916. Called subscriber's bell heard by caller.

1,354,388. Electric Motor; Francis C. C. Fox, Sawtelle, Cal. App. filed June 16, 1917. Radical departure in design.

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1,354,396. Fastening Device; Harry E. Hoenig, East Liverpool, Ohio. App. filed Oct. 20, 1915. Two-part cleat.

1,354,398. Welding System; Claude J. Holslag, South Orange, N. J. App. filed Dec. 13, 1919. Low open-circuit voltage.

1,354,451. Manufacture of Reducing Alkaline Melts; Einar Bergve, Christiania, Norway. App. filed March 10, 1919. Electrolytic.

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Emphasizing Public Unfairness Undiplomatic

TWO sides of the question of public relations to which attention was called by Thorne A. Browne, a member of the Nebraska State Railway Commission, in a recent address deserve careful thought. There is a natural tendency to dwell on the unfair attitude of the public without admitting that it has had some basis in utility history. Such an attitude has a bad effect. The real solution lies in a fair and broad-minded attitude that will beget a similar attitude on the part of the public. Controversy as to whether the public is unfair or not is going in the wrong direction. An honest-minded search for the trouble and a willingness to face the issues fairly, as pointed out by Mr. Browne, is the shortest road, though it may not be free from rough places.

Conservation of Human Lives

THE causes of accidents in central-station construction and operating work are so well known that their prevention should prove an easy task. Such would be the thought of the average individual. However, the discussions at the public utility section meetings of the National Safety Council at Milwaukee revealed such commonplace instances of neglect as improperly guarded excavations, tools carelessly left where men could stumble over them, rolling poles with cant hooks, workmen sitting on poles carried by truck, tools in poor condition and similar carelessness to be prolific causes of injury. To eliminate the ignorant neglect that causes most accidents requires untiring educational work on the part of men who know the danger thus incurred. This work must be backed by executives who understand thoroughly the serious cost to industry of the loss of time due to minor accidents and the irreparable injury when death or permanent crippling is the result. Untiring watchfulness and educational effort are necessary for the conservation of the human lives in industry, and the effort can be successful only where executives not only ask but demand that the causes of accidents be eliminated.

Commendable Co-operation

AT THE recent convention of the New England Section of the National Electric Light Association vigorous emphasis was placed upon the advisability of central-station companies sharing in the pioneer work that has heretofore been willingly and gratuitously done by electrical manufacturers in promoting industrial electric heating applications. Comprehensive plans for co-operative instruction of utility sales department representatives at the heating-device factories are soon to be developed. These men will thus be enabled to acquaint themselves better with the applications already made and those contemplated, with the various types of units which are available, limitations of various forms and types and methods of computing heating installations. The training at the factory will then be continued by contact with the industrial heating salesmen of the manufacturers. Central-station specialists will thereby become more effective in arousing and holding the interest of the prospective electric heating customer, in studying his needs, and in sharing in engineering work such as layouts, construction, "follow-up," analyses, tests and acceptance. The manufacturer will be relieved of much repetitive service, and ultimately the cost of providing equipment for heating service should be influenced favorably. This kind of co-operation cannot help but produce far-reaching benefits. It is also a fair division of the educational and service factors, so important in extending the applications of electric heating, by enabling the manufacturer to devote his efforts mainly to the production of the equipment and to secure his profits through individual sales, while the central-station company exercises its influence in extending those applications of its service that will improve load factors and bring in a return commensurate with the effort that must be expended.

The Contractor as a Merchant

THE convention of the National Association of Electrical Contractors and Dealers at Baltimore last week was in a sense a revelation. Not only did it show the result of the painstaking work of the officers, headed by W. Creighton Peet and W. H. Morton, but also the fruition of the cause fathered by William L. Goodwin. As a matter of cold fact, the contractors, or at least those of them who have essayed the merchandising game, have begun to show the earmarks of real merchants. They have discovered by observation or experience, it matters not which, that it costs money to do business and that if one is to be successful in merchandising electrical appliances the margin between the cost and selling price must be ample. They also appreciate that merchandising is competitive and that if the overhead expense is so great as to necessitate too high a discount the business will naturally gravitate to more efficient merchants. This realization on the part of the contractors is most promising and should result in much good. Next to conducting a successful business the most important thing is to know the fundamentals on which success is predicated, and these the contractor-dealers are fast learning. Moreover, armed with such knowledge, the contractor-dealer will no longer fall the prey of unscrupulous manufacturers who may wish to trade on his ignorance. Thus the contractor has emerged from the waters which heretofore engulfed him and set foot on the shores of sound business legitimately conducted. That he has been able to do this unassisted to

any appreciable extent by the other branches of the industry is immensely to his credit, and this work transcends in importance all the other work thus far conducted by the national association.

Psychology in Theater Lighting

THERE is probably no better example of the importance of psychological considerations in illumination design than may be found in the lighting of the pretentious theaters of recent years. While it is necessary to provide certain intensities in workrooms, etc., for the comfort and safety of the occupants, it may be said that foot-candles have only a small place in the lighting scheme of theaters. Where music and scenic effects predominate there appears to be an unlimited field for development of background and accompaniments by means of carefully planned lighting. In connection with orchestra selections and other musical features a careful use of colors and changing intensities has proved a powerful instrument for producing a sympathetic and appreciative attitude in the audience.

On another page is given an account of the usefulness of modern lighting equipment in one of the finest theaters in New York City. In this theater, such is the importance of the lighting of both stage and auditorium for the proper setting of the actual features to be presented, that a "lighting" rehearsal must be staged before the "dress" rehearsal for the new program each week. The electrical energy required each month for this theater is 60,000 kw.-hr.

There are also physiological considerations of great importance in theater lighting, especially where motion pictures are shown. The effect of the cinema on the eyesight has not received the study it deserves in consideration of the fact that motion pictures have become virtually universal entertainment in this and other countries.

When Wrong Disconnecting Switch Was Left Open

THERE are a great many Y-delta connected banks of transformers in this country and abroad, and the problem of forestalling the possibility of wrong switches being closed or left open is one of more than passing importance. A general solution is hardly feasible, since each case must be handled in accordance with local conditions. In some plants it may be sufficient to require a second operator to check the first one before any new equipment is connected to the lines. In other cases electrical or mechanical interlocking may have to be employed.

A recent case of interruption of service, with the moral attached, should be of interest to operating engineers confronted with similar conditions. The interruption happened in a substation in a city of more than 100,000 population where the incoming 60,000-volt energy is transformed to a lower voltage by means of a bank of 5,000-kva. transformers operated in parallel with a smaller bank rated at 1,000 kva. There is a spare transformer for each bank. The high-tension windings are Y-connected, while the low-tension windings are in delta. The operator on duty noticed that one of the large transformers seemed to be giving off smoke and decided to replace it by a spare one. He opened the high-tension oil switch of the bank, as well as the low-tension switches, cut in the spare transformer and again put the bank into operation, but forgot to close the disconnecting switch on the low-tension side of the new transformer. Because of the Y-delta connections of the bank the phase voltages became greatly distorted and large circulating currents flowed between the large and small banks. While the operators were hunting for the cause of the trouble, an additional heavy load came on the small transformers and the whole bank went up in smoke. The substation had to carry full load every day at certain hours, and the shutting off of the smaller set of transformers caused great inconvenience to a number of industrial plants and forced one steel mill to curtail its electric furnace operation. All available steam-plant generator capacity was hastily put into commission, at great additional expense in labor and fuel, in order to keep up service. This is an example of a waste that engineering ingenuity on the part of a manufacturer when properly applied can easily prevent.

Profiteering in Coal

SOME rather unpleasant data are presented this week on the fuel situation, which our readers well know to be bad. It grows worse the further one gets into it. The tables on pages 773 and 774 show the cost and grade of coal now and in 1914 at the beginning of the world war. They show, too, something of the supply with reference to the necessary storage, and disclose in general a condition of things which calls for sudden and prompt remedial action. Electric light and power companies are today paying on the average about 175 per cent more for coal than in 1914. In some cases the increase rises to from 400 to 500 per cent, and the lowest figure of increase is 80 per cent. Where companies carry coal clauses in their power contracts there is some measure of remedy available, but in many instances the increases under coal clauses scantily recoup the added costs of production. Far more serious is the question of supply, and particularly the obtaining of adequate reserve for storage so as to insure continuity of service. There is reasonable expectation, however, that the transportation will grow better before it grows worse, and we have ground to hope that a census two months from now may show better conditions than at present.

The quality of the coal is most discouraging. Despite the fact that most of the companies reporting are obtaining fuel from the same general source as before over substantially the same transportation routes, it is generally found that the quality of the fuel is of distinctly lower grade, something like 10 per cent less in thermal value than the coal in 1914. The effect of the reduction in grade is not only to make fuel costs more but to involve extra trouble in burning it.

On the whole, coal is dear and relatively poor as compared with pre-war conditions. It is pertinent to inquire why the price is at present so high. Miners are, of course, getting more wages and freight rates have increased, but in most instances these increases are only a very modest proportion of the total piling on of price. There should be concerted effort to find out who is profiteering and to what extent, and then to attack the situation with all the force that the united efforts of the central stations in the country can produce. It is a matter which interests the people most directly, since it affects the cost of electrical energy. Nothing

is more effective in reducing prices to a normal level than to drag out into the limelight the whole distribution of price as from the miner and the coal operator through to the last man to whom the electric company pays its bills. Publicity of this sort will reduce the price of almost any known commodity if it is inflated, and in this vital matter of fuel the public utility companies should join hands with the man who is paying $16 or $18 a ton for his home supply in ferreting out and expelling those who are responsible for needless increase in the costs.

A congressional investigation of the profiteering in steam coal is greatly needed if industry as a whole is not to be seriously hampered.

Factors in Designing 32,500-Kva. Generators

AN ACCOUNT of the factors which influenced the design of the 32,500-kva. generators built for the Niagara Falls Power Company is suggestive in the extreme. Huge machines with this rating involve at best very serious mechanical questions, particularly when laid out for the relatively high speed of 150 r.p.m. But the electrical design as well required considerable finesse, as is brought out in this issue. The mere question of the number of armature slots turned out to be a matter of larger importance than one would have supposed, particularly since the design most favorable in some respects proved to be inferior in others. The determining factor was the greater ratio of coil surface to copper loss which could be obtained by increasing the number of slots, corresponding to added capacity for transmitting heat developed in the copper through the insulation. It is the insulation around the armature conductor that limits the rate at which the heat is conducted away, and whereas in mica-insulated bars the thermal conductivity of the insulator is very poor, it becomes necessary to make up in area what is lost in specific conductivity.

Most of the rise in temperature of the copper is due to its thermal insulation and not to the temperature rise of the armature teeth above the cooling air. Mica insulation was chosen in this case on account of its remarkable heat-resisting qualities. These are conspicuous in large steam turbo-generators, but are advantageous anywhere as a guarantee of increased factor of safety and probable lessened maintenance. The coils were therefore formed of bare copper ribbon insulated by mica strips and mica tape. Liberal ventilating space was provided around the coil ends, and the same type of coil support was used here as in the very large steam turbo-generators, again with the purpose of increasing the factor of safety. The field coils likewise were formed of bare strap wound edgewise but insulated with asbestos, since there is no material potential difference to be considered. Both field and armature insulation are guaranteed to run up safely to a temperature of 150 deg. C.

The ventilating system, too, is worth a special word. In one generator the rotor has inclined fan blades mounted on each side of its spider. The ends of the armature are inclosed so that the fans deliver their air into pressure chambers, from which it is forced into the air gap, through ducts in the armature core, and to the field coils. For keeping close track of the temperatures in operation there are twenty thermocouples between the coil sides in the armature slots and six more on the outside of the end coils. It should therefore be possible to get a very close approximation of the actual temperature of the copper conductors.

Further Interconnection in South Will Benefit Many Districts

A VERY striking conspective view of the power situation in the Southern States is given by the report of Captains Miltenberger, Whitsit and Lamar, which is published in this issue. The rapidly growing Southern industries are now served by several overworked interconnected networks, and by isolated central stations. From the present outlook, as disclosed in the report, industrial developments and the needs of consumers now served by isolated plants will within the next five years require an increase of about one billion kilowatt-hours in the annual production. Approximately one-third of it is needed in the Carolinas, another third in Alabama and the remainder in Georgia and Tennessee. Apparently the Carolinas have no considerable hydro-electric resources undeveloped, at least to an extent adequate to supply the power which would probably be demanded. Therefore there is particular need for the completion of a network that would enable the Carolina requirements to be furnished by interconnection with Alabama, Georgia and Tennessee. The Alabama streams at present are good for a little over a quarter of a billion kilowatt-hours a year and Georgia for nearly half a billion, although the deficit to be supplied by steam power in a dry year is much larger than in Alabama. The Tennessee system, with comparatively little help from steam, runs close to 400,000,000 kw.-hr. annually.

The larger central-station systems in these three power-producing states have an aggregate generating capacity of nearly a billion and a quarter kilowatt-hours, which ought to be raised to two billion to provide for requirements now soon probable. Under existing conditions, about 13 per cent of the present possible output would have to be provided by steam. The report indicates that by interconnecting the several systems and operating for their maximum joint economy about 150,000,000 kw.-hr. can be added while still permitting a reduction of the annual coal consumption.

To raise the total capacity by the estimated 730,000,000 kw.-hr. the engineers advise a hydro-electric plant and a large storage reservoir near Cherokee Bluff, Ala., which would bring the total power available on the system up to the required amount. Several other developments are possible which would bring a still further increase. The main point of the report is that a general system of interconnection should be instituted to tie together the resources of Georgia, Alabama and Tennessee in such a way as to meet the requirements of these states and to supply the needs of the Carolinas. It is a big project and worth very serious consideration. It would seem more formidable were it not for the fact that the transmission system necessary is already well under way. Not yet is it at a point which facilitates the long transfers of power which would be finally required, but still it has progressed far enough to make the additional linkages comparatively easy. There is certainly a splendid opportunity for electrical developments in these Southern states which should be pushed to the utmost to conserve coal.



Schuyler Skaats Wheeler

Pioneer in electrical achievement who first proposed a code of ethics for engineers and who in the manufacture of motors was one of the earliest to put production efficiency methods into practice

APART from the pioneer work he did in installing the earliest of the Edison systems, in placing wires underground, in motor design, manufacture and standardization, S. S. Wheeler by the directness of his thinking has done much to place engineering on a higher level and develop efficiency in industry. In his presidential address before the American Institute of Electrical Engineers in 1906 Dr. Wheeler expounded his theory of professional ethics for the engineer, in which he defined the engineer's duty to his client, to the public and to his professional society. His stand met general commendation and was instrumental in a measure in the formulation by the separate national engineering societies of codes of ethics. When the field of industry was yet unblazed he was working on systems whereby production would be increased by making manufacturing routine less dependent upon the individual. The shop routing system now so commonly used was instituted by him. He was also a pioneer in devising methods for keeping stock records. In the past few years Dr. Wheeler has given considerable time to studying the blind, with the result that many industrial activities formerly closed to them have been opened.

Dr. Wheeler was born in New York City May 17, 1860. He left Columbia College in 1881, and as a member of Edison's engineering staff, was placed in charge of the old epoch-making Pearl Street station when it was started in 1882. He erected other Edison stations at Fall River, Mass., and at Newburgh, N. Y. In 1886 he entered what was to become his life's work—the manufacture of motors. Two friends of his, Charles G. Curtis and Francis B. Crocker, were just forming the C. & C. Electric Motor Company and induced him to become associate electrical engineer and manager of the company, the first to manufacture a standard line of motors based on the scientific principles of generator design then standard. Two years later with Mr. Crocker he formed the firm of Crocker & Wheeler, which ever since has been one of the recognized leaders in the manufacture of electric motors. Since 1889 Dr. Wheeler has been president of the Crocker-Wheeler Company. From 1888 until 1895 he was also engaged as electrical expert of the Board of Electric Control for New York, during which time he had the task of seeing that all overhead lines were placed under ground. In 1900 Dr. Wheeler purchased the Latimer Clark library, the largest collection in existence of rare electrical books, and presented it to the American Institute of Electrical Engineers. In 1904 the John Scott Medal was awarded to him by the Franklin Institute in recognition of his invention of the electric buzz fan, which laid the foundation of the fan-motor industry.

Power Development in the Southern States*

Report of Power Section of War Industries Board Reviews Electric Power Resources of Southern States at Close of World's War and Makes Recommendations for Efficient Development to Accommodate Estimated Demands of the Future

By Capt. GEORGE K. MILTENBERGER,† Capt. LYLE A. WHITSIT, and Capt. ROBERT W. LAMAR

THIS report considers the question of power generation by interconnected power systems in the States of Alabama, Georgia, Tennessee, North Carolina and South Carolina, termed the Southern States, and does not concern itself with the matter of distribution to customers beyond the main generating plants, substations and interconnecting trunk lines. The problem discussed has to do with steam and hydro-electric generation and the essential interconnection of generating stations in order to secure an adequate supply of electric power at the industrial centers at a minimum capital and operating cost. It should be noted that a very large additional expenditure is necessary to distribute power from these generating plants and trunk lines to power customers, and it is observed that frequently the cost of distribution from the trunk line to the customers exceeds the cost of generation and trunk-line expenses. While the survey was made during the year 1918 and the first part of 1919, the recommendations apply with equal force at the present time.

The power requirements of the Southern States are now supplied partly by central-station electric systems, which serve diversified industries, and partly by isolated steam and water-power plants built and operated individually for specific factory or other needs. In the interest of economy, reliability and conservation isolated-plant generation should be discontinued and central power substituted. Industrial developments in these states and the conveying of isolated-plant service will require approximately one billion kilowatt-hours increase in annual production within the next five years, or including 1924. Of this amount 300,000,000 kw.-hr. is allotted to the Carolinas, 350,000,000 kw.-hr. to Alabama, 200,000,000 kw.-hr. to Georgia and 150,000,000 kw.-hr. to Tennessee. With these allotments the 1917 output of the central stations of North and South Carolina would be increased 11.1 per cent, that of Alabama 24 per cent, Georgia 10.5 per cent and Tennessee 9.6 per cent annually. The annual increase for Tennessee is relative to the 1917 output exclusive of the service to the Aluminum Company. A conclusive investigation of the power resources of the Carolinas was not made, but the data in hand indicate that these states possess no natural resources in hydro-power or other sources that are suitable for the creation of this new power on a basis that would compare favorably with the production by a proposed tri-state interconnected system, as described, for Alabama, Georgia and Tennessee. It appears probable that a large part of the additional power required in the Carolinas could be more economically derived from an interconnected system of these three states. If the anticipated increase for the Carolinas is derived from these three states, the developments recommended for the latter will have sufficient excess generating capacity to supply the Carolina requirements.

The prime generating capacity of the present (1919) Alabama system, in kilowatt-hours per annum, is as follows:



One shift of Warrior Steam Plant crew.



One shift of Lock 12 Hydro-Electric Plant crew.

COMPARISON IN SIZE OF CREWS REQUIRED TO OPERATE STEAM AND HYDRO-ELECTRIC PLANTS

*This is an extract of a report on an investigation of the power service of the Southern States by Captains Miltenberger, Whitsit and Lamar, Engineers, U. S. A., made during the latter part of 1918 and the first part of 1919, under the authority of the Power Section of the War Industries Board of the War Department, the investigations of which were under the general supervision of Frederick Darlington, consulting engineer. Captain Miltenberger is now research engineer of the Union Electric Light & Power Company, St. Louis; Captain Whitsit is at present engaged on the power and transmission studies of the Boston-Washington super-power survey, New York City, and Captain Lamar is now manager of the power department of the Monongahela Valley Traction Company, Fairmont, W. Va.

†Formerly in charge of the Southern States District of the Power Section of the War Industries Board.

(a) In a year of average stream flow:	Kw.-Hr.
Hydro power	275,000,000
Steam power	110,000,000
Total power	385,000,000
(b) In an extreme dry year:	Kw.-Hr.
Hydro power	242,000,000
Steam power	143,000,000
Total power	385,000,000

Assuming that the present three major systems in the State of Georgia are interconnected and operated as one system, the combined systems will have the following generating capacity in kilowatt-hours per annum (1919):

(a) In a year of average stream flow:	Kw.-Hr.
Hydro power	500,000,000
Steam power	
Total power	500,000,000
(b) In an extreme dry year:	Kw.-Hr.
Hydro power	370,000,000
Steam power	130,000,000
Total power	500,000,000

The present Tennessee system will have the following prime generating capacity, limited by the present (1919) steam equipment when used to maintain this prime capacity in an extreme dry year:

(a) In a year of average stream flow:	Kw.-Hr.
Hydro power	373,000,000
Steam power	12,000,000
Total power	385,000,000
(b) In an extreme dry year:	Kw.-Hr.
Hydro power	345,000,000
Steam power	40,000,000
Total power	385,000,000

In estimating the additional power service that can advantageously be rendered by the central-station systems, account has been taken of the established central-station business and the reasonably expected increase in going industries. Provision has not been made in these recommendations for extraordinary additions to the power service to provide for large new electrochemical undertakings or for railroad electrification. One billion kilowatt-hours increase, as described, is the foreseen requirement without new electrochemical industries and railroad electrification.

The major central-station systems at present in operation in the States of Alabama, Georgia and Tennesseee have an aggregate prime generating capacity estimated at 1,230,000,000 kw.-hr. annually, and it is estimated that the central-station output should be increased by 700,000,000 kw.-hr. annually to provide for the conversion to central-station service of power now being generated by isolated plants and for normal industrial growth anticipated within the next five to seven years.

As the best means of increasing the aggregate capacity of the central-station systems of the three states, and to include economy and reliability, it is recommended that the major power systems now in these states be effectively interconnected by transmission lines and the best available resources for hydro-electric and steam power be developed to increase the interstate combined systems. An examination of the central power systems for 1919 conditions shows that these systems, when operated individually, have an aggregate generating capacity capable under commercial conditions of producing 1,230,000,000 kw.-hr. of prime power annually, of which 13 per cent, or 163,000,000 kw.-hr., in seasons of normal river flow would have to be produced by steam plants requiring a consumption of 190,000 tons of coal annually. By effectively interconnecting these systems and operating them for the best joint economy the capacity of the combined systems would be increased to 1,370,000,000 kw.-hr. annually, requiring in years of normal river flow the production of 132,000,000 kw.-hr. by steam with the consumption of 140,000 tons of coal. An increase of 140,000,000 kw.-hr. in the generating capacity is effected by complete interconnection and joint operation as above, which in itself is an important reason for interconnection.

In building plants for increased power production needed to convert isolated-plant service to central-station operation, and to provide for industrial growth, the proposed interstate interconnected power system affords a marked advantage over the present plan of independent, disconnected or inadequately interconnected systems, particularly as the interconnected system permits the use of the most economical sources of power within the area of the proposed interstate system, regardless of the relative location of these sources to localized market centers.

Contemplating the adoption of this plan, and in order to provide increased power facilities for the production of 700,000,000 kw.-hr. annually—the estimated requirement for isolated-plant conversion and industrial growth within the next five to seven years—it is recommended that a hydro-electric plant be built on the Tallapoosa River, Alabama, near Cherokee Bluff, together with a large storage reservoir. The present power systems combined with the proposed Tallapoosa plants would have a generating capacity of 2,100,000,000 kw.-hr. annually, which is an increase of 730,000,000 kw.-hr. over the capacity of the present systems if interconnected and jointly operated.

Building for increased power production in the three states under consideration should not and will not cease with the installation of 700,000,000 kw.-hr. increase in annual capacity. It is anticipated that with this increase provided for during the next five to seven years a still further increase in capacity should be undertaken for growth following the five-year period, and the recommendation of Tallapoosa is made with a view to later additions to the generating capacity of an interstate power system for Alabama, Georgia and Tennessee, and possibly the Carolinas. The Bartlett Ferry site may be developed for an installation of 36,000 kw. This development, when interoperated with the systems of the three states, would make possible the following generating capacity:

In a year of average stream flow:	Kw.-Hr.
Hydro power	2,120,000,000
Steam power	110,000,000
Total power	2,230,000,000

Following this, if still further development is required, the next development in order would be the

Mathias-Tallulah development on the Tallulah River, Georgia, between the Mathias Reservoir and Tallulah Lake, and the Tugaloo development on the Tugaloo River, Georgia, immediately below the confluence of the Chattooga River. The generating capacity of the entire system with these developments in service would be:

In a year of average stream flow:	Kw.-Hr.
Hydro power	2,336,000,000
Steam power	164,000,000
Total power	2,500,000,000

A large number of other developments, including steam plants at coal-mine centers, were examined and compared but considered less favorably than those mentioned as components of power systems composed of present central-station systems adequately interconnected.

The great advantages of interconnection and joint operation of power systems and the economy in building for increase in generating capacity apply equally to a combination of the privately owned power companies with the government plants now building at Muscle Shoals. The characteristics of this government power and the gain both to the government plant and to the privately owned plants that would result from interconnection and exchange of facilities were an important consideration in the recommendation of the Tallapoosa River project, inasmuch as the interstate combination, with other power substituted for Tallapoosa, might be quite as favorable as the Tallapoosa power in the combination without Muscle Shoals. Under the present laws, the government hydro-electric plant now building at Muscle Shoals cannot be connected to or operated in conjunction with private interests.

The government hydro-electric development at Muscle Shoals will be on a variable river with opportunity for the development of a vast amount of second-class or nine months' power and a relatively small proportion of twelve months' or primary power. A government-owned steam plant being built at Muscle Shoals will be capable of converting a portion of the second-class power into prime power, but it cannot do so as economically as by combination with the proposed interstate power systems, because if steam-plant auxiliary power is to be used with the Muscle Shoals power, other steam plants already constructed are more favorably situated than the government steam plant for furnishing the bulk of this supplementary power.

Still further, if the government needs do not require the entire output of the Muscle Shoals plant, it would be a criminal waste to deprive the industries of Alabama and adjacent states of this supply of power. It should be emphasized that an interconnected power system, as here recommended, is the best possible vehicle for taking over such part of Muscle Shoals' power as the government may not require for its own uses and delivering it to the industries of the Southern States, and that to make provision for doing this efficiently such use of the surplus power should be arranged for at a very early date and considered in connection with private-plant developments to the end that these developments may be of a character that will advantageously supplement Muscle Shoals.

It is recognized that the resources for primary power in the Southern States are one of their most valuable assets industrially, and the Muscle Shoals development has long been looked upon as a desirable project, particularly in combination with navigation improvements in the Tennessee River. Prior to the war a private corporation even went so far as to spend several hundred thousands of dollars in securing property rights, exploring foundations and making designs. It appears that with an exchange of power between the government interests and private power systems maximum economy will result to both interests, whereas if the present law is enforced, the government will lose the economic advantage of interchanging power with existing privately owned systems and Southern industries will be deprived of the benefit of Muscle Shoals power.

The proposed interstate power systems above described, including the proposed Tallapoosa River development, which are capable, as stated, of producing 2,100,000,000 kw.-hr. of primary power annually, if combined and operated with the hydro-electric plant at Muscle Shoals, could produce in a year of normal river flow 2,880,000,000 kw.-hr. annually of primary hydro-electric power without any steam generation.



WARRIOR STEAM PLANT, ALABAMA POWER COMPANY

A modern steam plant located at Gorgas, Ala., on the Warrior River. It contains two high efficiency steam turbines with a total capacity of 50,000 kw. One shift comprises twenty men.



LOCK 12 HYDRO-ELECTRIC DEVELOPMENT, ALABAMA POWER COMPANY

A modern hydro-electric plant located on the Coosa River in the central part of Alabama. It contains five units and has a total capacity of 70,000 kw. One shift comprises six men.

Effect of Coal Situation

Reports from Fifty-four Central Stations Show Storage One-third Normal—Prices Average 176 per Cent Higher, Economy and Boiler Rating Are Much Impaired and Operating Difficulties Are Greatly Increased

WHILE all readers of the ELECTRICAL WORLD know the effect of the present coal situation in their immediate neighborhood, the specific effects on storage, prices, economy, boiler rating, haulage, etc., in different parts of the country have not been so generally familiar. Recognizing this, the ELECTRICAL WORLD has collected data from fifty-four central stations scattered around the United States and having a total coal consumption of 2,214,568 tons (January to June, 1920). The data are presented in the accompanying table.

With few exceptions, the present supply of coal is sufficient only to meet the normal operating requirements. No particular section of the country is favored in this respect, although in those states where water power is predominant the situation is somewhat better. Nearly as much difficulty is experienced by those companies operating near the coal fields as by those operating in more remote sections.

With an average of only twenty-two days' storage as against a normal supply of sixty days, it is very evident that there is a low margin of safety in the present storage of companies. Should the supply of coal be interrupted for three weeks, electric service would have to be curtailed so much that the public would be greatly inconvenienced and industrial plants subjected to great losses. There is a bright side, however, in that some companies report slightly better deliveries on contract with less buying in the open market.

In the two sections where the study was most complete—namely, the Eastern Atlantic and Middle Western States—storage conditions are practically the same, twenty-two Eastern companies reporting an average of eighteen days' storage on hand and twenty-one Western companies fourteen days' supply. Normal requirements of Eastern companies would average fifty-one days and those of the Middle West companies thirty-six days. Present storage is, therefore, 35 and 39 per cent respectively in these two sections of the country.

Even if coal could be obtained under present conditions, the general problem of utility operation is far from satisfactory. Price and quality of coal in their effect on the cost of power, to say nothing of the effect of the quality on operating difficulties, are items that should certainly be taken into consideration in determining equitable rates. A comparison with conditions in 1914, which are taken as normal, show that utilities are paying from 80 per cent to 500 per cent more for coal. Reports of fourteen Eastern companies show an average increase of 190 per cent and seventeen Mid-Western utilities show average increases of 172 per cent. An average of forty-three companies shows an increase of 176 per cent. While this is a serious problem to those companies whose rates are not on a basis of coal prices, the most interest lies in the general reduction in the quality of coal. Virtually all companies are buying coal wherever it can be had, but even those companies that are obtaining a supply from the same sources as in 1914 are suffering from a reduction in quality. High moisture and ash content, dirt, sulphur, clinkering and difficulty in keeping up fires have reduced the efficiency of the boiler room. Although their coal is virtually all bought from the same mines as in 1914, twelve of these companies which had modern equipment and made no change are burning 20 per cent more coal per kilowatt-hour than they did in 1914, owing to the lower quality of the coal. These same companies are paying an average of 181 per cent more for coal than in 1914. In other words, the combined increase due to cost of coal and loss of efficiency is 217 per cent. The plants considered are typical average plants with a coal consumption of 2.5 lb. to 4.0 lb. per kilowatt-hour.

In the majority of cases, plants were not as modernly equipped in 1914 as at present, so that there has been a reduction in pounds of coal burned per kilowatt-hour even with present coal. With coal of the same grade as that of 1914, the increase in efficiency would be even more marked for those companies that have shown improvement. It is evident, therefore, that the central station is not realizing on the result of careful engineering practice in so far as increased profits are concerned and that the improvements have helped only to meet the present condition of high prices and poor quality of coal.

An average of 3.8 lb. of coal per kilowatt-hour is shown by twenty-one Middle Western companies and 2.6 lb. per kilowatt-hour by twenty-one Eastern Atlantic companies. A conservative estimate would show a reduction of at least 20 per cent in these figures, if it were possible to secure coal of the same quality as that used in 1914. This in spite of the fact that prices have increased for this fuel supposedly of the same grade.

COAL BEING BOUGHT VIRTUALLY IN THE SAME LOCALITIES AS 1914

In general, there has been little change in the district from which coal is obtained since 1914. Of twenty-two Middle Western companies, sixteen are still obtaining their coal in local districts as in 1914. Three companies that had formerly been using Eastern coal have changed to local coal and three companies still continue to obtain their coal from Eastern territory. The hauls of Middle Western companies are about 400 miles (644 km.) as a maximum, with most hauls not over 125 miles (201 km.). In the Eastern Atlantic States there has been very little change in the source of supply other than local changes. The maximum haul is about 500 miles (804 km.), with a haul of not over 100 miles (161 km.) in most cases.

Delivery conditions are about the same throughout the country, the supply received being sufficient for immediate requirements in most cases. In numerous instances operators are not fulfilling their contracts and central-station companies have found it necessary to go into the open market to buy coal to keep the plants operating.

If the present grade of coal were to be stored in large quantities, it is probable that the difficulties attendant upon such storage would be materially in-

How the Coal Situation Has Affected Central Stations in the Last Six Years

O. M. Open Market. C. Contract. L. T. Long Ton. R. of M. Run of Mine. M. R. Meeting Requirement.

Company	Tons Used Jan. 1 to July 1 1920	Kw.-Hr. During Period	Load Factor	Tons of 1914 Coal That Would Have Been Used in Same Period	Tons of Her Coal Prospects	Storage Mouth in Tons	Source of Coal Supply and Distance to Consumer: Present	Source of Coal Supply and Distance to Consumer: 1914	Method of Delivery	Nationality (coal 1920)	Per Ton Delivered at Boiler Room: 1920	Per Ton Delivered at Boiler Room: 1914	Name of Coal	Per Kw.-Hr. Delivered at Boiler Room: 1920	Per Kw.-Hr. Delivered at Boiler Room: 1914	Per Ton Cost	Labor Handling Coal	Fuel Handling Coal	Other Items
NEW ENGLAND																			
Cambridge (Mass.) Electric Lighting Co	17,809	15,547,747	42	15,540	5,356 L T		Pa	Norfolk	Navigating the coastwise supply		13,900 25	$1 53 L T	New River	14,500 13	$4 49 L T				
Edison Electric Illuminating Co of Brockton, Mass	21,306	25,024,810	49	20,284	4,164 Very poor	20,000	West Va	West Va	M R	Kanawha & New River	13,500 2 80			4,600 14 83	$4 03				
New Bedford (Mass.) Gas & Edison Light Co	53,799	63,632,775	52	15% less	+3,000 Fair	13,000	Pa	Pa	Very irregular			$				C & O M Impossible to keep moving			
Pittsfield, Mass., Electric Co.	10,500	8,000,000		9,000	5,600 poor	9,000	Pa	Pa	M R		14,000 20 10	$6 03		4,500 16 8	$1 25	25% over contract Bal. C. M.			
Turner Falls (Mass.) Power & Electric Co	12,000	10,000,000	11 5 Reserve plant	Same	2,400	2,400	550 Cambria Pa	Same	10% prior to July 27 100% since and all at present		13,700 28 10 5	$3 10 at mine		4,500 22 4 1	$1 25	Contract now at Mariant up to July 27			
Danbury & Bethel Gas & Electric Light Co., Danbury, Conn	5,792	2,899,971	49 1		600 Poor	2,500	200 Pa	Same				$ 1 90	Hocking		$2 21	O. M. Very little			
EASTERN ATLANTIC																			
New York																			
Buffalo General Electric Co	60,000				None	40,000	250 Pittsburgh		M R	Various	12,500 14 8 1 6 3 3					C	Not operating	$	
Central Hudson Gas & Electric Co., Poughkeepsie	20,000 L T	16,059,980	45	16,000 L T		10,000	400 Du Bois Clearfield & Moreland	Same	M R		12,100 27 15 5	$7 12 alongside		4,000 13 0 9 2 0	$3 16 alongside		C		
Company "A"	22,453	8,210,973	16 2	Same	5,000	15,000	450	400	M R	Kanawha	13,000 25 8 5 4	$3 75				C			
Flatbush Gas Co., Brooklyn	12,475	6,081,870	32 47	11,200	5,000	Same	St. Clair Pa	Pittston Pa	O M	Raven Run	11,200 6 75 5 20 10	$6 70		12,200 12 35	$2 40	C			
Richmond (N. Y. City) Light & Railroad Co	23,200	19,719,000	62	18,000	400 Poor	3,600	Connellsville Pa	Same	Pont	Various	13,800 Av. 22 6 16 2 6 4	$11 00	Connellsville	13,800 28 1 0	$3 70	C 50% C. M.	C		
Pennsylvania											14,500								
Company "B"	7,004	2,652,585	82	6,300	600		160 mi Cambria County Pa	Same	M R	R. of M Cambria		$4 00	Same		$1 25 grate bars	C			
Counties Gas & Electric Co., Norristown	31,053	21,310,400	55	Same	1,500 Poor	10,000	300 W. Va. W. Pa.	Same	M R	Various	13,800 18 20 8 10 1 0	$4 10	Various		$2 35	C	C		
Duquesne Light Co., Pittsburgh	649,441	160,806,230	70	Same	+9,211 Poor	124,500	10-90 Eighth Pool Monongahela River	Same	M R	R. of M	2,800 10 95 4 14	$3 84	Bit. Black	12,784 10 73 400	$1 13	C			
Hanover Light & Power Co., Scranton	3,639	1,680,097	63 2	Not operating	620 Slight	1,206	175 mi Pa	100 mi W. Va	M R		13,700 28 92 9 16 6 68	$6 18				C		A	
Jefferson Electric Co., Scranton	2,937	1,378,604	45	Same	275 Slight	800	Local	Local	M R			$3 25			$1 25	C			4 46 4
Ohio Service Co., Scranton	28,735	12,728,910	46	Same	1,641	10,000	10-50 mi Ohio	Same	M R		13,180 18 8 10 3 5 12	$3 26			$1 25	C & O M			5 46 8
Penn Central Light & Power Co., Altoona	46,020	19,043,960	63 6	Same	600 Good	18,000	25 to 40 mi Cambria and Clearfield	Same	M R	R. of M	13,492 23 38 9 98 5 5	$3 69	R. of M	13,875 21 63 9 2 1 7	$1 09	C Own mines	C		
Susquehanna County Light & Power Co., Scranton	1,305	336,195	14 Standby		16 Slight	150	50 mi	50 mi	M R			$4 15				C. M.	Not operating		
Warren Light & Power Co., Scranton	6,661	3,760,600	64 1	Same	913	2,004	75 mi	25 mi	M R		13,590 31 62 10 6 1 12	$7 05			$2 50	C & O M		40	1 6 5 0
New Jersey-Maryland											14,000								
Monmouth Lighting Co., Keyport, N. J.	10,400	4,017,870	.....	9,000	1,500 No prospects	4,000	200 mi Clearfield	O. M.	M R	Trojan No. 2	8 14 1 5	$4 10	Various			C	O. M.		4
Hagerstown & Frederick Railway Co. (Md.)	23,250	14,229,800	35	28,000	500	5,000	100 Georges Creek	Same		Various	15	$7 50		7	$2 40	C & O M Own mines		35	1 4 4
Municipal Electric Light Plant, Hagerstown, Md.	6,250	3,140,000	46	5,250	100 No prospects	1,200	175 Consolidation Mines	150 Jerome Mines	M R			$7 20 alongside $4 55 at mine	Jerome		$3 00	C	C		4 46 1 25
Potomac Electric Power Co., Washington	95,146 L T	110,348,933	63 3		6,500	10,000	200 350	200 Georges Creek	M R	Big Vein	14,700 17 0 10 0 2 9	$7 02 L T del	Big Vein	14,600 17 10 0 9	$3 25 L T del	C	C		5 2 58
West Virginia and Virginia																			
Company C	30,087	11,362,780	46 2	Same	1,400 Ranver Storage only	1,400	Local	Local	Satisfactory	Pitts Seam	14,100 32 24 6 19 20		Same	Same		Own mines			
Consolidated Light, Heat & Power Co., Huntington, W. Va.	14,243 Also natural gas	40,705,800			2,525 Better since Aug. 1		40 mi W. Va.	Same	Gaining 100 tons per day	Elon Mine	12,500 31 27 6 12 3 44	$6 01 alongside							
Wheeling Electric Co., Wheeling, W. Va.	26,331	15,389,270		Same	Full storage		Local	Local	Delivering as required		14,000	$1 [illegible]	Same	14,000	$1 40				
Electric Transmission Co., Big Stone Gap, Va.	15,328	13,299,000	47	Same	2,100	1,000	[illegible]	Local	60%	Kanawha	6,250 15 5 1 0	$4 50	Same	60				13	
Newport News & Hampton (Va.) Railway Gas & Electric Co	24,705	20,185,400	51 2	22,000	500 Poor	3,000	Cub Creek, Va.	Same	M R	Kanawha		$2 85 alongside $3 50 at mine				O. M.			
SOUTHEASTERN											6,000								
Pensacola, Fla., Electric Co	7,006	4,788,780	62 6	Same	No storage No prospects	1,000	100 Ala.	Same	M R	Pratt		$5 40 alongside	Pratt		$2 [illegible] alongside				
Valdosta, Ga., Lighting Co	5,895	1,951,599		6,300	[illegible] No prospects	2,500	Big Stone Gap Va.	Oaken Ky.	70%	Various		$4 25 alongside	Southern Star	4,200	$3 [illegible] alongside	[illegible]			
Charleston (S. C.) Consolidated Railway & Lighting Co	20,400	12,082,000	63	Same	1,200 No prospects	13,000	400 Big Stone Gap Va.	Same	Just before M R	Stonega Coal & Coke		$4 50 and $4 50	Same			A. C. M. Contract obligations			

HOW THE COAL SITUATION HAS AFFECTED CENTRAL STATIONS IN THE LAST SIX YEARS. (Continued)

O. M. –Open Market. C.—Contract. L. T.—Long Ton. R. of M.—Run of Mine. M. R.—Meeting Requirement

Company	Tons Used, Jan. 1 to July 1, 1920	Kw-Hr. During Period	Load Factor	Tons of 1914 Coal that Would Have Been Used in Same Period	Tons on Hand at Prospects	Storage Should be Tons	Source of Coal Supply and Distance from Station: Present	Source of Coal Supply and Distance from Station: 1914	Condition of Delivered	Name of Coal 1920	B t u Volatile % Ash % Moisture	Price per Ton	Name of Coal, 1914	B t u Volatile % Ash % Moisture	Price per Ton	Method of Obtaining Coal in: 1920	Method of Obtaining Coal in: 1914	Cost per Ton for Handling and Storing	Lbs per Kw-Hr 1920-1914
Athens Gas Railway & Electric Co	2 657	1 133 812	42	2,400	727	.,500	340 Ky	340 375 Ky Tenn	Very poor	Red Feather	10,972 32 24 24 38 2 04	$10 39	Water	14,740 36 41 9 50 3 05	16 70 del	O M	O M.	15	3 5 4 5
MIDDLE WEST																			
Wisconsin																			
Eastern Wisconsin Electric Co., Sheboygan	15 163	8 655 289			1 171					Various						O M.	.....	.20	3 07 3 51
Milwaukee Electric Railway & Light Co	256 380	132 965 838	48	247 143	47 180	90 537	400 Ill Ind Ohio Penn	400 Pa W Va	Falling short	Various	9 500-12 000 8 25 6–10	$8 50		13,000 9–11 9 4–7	$2 60	C & O M	O M.	.36	2 76 2 66
Wells Power Co., Milwaukee	14 860	2 266,300	36	12 600	None	None				Ill	10 890 34–37 15–20 10 15	$7 00		12,800 6 11 3–9	$3 02	O M	O M.	....	8 6
Iowa, Illinois, Michigan.																			
Board of Water & Electric Light Commissioners, Lansing, Mich	45 076	18 253 350	55	-	1 000	13 000	300 400 Ohio Ind Ill	400 500 W Va Ky	Have gained in storage approx 5,000 tons since July 1	Ill Ohio Ind		$3 60 to $6 75 mine	W Va		70c to 90c f o b mine	O M	C.	. . .	4–4 25 3–3 25
Gas of Detroit Public Lighting Commission	21 152	12 011 766	53 3	16 517	2,210 Fair	9,000	Hobson, Ohio	W Va	Gaining about 300 tons per week	Hocking Valley	12 270 39 40 12 40 4 88	$5 37 $7 35 del	Meadow Brook	14,741 37 98 4 52 1 30	$2 40	C & O M	C.	....	3 63 2 75
Consolidated Light & Power Co., Kewanee, Ill	6 644	1 489 868	40	5 500	None	1 000	150 Franklin County, Ill	85 Fulton County, Ill	30%				Fulton		..	C & O M	C.	.75	20 more
Consumers Power Co., Jackson Mich	157 719	107 252 928	43 9	10 less	32 376	28,000	475 W Va Logan Co	Same	M R	Various	13 000 14 000	$2 25 10 00	Various W Va	13,000-14,000	$0 85 1 25	O M & C	C.	. . .	2 48 3 70
Moline (Ill.), Rock Island Manufacturing Co	60 940	41,006 000	41 72	About 5% less	2,650 Poor	8,000 to 10,000	85	Same	M R.	Various Ill	10,332 to 11 680 21 4–35 5 20–24 5 13–18 2	$3 66	Various	10 234–11 238 34 9–37 8 19 3–24 5 12 1–18 1	$1.71	C & O. M.	O. M.	.12 labor charge only	2 95 3 97
Sioux City (Iowa) Gas & Electric Co	15 000	8,974,134	60	13,000	1 400 No prospects	6,000	Franklin County, Ill	Same	85% now, was 25%	Ill.	11,500 35 10 8	$3 00 mine	So Ill.	12,000 35 10 8	$0 90 mine	C.	C.	.50	3 0 3 0
People's Gas & Electric Co., Mason City, Ia	16 561	5,962,000		Same	1,078	5 000	350 North. Ill	Same	Meeting requirements		11 065 36 21 2 16	$2 35	Same			C.	C.	....	4 7
Ohio											10 500 27 97 25 57 4 7								
Central Electric Producing Co., Hoodwood	15 865	7 899 350	40	Same			Local	Local	Ample	Hocking Valley		$3 26			$1 01	Own mines	Same	....	
Massillon Electric & Gas Co	29 527	8 620 269	70	Same	750	2 000	60 Adena, Ohio	80 Belmont, Ohio	About five cars a week above requirements	Sonora Belmont	12 000 40 20 10	$3 75	Same	Same	$2 08	C & O M	C.	1 56	1 5 less
Northwestern Ohio Light Co., Lima	14 000	4 905 619		Same	500	3,500	190 W Va	Same	Meeting requirements	W Va	13 500 16	$8 75 mines		14,000 12 ..	$3 00 to $4 50	C. & O.	C	20	
Toledo & Indiana Railroad	7 300	3 315 000	50	6 200	1 020	2 000	450 Cardinal, Ky	Same	Gaining about 50 tons per week	Ky	15 000	$3 96 mines	Same		$1 05 mines	C	C.		4 4 3 2
Toledo Railway & Light Co	132 221	105,294 890		110 100	6 6 10 per t	15 000	140 Hocking Valley Mines	1401 1 250 Cambridge Ohio A W Va	M R	Hocking Valley	10 000 11 560 M 36 11–25 6–10	$4 28	Cambridge, Ohio and W Va	13,000-13,500		C	C	0 10 to 0 25	2 52 3 10
Trumbull Public Service Co., Warren	60 594	42 686 000	6	43 600	3 000	20 000	100 Pitts., Pa	Same	Meeting requirements	Various	12,148 32 18 8	$5 09 del		13 758 36 8 4	$2 00	O M & C	C	30	70%
Union Gas & Electric Company Cincinnati	40,209	135 43 913	59 04	Same	30 000 Fair	85 000	245 W Va	210 250 N Y W Va	40 Supply	Logan	12 111 12 88 4 12	$7 00	Keels Creek Hazard Logan	13 000 33 0 7–14	1 79 to 1 84 del	O M & Own Mine	C	0 75	3 50 3 13
Indiana											12,500								
Indiana Power Co., Vincennes	22 700	12 060 063	60	Same	2 500 Fair	6 000 to 10 000	Local									Own mines		12	
Indiana Railways & Light Co., Kokomo	22 030	9,970,000		20 000	600 N prospects	5 000	150 Ind	Same	Contract furnishes 75% requirements						$7 30	85% O M 15% C	C	....	Same
Indiana Service Corp., Fort Wayne	45 544	24 425 429	53 15	Same	3 218	7 000	165 Linton, Ind		Good	R of M	11 560 10 16 9	$2 05 $6 00	Same		$2 00	225 tons daily from own mine, balance O M	C.	05	
Logansport Gas & Electric Co	10 555	2 291 814	50	Same	500	1 500	200 Ill Ind	Same	M R		10 500 15 $2 75 C $5 50 M		Various	10,500	$0 90	70% C 30% O M	C	20	Same
Northern Indiana Gas & Electric Co., Michigan City	10 [illegible]	4 360 066	40	9 000	1 000 Fair	3 000	140 Indiana Ill Ind	Same	30%		10 000 12 10 12	$3 40 de		11 503 30 10 10	$1 60 del	O M	C	35	20% more
Northern Indiana Gas & Electric Co., Lafayette	24 [illegible]	9 514 364			500	3 000	118 M [illegible]	Same	M R	[illegible]	10 000 12 1 1 44 11 44	$3 61	Same	Same		O M		1 00	
Colorado, Missouri, Nebraska, Kansas																			
Grand Junction Electric, Gas & Manufacturing Co., Colorado	4 [illegible]	1 163 919	35	Same			14 Col	12 Col	Good	Canon and Palisade	12 000 12 7 4	$1 00 $3 45	Same	12 000 12 8 4	$3 70	C	C	. .	$3.0
Empire District Electric Co., Joplin, Mo	2[illegible]	7 560 340	63		4 500 Fair	9 000	40 [illegible]	Same	Very fine requirements	[illegible] M R	11 [illegible] 4 [illegible] 9	$3 32 $4 53	Same	11 030 14 10 9	$1 8 o $2 00	O M	C		
Little Rock, Ark., Railway & Electric Co	17 511	17 215 342	7	Same	1,300	5 000	200 [illegible] Ark	Same	M R	[illegible] Coal	13 000 13 40 14 1 9	$2 75	Same	Same	$1 25	C	O. M.	04	1 5
Toledo, Ned Traction Co	[illegible]	5,169 000	.....	[illegible]	415	1 000	[illegible]	[illegible]	R M		13 500 12 12 4		Same	Same		C	C		Same
WESTERN																			
Albuquerque N M Gas & Electric Co	[illegible]	[illegible]	3	[illegible]	500	1 500	[illegible]	[illegible]	M R		[illegible] 84	$5 25	Same		$3 35	O M	O M	20	3 37 5 00
Deming (N Mex) Ice & Electric Co	[illegible]	521 [illegible]	10 1	Same	100 Fair	[illegible]	100 Deming N Mex	500 Ration N Mex	M R	Carthage	12 500 27 14 1	$5 00 ton	Superior	12,500 5	$2 50	C Some on O M.	O. M	45	
Denver (Col.) Gas & Electric Co...	55 457	24 [illegible] 560	59	55 000	4 150	60 000	35 Texas	35 Texas	60% of [illegible] requirements	Texas Canon	9 000 30 [illegible] 2[illegible]	$1 02 [illegible] ton	Ligonite	9 000 30 25 6 5	$0 50	C	No contract	3 15	3 5 6 5

creased. Owing, however, to the fact that storages are in most cases relatively small, and that in case heating takes place the coal can be used immediately, the solution of the storage problem is not so involved as it would normally be. Several companies report more than the normal difficulties with coal storage, but in practically every case the trouble has been overcome by repiling the fuel and using it as soon as possible. The Public Lighting Commission of Detroit reports that its coal will heat in about thirty days, and that when heating ensues it is transferred and used as soon as possible. The Empire District Electric Company of Joplin, Mo., limits the storage to thirty days on account of trouble experienced in firing. The Little Rock (Ark.) Railway & Electric Company is working on a 5,000-ton submerged storage to eliminate this source of trouble. As the Denver Gas & Electric Company uses lignite coal, the storage situation is so difficult, on account of spontaneous combustion, that no attempt is made to store more than a twenty-four-hour supply. Instead, the company uses bituminous coal for storage purposes. The Alabama Power Company, which has had some trouble with spontaneous combustion of storage coal, has overcome the difficulty by moving the coal with a crane.

Expense of Storing and Handling Coal

So many factors enter into the cost of storing and handling coal that little uniformity is shown in the costs given for this work. The cost for unloading and handling through bunkers seems to be in the neighborhood of from 10 cents to 15 cents per ton, while the next uniform price for yard storage and handling jumps to 50 cents per ton. With those companies which maintain more elaborate storage facilities and which include in their figures all items—depreciation, interest on the investment and everything that enters into this expense—the cost is approximately $1 per ton.

Difficulties with Burning Present Grade of Coal

More than usual difficulty has been experienced in burning the present coals on account of their high ash content and dirt. In a great many cases clinkering has given considerable trouble.

The Milwaukee Railway & Light Company reports that the high sulphur content injures the stacks and buildings, while the large clinkers damage the stokers. The Board of Water and Electric Light Commissioners of Lansing, Mich., states that with the present grade of coal the grates clog up so much that the fires must be pulled occasionally and a fresh start made. The Trumbull Public Service Company of Warren, Ohio, reports that considerable ignition trouble has been experienced with chain grates and with heating of the chains. There has been a marked increase in stoker and furnace maintenance expense due to inferior grades of coal which have been obtained for the most part in the open market. Removal of natural draft stokers and replacement with forced draft underfeed stokers is contemplated by the Duquesne Light Company. A combination of coal and coke oven gas for fuel has improved operation of chain grate natural draft stokers, states the Toledo Railways & Light Company.

Reduced boiler rating has been the most marked result of the poor coal, this reduction having been reported to be as high as 20 per cent in some cases. As a result of these troubles companies which have not installed completely modern boiler-room equipment are either doing so or are contemplating such action. The municipal electric light plant at Hagerstown, Md., expects, for instance, to put in stokers and other accessories for increasing the plant efficiency. One company reports that it will change from a turbine stoker drive to a variable-speed motor. In some cases more boilers are being installed to increase the plant capacity and make up for the loss. The Indiana Railways & Light Company of Kokomo, Ind., reports that clinker troubles have been reduced by raising the water backs on the chain grates in order to let very large clinkers pass. The Grand Junction Electric, Gas & Manufacturing Company of Grand Junction, Col., is installing stokers and superheaters and raising the boilers to overcome some of these difficulties. The Northern Indiana Gas & Electric Company of Michigan City, Ind., asserts that the solution lies in better furnaces, higher settings and larger grates.

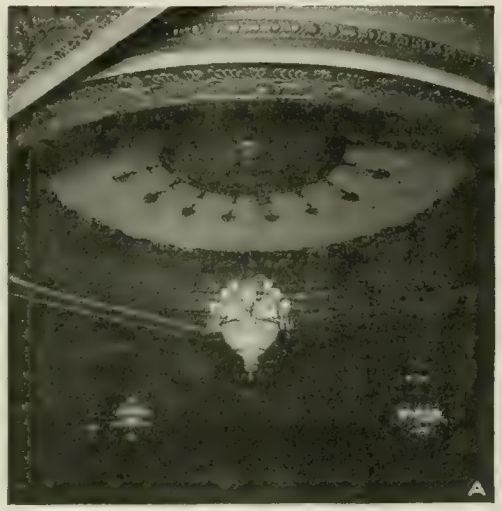
Labor conditions have also added to the difficulties of meeting the situation. The Newport News & Hampton Railway, Gas & Electric Company of Hampton, Va., is devoting more attention to training firemen, and other companies have also reported increased supervision of boiler-room operation as well as an enlargement of boiler-room operating forces. The Moline-Rock Island Manufacturing Company considers that closer supervision and refinements of operation will aid materially in the solution of its boiler-room problem, which is that of reduced boiler capacity due to the grade of coal. The New Bedford (Mass.) Gas & Edison Light Company also believes that greater care on the part of firemen is needed. The Albuquerque (N. M.) Gas & Electric Company is changing its coal-burning equipment and will burn wood-refuse fuel. The Charleston (S. C.) Consolidated Railway & Lighting Company reports that additional stokered boilers will be required as well as more efficient units.

From a survey of the general situation it is evident that those plants which do not have all of the refinements of equipment will be compelled to install new apparatus if the present situation continues. Even those companies which are well equipped will necessarily have to give closer supervision to operating conditions in the boiler room.

Water Power Conservation Urged for North Carolina

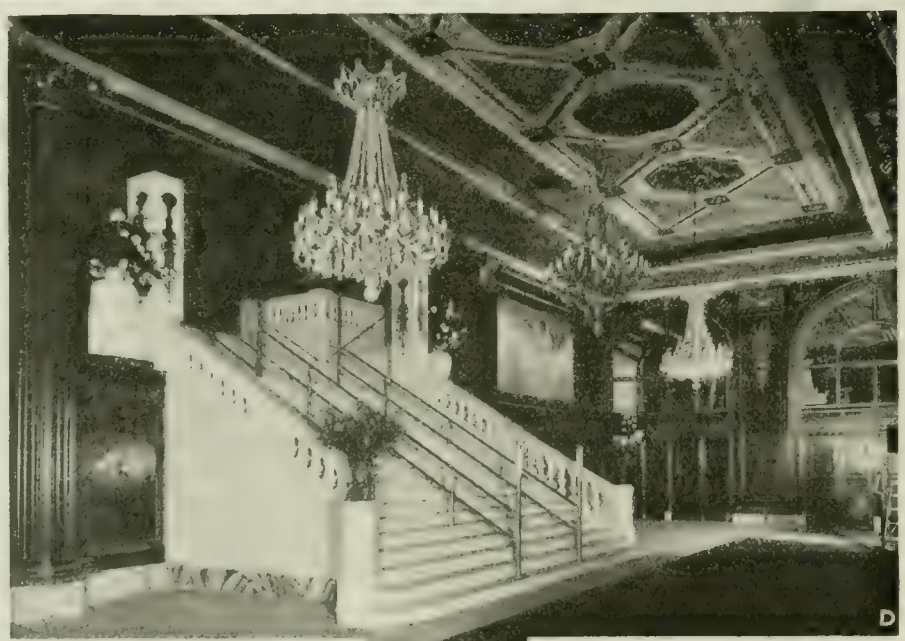
A COMPLETE compilation of data relating to the present status of power demand in the state, a power census; a comprehensive survey of the water power resources; the development of a general scheme for district power service through proper interconnection; and the passage of a water power conservation law similar to those of California and New York which retain to the state authority over their water and forest resources, are the recommendations for the plans of a definite and constructive program presented to the North Carolina State Chamber of Commerce in the power report rendered recently by Thorndike Saville, hydraulic engineer, N. C. Geological and Economic Survey. This report estimates that 325,000 hp. of hydroelectric energy is developed in that state, but of this only 125,000 hp. is available for general use within the state. The possible further development should exceed 1,000,000 hp.

Lighting Plays Important Part in Artistic Productions at the Capitol Theater, New York City



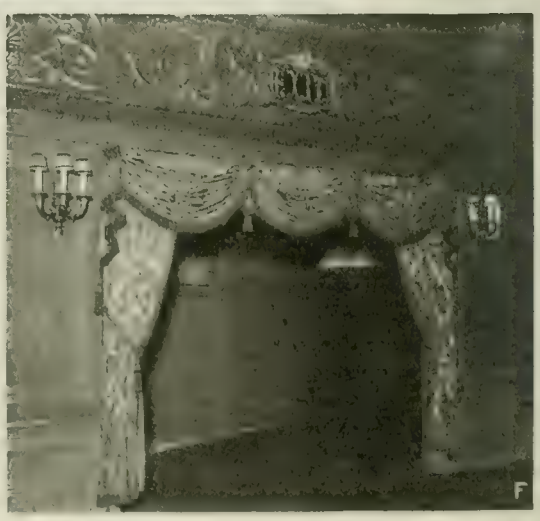








Artistic Appearance and Harmonious Color More Important Here than Light Intensity



A—One of the smaller domes with crystal chandelier and cove lighting in different colors. B—Center piece for mezzanine lobby where chandelier, wall brackets and cove lighting are combined with pleasing effect. C—One of the panels for lighting main floor under balcony. D—Main lobby is brilliantly lighted with ornate chandeliers, coves and wall brackets. E—Rest room tastefully decorated in tan, white and gold and lighted with amber lamps. F—Typical exit lighted with amber bracket lamps. The various lighting effects in the auditorium are blended into a harmonious whole.

Lighting the World's Largest Theater

Extensive Use of Lighting Equipment at Capitol Theater, New York, Shows Increasing Importance of Lighting in the Modern Theater—Wonderful Opportunity for Electrical Effects

SOME idea of the extensive equipment required for interior and exterior lighting of a modern theater may be gleaned from a brief discussion of the electrical installation at the Capitol Theater in New York City, which was opened just a year ago. With a seating capacity of 5,300, it is said to be the largest theater in the world. The entertainment consists of the combination of motion-picture and musical features, and in connection with the latter the lighting of the stage and auditorium offers endless opportunity for effective production. Such is the importance of the lighting that a "lighting rehearsal" is held each week in preparation of the new program. At this rehearsal appropriate lighting effects are worked out by S. L. Rothafel, who is a pioneer in this form of entertainment. From the table of equipment may be seen the color and electrical resources available.



AUDITORIUM OF CAPITOL THEATER, SHOWING MAIN DOME; 400 LAMPS IN CHANDELIER AND 1,095 COVE LAMPS

The principal problems in lighting the auditorium are to supply a soft, harmonious illumination, bright enough to permit programs to be readily consulted but not so intense that the contrast from the dark scenes becomes disagreeable. When dimmed the illumination should be sufficient to permit entrance and egress of spectators without difficulty. In lighting the auditorium of the Capitol Theater, where tan, brown and gold predominate on walls and ceiling, three colors are available in the concealed lighting, namely, canary, red and blue, while the chandeliers and wall clusters are largely equipped with amber lamps.

A large dome in the center is lighted by lamps concealed in a cove around the edge of the dome, using one of the three colors available. From the center of the dome is also suspended a huge crystal chandelier. An interesting shadow effect is produced by the crystals when the spotlights are directed through them upon the stage. Then smaller domes are arranged similarly for lighting the auditorium. The main floor, under the balcony, on the other hand, is taken care of by panel lighting. Recesses in the ceiling under the balcony are equipped with colored lamps, which give a soft, diffused light through the slightly projecting glass panels beneath them. Panel lighting thus gives a skylight effect when the lamps are arranged to give uniform illumination over the glass. The combined effect of cove, panel and direct lighting is particularly pleasant and the colors are used with care in the interest of general harmony, depending upon what may be deemed appropriate for the music or other features presented.

For the stage four principal sources of light are available, namely, footlights, border lights, "bunch" lights or floodlights, and spotlights. The footlights are directed up and back upon the stage, while from the border lights, arranged in rows above the stage, light is directed down and back upon the stage. In the present instance foot and border lights are equipped with lamps in four colors, white, red, blue and green. The "bunches," 1,000-watt floodlight units, are arranged above, behind and in the wings of the stage, and they

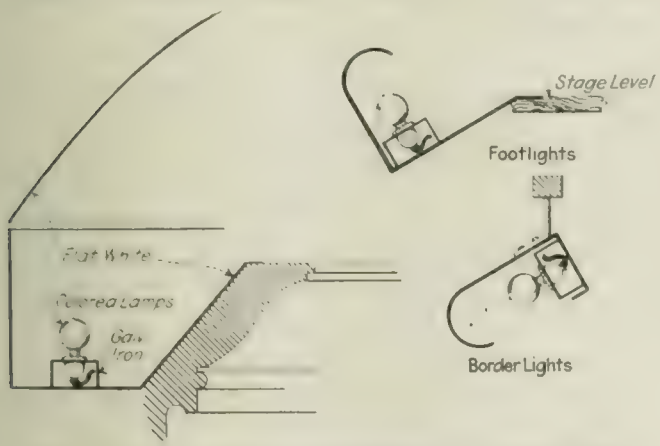


FIG. 1—DETAILS OF COVES, FOOTLIGHTS AND BORDER LIGHTS

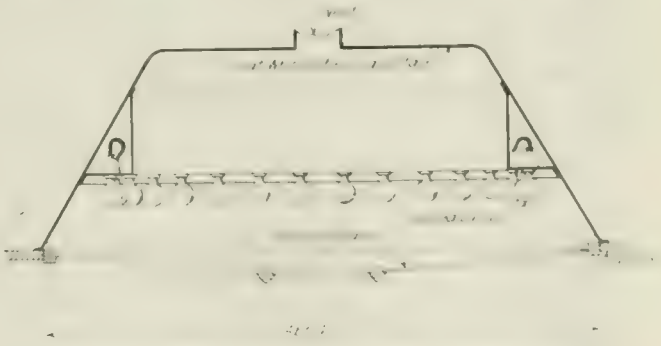
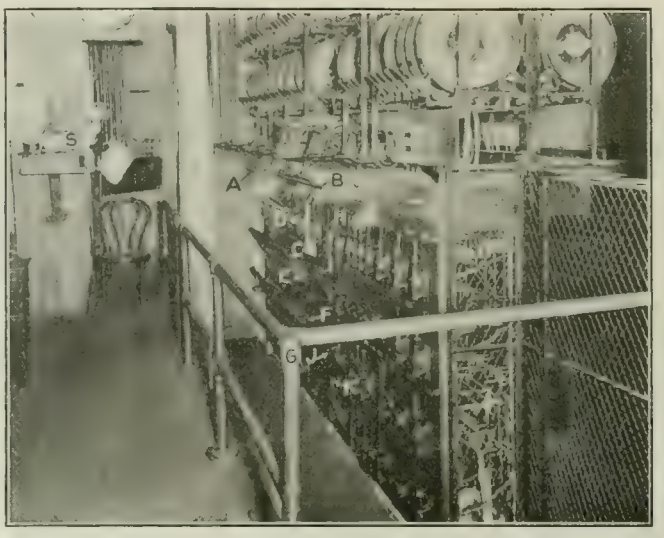


FIG. 2—CROSS-SECTION OF PANEL LIGHTING UNIT

may be provided with screens of any color for the particular purpose in hand. Of the ten spotlights, eight are mounted in a booth at the rear of the balcony and two in the wings of the stage. The "spots" and "floods," provided, as they are in this case, with dimmers of generous proportions, constitute a powerful battery of lighting units for the director's manipulation.

Frequent reference has been made to the use of different colors and the use of dimmers. These are controlled by the electrician at the switchboard, where the prearranged lighting schedule is kept at hand. A scheme of switching is used whereby individual circuit switches may be operated beforehand and then connected to the bus by a master controller. This gives the electrician ample time to prepare for a change in the lighting, also a means of closing several circuits simultaneously. The wiring scheme is particularly flexible, permitting the use of dimmers on practically any combinations of lamps or colors. One color on the stage may be faded out as another color increases by an interlocking device on the dimmer control wheel, and by cross-interlocking of house and stage dimmers the house lights may be raised while the stage lights are lowered or vice versa.



CONTROL BOARD FOR HOUSE AND STAGE

Stage and house dimmer control wheels are shown at *A* and *B; C* is the main stage master switch, while *D, E, F* and *G* are color master controls for stage lamps and *H, I* and *J* for the house. *K* controls miscellaneous stage outlets.

The table shows there are in regular use more than 17,000 lamps, from the 10-watt sign lamps to the 1,000-watt floodlighting units, and that these represent a connected load of about 450 kw., exclusive of the picture machines, organ motors and other apparatus. The average energy consumption

DETAILS OF PRINCIPAL LIGHTING EQUIPMENT AT CAPITOL THEATRE

Main Units	Number Each	Lamps Total	Watts Each Lamp	Color Lamp	Color Surroundings	Total Watts of Lamps
AUDITORIUM						
Main dome: Chandelier	400	400	25	Amber	Faint purple and gold	10,000
Coves	1,095	1,095	25	Canary, red, blue	Faint purple and gold	27,375
Six domes: Chandelier	20	120	25	Amber	Faint purple and gold	3,000
Coves	192	1,152	25	Canary, red, blue	Faint purple and gold	28,800
Four domes: Chandelier	10	40	25	Amber	Faint purple and gold	1,000
Coves	192	768	25	Canary, red, blue	Faint purple and gold	19,200
Eight panels	32	256	25	Red, canary, blue	Faint purple and gold	6,400
Eight panels	18	144	25	Red, canary, blue	Faint purple and gold	3,600
Sixteen bracket clusters	3	48	25	Amber	Brown, gold, green	1,200
Four box standards	16	64	25	Amber	Brown, gold	1,600
Two box chandeliers	35	70	25	Amber	Brown, gold	1,750
Four bracket clusters	2	8	25	Amber	Brown, gold, green	200
Eight bracket clusters	3	24	25	Amber	Brown, gold, green	600
Orchestra coves		600	25	Canary, red, blue	Brown and gold	15,000
Three chandeliers	9	27	25	White	Tan, brown, gold	675
STAGE						
Six borders	204	1,224	25	Amber, red, blue, green		30,600
Fifty-eight "bunch" or flood lamps		58	1,000	All colors (by use of screens)		58,000
Ten spotlamps		10	75 amp	All colors		82,500
Front footlights		354	25	White, red, blue, green		8,850
Rear foot lights		80	25	White, red, blue, green		2,000
Sixty orchestra stands	2	120	10	White		1,200
Four columns	1	4	1,000	White		4,000
ENTRANCE						
One row over booth		90	50	White,	Brown, tan, white	4,500
Two chandeliers	5	10	25	White	Brown, tan, white	250
One chandelier	9	9	50	White	White, tan, gold	450
Four bracket clusters	5	20	25	Amber	White, tan, gold	500
Coves		150	25	White	White, tan, gold	3,750
MAIN LOBBY						
One chandelier	42	42	25	White	Brown, gold, white	1,050
Two chandeliers	24	48	25	White	Brown, gold, white	1,200
Coves		300	25	White	Brown, gold, white	7,500
Two brackets	9	18	25	Amber	Brown, gold, white	450
Two chandeliers	4	8	25	Amber	Brown	200
MEZZANINE						
Five chandeliers	9	45	25	Canary	White, tan, gold	1,125
Coves		500	25	White	White, tan, gold	12,500
Eighteen wall brackets	2	36	25	Canary	White, tan, gold	900
UPPER LOBBY						
Three chandeliers	4	12	25	White	Light tan	300
Four domes	1	4	25	White	Tan	100
SIGNS AND MARQUISE (Outside)						
Marquise (above)		1,649	10	Amber		16,490
Marquise (below)		205	50	White and amber		10,250
Four large globes		4	100	White		400
Attraction lamps (changeable)		1,000	10	White and amber		10,000
Main vertical sign		2,470	10	Amber and white		24,700
Roof signs		3,717	10	Amber, red, and white		37,170
LADIES' REST ROOM (Mezzanine)						
Six wall brackets	5	30	25	Amber	Tan, white, gold	750
One chandelier	9	9	25	White	Tan, white, gold	225
Miscellaneous		7	50	White	White	350
LADIES' ROOM (Orchestra Floor)						
One chandelier	14	14	25	Amber	Tan	350
Eight brackets	2	16	25	Amber	Tan	400
MEN'S ROOM						
Two chandeliers	5	10	25	White	White	250
Miscellaneous		2	50		White	100
MISCELLANEOUS						
Hallways, stairways, storerooms, etc.		150				7,000
Total		17,637				451,010

per month is 60,000 kw.-hr. There are five picture machines, each rated at 100 amp., two of which are in use at the same time, one for reserve, while two 15-hp. direct-current shunt motors supply the organ.

Particular care was exercised in preserving the architecture of the building exterior against the use of unsightly and disfiguring signs. Aside from the roof signs, which may be seen from a considerable distance, and the attraction signs on the marquise there is but one large sign giving the name of the theater. This is hung vertically in front of the building.

Lighting in the lobbies and rest rooms has been carried out with the same care as in the auditorium, though the problems here are, of course, much simpler. A combination of cove lighting, chandeliers and wall brackets is used in the lobbies, and there is a gradual change from predominating white at the entrance to tan, brown and gold in the interior.

In order to keep all performances up to the minute of the schedule a dial switch *s* is provided for the stage manager from which he may signal to the orchestra director and the picture machine operator, indicating that the performance is ahead of or behind schedule, when a new number on the program is to be started and so on. The stage manager's equipment may be seen at the left of the switchboard in the photograph.

The theater, which embodies the principles of architectural lighting originated by Mr. Rothafel, was designed by Thomas W. Lamb, architect, while the electrical work was put in and the switchboard was furnished by the Edwards Construction Company. The dimmers were furnished by the Cutler-Hammer Manufacturing Company and the lighting fixtures by the Black & Boyd Manufacturing Company. The data concerning the lighting equipment was obtained through the co-operation of William Edwards, chief electrician of the Capitol Theater. Electric service for this theater is furnished by the United Electric Light & Power Company.

Factors Determining Generator Design*

The Waterwheel-Driven Generators in the New 100,000-Hp. Extension of the Niagara Falls Company Are Exceeded in Rating by Only a Few Steam Turbines —Some of the Design Problems Involved in These Units Are Considered

FOR the extension to Station No. 3 the Niagara Falls Power Company placed orders for three generators with three different manufacturers. While about all that was specified was the highest efficiency consistent with other desirable and important characteristics, such as reliability, no restrictions as to the kind of material or weights of parts were placed upon the designer. They are so nearly alike in external appearance, however, that they might well have been built from the same patterns. Features of these machines are now given by the several designing engineers.

Reliability Is Keynote of Generator

Problems Arising in the Selection of Number of Stator Slots, Provision for Insulation and Support of Coils and Thrust Bearing Design Are Discussed

BY F. D. NEWBURY
Westinghouse Electric & Manufacturing Company

THE 32,500-kva. generator built for the Niagara Falls Power Company by the Westinghouse Electric & Manufacturing Company is notable chiefly for its size and for precautions taken in its design and construction to assure reliability and safety in operation. Owing to the rating of the unit (12,000 volts, 1,565 amp., 25 cycles and 150 r.p.m.), certain details of design attracted particular attention, namely, the number of slots to use, armature-coil insulation for 12,000 volts, support of coil ends, rotor construction, field-coil insulation, bearing support, lubrication and ventilation. The factors which were taken into consideration in deciding on these details are discussed in the table opposite.

Number of Armature Slots.—The number of armature slots is a detail that received considerable thought during the design. The choice was between 240 slots and 300 slots, the larger number being finally selected. The advantages of the smaller number of slots are greater ratio of copper to insulation space and a more rigid and stronger coil due to the greater ratio of coil width to coil depth. This is a matter of considerable importance in insulating long coils with mica. The important advantage of the larger number of slots, and the one that decided the selection, is the greater ratio of coil surface to copper loss and the resulting ability

PRINCIPAL DIMENSIONS AND WEIGHTS OF 32,500-KVA., 12,000-VOLT, THREE-PHASE, 25-CYCLE, 150-R.P.M. WESTINGHOUSE GENERATOR

Stator		
Outside diameter of core	228	in.
Inside diameter of core	197	in.
Core width (including 30—¼ in air ducts)	65	in.
Number armature slots	300	
Dimensions of slots	.75 x 4.75 (over all)	
Coils located in slots	1 and 14	
Armature winding	Y connected — 4 parallel circuits	
Size of conductor strands	{ 204 x .258 (mica taped) { 129 x .274 (bare)	
Arrangement of conductors	See illustration	
Turns per phase in series	75	
Development length — one turn	257	in.
Rotor		
Outside diameter	196	in.
Single air gap	0.5	in.
Pole face	21 in. x 65	in.
Pole body	15 in. x 65	in.
Radial height of pole	12½	in.
Field winding	42½ turns per pole	
	.203 x 2.25 bare strap	
Developed length one turn	167	in.
Amperes excitation no. load 12,000 volts	323	
Amperes excitation 1,565 amp. 12,000 volts, 80 per cent P.F.	632	
Weights		
Total weight of generator	650,000	pounds
Total load on thrust bearing	478,000	pounds
Weight of generator rotor with shaft	318,000	pounds
Weight of one pole and coil	4,800	pounds
Net weight armature punchings	133,000	pounds
Weight top supporting bracket	58,000	pounds
Total weight copper	33,000	pounds
Flywheel effect rotor (FR^2)	11,500,000	
Shaft and bearings		
Outside diameter thrust bearing	49	in.
Total bearing surface—thrust bearing	1,350	sq. in.
Dimensions upper guide bearing	25 in. diameter 42 in. length	
Maximum diameter shaft	28	in.
Outside diameter shaft flange	45	in.

*Third installment of a symposium on the 100,000-hp. extension to Station No. 3 of the Niagara Falls Power Company; see Sept. 18 and Oct. 2 issues of the ELECTRICAL WORLD.

to transmit the heat developed in the copper through the insulation with a lower temperature drop. A 0.75-in. slot is narrower than is commonly used in a large 12,000-volt generator. The ratio of *bare* copper width to the *punched* size of the slot is, however, 0.44, which is good considering the high voltage and narrow slot and is possible largely because of the compact machine-wrapped coil insulation.

The importance of a large ratio between armature coil surface and armature copper loss is sometimes overlooked. The problem of dissipating the armature copper loss is very largely a problem of heat-conduction through the armature-coil insulation. In high-voltage 25-cycle generators, having relatively low tooth losses and core temperatures, roughly two-thirds of the temperature rise of the copper is due to the temperature drop through the insulation and only one-third is due to the temperature rise of the armature teeth above the cooling air. It follows, therefore, that the factors affecting the dissipation of heat by ventilation are relatively only half as important as factors affecting the conduction of heat through the insulation. To illustrate: Assume a total armature copper temperature rise of 60 deg., then 20 or 25 deg. would be the temperature rise of the armature teeth above the cooling air and the balance would be the temperature drop through the coil insulation. If by some means, such as doubling the quantity of cooling air or doubling the surface exposed to the air, the heat dissipation by convection could be doubled, the copper temperature rise would be reduced by 10 or 12 deg. If, on the other hand, the drop through the insulation could be cut in half by increasing the coil surface or by decreasing the thickness of insulation, then the copper temperature rise would be reduced by approximately 20 deg. This discussion is based on the assumption of long cores (as in the present case), in which the ventilation of the coil ends has very little influence on the temperature of the copper in the center of the core.

Armature Coil Insulation.—One of the distinctive features of this generator is the heat-resisting qualities of the insulation. Mica is used as the insulating material beginning with the bare copper conductor. This type of insulation has been developed particularly for the larger 60-cycle steam-turbine driven generators, in which it is impossible to design the windings so that the copper temperature is within the safe limit for ordinary vegetable fiber insulation. This mica insulation is regularly guaranteed for operation up to a temperature of 150 deg., and it has been successfully tested up to 300 and 400 deg. for short periods. Its use in the present instance was not dictated by operating temperatures, as these are well below 100 deg. (even allowing for inevitable differences between measured temperatures and the actual copper temperature), but it was used in accordance with the builders' policy to use the best materials and constructions available and thereby provide the maximum operating factors of safety.

The detail construction of the armature coil will be understood by reference to accompanying illustrations. Each coil consists of three active conductors and each conductor is built up of four strands or wires. The single conductor is split up in this way in order to reduce eddy currents. The winding is also connected in several parallel circuits for this same reason, as well as for the additional purpose of obtaining the desired number of conductors.

The coils are formed of bare copper ribbon. Two sizes of strap are used, so that complete strand insulation is provided by taping the two larger ribbons with mica tape. Each group of four strands, forming an active conductor, is insulated with mica tape and the insulation between conductors is reinforced by strips of hard-baked mica. The three conductors of one coil are then assembled and the complete coil bound with thin cotton tape, after which the straight parts to be embedded in the slots are brushed with bakelite, and

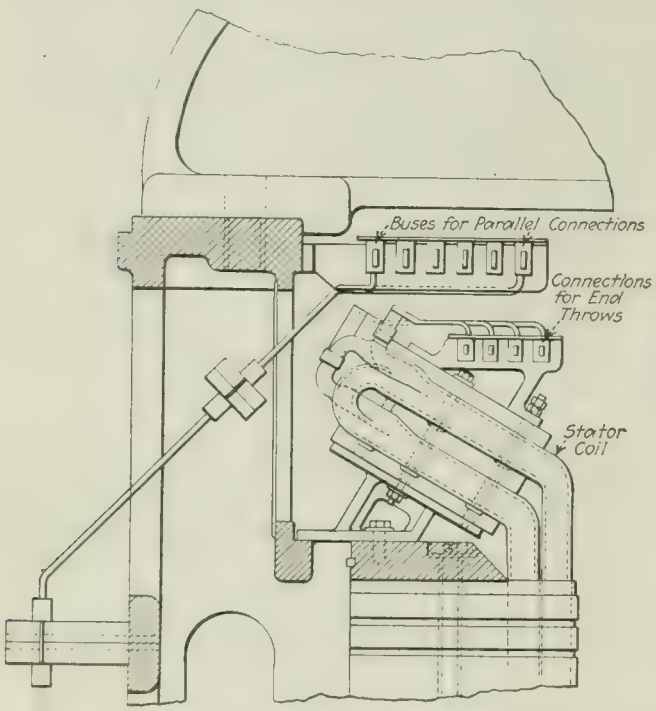


FIG. 1—SECTION THROUGH PORTION OF STATOR SHOWING SUPPORT OF END COILS.

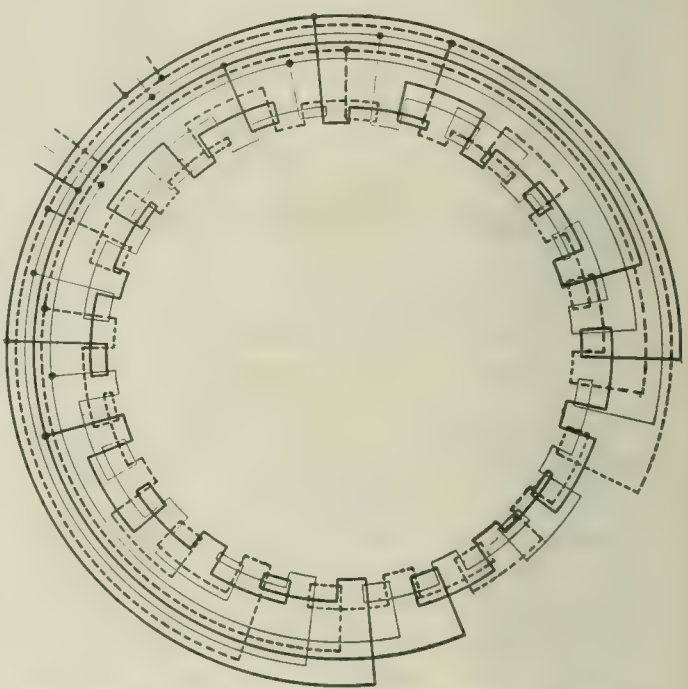


FIG. 2—SIMPLIFIED ARMATURE WINDING

As seen in Fig. 2, parallel grouping of coils is accomplished through leads shown by the six outside circular arcs. Six leads are taken off (both ends of three phases) and the star and neutral connection made outside of the machine.

these parts are pressed to the required dimensions in a steam press. This solidifies the bakelite and makes the straight parts of the coil sufficiently strong and rigid to withstand the twisting forces of the wrapping machine. The ends of the coils, which must be relatively flexible, are impregnated in a vacuum tank with hydrolene.

After this impregnation, the mica wrapper is applied to the straight parts of the coil. The wrapper is first applied to the coil in sheet form by hand, being drawn around the coil rather loosely. It is then placed in a wrapping machine equipped with electrically heated ironing plates, which revolve around the coil, heating and softening the bond. This permits the different turns of the wrapper to slide, one on the other, and with the heavy pressure exerted by the ironing plates produces an extremely solid and compact insulating wall. This machine-wrapping process has two important advantages due to the compactness with which the insulation is applied. The relatively poor heat conductivity of all coil-insulating materials is due to the minute layers of air between the layers of insulating material. Consequently, the more tightly the insulation can be wrapped and the more completely these air pockets are eliminated the better will be the heat conductivity of the insulating wall. The total thickness of the insulating wall is also reduced, and thus relatively more space is available for the active materials.

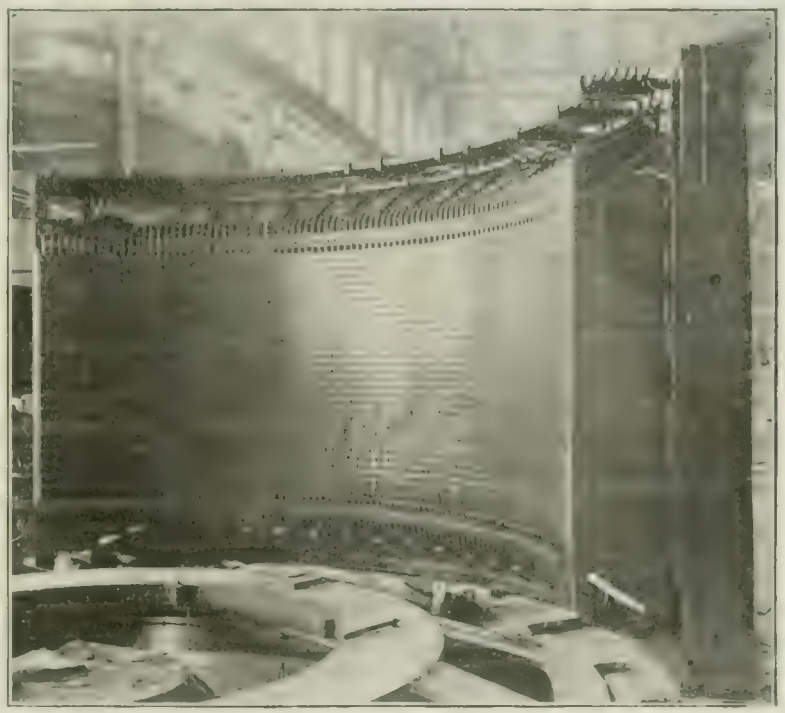


FIG. 3—SECTION OF COMPLETED ARMATURE IN PLACE

These windings are connected in parallel with three similar sections by heavy buses shown at the top. Fig. 2 shows the armature winding scheme

The curved ends of the armature coils are insulated with a number of overlapping layers of varnish-treated cloth, each layer being brushed with insulating varnish. Cloth insulation is best suited for this part of the coil on account of the curved form of the coil and the required flexibility while placing the coils in the slots. The temperature of the coil ends is low compared to that at the center of the core, so that cloth insulation can be used with a liberal factor of safety notwithstanding its low safe temperature.

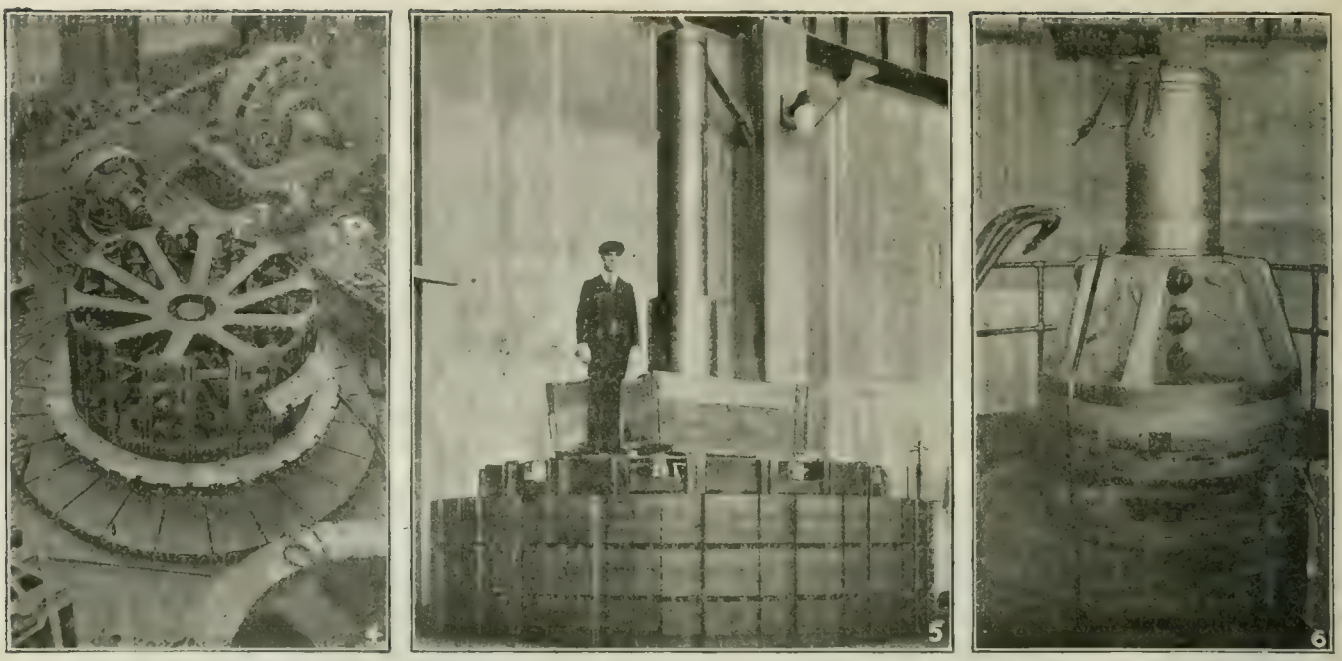
Mica insulation requires no protection against the disintegrating effects of static discharge or corona, such as, for example, the grounded metallic sheath that is sometimes used when varnished cloth or paper is used in high-voltage generators for the slot insulation. Many years' experience with mica insulation has proved beyond question that this material is unaffected by corona at the voltage gradients ordinarily employed. At the same time static discharge is more commonly present—evidenced by ozone—in mica-insulated generators than in those employing vegetable fiber insulation. This is due, of course, to the higher voltage gradients that are possible with mica and to the higher specific inductive capacity of this material.

Armature Coil Supports.—The coil ends are so shaped that the conical surface formed by the complete winding forms an angle of 60 deg. with the armature air gap surface. This is done to provide room for the coil bracing and to decrease the axial length of the coil ends. Liberal ventilating spaces are provided between coil ends, which are also necessary for the bronze bolts of the coil supports. This type of coil support has been developed for the largest steam-turbine generators and provides an unusually large factor of safety when applied to a 20-pole water-wheel generator. This is another instance of using the best available construction and providing a very liberal factor of safety. The straight parts of the coils immediately outside the core are supported, in a circumferential direction, by carefully fitted wood blocks.

Rotor Construction.—The rotating part is guaranteed to operate safely at 100 per cent overspeed and at this speed the surface velocity is 15,400 feet per minute. This is a relatively low angular velocity—less than one-sixth that of large 60-cycle turbo-generators — so that the stress conditions are relatively easy and can be taken care of by any one of a number of well-established constructions. The spider hub and arms form a single casting. Each arm carries two small dovetail slots for spacing the punchings in building up the rim, but these small dovetails are not depended on to carry any of the radial load imposed by the rim, poles and field coils.

Field Coils.—The field coils are formed of bare strap, wound on edge and insulated between turns with asbestos. This is applied with shellac, and during the construction of the coil the coil is heated in an open gas flame to completely burn out the shellac. The insulation between the copper and pole is formed of molded mica and asbestos, and micarta washers are used at the top and bottom of the coil for mechanical protection. The field coil insulation, as in the case of the armature coil insulation, is guaranteed to withstand safely a total temperature of 150 deg. even though the operating temperature is well below this figure.

Thrust Bearing.—The thrust bearing is of the well-known Kingsbury type. There are six babbitted shoes supported on hardened jack-screws, which are raised or lowered as necessary to adjust the shoes to take equal shares of the load. The use of these adjusting screws also permits any shoe to be removed for inspection without lifting the entire rotor. Occasional inspection is desirable because it may disclose, by the scoured ap-



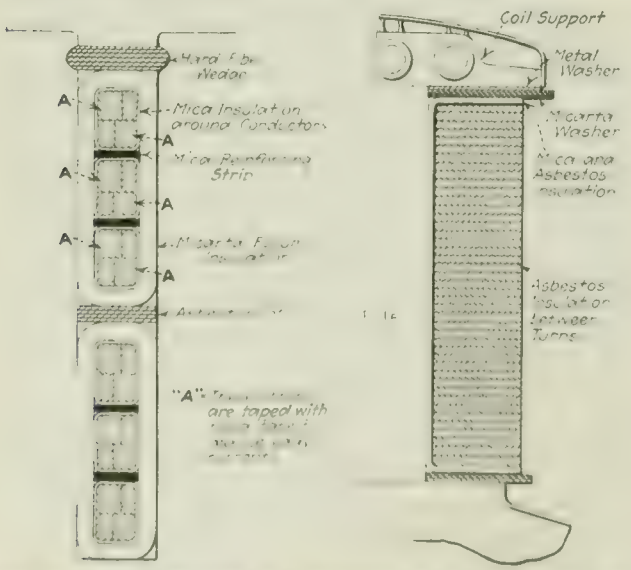
FIGS. 4, 5 AND 6—ROTOR SPIDER AT FACTORY AND BEING ASSEMBLED WITH RIM. THRUST BEARING DURING ASSEMBLY AT RIGHT

pearance of the babbitt, the presence of dirt in the oil or other objectionable conditions and permit the correction of the difficulty before serious damage to the bearing or interruption to the service has occurred. When filled with oil to the running level the bearing housing holds 270 gal.

Lubrication.—There are but two points of lubrication in the generator, the thrust bearing and the upper guide bearing. Both of these bearings are fed independently from a central station oiling system and drain independently to the station reservoir. The oil drainage from the guide bearing passes through a hole in the spider hub to a stationary oil pan below. There is an instrument board, located on the thrust bearing housing and facing the passageway to the station operating gallery, containing indicating dials for oil meters in the thrust-bearing line and in the guide-bearing supply line and indicating dials for thermometers in both thrust and guide bearings.

Ventilation.—The generator rotor has inclined fan blades mounted on each side of the spider rim. Each end of the armature is enclosed so that the fans deliver air into closed pressure chambers, from which air is forced into the air gap and between the field coils and through radial ducts in the armature core. Air enters the generator from both top and bottom. The generator frame is surrounded by a circular sheet steel casing in which all of the warm air from the generator is collected and discharged outdoors.

There are twenty thermocouples located between coil sides in the armature slots and six couples on the outside of the armature coil ends. These latter couples were installed to duplicate mercury thermometer measurements as ordinarily taken on smaller open-type generators and for comparative purposes only. The couples built in the core are well protected from possible air currents where the armature vent ducts cross the slots and should give indications reasonably close to the actual temperature of the copper inside the insulation. At 28,500 kw., 90 per cent power factor and 13,000 volts the highest reading thermocouple within the core gave a rise of 56 deg. C. and the highest reading couple on the outside of the coil ends showed a rise of only 23 deg. C. This, as stated before, is equivalent to the thermometer measurement formerly used and for which a temperature guarantee of 50 deg. rise was standard practice.



FIGS. 7 AND 8—SECTION OF ARMATURE SLOT AND FIELD COIL. Armature strands of different size and complete insulation is provided when only two strands are insulated.

Operating Experience Proves Correctness of Design of 32,500-Kva. Generator

By R. B. Williamson
Engineer in Charge of Alternating-Current Design
Allis-Chalmers Manufacturing Company

THE 32,500-kva. generating unit built for the Niagara Falls Power Company by the Allis-Chalmers Manufacturing Company is mounted directly above a 37,500-hp. turbine, the two forming a close-coupled unit with a relatively short distance between the two machines. The generator of this unit was described by the writer in the Electrical World, Aug. 30, 1919 before it was put into service, but further information

is now available as a result of several months of operation.

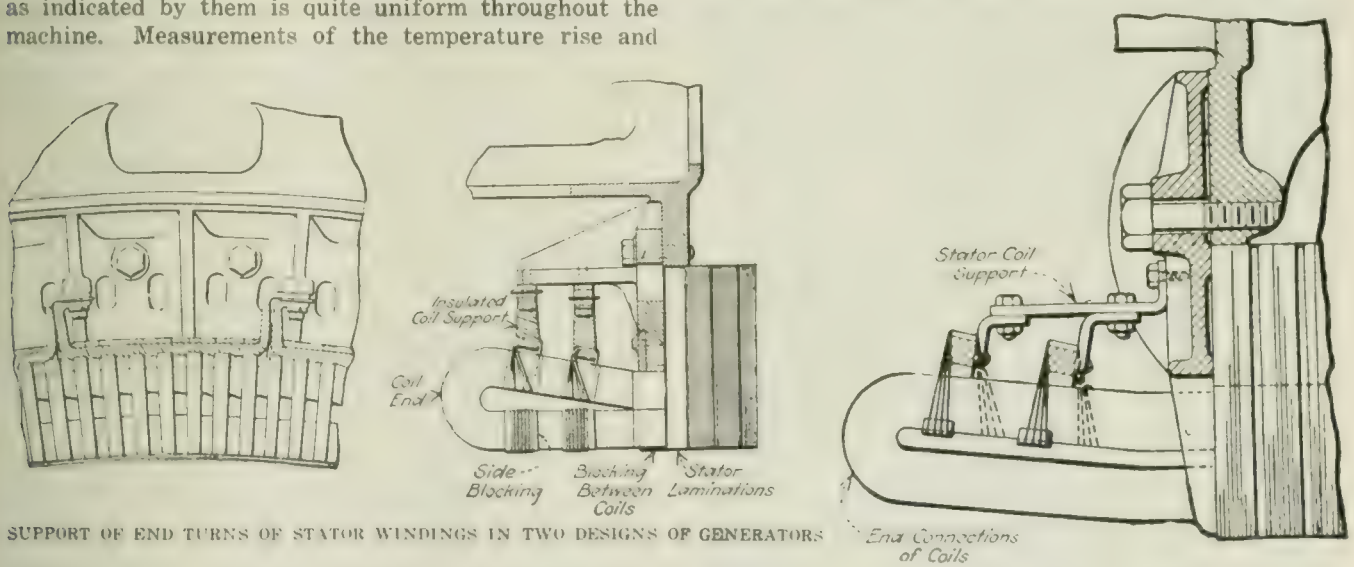
The shaft is short and stiff and the combined unit has but two guide bearings, one at the top of the generator immediately below the thrust bearing and the other directly above the waterwheel runner. To carry the generator a large cast-iron barrel of heavy-ribbed design is bolted to the cast-steel speed ring of the turbine, thereby transmitting the weight of the generator through the barrel to the speed ring and foundation below the wheel.

With these large vertical units it is necessary to provide brakes for bringing the machine to rest and for holding it in case of leakage through the wheel. In this instance the brakes are operated by air pressure and engage the lower surface of the field spider rim. On account of the large size of the generator it was considered advisable to stack the laminations and put the stator coils in place in the field after the stator yoke had been set on the pit liner connecting the generator and turbine.

The temperature rise guaranteed on the generator was 55 deg. C. as indicated by resistance coils placed in the windings between the upper and lower coils in the middle of the stator core. Continuous operation at full load has shown the rise as thus indicated to be well within the allowable limit. The winding is equipped with twenty temperature indicating coils, and the rise as indicated by them is quite uniform throughout the machine. Measurements of the temperature rise and quantity of oil circulated through the thrust-bearing casing indicate that the friction loss in the bearing does not exceed 25 hp. or 0.066 per cent of the rated output.

In the present design the coils are securely blocked just where they project beyond the core to protect them against any side motion and consequent danger of breaking the insulation at the ends of the slot. They are also lashed to the insulated supports, as indicated at the right in the accompanying sketch. These supports are made in sections and are bolted to projecting brackets cast on the stator end heads.

As this generator requires approximately 80,000 cu.ft. (2,240 cu.m.) of air per minute for carrying off the heat, the arrangements for handling the air required careful consideration. Air is taken in at the top and also from the pit underneath and, after passing over the windings and through the stator yoke, it flows through ducts and is forced out of the station by means of auxiliary fans. This method was decided upon after careful consideration and conferences between the engineers of the Niagara Falls Company and the designers.



SUPPORT OF END TURNS OF STATOR WINDINGS IN TWO DESIGNS OF GENERATORS

Design of 32,500-Kva. Generator Is Conservative

BY W. J. FOSTER
Designing Engineer General Electric Company

CONSERVATISM has characterized practically every feature of the design of the generator built by the General Electric Company. The mechanical stresses allowed in the various parts, such as bearings, spider and rotor, are in many cases no higher than is sometimes allowed when using cast iron, whereas the best steel is being used. Because of the high efficiency that has been striven for relatively small losses occur and the insulation is not required to withstand abnormal temperatures. The guarantee to the customer is a 100-deg. C. machine at the rated output—32,500 kva. This is 5 deg. more conservative than the standard of the American Institute of Electrical Engineers for class A, or low-temperature, insulation, whereas the insulation that has been used in the armature for both turn and external insulation is class B. This insulation, according to A. I. E. E. standard, is suitable for 125 deg.

In order to produce a simple and mechanically strong rotor the rotor spider was constructed of six wheels, each wheel a single casting of steel. The upper end of the shaft is machined for a thrust collar which takes the entire weight of rotating parts and for a guide bearing which is immediately below the thrust bearing. Only one other guide bearing is provided, and that is on the waterwheel.

The reactance of the generator is approximately 20 per cent, which permits the stator winding to be supported mechanically with unusually large factors of safety against the stresses produced by instantaneous short circuits. The projecting ends of the winding at both top and bottom rest back against two solid steel rings that are carried by brackets attached to the heads of the stator. These rings are heavily insulated to form a seat for the coils. The individual coils are laced to supporting bands by strong linen cord specially treated. The individual coils also have spacing blocks laced to their sides at short intervals, of such thickness as to make the completed winding perfectly ring-bound.

Readers' Views and Comments

Characteristics of Arc-Welding Machines

To the Editor of the ELECTRICAL WORLD:

SIR: I have read on page 241 of the July 31, 1920, issue of the ELECTRICAL WORLD the comments of J. F. Lincoln relative to the machine which was described in a paper that I read before the A. I. E. E. at its thirty-sixth annual convention on "Characteristics and Performance of Arc-Welding Machinery." I believe that Mr. Lincoln's remarks do not apply to the machine described.

The idea of devising a generator having shunt and series fields and a separately excited field was described by Kramer in 1908 in Germany, Kramer having obtained his patent (1,096,923) in the United States covering this invention. Kramer describes a machine having three fields, the independent and shunt fields being cumulative, while the series field is differential to the other two. This arrangement appears to be very similar to the arrangement shown in the Lincoln Electric Company's patent No. 1,295,278, issued in 1919. The only material additions that are apparent are the use of a reactance in the circuit and a double-pole reversing switch to allow the series field to be made cumulative or differential, as desired, presumably to provide for applications other than welding. For welding the machine would probably be operated differentially at all times.

As a preliminary step in the development of an improved single-operator arc-welding generator, in 1915 the Westinghouse Electric & Manufacturing Company built an experimental machine embodying the scheme of connections shown by Kramer and also by the later disclosures of the Lincoln Electric Company's patent. This machine was subjected to exhaustive tests which led to the conclusion that the machine was too sluggish and erratic for bare metallic electrode welding, due primarily to the magnetic lag in the generator. However, no difficulty was experienced in the commutation of this machine, which was practically perfect, due to the use of modern commutating pole windings. Because of the recognized inherent defects of such a machine and realizing that good welding could not be performed consistently with such an equipment, we made no attempt to place machines of the description just referred to on the market.

To nullify the magnetic lag and undesirable transient mutual induction phenomena (unavoidably present in any compound-wound direct-current generator operated at rapidly and widely varying potentials) the scheme of interconnecting the constant-potential exciter with the variable-voltage generator was finally evolved (after several years of experimental development) as described in the writer's A. I. E. E. paper, thereby producing a generator having three fields, namely (1) a separately excited shunt field; (2) a reversing (polarity) field, and (3) a differential or bucking series field. Under open circuit and normal welding conditions the reversing field acts as a self-excited field (receiving current from generator terminals), assisting the separate field and opposing the series field, but under short-circuit conditions (striking the arc) this field is separately excited in the opposite direction by current from the constant-potential exciter flowing through the welding circuit. In this latter case it opposes the separate field and assists the bucking series field. In this manner the undesirable sluggish "collapse" (to zero) of an ordinary, straight, continually self-excited shunt field is eliminated. Furthermore, with a minimum amount of material, the permanent short-circuit current of the generator is maintained at approximately the normal welding current instead of a value 40 per cent to 50 per cent in excess of normal. Furthermore, when the electrodes are separated quickly (for starting the arc) the current from the constant-potential source (exciter) through the welding circuit is a very decided factor in initiating ionization and electron emission, which is of very material assistance in starting the arc during the short time interval required for the generator proper to build up its magnetic circuit and establish its terminal voltage, subsequent to removal of the short-circuit condition incident to touching the electrode to the work.

It will be seen that the new machine developed embodies a very important characteristic, namely, the interconnected exciter and generator scheme involving a reversing field, which is not even suggested by either of the structures disclosed in above-mentioned patents.

It is hoped that this explanation of the operation of the machine described by the writer in his A. I. E. E. paper clearly differentiates the principle embodied therein from the machines previously produced.

A. M. CANDY, Welding Engineer,
General Engineering Department.
Westinghouse Electric & Manufacturing Company,
East Pittsburgh, Pa.

Letter received Aug. 9, 1920.

To the Editor of the ELECTRICAL WORLD:

SIR: In the discussion on alternating-current welding in the ELECTRICAL WORLD, July 31, 1920, page 241, J. F. Lincoln admits that he investigated this desirable addition to the welding trade some ten years ago. The writer cannot help but point out that Mr. Lincoln must by his own words take the stand as being unfamiliar with the advantages of present-day alternating-current welding equipment, or not having provided the proper characteristics therefor, as it is well known by this time that alternating-current welding, like alternating-current motors, has come to stay and is being widely used where direct-current apparatus has been employed.

This statement is substantiated by letters which the writer has received from various users of alternating-current welding apparatus, such as the Newburgh (N. Y.) Shipyards, Pensacola (Fla.) Shipbuilding Company, Federal Shipbuilding Company, Kearney, N. J.; New York Central Railroad, American International Shipbuilding Company, Philadelphia; International Equipment Company, Ltd., Montreal; Tidewater Shipbuilders, Ltd., Montreal; General Welding Company, Montreal; Canadian Car & Foundry Company, Montreal, and William Beardmore & Co., Ltd. (naval construction), Dalmurir, Dumbartonshire, Scotland.

C. J. HOLSLAG, Chief Engineer,
Electric Arc Cutting & Welding Company,
Newark, N. J.

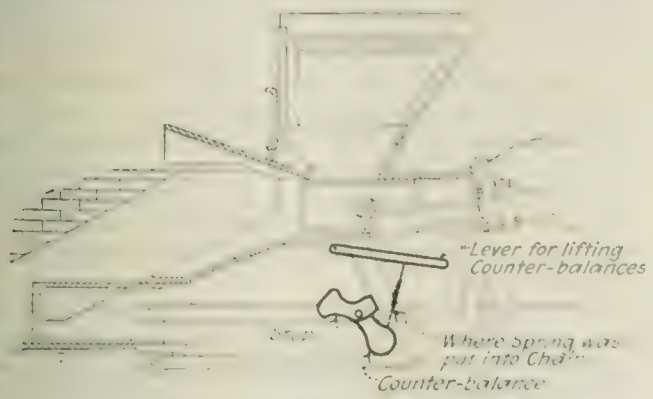
Letter received Aug. 17, 1920.

Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation an Distribution of Electrical Energy

Stoker Trouble Eliminated by Using Spring to Lift Counterbalances

INSERTION of a suitable spring in place of a chain to lift the counterbalance weight of the long-stroke mechanism of Taylor stokers prevented shutdowns due to broken chains in the Elm Street plant of the Consumers' Power Company. Operators frequently tried to operate this mechanism without waiting for the stops to be disengaged, with damage as noted, but replacement of a short portion of the chain by a spring as shown in the illustration prevented the trouble.



SPRING RELIEVES STRAIN PUT ON STOKER MECHANISM

Consumers' Power Company, Battle Creek, Mich. KENNETH WALZ.

Station Records Used to Improve Operation

IN ORDER to improve operation and prevent breakdowns of its stations, a complete system of records has been worked out by the Pennsylvania Water & Power Company which give sufficient data for analysis of all troubles so that the causes of the trouble may be determined and eliminated. Among these records are the station log sheet, the interruption report, the trouble report, the machinery record, the packing and brush charts, a lamp record and a record of relay connections.

Some of the valuable features incorporated in the Holtwood station log sheet are a detachable so-called "operating sheet" on which are drawn the output curves of all generating stations on the system, water flow and elevation curves, and data regarding apportionment of load, customers' requirements, steam generation, weather conditions, river data, abnormal operating conditions, etc. This operating sheet is detached and filed on the switchboard so that it is available to the operators. The main sheet goes to the office. Another feature of this log sheet is a record of the names of all the men who are on duty. There are also on it three one-line wiring diagrams of the station, one of which is filled out by each operator as he comes on duty. The diagram when completed indicates whether each switch is open or closed and all station connections. It serves the purpose of assisting the operator in checking the station conditions when he takes charge of his watch and is of value for future reference. Provisions are made for cross-checking the watt-hour meter readings. Energy used for excitation and local station requirements and transmission losses are recorded.

Whenever an interruption occurs on the system an "interruption report" is made out. In addition, a one-line wiring diagram of the station is filled in to indicate what the operating conditions were and what switches operated. For a series of unusual interruptions a more detailed report with photostats of meter charts is added. At the end of each year a complete analysis is made of all interruptions by classifying them as to whether they were total interruptions, partial interruptions or disturbances and according to the cause and the system on which they originated. A tabulation is also made showing how the various protective devices functioned on each trouble and the "batting average," as it is called, of each device. This tabulation and classification have been extremely valuable in cutting down the number of serious disturbances.

Whenever apparatus in the station is found to be in need of attention or repairs by the regular maintenance crew, what is known as a "trouble report" is made out. This report is addressed to the chief operator. He refers it to one of the maintenance chiefs, who writes on it the necessary instructions and turns it over to a maintenance man. When the trouble is corrected a detailed report of it and of the correction or repairs made are recorded on the sheet and it is returned for the attention of the chief operator. The trouble report is filed according to the apparatus to which it applies. This file is referred to whenever new apparatus is bought. For instance, if a new generator is to be bought, the trouble reports filed under "Generator" indicate that there have been certain inherent defects in the present generators. The specifications for the new machine will provide for the elimination of these defects if possible.

Before the report is filed it is entered in what is known as a "machinery record." This is a loose-leaf system in which a page is provided for every piece of the apparatus. On this sheet are recorded the name-plate rating of the apparatus, its use, location and contract number, with reference to drawings, and then follows the history of the apparatus.

A considerable amount of experimenting has been done with various kinds of cylinder and pump packings for which a special chart has been provided. On this chart every stuffing box in the station is recorded with data regarding dimensions, size, quantity and kind of packing, date installed and life. From this chart it has

been able to find out what kind of packings give the best service in each particular case.

The "lamp record" has a sheet for each wattage or variety of lamp used for station lighting. This record provides for the detection of defective lamps, abnormal breakage, etc.

In order that relays may be properly set a complete record of their setting and connections is maintained. The wiring diagrams have been made simple and easy to read. Symbols are employed for the different kinds of relays which indicate the actual connections and conditions. Careful thought has been given to the arrangement of the parts of the drawings so that a minimum number of intersections occur, and to the weight of the lines representing the circuits used for different purposes, all with the view of increasing the readability of the drawing and the vividness of the impression made on the user's mind.

One other record system is that showing pull boxes, conduits and the various conductors that go in them. Such records with diagrams are mounted on the wall near each pull box.

Mechanical Oil Atomizer Efficient at 320 per Cent Boiler Rating

AS HIGH as 75 per cent efficiency at 320 per cent of the boiler rating was obtained in recent tests made by the Babcock & Wilcox Company on a 450-hp. boiler fired by mechanically atomizing oil burners. Other remarkable features of the test were that in a rather restricted furnace volume, 445 cu.ft. (12.4 cu.m.), enormous quantities of oil were burned, and even at high percentages of rating the combustion was maintained very uniformly as indicated by the flue-gas analyses. The efficiency ran from the foregoing figures as indicated to 82 per cent with the boiler operating at 116 per cent rating. The fact that in these tests such satisfactory combustion was secured in a rather limited furnace volume indicates that this burner may be used in a very much smaller furnace than is possible with steam-atomizing burners without encountering troubles with brickwork. The mechanical burner makes use of a larger percentage of furnace volume than does the steam pipe, on account of the shape of the flame. The flame is much shorter because of finer atomization of the oil and should not require any extra protecting wall in the furnace such as is frequently used with a steam burner. With mechanical burners it is necessary to have a greater furnace draft than with steam burners, as the air must be delivered at high velocity in order to secure an intimate mixture with the oil. This draft pressure may be either induced or forced as may be necessary.

By referring to tests it will be noted that it is not necessary, even at heavy overloads, to carry excessive oil pressures, as these are well below the average steam pressures in modern plants. Temperatures and pressures unquestionably will vary with the quality of the oil, but probably with the heavier oil now being sold no difficulty will be experienced along these lines. In these tests very little difficulty resulted from the boilers clogging. Although this trouble will be present if the oil is not properly strained, there is not the probability of carbon depositing on the burner tip as is frequently the case with steam atomizers. The mechanically atomizing burner operates very quietly and is, therefore, preferable for certain installations. Fires are easily lit and put out and burners can be quickly and easily removed. On account of the size and shape of the flame it is also most readily adaptable to installation in existing coal furnaces where oil might be used as an emergency fuel.

Although high ratings were obtained at these tests, the writer does not wish unreservedly to recommend operating boilers at such heavy overloads, for such operation requires the most careful attention. Boilers must be clean and the feed water of the best quality. In certain plants it may be necessary to purify or distill the make-up water.

As the supply of fuel oil may perhaps diminish in the future, the greatest advantage of the oil burner will probably be for stand-by service. Ability to get up steam in a cold boiler in thirty minutes and to be operating the boiler at 200 per cent of rating or more shortly afterward makes this fuel ideal for such work.

Charles C. Moore & Company. DARRAH CORBET.*
San Francisco, Cal.

* From a paper read before the Portland (Ore.) Section of the A. I. E. E.

TESTS WHICH SHOW THAT HIGH RATINGS ARE POSSIBLE WITH MECHANICAL ATOMIZER OIL BURNER

450-hp. Babcock & Wilcox boiler, 15.45 per cent superheating surface, 445 cu.ft. furnace volume, Lodi burner

Number of test	1	2	3	4	5
Number and size of sprayer plate	3-47-2	3 40 2	3 40 7	3 104	3-25-1 1
Duration of test, hours	6	4	4	2 5	3 58
Steam pressure, lb. per sq.in.	178 2	178 4	177 9	186 2	192 1
Steam temperature, deg. Fahr.	453 6	486 9	482 3	504 9	530 4
Superheat, deg. Fahr.	74 7	88 0	103 6	122 6	146 1
Feed temperature, deg. Fahr.	71 9	70 35	72 3	70 8	71 6
Factor	1 2394	1 2484	1 2549	1 2675	1 2798
Oil pressure at burners, lb. per sq. in.	169 7	120 3	194 7	193 2	188 7
Oil temperature at burners, deg. Fahr.	250 7	252 6	248 2	258 6	232 7
Oil burned per hour per burner, lb.	389 8	520 4	680 9	874 4	1,179 0
Temperature of flue gases, deg. Fahr.	413	443	485	523	616
Temperature of room, deg. Fahr.	81	86	89	93	97
Draft, inside damper, inches of water	0 24	0 40	0 71	0 77	0 72
Draft in furnace, inches of water	0 14	0 18	0 24	0 21	0 17
Air pressure in duct, inches of water	0 22	0 44	0 75	1 82	3 64
CO_2	13 77	13 71	13 53	13 41	13 70
O } Third pass	2 26	2 30	2 61	2 95	2 65
CO	0 05	0 06	0 04	0 0	0 05
Actual evaporation per lb. of oil, lb.	12 47	12 45	12 11	11 76	11 03
Equivalent evaporation from and at 212 deg. Fahr., per lb. of oil, lb.	15 46	15 54	15 10	14 60	14 12
Water from and at 212 deg. Fahr. per sq.ft. of heating surface.	4 02	5 39	6 89	8 69	11 10
Per cent rating	116 4	156.3	199.9	251 8	321 7
Efficiency, per cent	81 80	81 41	79 05	77 91	75 29
Gravity of oil, Baumé	15 3	15 3	19 5	15 3	17 0
B.t.u. per lb. of oil	18,340	18,530	18,650	18,560	18,200

Industrial Applications

The Economical Utilization of Electrical Energy
in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

Motor Load at Granite Quarry

DATA on the connected load at the granite quarry of the Crumb Quarry Company, Bradford, R. I., are presented in the following table and description. The plant has installed motors totaling 264 hp., all 550-volt, three-phase, 60-cycle. At the present time the company is billed on a 180-kw. demand, and the yearly consumption of electricity is 209,300 kw.-hr. This low consumption is due to the fact that the air compressor is larger than is needed for present requirements.

MOTOR EQUIPMENT AT GRANITE QUARRY—ALL MOTORS 550-VOLT, THREE-PHASE, 60-CYCLE

Equipment Operated	Size Hp	Type	Speed R.p.m.
Twin air compressor, 1,418 cu.ft. per minute	225	Synchronous	225
Centrifugal pump, 200 gal. per minute, against 176-ft. head	25	Squirrel-cage	1,750
Centrifugal pump	15	Squirrel-cage	1,750
Centrifugal pump, 25 gal. per minute against 70-ft. head	3	Squirrel-cage	1,750
Centrifugal pump, 25 gal. per minute against 30-ft. head	1½	Squirrel-cage	1,750

This compressor is of the Sullivan Machinery Company twin-angle, compound, direct-connected, air-compressor type WN-4, driven by a 225-hp., 550-volt, three-phase, 60-cycle, 225-r.p.m. Westinghouse synchronous motor with belt-driven exciter. When the demand for air is light one unit can be cut out, leaving the other operating at full load, or one side can run at full load and full efficiency, while the regulation is applied to the other to meet the varying demand.

Next in importance are centrifugal pumps used for pumping water from the quarries. An interesting attachment on the Platt centrifugal pumps is a vacuum regulator which automatically opens the circuit (acting on the low-voltage release of the starting compensator) when the vacuum in the suction pipe reaches a predetermined point, thus preventing injury to the pump.

The largest pump motor is a 20-hp., 1,750-r.p.m. squirrel-cage motor with hand-operated compensator, driving a No. 2 Platt double-suction split-case centrifugal pump in the old quarry. This pump has a capacity of 200 gal. (757 l.) per minute against a head of 176 ft. (53.6 m.) when operating at 1,750 r.p.m. It discharges water from the quarry and is operated only during the night, so that the quarry will be dry in the morning when work starts. It is thus an off-peak load. The discharge line of this pump consists of about 250 ft. (75 m.) of 3-in. (7.6-cm.) pipe.

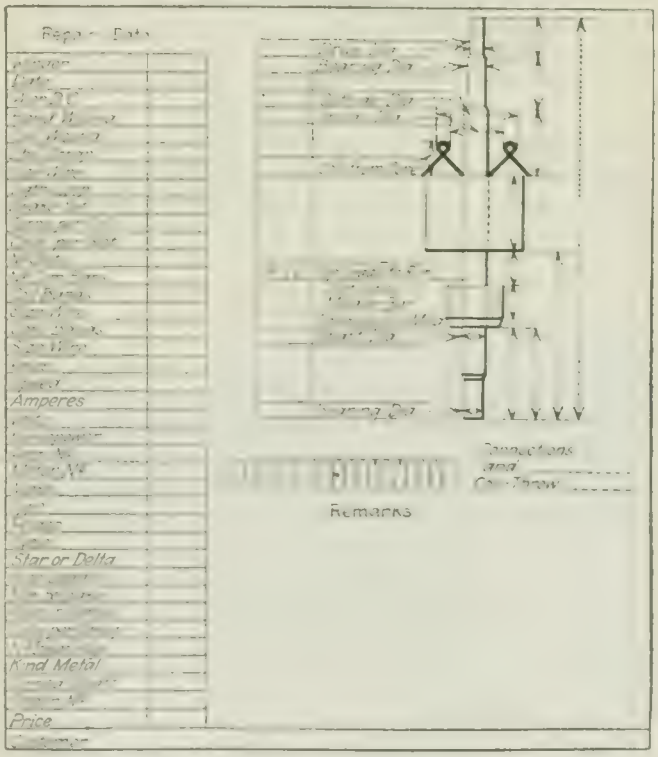
A 15-hp., 1,750-r.p.m. squirrel-cage motor with hand-operated compensator drives a No. 2 two-stage Platt horizontal double-suction centrifugal pump in the new quarry. This pump operates against a head of 120 ft. (42 m.) when operating at 1,750 r.p.m. It is equipped with a hand primer. A 3-hp., 1,750-r.p.m. motor, driving a No. 1½ Platt single-suction centrifugal pump, has a capacity of 25 gal. (94 l.) per minute against a head of 70 ft. (21 m.) when operating at 1,750 r.p.m.

To supply cooling water to the air compressors a 1.5-hp., 1,750-r.p.m. Westinghouse motor drives a No. 1 Platt single-suction centrifugal pump, having capacity of 25 gal. per min. against 30-ft. (9-m.) head when operating at 1,750 r.p.m.

C. R. BROADHEAD,
Narragansett Electric Lighting Co. Power Engineer.

Data Sheet for Armature Winding and Repair Information

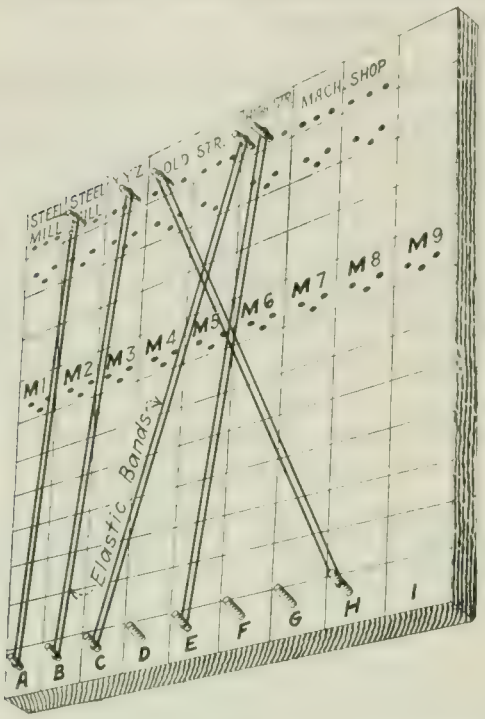
FOR recording complete data on motors being repaired in the shops of the Edward Ford Plate Glass Company, Rockford, Ohio, the form shown here is used. In the left-hand corner of this 11-in. x 11½-in. (28 cm. x 29 cm.) sheet is a column for recording the name-plate data of the motor, information on the type of winding and other parts of the motor, including the bearings. In the right-hand side of the sheet is a diagram opposite which is a column where the dimensions of the machine, including those of the bearings the coils, the commutator, etc., may be placed. In this column may also be recorded the shape of the coils as well as their throw. In the lower right-hand corner of the sheet is a large space in which are placed remarks.



RECORD SHEET FOR MOTOR WHICH IS BEING REPAIRED

Chart Tells Where Troublemen Are

FOR showing at a glance the location of the men who maintain electrical crane equipment in the Fore River yard of the Bethlehem Shipbuilding Corporation a simply constructed board is employed. At the bottom



PIN AND ELASTIC-BAND CHART SHOWS WHERE MAINTENANCE MEN ARE

of this board (see illustration) are a number of sections each marked with the name of a maintenance man, and in the upper part of the board are sections bearing the names of the different shops, mills, etc., in the works. A rubber band is stretched from a pin in the bottom section to a pin in the upper section to show where the man has gone.

Test for Defective Squirrel-Cage Rotor

AS THE stator of a squirrel-cage motor may be damaged by a defective rotor the test outlined here is made by the writer on motors giving evidence of such trouble. A motor with a defective rotor has a non-uniform starting torque and often refuses to start its normal load, or it may make considerable noise when starting, and if the trouble is quite bad it will spit fire when thrown on and off the line.

When a motor gives such indications an ammeter is inserted in one line and voltage is put across one phase of the motor sufficient to cause the ammeter to read, but the current value should not be so high that it will damage the motor. The rotor is then turned slowly by hand while the meter is watched. If the rotor winding is good, the impedance will be uniform and the meter readings will stay within 1 or 2 per cent, but if there are any defects in the electric circuit of the rotor, the needle of the ammeter will swing back and forth sometimes as much as 40 per cent in bad cases. The reason for the current varying is that the winding of the rotor acts like a shorted secondary on a transformer but varies in resistance as the rotor is turned and the defective bars pass into and out of the active field, or rather from one phase into another.

The trouble may be due to unsoldering at the end rings or loose or broken bars. It is almost sure to spread after it has once started, and the motor will gradually take more and more current to carry the same load, while the slip of the rotor increases, the efficiency of the motor goes down and the temperature of both stator and rotor increases. If the trouble is not remedied, the motor may be very badly damaged.

East Orange, N. J. PHILIP C. BERNHOLZ.

Lighting in Modern Automobile Factories

LIGHTING equipment and its control has been laid out with a view to maximum convenience and utility in the new reinforced-concrete factory built for the Cadillac Motor Company in Detroit. The columns of the building are on 22-ft. (6.6-m.) centers and 75-watt to 200-watt type C lamps are hung on 11-ft. (3.3-m.) centers in a square with sides parallel to the lines of columns. Convenient outlets for electrically driven tools are installed on every column. Although the intensities of illumination in this plant have not been measured, the installation is based on other plants of the General Motors Corporation, where intensities have been found to be as shown in the accompanying table.

The wide variation in the spacing and the difference in the size of lamps used in the several plants is partly due to manufacturing and structural conditions of the buildings, but is largely for experimental purposes to find out which of these combinations works out the best. As far as the factory operatives are concerned, there does not appear to be much difference, but taking first cost, efficiency and maintenance into consideration, the 300-watt unit seems to work out to best advantage.

RECENT LIGHTING INSTALLATIONS IN AUTOMOBILE FACTORIES

Where Used	Foot Candles on Working Plane	Lamp			Spacing	Height
		Reflector	Watts	Type		
New Cadillac Plant, Detroit:						
Toilets and dressing rooms		Holophane	75	C, bowl enameled	5 5 ft. x 5 5 ft.	14 ft
Storing and shipping departments		Deep bowl	75	C, clear	11 x 11 ft	14 ft
Storage space in manufacturing and assembling departments		R.L.M.	100	C, bowl enameled	11 x 11 ft	11 5 ft
Rough manufacturing and assembling		R.L.M.	150	C, bowl enameled	11 x 11 ft.	11 5 ft
Machining, body painting and all close work		R.L.M.	200	C, bowl enameled	11 x 11 ft.	11.5 ft.
Canadian Products Co., Ltd., Walkerville, Ont.:						
Motor and axle plants	7	Deep-bowl	100	C, clear	8 x 10 ft.	13 ft
Olds Motor Co., Lansing, Mich.:						
Axle plant	7.3	R.L.M.	200	C, bowl enameled	12 x 13 ft.	12 ft.
Oakland Motor Car Co., Pontiac, Mich.:						
Motor plant	12	R.L.M.	300	C, bowl enameled	13.3 x 15 ft.	13 ft
Northwayn Motor & Mfg. Co., New York:						
Motor plants		X-ray beehive	300	C, bowl enameled	15 x 16 ft.	15 ft
Grinding plant		R.L.M.	100 or 150	C, bowl enameled	8 x 10 ft.	12 ft.

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

Right Understanding of Commission Rulings Aids Public Confidence

THE Public Utilities Commission of Illinois has found that certain public utilities under its jurisdiction have been wording the notices given their customers relative to changes in rate, character of service or rules and regulations so adroitly as to make the customers and the general public think that these changes were made on the initiative of the commission and without any responsibility therefore attaching to the particular public utility company affected. The commission states that it does not seek to evade its responsibility in issuing any order, rules or regulations, but individual customers and the public generally may not be aware of the fact that such changes are generally entered as the result of action initiated by the public utility company. The commission does not intend that customers of such utilities and the general public shall be misled. It has therefore ordered all public utilities, in giving notice to customers or to the public of any change in rates, rules or regulations, to state the title and number of the case, the date filed, by whom initiated and the date of entry of the order, rule or regulation which relates to that particular notice.

Milwaukee Company Asks Customers to Curtail Consumption

AN APPEAL to its light and power customers substantially to curtail the use of electrical energy in order to prevent a general shut-down is being made by the Milwaukee Electric Railway & Light Company through the medium of advertisements in the Milwaukee newspapers. The company asserts that for the past year it has been exerting every effort to complete its new generating plant, known as Lakeside, and that, in spite of construction difficulties, it expects to complete the installation of the first unit of 20,000 kw. before Jan. 1 next. It is, however, confronted with an unexpectedly large use of electricity by most of its customers and with a reduction in the capacity of its present plants due to the poor quality of the best coal that it is able to obtain.

The company further points out that during the past two months, when on several occasions the load has exceeded the plant capacity, it had been necessary to reduce the load promptly to avoid a general shut-down by stopping the street cars for a few minutes and cutting off certain power lines at the station. In such cases the company was not always able to notify its electric service customers that the power would be off. In order to avoid repetitions of such a situation, all users of electric service are asked to reduce their consumption of electricity immediately by 20 per cent between the hours of 7 a.m. and 7 p.m. on weekdays.

It is declared that with the co-operation of all customers the load will be kept within the capacity of the present plants until the new plant can be operated and a minimum amount of hardship will be imposed.

Results of California Electrical Home Campaign

WITH the doors of the exhibition electrical homes of San Francisco, Sacramento and Oakland hardly closed, results have already been reported which are far beyond those anticipated. Residences which follow the plans of the electrical homes are being built, and increased enthusiasm is being shown on the part of house owners and prospective builders for a high grade of wiring and for more outlets. In Oakland it is reported that every builder has increased the number of his outlets 50 per cent.

The cost of the wiring in the San Francisco home was $700, in the Sacramento home $250 and in the Oakland home $500. There was $3,000 spent for advertising the San Francisco home, $1,200 for advertising the Sacramento home and about $3,000 for advertising the home in Oakland. Of the $20,000 which will be spent in advertising such electrical homes before the end of the year, real estate firms will pay $15,000 and the electrical interests $5,000.

Daily records were kept of the visitors to the homes, and it was found that 20,000 persons visited the San Francisco home, 10,000 the Sacramento home and



OUTLETS AND APPLIANCES IN BEDROOM OF ELECTRICAL HOME

30,000 the Oakland home. In each case the homes were on exhibition two weeks. Other such electrical homes are now being built in California, and it is estimated that before Jan. 1, 1921, 200,000 persons will have visited these exhibitions.

Constructive Versus Defensive Use of Rules

"I WOULD like to do it for you, but it is against the rules of the company," is a statement which the East St. Louis Light & Power Company does not permit its employees to make to customers. John H. Mitchell, manager of the company's new-business department, considers that crawling behind conventional company rules is a very weak defence which usually annoys or disgusts customers. The employees are taught the reasons for all of the company's rules, are made to understand why they are necessary and are shown that they are not simply arbitrary conditions. Having learned all about the rules the employees are then in a position to tell a customer why his request cannot be granted without telling the customer that there is any "rule" to that effect.

The majority of people are reasonable when conditions are explained to them in the proper manner. Customers who do not at first see the utility's viewpoint are often won over when asked what they would do if the positions were reversed. By this attitude on the part of employees instead of saying "there is a rule—" the customer is given a clear picture of the situation in his particular case from which he can formulate the rule himself.

Electric Range Lowers Initial Cost of Building

BY L. P. PERRY
Manager Central Connecticut Power & Light Company, Easthampton, Conn.

BY THE installation of an electric range in the house shown in the illustration a considerable saving in the original cost of construction was realized. Through the use of the range the architect avoided building a chimney on the other end of the house where the kitchen is located. The kitchen as designed, while rather small, was compact and convenient, but the only place for a refrigerator was next to the range. Had a coal or



AN ELECTRIC RANGE SAVED BUILDING ANOTHER CHIMNEY ON THIS HOUSE

gas range been installed instead of an electric range, the refrigerator would have had to be inconveniently placed in the cellar or an expensive addition built on the rear of the house. In this case the electric range cost much less than either the chimney or the addition, both of which would have been necessary to make a satisfactory arrangement.

For four years all cooking for a family of three has been done on the electric range at an average cost of less than $4 per month and there has been no expense for repairs. The comfort, convenience and saving of time are also factors in favor of the installation.

Electric Water Pumping Plants Found Satisfactory

THAT electrically operated pumping plants are desirable for cities of all sizes was the verdict of members of the engineering experiment station staff of Purdue University after an inspection of twenty-seven plants in Indiana. The conclusions arrived at were:

1. Where the type and capacity of pump and motor have been intelligently selected to fit local conditions, electrically driven pumps have proved highly satisfactory; they are easily handled, convenient, reliable and economical.

2. While the motor itself is unlikely to give trouble and transmission lines are quite reliable, it appears advisable to provide some auxiliary source of power where service is subject to interruptions.

3. The energy consumption in properly designed plants may be expected to vary from 0.2 kw.-hr. to 2 kw.-hr. per 1,000 gal. (3,785 l.) per 100-ft. (30-m.) head, with 1 kw.-hr. as a fair average.

4. The operating expenses for an electrically operated plant are low—considerably below those for a steam plant and appreciably below those for an internal-combustion-engine plant.

5. The pumping-plant load is a desirable one from the central power station point of view.

The plants visited supply water to communities ranging in population from 500 to 25,000 and were found to be operating under a variety of conditions. Fifteen plants used elevated storage, six used compression tanks, while the remaining six had no storage but maintained direct pressure by continuous operation of the pumps. The most common source of water supply was the drilled well, 6 in. to 10 in. (15 cm. to 25 cm.) in diameter and from 100 ft. to 300 ft. (30 m. to 90 m.) deep. In a few cases the supply came from streams or spring-fed reservoirs. Centrifugal pumps and triplex displacement pumps were encountered, but in 75 per cent of the plants inspected the single-stage system was used. In most cases the energy was 60-cycle, three-phase, and the choice lies between the squirrel-cage and the wound-rotor types of motor; the former being used for centrifugal pumps, where the starting load is light, and the latter for displacement pumps, where the starting load is heavy. The average pump capacity for domestic service is about 200 gal. (750 l.) per minute per 1,000 population, but depends very largely upon local conditions.

In fourteen towns the energy consumption ranged from 0.2 kw.-hr. to 3.28 kw.-hr. for 1,000 population, giving an average value of 1.31 kw.-hr. A better measure of performance, based on 100-ft. total head, gives values ranging from 0.125 kw.-hr. to 1.96 kw.-hr., with an average of 0.9 kw.-hr. per 1,000 gal. per 100-ft. head. The operating cost per 1,000 gal. ranged between 0.88 cents and 16.83 cents, with an average of 4.97 cents. Reduced to a basis of 100-ft. head, this average becomes 3.74 cents per 1,000 gal. per 100-ft. head.

This information is taken from a paper read before the Indiana Engineering Society by C. C. Blalock, instructor in electrical engineering, Purdue University.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Two Cases of Instability of Direct-Current Machines.—J. KELEN.—A large shunt motor, directly connected to a generator, could not be made to take full load without instability. As soon as the current reached a certain value it would suddenly start to increase very rapidly till the breakers went out. The author explains this as a case of self-compounding, due to armature reaction, which causes a tendency to increase speed as the load increases. Mathematical analysis shows that the machine is stable at small loads, the instability beginning at a certain critical current. The phenomenon is often observed in machines with commutating poles, but by changing the windings on the commutating poles the critical current may be given such a value that it falls outside the working range of the motor. In another case a small self-excited booster dynamo, connected in series with direct-current buses for charging storage batteries, was observed to be unstable. If a sudden change occurred in the bus voltage, owing to load variations, the breakers would go out and upon inspection the dynamo would be found to have reversed polarity. The author shows that this trouble also may be accounted for by the assumption of slight self-compounding and derives expressions for the condition of stability. For machines with auxiliary poles the same remedy is suggested as above, but the insertion of a small resistance in series with the booster armature will answer the purpose, if the trouble cannot be overcome by simply adjusting the brushes.—*Elektrotechnik und Maschinenbau*, Aug. 8, 1920.

Generation, Transmission and Distribution

Use of Aluminum Conductors for Transmission Lines.—The article by Fischinger in the *Elektrotechnische Zeitschrift* of Aug. 14, 1919, which was referred to in these columns on Feb. 7, seems to have aroused much interest among German engineers. Fischinger warned emphatically against all use of non-reinforced aluminum, stating that breaks will inevitably occur in this soft material due to the repeated bending and unbending of the wire near the points where it is tied to the insulators. In the big Gröba system in Germany, however, pure aluminum has been used to a great extent for transmission lines, and several engineers connected with the Gröba developments, in letters to the editor of the periodical just mentioned, take a decided stand against Fischinger's point of view, testifying that pure aluminum will give excellent service if properly used. Wires of smaller gage than No. 3, for instance, appear not to be permissible. W. Prehm presents some interesting statistics from a 15,000-volt aluminum transmission system, with 60 m. (197 ft.) distance between insulators and 900 mm. (35.6 in.) distance between phases. Of 341 conductor breaks, 84 were due to arcing started by birds and bugs, 54 to insulator defects, 72 to touching of wires with each other or with ground wires or other grounded metal parts, while 51 occurred during storms. Prehm concludes that there is little reason for condemning pure aluminum as a transmission-line material and points out that so far there is relatively little practical experience regarding the proper design of aluminum lines. He admits that, owing to the low temperature of fusion, aluminum lines tend to break at once when an arc occurs, but insists that the remedy for this is a construction that will avoid all arcing between wires rather than the use of copper conductors. L. M. Cohn points out the advantages of the patented alloy duralumin, while Feussner warns against use of alloys, which are said to have a tendency to recrystallize and become brittle. Fischinger, in a reply, maintains a skeptical attitude, indorses duralumin, but emphasizes again the importance of mechanical fatigue in soft metals.—*Elektrotechnische Zeitschrift*, April 1, 1920.

National Electrification for Holland.—On account of the scarcity of coal in Holland, it is proposed to use electricity and to use it economically. The scheme now in view provides for the electrification of virtually the whole country, including the industries as well as lighting and railways. It is said that a consumption of 100 kw.-hr. per capita is anticipated as compared with from 35 kw.-hr. to 40 kw.-hr. at present.—London *Electrical Times*, June 3, 1920.

Impulse Turbines Utilize Wide Range of Head and Flow.—At Fontana, Cal., an irrigation project was recently extended to include the development of water power when it was found that a favorable contact could be made with the local power company. The conditions imposed on the plant by the irrigation requirements vary the effective head 30 per cent and the flow 83 per cent. With the hydraulic impulse turbines which were designed to meet these conditions it has been found possible to operate at minimum flow with a loss of only 3 per cent in the efficiency attained at maximum flow. This has made it profitable to utilize the power even under the disadvantage of the wide variations.—*Engineering News-Record*, Aug. 5, 1920.

Traction

Regenerative Braking with Single-Phase Locomotives.—M. SCHENKEL.—The author gives a comparative discussion of four different systems of single-phase regenerative braking on electric railroads. A number of curves are presented which show the performance of a particular type of freight locomotive, built by the Siemens-Schuckert works, with a draw-bar pull of 16,300 kg. The conclusion is that the four types of connections investigated for regenerative braking are about equally good as far as motor heating is concerned. *Elektrotechnische Zeitschrift*, July 22, 1920.

Mechanical Coupling Between Motor Axis and Drive Wheels on Electric Locomotives.—SEEFEHLNER.—The

article contains a comparative discussion of a number of different drive types used on electric locomotives of American, Swiss and German manufacture for transmitting the motor torque to the driving wheels. Numerous cuts of photographs and drawings are included. Various drives, such as crank couplings, gear drives and elastic couplings of different kinds, are described in detail, and combinations of gears and cranks are dealt with. Systems based on the principle of individual drive and special designs with built-in motors are also considered. The discussion brings forth relative advantages and disadvantages of the various drive systems, and permits certain conclusions as to the fields of adaptability for each particular drive.—*Zeitschrift des Vereines deutscher Ingenieure,* Sept. 18 and 25, 1920.

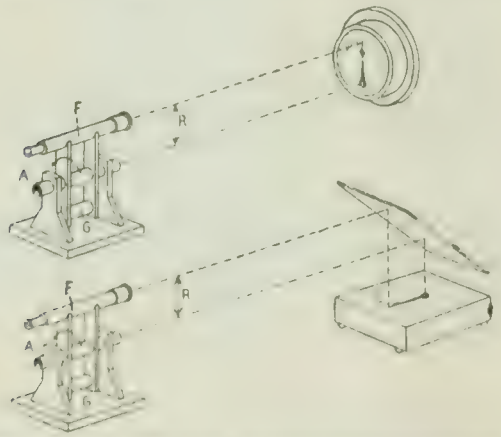
Installations, Systems and Appliances

Electric Propulsion of Ships.—CHARLES RETTIE.—It is stated that little progress has been made in Great Britain in the matter of electric propulsion of ships, and the discussion is principally directed toward progress that has been attained by the United States in the propulsion of battleships.—London *Electrician,* Sept. 3, 1920.

Lighting and Starting of Motor Cars by Electricity.—An outline of the methods at present adopted for the lighting and starting of motor cars by electricity. The following points, in the opinion of the writer, should receive more attention from manufacturers: (1) The question of designing the equipment so that the storage battery will be kept charged under the worst conditions; (2) the method of bringing the starter into engagement with the flywheel, the present arrangement being considered crude; (3) greater liberality in weight allowance, particularly where higher reliability may be secured by the addition of a few pounds extra weight: (4) avoidance of carrying simplicity of design to such an extreme as to limit the usefulness of electrical devices.—London *Electrician,* Aug. 27, 1920.

Units, Measurements and Instruments

Method for Reading Indicating Instruments from a Distance.—PALM.—For this purpose a telescope *F* is used, as shown in the figure. The telescope is placed in a holder together with a counterpoise *G* so that the whole may be rotated around an axis coinciding with



READING HIGH-TENSION INDICATING INSTRUMENTS WITH A TELESCOPE

the axis of rotation of the instrument moving system. The radius *R* must be equal to the scale radius. The telescope, once adjusted, will stay adjusted, and by simply turning the holder around its axis any part of the scale may be observed. Thanks to the counterpoise, the holder may be left in any position desired, so that both hands are free for manipulating other apparatus. The device is said to be particularly useful in taking observations on instruments which are in direct connection with high-potential apparatus or which must be electrically or magnetically shielded.—*Elektrotechnische Zeitschrift,* June 17, 1920.

Telegraphy, Telephony and Signals

Use of Alternating Currents for Submarine Cable Transmission.—FREDERICK E. PERNOT.—This paper contains results of experiments performed in an attempt to develop a method of signal transmission over submarine cables which would permit of a more effective use of existing cable systems. By this scheme signals are transmitted by means of alternating currents simultaneously with the normal battery, or direct-current, operation of the cable. Currents of several different frequencies may be used, reserving a given frequency for each message, and by tuning or equivalent methods at the receiving end these messages may be separated, so that the simultaneous transmission of a number of messages is rendered possible. Actual trial of the proposed alternating-current method was made covering distances up to approximately 700 km., with results which are said to be completely satisfactory.—*Journal Franklin Institute,* September, 1920.

Miscellaneous

Electric Power in the Oil Fields as a Central Station Load.—W. G. TAYLOR.—The author gives detailed information as to the nature of oil field loads, the motor equipment for various local conditions, the cost of installation and the power consumption. In comparing the electric drive and the gas-engine drive, the writer gives the time lost from shutdowns with gas engine and electric drive under similar normal operating conditions in Kansas, as shown in the following table:

	Gas-Engine Drive Augusta Field		Electric Drive El Dorado Field	
	Nov., 1917	Feb., 1918	Oct., 1918	Nov 1918
Number of wells	208	216	26	27
Percentage of available pumping time lost, all causes	23 5	28 2	10.7	9 8
Percentage of available pumping time lost, engine or electric trouble only	4 8	8 15	1 98	0 63

Another table of interest is that giving comparative consumption with steam-engine and electric drive under identical operating conditions on the same well, pumping by engine at night and motor in the daytime.

	August, 1916		September, 1916	
	Barrel	Per Cent	Barrel	Per Cent
Oil pumped by motor	1,311	42 5	1,310	45 4
Oil pumped by engine	1,777	57 5	1,587	54 6
	August, 1916		September, 1916	
	Hours	Per Cent	Hours	Per Cent
Total time motor operation	271	36 5	270	37 5
Total time engine operation	473	63.5	450	62 5
Barrels per hour, motor	4 84		4 82	
Barrels per hour, engine	3.75		3 52	
Increase in production due to motor drive		28 5		36 0

Full consideration is given to the electrification of gathering and line pumps, vacuum pumps, compressors and circulating pumps for casing-head gasolene plants, dehydrators, machine shops and lighting.—*General Electric Review,* July, 1920.

Scientific and Industrial Research

(PRINTED IN THE THIRD ISSUE OF EACH MONTH)

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available, and Suggestions for Co-operative Work.

Conducted by PROF. VLADIMIR KARAPETOFF
Cornell University, Ithaca, N. Y.

Research in Progress and Completed

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

CORONA IN STATOR COILS.

During the past two or three years we have done considerable work on the effects of corona on various kinds of insulating materials as applied to stator coils for high voltage alternating-current generators and on the best means of taking care of it so as to prevent deterioration of the insulation. We find that the so-called corona sheath on coils is not entirely satisfactory, as it is too flimsy and easily damaged. There is room for research regarding the effects of corona on built-up mica insulation, as well as other materials, and on the effects of temperature and humidity upon the action of corona on various kinds of coils. This problem is of great importance since high-voltage machines are now being built in such large sizes and are being worked at much higher temperatures than was customary a few years ago.—*R. B. Williamson, Milwaukee, Wis.*

HEAT DISSIPATION, INFLUENCE OF AIR VELOCITY AND OF ANGLE OF INCIDENCE ON.

Tests were made on the dissipation of heat from the surfaces of the coil ends of turbo-generators. A heater having the same cross-section as the coil ends—*i.e.*, about 4 cm. square and 50 cm. long—was constructed and covered with the typically treated cloth wrapper that is used on such coil ends. The temperatures just under the wrapper and on its outside surface were measured by means of thermocouples made from 0.13-mm. copper and constantan wire. The heater was placed in a current of air which could be given various velocities from 0 m. to 100 m. per minute. Observations were taken of the internal, surface and room temperatures for various inputs and air velocities. The distribution of the velocity in the air stream was determined by means of a Pitot tube made from hypodermic needles. For a definite input or dissipation per unit area the temperature excess of the surface above that of the temperature of the air stream was found to vary approximately inversely with the velocity. The watts dissipated per unit area varied directly as the temperature excess for each constant air velocity. A very marked difference was found between the amounts of heat dissipated when the air was blowing at right angles and when at an angle of 45 deg. For an air velocity of 100 m. per minute and a definite input the temperature excess of the surface of the heater above air temperature when the heater was at right angles to the air stream was found to be 40 per cent more than when it was at an angle of 45 deg. to the air stream. A somewhat similar condition was also found to hold for a small coil of wire 3 mm. in diameter. The thermal conductivity of the material used for such wrappers was found from a large number of determinations to be 0.00036 calories per degree Centigrade per centimeter per second.—*L. S. Taylor, Pittsburgh, Pa.*

HYDROGEN ION RECORDER.

A hydrogen ion recorder and controller has been developed which will find many applications where it is desired to record or control the hydrogen ion concentration in industrial processes or research work. With this instrument changes in acidity or alkalinity may be readily followed or controlled.—*Leeds & Northrup Company, Philadelphia.*

INSULATORS, MATERIAL FOR, RESISTANT AT HIGH TEMPERATURES.

A new material for high-tension insulators has been developed which can withstand a considerably higher degree of heat than the usual porcelain. For example, a certain sample of conventional porcelain will have a resistance of 2 megohms at about 370 deg. C. An exactly similar piece made of the "new body" has a resistance of 2 megohms at 627 deg. C. An ideal material to be sought is one wherein the quartz is dissolved as completely as possible in feldspathic magma.—*W. D. A. Penniman, Huntington, W. Va.*

LAMPS, INCANDESCENT, RIBBON, VERSUS WIRE FILAMENTS FOR FLASH SIGNALING.

Owing to the quantity of material in a ribbon filament being much less than that in an equivalent wire filament, one should expect in going from a wire filament to a ribbon filament either a considerable increase in signaling speed or, without a reduction in speed in a gas-filled lamp, a possibility of change in atmosphere to one involving a decreased gas loss (higher efficiency). A lamp containing a ribbon filament in argon, as proposed by our laboratory, was tested in comparison with the best existing lamp for the same purpose and gave speeds and efficiencies in favor of the former special lamp of the order respectively of 1.6 and 1.[illegible].—*A. G. Worthing, Nela Research Laboratory, Cleveland, Ohio.*

RUBBER GOODS, THE EXTRACTION OF.

A complete [illegible] of various extracts as determined in the analysis of rubber goods. The advantages of the use of mixed solvents, namely, acetone-carbon bisulphide and acetone-chloroform, over the methods previously employed have been studied with considerable detail. A mixture of 55 per cent carbon bisulphide and 45 per cent acetone by volume, boiling constantly at 34.25 deg. C., is adopted rather than the acetone-chloroform mixture because of the less solvent effect of the acetone-carbon bisulphide mixture on the rubber. This makes it possible to eliminate the extraction with chloroform and to determine free sulphur directly in the extract provided the bisulphide is properly purified before use. A large number of figures have been obtained to show the distinct advantage of the use of a mixed solvent over the separate extractions with acetone and chloroform, particularly in cheap compounds when the material is not all removed by the separate extractions.—*S. W. Epstein and R. L. Gamble, Bureau of Standards, Washington, D. C.*

SYNCHRONOUS MOTOR, PROPERTIES OF V-CURVES.

The V-curves (or rather the complete O-curves), each of which corresponds to a different value of power, may be looked upon as contour lines of a surface of sugar-loaf shape. Likewise the series of concentric circles, which represent the locus of the current vector for various constant values of power, may also be considered to be contour lines of a surface of revolution, and this particular surface happens to be a paraboloid of revolution.—*A. S. Langsdorf, Washington University, St. Louis, Mo.*

Suggestions for Research

ANNEALING, ELECTRIC, OF NON-FERROUS METALS.

It is desirable to develop a method of annealing non-ferrous metals in an electric furnace or by passing electricity directly through them. The main object would be to avoid the oxidation which occurs in gas furnaces and which requires a troublesome and expensive pickling process to remove. Some work has been done in this direction, particularly in England, but with little or no commercial success. Metallurgical research on the effects of various methods of annealing on the physical properties of the non-ferrous metals is not alone sufficient; the question of quantity production is of paramount importance.—*N. S. Diamant, Lockport, N. Y.*

AUDION, USE OF, FOR VOLTAGE OR SPEED REGULATOR OF ELECTRICAL MACHINERY.

The audion or thermionic valve has the property of not allowing any appreciable current to pass through it until the voltage has reached a certain limit, beyond which the device acts as an amplifier. It would seem that this property could be utilized in the field circuit of an electric generator for automatically keeping the voltage constant. A similar arrangement in the field circuit of a motor might be made to keep its speed constant.—*Editorial Suggestion.*

CLUTCH, ELECTROMAGNETIC, FOR DIESEL MARINE ENGINES.

One of the principal difficulties in the use of oil engines for marine propulsion, especially for tugs, is the impossibility of throttling an oil engine down for the very low speeds necessary for maneuvering in a harbor. A simple electromagnetic clutch is desired which at a high speed would couple the engine shaft and the propeller shaft rigidly, but which would permit speed reduction of the propeller shaft to a very low value without affecting the speed of the engine. The clutch may be of the induction-motor type, with power converted into heat in secondary resistances. The efficiency at low speeds is immaterial, and the engine may run at nearly its rated capacity at all speeds. Such a clutch in sizes up to several hundred horsepower would materially promote the use of Diesel engines on smaller vessels.—*Editorial Suggestion.*

CONTACT RESISTANCE.

I should suggest research on the resistance of metallic contacts, so as to provide data for the design of electric switches, circuit breakers and contact makers of all kinds through a wide range of capacities. The investigation should include the contact resistance of various metals, such as copper, brass, phosphor bronze, steel and iron, the variation of the contact resistance with the pressure over the entire range from zero to the pressure at which the structure breaks down, and the resistance between various curvatures of contact points, as well as flat surfaces. A study should also be made of the resistance at laminated contacts and contacts formed by the end edges of flat springs.—*J. Jacobs, Milwaukee, Wis.*

POWER STATIONS, STABILITY OF

When two or more interconnected alternating-current power plants or sections of a plant experience a disturbance, such as a short circuit somewhere on the system, a condition of instability may result causing individual generators or groups of alternators to fall out of step. If the synchronizing power of the machines is sufficient, they pull in step after some oscillations or "hunting." Under more aggravated circumstances the so-called "slipping" takes place, one group of machines running slightly faster or slower than the rest, unable to pull into synchronism on account of too great a difference in speed. A case of slipping is treated by Dr. C. P. Steinmetz in his A.I.E.E. convention paper, June, 1920. Further theoretical and experimental investigations are desired with the view of determining various factors which make slipping more difficult. This problem is going to be of increasing importance with the growth of large interconnected systems.—*Editorial Suggestion.*

TELEPHONE, AUTOMATIC, DIALING.

Properties of telephone lines might be investigated in relation to automatic dialing—three-wire and two-wire. The investigator should first become familiar with the subscriber's line circuit from telephone to switch, including the operation of the apparatus in the switch which is concerned with the selector. The investigation should cover the effect of resistance, inductance, leakage and capacitance upon the impulse delivered to the motor magnet. The investigation may be both mathematical and experimental.—*A. B. Smith, Chicago, Ill.*

News in Brief

Summary of Market Conditions and of Recent and Approaching Happenings of Importance to the Industry

SPECIAL permits to take care of the needs of individual public utilities are to be issued by the Interstate Commerce Commission under a new service order which takes the place of the former order assigning cars for the use of these utilities under priority regulation. Absolute open-top-car priority for coal transportation is to be enforced, with the object of providing carrying facilities for a minimum weekly production of 12,000,000 tons.

SALT LAKE CITY has been determined upon as the meeting place of the 1921 convention of the American Institute of Electrical Engineers, and the week of June 21 as the date. The midwinter convention in New York City will be held on Feb. 23 to Feb. 25.

SEVEN additional societies have become charter members of the Federated American Engineering Societies, bringing the total number so far to seven local and six national societies, with a combined membership of 37,171.

A MEETING of the A. I. E. E. standards committee showed close co-operation between this and the corresponding committees of other American engineering associations and the American representatives on the International Electrotechnical Commission in the matter of rating electrical machinery.

OPTIMISM as to the prosperity of public utilities was expressed by Samuel Insull in an address to Commonwealth Edison Company employees.

BELIEF in the inherent stability of the electric railway industry was expressed in President Pardee's address before the Atlantic City convention of the National Electric Railway Association.

ADOPTION of a standardized attachment plug for all appliances was favored by a meeting of the Heating Appliance Section of the Associated Manufacturers of Electrical Supplies.

A STATEMENT made public by the American Wholesale Coal Association is to the effect that there is no shortage of bituminous coal and that the prevailing high prices and restrictions are without justification.

THE FUTURE of the Jovian Order will be decided at the eighteenth annual convention, to be held at St. Louis Nov. 18 and 19.

TESTS carried out by the wiring committee of the N. E. L. A. show that some brands of No. 16 heater cord are a hundred times more durable than others.

PRICES of electrical goods are well maintained in all sections except the East. Jobbers in New England and New York State, however, are cutting prices in an endeavor to move large stocks. Wire is quoted lower owing to lower copper and cotton prices. Collections everywhere are lengthening, even some of the large utilities taking more time to meet their accounts. Credits naturally are much tighter. Jobbers are watching dealers' stocks and not attempting to unload on contractors except in the East. Deliveries are better and shortages are reported in a few lines only. Building operations still hang fire.

PROSPECTS for farm-lighting-plant sales are improving with the close of harvest and the opening of country fairs, although the market for agricultural produce is dull.

THE EXTENT to which the output of electrical automobile accessories will be affected by the slump in the automobile market is uncertain, the lamp producers being in a better position than storage-battery or wire manufacturers because of the local character of their trade.

POWERS of the Nebraska State Railway Commission have been enlarged by a constitutional amendment carried by the voters. An industrial commission designed to prevent strikes in public enterprises has also been authorized.

NEW CAPITAL stock to the value of a little more than $5,000,000 is offered at par to its present stockholders by the Commonwealth Edison Company of Chicago.

TWENTY per cent reduction in the use of electric service is asked of its customers by the Milwaukee Electric Railway & Light Company in order to avert a tie-up until it can start up a 20,000-kva. unit at the plant now being built.

AFTER an animated debate between open-shop and closed-shop members of the National Association of Electrical Contractors and Dealers, it was determined at the Baltimore convention to continue the labor committee for another year.

A SUCCESSFUL meeting was held at Washington on Thursday and Friday of last week by the newly organized Water Power League of which Dr. George F. Swain of Harvard has accepted the presidency.

AUTOMATIC substations were discussed at the meeting of the Providence Section, A. I. E. E., G. H. Roosevelt of the General Electric Company and R. J. Wensley of the Westinghouse company making the main contributions.

ACHIEVEMENTS of electrotechnical pioneers were celebrated by Dr. Elihu Thomson and Dr. M. I. Pupin before the Philadelphia Section meeting of the A. I. E. E.

ILLUMINATION in its relation to safety is to be discussed on Friday next at a joint meeting of the New York Section, I. E. S., and the American Society of Safety Engineers.

INCREASING use of high-voltage cables and a growing interest in interconnection are said by R. F. Schuchardt of the Commonwealth Edison Company to have impressed him in a recent European trip as outstanding facts in the electrical world.

PRIVATE and state-owned hydroelectric plants are being co-ordinated for successful conservation of water and fuel through the triple interconnection of the New England Power and Boston Edison companies and the Metropolitan Water Board plants at Sudbury and Clinton, Mass.

CALIFORNIA electrical interests have formed a joint committee to discuss safety codes and assist the Industrial Accident Commission.

EXPENDITURE of more than $40,000,000 in the extension of its Big Creek and San Joaquin River hydroelectric projects is contemplated by the Southern California Edison Company.

PROMINENT engineers will debate the relative advantages of electric and steam locomotives next Friday at a joint meeting of the A. I. E. E. and the A. S. M. E. in New York.

PERMISSION to lease part of an industrial power plant has been asked by the Pacific Gas & Electric Company in an effort to overcome the shortage of electrical energy caused by the long drought in California.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

California Electrical Interests Combine to Discuss Safety Codes

A JOINT committee has recently been formed in California to consider such safety matters or safety legislation as will be of general interest to the electrical industry and will represent California in this respect and assist the California Industrial Accident Commission in the application of its safety orders. The committee represents the following organizations: Pacific Coast Division of the N. E. L. A., the A. I. E. E., California Electrical Contractors and Dealers' Association, Manufacturers' Safety Association, Pacific Coast Division of the Electrical Supply Jobbers' Association, San Francisco Electrical Development League and California Association of Electrical Inspectors.

Insull Sees Better Times Ahead for Public Utilities

PUBLIC confidence in public utilities is increasing, declared Samuel Insull in an address delivered in Chicago, Tuesday, to 1,800 of the Commonwealth Edison Company's employees. This is shown by the relief which has been granted utility companies during the past two years and which could not have been obtained if the public utility commissions, according to Mr. Insull, had not been supported by the people in the communities served.

That the darkest days of this period have passed, as far as the utilities are concerned, is the belief of the speaker, and better times are ahead. When hard times come, Mr. Insull pointed out, the operating expenses of central stations go down much more rapidly than their revenues, so that net earnings are maintained. There is no better opportunity for acquiring utility securities than at times like the present when they are selling at a low price. The market price of outstanding securities of this kind has dropped in order to bring their interest yield up with the current price of money; but as the price of money and commodities goes down the market price of public utility securities will advance.

Stability of Electric Railway Industry Theme of A. E. R. A. President

ATLANTIC CITY was again the annual meeting place of the American Electric Railway Association this week, its convention opening on Tuesday, Oct. 12. Finance, public relations and labor were prominent among the topics discussed.

J. H. Pardee, the retiring president, in his annual address, in speaking of the general situation, declared that statistics show large earnings and increased riding and that only a few companies are in that desperate financial condition that confronted nearly all of the companies two years or even a year ago. This, he held, emphasizes the inherent stability of the industry and that it is performing a necessary service. A most encouraging sign of the present time, in so far as the electric railways are concerned, Mr. Pardee said, is the growing public recognition of common-sense principles in dealing with the electric railway situation.

Membership in Federation Growing

ANNOUNCEMENT is made that seven additional societies have become charter members of the Federated American Engineering Societies, bringing the total number to date up to seven local and six national societies, with a combined membership of 37,171. The seven new member societies are the American Institute of Chemical Engineers, the Engineering Society of Buffalo, the American Institute of Mining and Metallurgical Engineers, the Society of Industrial Engineers, the Kansas Engineering Society and the Alabama Technical Council. These societies all expect to send delegates to the meeting of the American Engineering Council on Nov. 18 and 19.

The American Institute of Electrical Engineers has appointed the following members as representatives on the American Engineering Council: Comfort A. Adams, A. W. Berresford, H. W. Buck, F. L. Hutchinson, W. A. Layman, William McClellan, L. F. Morehouse, L. T. Robinson, Charles S. Ruffner, Charles F. Scott, L. B. Stillwell and Calvert Townley.

Emergency Coal Needs of Utilities to Be Taken Care of by Special Permits

BY A NEW service order, No. 21, the Interstate Commerce Commission has arranged to issue special permits to take care of individual cases of distress among public utilities instead of permitting the assignment of cars to public utilities generally. These special permits are by the new order made mandatory on the railroads. Applications for relief should be forwarded to the National Committee on Gas and Electric Service. Each of these applications will be considered by a committee of three appointed by the Interstate Commerce Commission as follows: W. L. Barnes, executive manager of the division of car service of the American Railroad Association; D. B. Wentz, president of the National Coal Association, and George W. Elliott, secretary of the National Committee on Gas and Electric Service.

The text of the new service order regarding the handling of coal for public utilities is as follows:

It is ordered that, effective Oct. 15, 1920, and until further order of the commission, all common carriers by railroad within said territory to the extent that may be necessary in order that public utilities which directly serve the general public under a franchise therefor with street and interurban railways, electric power and light, gas, water and sewer

works; also ice plants which directly supply the public generally with ice; also hospitals, schools and other public institutions of the United States, state or municipal governments, may be kept supplied with coal for current use, but not for storage, exchange or sale, be, and they are hereby, to the extent that the commission or its agent or appointee thereunto duly authorized shall hereafter from time to time designate in individual cases, but not otherwise, authorized and directed to place, furnish and assign cars to coal mines for the transportation of such coal in addition to and without regard to the existing ratings and distributive shares for mines upon said railroad; provided that such coal shall not be subject to reconsignment and that a written report of the cars placed hereunder shall be made to the Interstate Commerce Commission by the railroad placing the cars as often as once each week.

Simultaneously with the issue of Service Order No. 21, another order was handed down giving an absolute priority on open-top cars for use in coal transportation.

This has been made necessary in order to meet the program mapped out for shipments to the Northwest by way of the lakes and at the same time start quantity distribution of domestic fuel in the Middle West. The cold snap early in October found most domestic users in the Middle West with inadequate supplies and resulted in the state public utilities commission refusing to wait longer before starting the distribution of domestic fuel in that territory. A minimum of 2,000 cars daily was necessary to initiate the distribution. The railroads were in no position to take cars out of the lake trade. This resulted in railroad officials calling a meeting in Washington at which they laid the situation before the coal operators, representatives of the public utilities and others interested. It was found that the situation was one that would require further action on the part of the Interstate Commerce Commission.

The new order has some advantages over the old one. In the first place, it is mandatory on the railroads instead of permissive. It also gives what amounts to a super-rating which insures immediate supply.

The National Committee on Gas and Electric Service, J. W. Lieb chairman, has represented the National Electric Light Association, the American Gas Association and the American Electric Railway Association throughout the existing coal crisis and will immediately set up the necessary machinery to care for the emergency requests of all public utilities.

Salt Lake City to Be Meeting Place of Institute in 1921

MEETING in Philadelphia last week, the directors of the American Institute of Electrical Engineers took up the matter of settling upon the place where the 1921 annual convention should meet and determined to accept the invitation of the Utah Section to convene in Salt Lake City during the week beginning June 21. This proposal had the warm support of the Pacific Coast Section of the Institute.

The meetings and papers committee reported that plans were in progress for meetings in Chicago on Friday, Nov. 12; in Cleveland on a date in January to be fixed later; in New York on March 11, and in Pittsburgh on April 8 next. The midwinter convention will be held in New York on Feb. 23 to Feb. 25 inclusive.

Bancroft Gherardi was appointed to fill the vacancy in the Institute's representation on the board of trustees of the United Engineering Societies caused by the recent death of Dr. Samuel Sheldon.

Electrical Manufacturers' Association Schedules Fall Meetings

NEARLY all the members of the Heating Appliance Section of the Associated Manufacturers of Electrical Supplies were present at the fall meeting of the section held in New York on Oct. 12. One of the principal matters considered at the meeting was the adoption of a standardized attachment plug for all appliances. This is favored by all members, and it is expected that definite action will be taken by the association in the near future.

The schedule of meetings of other sections of the association to be held in New York City during October is as follows:

Monday, Oct. 18.—Association rooms: Line Material Section, 2 p.m.; Industrial Lighting Fixture Section, 2 p.m.

Tuesday, Oct. 19.—Association rooms: Outlet Box Section, 10 a.m.; Snap Switch Section, 10 a.m.; Lamp Receptacle and Socket Section, 2 p.m.; Attachment Plug Section, 4 p.m.

Wednesday, Oct. 20.—Association rooms: Magnet Wire Group, 9:30 a.m.; Fuse Section, 10 a.m.; Knife Switch Section, 2 p.m.; Molded or Formed Insulation Section, 2 p.m. Yale Club: Rubber-Covered Wire Group, 12:30 p.m.; Wire and Cable Section, 7 p.m.

Thursday, Oct. 21.—Association rooms: Air-Circuit-Breaker Section, 10 a.m.; Panelboard and Switchboard Section, 10 a.m. Union League Club: Weatherproof Wire Group, 12:30 p.m.

Friday, Oct. 22.—Association rooms: General standards committee, 10 a.m.; Signaling Apparatus Section, 2 p.m.

Tuesday, Oct. 26.—Association rooms: Non-Metallic Conduit Section, 10:30 a.m.; Rigid Conduit Section, 2 p.m.

Wednesday, Oct. 27.—Association rooms: Armored-Conductor Section, 10 a.m.

Contractors Vote to Continue Labor Committee

AFTER a spirited debate the National Association of Electrical Contractors and Dealers voted at the annual convention held last week in Baltimore to continue the labor committee. The appointment of this committee was authorized at the Milwaukee convention last year for the purpose of conferring with labor in order that electrical contractors might be able to negotiate with organized labor in securing stability of labor contracts. The committee presented its report last Thursday, showing that it had been organized, but that nothing had been accomplished and that the members had resigned.

The presentation of this report precipitated an intense discussion on the propriety of the association's having negotiated with organized labor, the contention of the open-shop adherents being that by recognizing unionism the association placed them in a trying position. The discussion went so far as to bring forth a resolution to make it forever impossible to discuss any of the manifold phases of the labor topic at any future convention of the association.

Contractors operating closed shops brought before the convention their need for a conciliatory committee. They said frankly that in their opinion the fears of the open-shop employers on this matter were imaginary and urged that the association should not rescind its action of last year but give the labor committee another year in which to demonstrate whether it had a function and could perform it. This latter view finally prevailed by a slight majority, and as a result another labor committee will be appointed.

Society for Electrical Development to Issue Christmas Sales Service

WITHIN the next few days the Society for Electrical Development will issue its November sales service bulletin, devoted entirely to advertising suggestions and material for an intensive Christmas sales campaign. Features of the campaign material to be issued this year are a five-piece window display cutout, hand-lettered invitations for electrical merchants to mail to prospective customers urging a visit to their shops, folders and booklets describing appliances suitable for gifts, lantern slides and poster stamps. In addition there will be suggested newspaper advertisements. This material will be ready for distribution by Nov. 1.

That the electrical dealers must meet keen competition for the Christmas trade from other businesses this year was emphasized by James M. Wakeman, general manager of the society. He pointed out that many merchants have made plans for large advertising campaigns and said that any electrical merchants who are laboring under the impression that it will be unnecessary to make particular efforts to secure a satisfactory volume of Christmas sales will be disappointed.

Schuchardt Tells of Developments in European Electrical Practice

ON HIS return from a visit to England and France, where he went to study new electrical developments, R. F. Schuchardt, electrical engineer of the Commonwealth Edison Company of Chicago, in a brief interview with an ELECTRICAL WORLD representative, spoke of a number of things of interest to American engineers. Among them is the relatively greater tendency in Europe to make use of high-voltage cables. Twenty-thousand-volt to 33,000-volt cable work is comparatively frequent, and at one plant a three-conductor cable for 55,000 volts is being manufactured for use in Belgium, and ratings even as high as 60,000 volts are planned. There is also a greater development of mercury-arc rectifiers, sizes up to 500 kw. and 700 kw. having been made, while sizes up to 1,500 kw. and for 3,000 volts direct current are considered as practicable.

"Europe in general," said Mr. Schuchardt, "appreciates that it must supply its power requirements more economically than in the past and that this means interconnected systems and mass production. There is naturally a good deal of interest in those American systems in which this has been done with marked success, though the splendid example of the northeast coast system in England, a pioneer in this work and in the utilization of waste gases, is also studied with interest. The British Electricity Commission is devoting nearly all of its attention to this question, and on the continent also interconnections and so-called superpower houses are being erected.

"Several of these new stations employ the iron-clad switchgear which has found much favor in England but is almost unknown in America. The latest development in this line is a switch rated at 1,500,000 kva., rupturing capacity at 12,000 volts, with isolators or disconnections in oil tanks and with all parts thoroughly interlocked. The aim has been to make this important part of the station as nearly foolproof as possible. The size of the units in these stations ranges from 20,000 kw. to about 25,000 kw., and one station in France is designed for 40,000-kw. units."

A. I. E. E. Celebrates Discoveries of Ampère, Arago, Davy and Oersted

REGULAR meetings of the American Institute of Electrical Engineers were resumed at Philadelphia on Oct. 8, under the lead of President A. W. Berresford, with a memorable program celebrating the centennial of early electrical discoveries. Dr. Elihu Thomson, the well-known consulting engineer of the General Electric Company, and Dr. M. I. Pupin, professor of electro-mechanics at Columbia University, were the principal speakers. These two men, who are themselves distinguished for original and pioneer electrical investigations, gave an intimate interpretation of the experiments of Ampère, Arago, Davy and Oersted. Dr. Thomson in his characteristic and fascinating style prefaced his remarks with a review of the early electrical work in this country and referred to Philadelphia as the birthplace of this work. It was there that Franklin's experiments were performed, the achievements of Morse recorded, the first electric lamp displayed and the Franklin Institute organized. It might be added that Philadelphia was also the place where Dr. Thomson himself more than forty years ago began his career first as a teacher of electrical subjects and then as an inventor of devices which since have been the very foundation of electrical development in the United States.

In the course of his address Dr. Thomson read from the early works describing the experiments of Ampère and Oersted, explaining the action of the compass needle in the field of a conductor carrying an electric current. Throughout his talk the actual experiments performed by these pioneers one hundred years ago were performed with replicas of the apparatus they used. Much credit is due to Prof. Harold Pender for the preparation of this apparatus.

In his address Dr. Pupin discussed in a masterful manner, from a philosophical viewpoint, the influence of these early discoveries and the part they have played in developing electrical science. He reviewed the early studies of the physical forces of the universe, leading up to the discoveries of Ampère and Oersted, which related to the dynamics of the electrical science.

During the afternoon preceding the evening session at which Dr. Thomson and Dr. Pupin spoke two technical papers were presented, one on "Economic Study of Secondary Distribution," by P. O. Reyneau and H. P. Seelye of the Detroit Edison Company, and the other on "Electrical Demand Measurements," by P. A. Borden of the Hydro-Electric Power Commission of Ontario. The former was a detailed study of the fundamental considerations in selecting economical wire sizes and combinations of secondary installations. From an analysis of curves and other data the authors drew conclusions on (1) the most economical voltage drop, (2) the most economical transformer spacing, (3) the most economical transformer size, and (4) the most economical wire size.

Mr. Borden took up the subject of demand measurement through a study of the quantity measured and showed by numerous lantern slides the characteristics of meters now available and the records they produce. The study was based upon practical loads leading to conclusions which indicate that since heating follows a logarithmic rather than an arithmetical law, the logarithmic average is fully as justifiable as the arithmetical for a basis of demand measurement

To Discuss Relative Advantages of Steam and Electric Locomotives

AT A JOINT meeting of New York, metropolitan and railroad sections of the American Institute of Electrical Engineers and the American Society of Mechanical Engineers to be held at the Engineering Societies Building on Oct. 22 a number of prominent engineers will discuss the relative advantages of modern steam and electric locomotives.

The subject will be introduced by Frank J. Sprague, consulting engineer. The advantages of electric locomotives will be presented by A. H. Armstrong, chairman electrification committee, General Electric Company, and F. H. Shepard, director of heavy traction Westinghouse Electric & Manufacturing Company, and the advantages of steam locomotives by John E. Muhlfeld, of the Railway and Industrial Engineers, Inc., and another speaker not yet announced. The electric point of view will be discussed by C. H. Quinn, chief electrical engineer Norfolk & Western Railway Company; A. L. Ralston, mechanical superintendent New York, New Haven & Hartford Railroad; R. Beeuwkes, electrical engineer Chicago, Milwaukee & St. Paul Railway, and E. B. Katte, chief engineer electric traction New York Central Railroad, and the steam point of view by W. L. Bean, assistant general mechanical superintendent New York, New Haven & Hartford Railroad; A. W. Gibbs, chief mechanical engineer Pennsylvania System; F. H. Hardin, chief engineer of motive power New York Central Railroad, and William F. Kiesel, Jr., mechanical engineer Pennsylvania Railroad, after which the discussion will be closed by George Gibbs, consulting engineer Pennsylvania Railroad.

Coal Wholesalers State High Prices for Bituminous Coal Are Unjustified

THE executive committee of the American Wholesale Coal Association, in a public statement, says that at a meeting in Washington on Oct. 6 it made a thorough canvass of the present coal situation and as a result it feels justified in advising the members of the association and the public generally as follows:

"The American people some months ago were of the opinion that there was danger of an impending shortage of bituminous coal. The satisfactory production since July 1 has proved the momentary alarm to have been unfounded.

"Abnormally high prices were paid by the consumers while they were animated by the fear of possibly impending famine. These prices are now placed wholly out of line by the quite satisfactory production.

"For a while many restraints were put upon distribution of bituminous coal, with the result that retail dealers were unable to fill urgent orders. Since the supply promises to be abundant there is no reason for continuing any such restrictions. Due allowance should be made by the public for the fact that this statement relates only to soft coal and for the further fact that retailers cannot do all of their normal winter business in a month or two. They have not and cannot get the equipment necessary for such a feat even if they could get the coal.

"It is the opinion of the committee that a great change in the whole market situation is imminent. Therefore it suggests to buyers of bituminous coal who have a month's supply in storage that they confine purchases to immediate needs."

It is well known that this committee has been very active in trying to prevent public utilities from securing priority privileges in the assignment of coal cars.

"Illumination and Safety" to Be Discussed at Joint Meeting

ON FRIDAY evening next, Oct. 22, the New York Section of the Illuminating Engineering Society will meet with the American Society of Safety Engineers at the Enginering Societies Building, New York, to listen to papers on the general subject of "Illumination and Safety." S. E. Doane will discuss "Elements of Good Industrial Lighting," and S. A Hibben "Industrial Lighting Equipment and Its Maintenance." Other papers will be read.

Need for Better Public Relations Seen by New York Utility Men

THE best methods of presenting their cases to the public and how to conduct their affairs so that when the necessity arises for rate changes these may be effected without friction were the principal points of discussion at the sixteenth annual convention of the Empire State Gas and Electric Association, held at the Utica Hotel, Utica, N. Y., Oct. 7 and 8.

The gains to be made by withdrawing from the merchandising field were pointed out by H. K. Stein, Genesee Light & Power Company, who maintained that this was the proper function of the contractor-dealers and should be left to them, thus relieving the central-station company of many petty troubles by eliminating unnecessary contact with the public. This view of contact with the public was the opposite of that of G. I. Vincent, Syracuse Lighting Company, as expressed in his paper on "The Consumer's Viewpoint," in that he thought a well-developed system whereby the consumers would have greater contact with the representatives of the utility companies would be of value. The plan he outlined contemplated the districting of a territory and the placing in each district of a competent man to attend to all calls for service. Doubt was expressed as to the possibility of finding sufficient qualified men.

That more thorough education of employees in the business and policies of the companies will go far in cementing public good will was agreed. Another method of increasing public confidence is proper testing of all meters and publication of the results. Tests reported by H. W. Peck, Adirondack Power & Light Company, Schenectady, show that modern electric meters are generally within 2 per cent of being correct.

Two papers of particular interest to small utilities were those by O. E. Wasser, Associated Gas & Electric Company, Ithaca, N. Y., on "Office Location and Arrangement," and by P. B. Murphy, Potsdam Electric Light & Power Company, Potsdam, N. Y., on "Office Work," which discussed the selection of office sites, arrangements of office interiors and record keeping.

New officers were elected as follows: President, H. W. Peck, Schenectady; vice-president, E. H. Rosenquest, New York; second vice-president, E. H. Beals, Buffalo; treasurer, W. J. Welsh, Stapleton; secretary, C. H. B. Chapin, New York. E. C. Scobell of Rochester, H. L. Mann of Buffalo, S. J. Magee of Ithaca and H. M Brundage of New York are the executive committee.

Future of Jovian Order to Be Decided at November Meeting

THE eighteenth annual convention of the Jovian Order has been called by Jupiter A. J. Binz of Houston, Tex., for Nov. 18 and 19, at St. Louis, Mo., at the American Hotel Annex. The convention will consist of business meetings only, held on the afternoon of the eighteenth and the forenoon and afternoon of the nineteenth. This meeting will from a Jovian standpoint be in some respects the most important annual gathering the order has ever known, for at it the future conduct of the order must be decided definitely.

Louisville Public to Hear About Essentials of Light and Power Business

BEGINNING Oct. 11 and continuing weekly until Dec. 20, the Electric Club of Louisville, Ky., in co-operation with the Engineers and Architects' Club, will sponsor a series of eleven lectures covering the essentials of the central-station business. They are designed especially for the benefit of the non-technical man and deal with the power plant, distribution systems, interior wiring, meters, the sale of electricity, lighting, motors and industrial control, railway substation and car equipment and administration. Each lecture covers one subject and will be given by a specialist in that subject. Lectures will occupy one hour, and one-half hour will be given to discussion.

Automatic Substations Discussed at Providence

ADDRESSES by G. H. Roosevelt of the railway and traction engineering department, General Electric Company, and R. J. Wensley of the switchboard engineering division, Westinghouse Electric & Manufacturing Company, were features of the meeting of the Providence (R. I.) section of the American Institute of Electrical Engineers upon "Automatic Substations" on Oct. 8. Engineers from places as far distant as Chicago and even San Francisco were present Mr. Roosevelt discussed, with C. M. Gilt, lighting engineering department, General Electric Company, as joint author, "Automatic Systems for Lighting and Railway Service," and Mr. Wensley outlined recent progress in "Industrial Automatic Substations." Both papers were illustrated by lantern slides, and a comprehensive discussion followed. W. C. Slade, superintendent of power, Rhode Island Company, Providence, was elected chairman of the section for the coming year.

In the discussion E. W. Allen, Chicago office, General Electric Company, pointed out that the large amount of feeder capacity required with hand operation is an obstacle in many cases to best distribution service. In future railroad electrification automatic substations will have to be considered, he said, as they offer advantages over both the 3,000-volt direct-current and the alternating-current system of operation. Here appears to be the largest field of future service for the automatic substation. Mr. Wensley stated that his company has recently quoted prices to a central station on an automatically operated high-pressure steam plant with thermostatic control which is designed to furnish low-pressure steam to a building for heating service and to supply electrical energy to an Edison network.

A. V. Thompson, San Francisco office, General Electric Company, said that the load-limiting feature of the automatic substation tends to cut down the peaks in railway service and thus is advantageous to traction companies purchasing energy on demand basis.

Mr. Allen asserted that at a substation of the automatic type near Camp Dodge trainloads of troops and army supplies were handled by a 300-kw. rotary-convertor installation with automatic control, whereas if hand-operated substation equipment had been in service the breakers would have had to be set for 1,000 kw.

It was also brought out in the discussion that an automatic substation will soon be placed in coal-mining service, the apparatus being placed in a shaft pocket 1,000 ft. below the ground. This will greatly reduce the copper investment.

Nicholas Stahl, general engineer Narragansett Electric Lighting Company, Providence, pointed out that the application of automatic control to the operation of synchronous condensers is an important field of service for automatic substation equipment. Used in connection with super-power transmission lines, such installations will reduce the investment needed in prime movers and will save fuel. The charging current is extremely heavy on some lines of great length, and the provision of automatic control for synchronous condensers will reduce overvoltage and facilitate regulation.

Co-operative Plan Launched at Vancouver, B. C.

THE British Columbia Electrical Co-operative Association was launched on Sept. 21 at a rally and dinner held in Vancouver, B. C. This was by far the largest gathering of electrical men ever held in that city, numbering some 150 representatives of central stations, manufacturers, jobbers and contractor-dealers. Great enthusiasm marked the assembly and the success of the movement was considered assured. George Kidd, general manager of the British Columbia Electric Railway, was chairman and all the members of the advisory council were present. Every branch of the industry was represented by the speakers. Figures produced set the sales bogie for greater Vancouver at $1,570,600, and it was estimated that only half of the possible sales of domestic appliances were being made.

Plans of organization were outlined showing the division of the work of the advisory council into merchandising, accounting, advertising, store and window display, architects and contracting branches.

A. W. Douglas on the Industrial Outlook

NATURAL laws are no respecters of persons, declares Archer Wall Douglas, chairman of the committee on statistics and standards of the Chamber of Commerce of the United States, in his monthly report on general business conditions, just issued, and no price understandings or withholding of products from the markets can long maintain the price of a commodity. Prices are in a downward movement despite the fact that the amount of currency in circulation is greater than ever before.

Declines in food prices, Mr. Douglas says, are naturally following the abundant harvest. Corn is selling at half the prices of a year ago. Wheat, of which Canada has a great crop for export, is declining. Nothing has sufficed to keep up the price of cotton. More efficient and economical methods of marketing are called for if

the farmer is to receive his due return. Non-employment is again reported, the strike fever is waning, and there will probably be no labor shortage in the coming months. Building continues dead, despite figures of estimates—a characteristic example, Mr. Douglas holds, of the difference between statistics and cold facts.

New Plant Will Relieve Milwaukee Power Shortage About Dec. 1

THE Milwaukee Electric Railway & Light Company is advising its customers that a 20 per cent reduction in the use of electric service is the only thing that can avert a tie-up in Milwaukee. In an interview with an ELECTRICAL WORLD representative President John I. Beggs said:

"We are simply suffering the results of the stoppage of development of our facilities during the war period, and incidentally of the lessened output we are able to get from existing equipment because of the poor quality of fuel we are forced to take. We have a new plant under construction and expect to have one 20,000-kva. unit in service about Dec. 1, which will relieve the present acute situation. Until we are able to place the new plant in service the co-operation asked of the public in our advertisements will be necessary to prevent serious public inconvenience."

The company is running very frank advertisements in the Milwaukee papers, telling the exact situation and appealing for a voluntary reduction of service by consumers between 7 a.m. and 7 p.m. each day.

Geological Survey's Figures on Energy Production and Fuel Consumption

FIGURES just issued by the United States Geological Survey for the month of July show a total production of electrical energy for the United States of 3,609,319,000 kw.-hr., of which 1,414,177,000 kw.-hr. was produced by water power. The total production for the first seven months of 1920 is put at 25,421,000,000 kw.-hr., an increase of 16.8 over the same period in 1919. In this period production by water power increased 10 per cent and production by fuels 21 per cent. The Geological Survey's figures are based on returns from about 3,000 power plants rated at 100 kw. or more, including central stations, electric railways and other plants, the capacity of the plants submitting reports being about 90 per cent of the capacity of all plants listed. They agree closely with the figures published in the monthly tables of the ELECTRICAL WORLD, bearing in mind that the latter do not include electric railways

In the month of July electrical plants consumed 2,943,775 tons of coal, 1,094,833 barrels of fuel oil and 2,562,554,000 cu.ft. of gas.

Bureau of Mines May Study Physiological Effect of Electricity

THAT more accurate knowledge may be available as to the physiological effects of direct and alternating current, O. P. Hood, the chief mechanical engineer of the Bureau of Mines, is anxious that the bureau shall make such an investigation a part of its next year's program. In connection with the recommendation of a committee of the American Mining Congress that the limits of direct-current voltage be increased, the Bureau of Mines has had numerous requests for data.

A Durability Standard for Flexible Cords

SOME brands of No. 16 heater cord are shown to be more than a hundred times more durable than others in the records of tests conducted especially for the wiring committee of the National Electric Light Association and presented at the meeting of the committee in Cleveland on Oct. 7. Eleven manufacturers submitted for test twenty-six brands which were supposed to be standard cords approved by the Board of Underwriters and sold for general use. The figures given for each brand (names not published) are the averages obtained from tests of five samples. On this basis the best record for the bending test over an 8-in. (20-cm.) pulley was 343,000 bends and the worst cord withstood only 2,000 bends. The abrasion test consisted in passing the cords over a piece of a 12-in. (30-cm.) half-round second-cut file, and results with the different cords showed a variation from 8,360 to 286,000 passes.

The cord which withstood the greatest amount of bending was below the average in the abrasive tests and vice versa. However, two of the brands came third and fourth respectively in both tests. A reasonable standard for the present was thought to be 50,000 bends and 50,000 passes. One-half of the cords tested above and one-half below these figures in each test, and it was suggested that many of the cords could probably be improved at slight expense.

Before the tests were begun practical men were asked to grade the cords, and although some of the ratings given by inspection were approximately as found by test, in many cases the actual tests of durability were entirely different. Furthermore, the tests indicated that the durability of the cords established in this manner is independent of the details of cord construction.

The results have encouraged the committee and it now intends to have similar tests conducted on No. 18 heater cord and on various kinds of lamp cord.

Consumers' Power Company Starts Record Frequency Changer



ON SEPT. 15 the Consumers' Power Company started its new 15,000-kva. frequency changer at the Elm Street plant in Battle Creek, Mich. This machine will operate in parallel with a smaller machine installed at Kalamazoo some years ago. The new machine, which is pictured above, ties the 30-cycle and 60-cycle, 140-kva. transmission system of the company together and is said to be the largest frequency changer in the world.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Electric Railway May Be Built Over Blue Ridge Mountains.—Despite the almost total cessation of electric railway extensions, preliminary work on a proposed 105-mile railway across the Blue Ridge Hills from Charlottesville to Blowing Rock, Va., has been done. This line would attain an altitude of 4,000 feet and have scenic characteristics.

Big Power House Under Construction at Skowhegan, Me.—The substructure for the Central Maine Power Company's new power house at Skowhegan, on the Kennebec River, is entirely completed and the steel roof trusses are in place. Brick and stone for the walls are on the ground, and the structure will rapidly approach its final stage. The engineers are now engaged on the cofferdam, a more than ordinarily difficult task on account of the extremely irregular river bed, where there are large boulders and loose, porous gravel to contend with. Five units will eventually form part of this hydro-electric installation.

New Zealand Starts Railroad Electrification.—Contract for the electrification of a section of the Midland Railway of New Zealand has been let to a British company. The section to be electrified is known as "Arthur's Pass" and connects the government railway systems on the east and west coasts. A great portion of the section is on a gradient of one to thirty-three and the summit is 2,400 ft. above sea level. The system to be used will be 1,500 volts direct-current overhead contact. An attempt to use coal dust from nearby mines as fuel will probably be made. This will be the first railroad electrification in New Zealand.

Atlanta Company Gets Increased Rates.—Under a decision handed down by the Railroad Commission of Georgia, new rates for residential and commercial light and power, wholesale hydro-electric power, gas and street railway fares were made effective for all customers of the Georgia Railway & Power Company, Atlanta Ga., on Oct. 1. Increases in residential lighting amounted to approximately 1⅞ per cent; commercial retail power rates, approximately 9¾ per cent; commercial lighting rates, approximately 9⅞ per cent; hydro-electric power rates, approximately 15 per cent. This order is the final decision on the petition of the company filed in the late spring. The increases granted amount to approximately one-half of those which were requested.

Sespe Power Corporation Authorized to Go Ahead.—The Sespe Power Corporation, which plans the construction of five hydro-electric plants on the Sespe River, in Ventura County, Cal., the output to be sold to the Southern California Edison Company, has received authority from the Railroad Commission to raise funds by the issue of $2,000,000 in bonds and $1,000,000 common stock. None of this money is to be expended, however, until there are sufficient funds on hand to construct the plants expeditiously. The corporation's estimate of output, 197,962,017.6 kw.-hr., is not concurred in by the commission's engineers, who hold that an average annual output of 75,000,000 kw.-hr., is all that can be depended upon.

London's Electrical Supply in Administrative Tangle.—What with private companies, "local authorities," as those administering municipal plants are called in England, the London County Council with its large powers, and the government commissioners appointed under the new electricity supply act of Parliament, the project of consolidating and improving the supply of electrical energy in the British capital has reached a tangle of which no immediate solution appears. It is held to be feasible to agree on an engineering scheme that would bring about the desired advance, but to get rid of vested administrative interests is another question. One plan considered is for the London County Council to exercise its powers of purchase and unify the distribution, taking what additional energy it may require in future from the less congested areas outside. This, says a London contemporary, if done properly, would be worth doing "even at the cost of handsomely pensioning the officials who would become superfluous."

Warship Piloted Into Port by Radio Cable.—The method of guiding ships into port no matter how thick the fog which was explained in the ELECTRICAL WORLD for Sept. 4, page 497, received an actual demonstration last week, when Commander Norton of the U. S. S. destroyer Semmes piloted his vessel from near the Ambrose Channel Lightship through Lower New York Bay to Fort Lafayette, following a magnetized pilot cable. With the pilot-house windows covered by heavy canvas, the commander picked up the cable and guided the ship by "listening in" and steering to port or starboard as the volume of sound indicated his position. In this experiment the magnetic field extended about 1,200 ft. on each side of the cable, and the greatest depth encountered was 116 ft. The lightship end of the cable was grounded and anchored with concrete anchors. In the Narrows the line had to be laid underneath police, army and Western Union cables. Several radio experts who were on board pronounced the trial a success. The cost of equipping a vessel with receiving apparatus is put at $1,200, while delay because of fog may cost an ocean liner as much as $500 an hour.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

West Virginia Public Utility Association.—The first annual meeting of this association to be held since 1917 took place at Charleston on Oct. 5. Herbert Markle of Bluefield has been elected president.

Engineers' Club of Philadelphia.—On Oct. 19 Norris L. Cooke will make an address at this club's Tuesday luncheon on "The Inspiring Outlook for American Engineering." In the evening Robert B. Wolf will discuss the operation of changing from a two-shift to a three-shift working day.

St. Louis Electrical Board of Trade.—The first of the weekly luncheons of the St. Louis Electrical Board of Trade for 1920-21 was held Sept. 21 at the Hotel Statler. A. W. Douglas, chairman of the committee of statistics of the United States Chamber of Commerce, spoke on "Business Conditions the World Over." Ell E. Bennett presided.

Joint Meeting of Engineers in Chicago.—Dr. Charles Proteus Steinmetz consulting engineer General Electric Company, Schenectady, N. Y., has promised to address a joint meeting of the Western Society of Engineers and the Chicago Sections of the American Institute of Electrical Engineers and the American Society of Mechanical Engineers in Fullerton Hall, Art Institute, Chicago, at 8 p.m. Wednesday, Oct. 20. On Oct. 21 he is scheduled to address the Electric Club of Chicago.

Coming Meetings of Electrical and Other Technical Societies

British Columbia Association of Electrical Contractors and Dealers — Vancouver B. C., Oct. 19.
International Association of Municipal Electricians—New Orleans, Oct. 19-22.
American Society of Safety Engineers — New York, Oct. 22.
Association of Railway Electrical Engineers —Chicago, Oct. 28-31.
Institute of Radio Engineers—New York Nov. 3.
Association of Iron and Steel Electrical Engineers, Philadelphia Section, Nov. 6; Cleveland District Section, Nov. 8.
Society of Naval Architects and Marine Engineers—New York, Nov. 11-12.
Electrical Supply Jobbers' Association — Cleveland, date in November to be fixed.
American Institute of Electrical Engineers —Chicago Section, Nov. 12.
Electric Power Club — Hot Springs, Va., Nov. 15-18.
Southeastern Geographic Division, N. E. L. A.—Miami, Fla., Nov. 17-19.
Jovian Order—St. Louis, Nov. 18 and 19.
National Electric Light Association—Central Western Section, Chicago, Nov. 18-20.
American Electrical Society—Cleveland Nov. 22-24; National Meeting, Chicago, Dec. 28-31.
American Society of Mechanical Engineers —New York, Dec. 7-10.
American Association for the Advancement of Science—Chicago, Dec. 27-Jan. 1.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Accuracy of Meters.—Electric meters on a transmission line about 10 miles long which show losses, including transformer losses at both ends of the line, of about 6.6 per cent are deemed by the Missouri Public Service Commission to register accurately.

Business and Domestic Consumers Must Pay the Same Rates for Same Character of Service.—It is discriminatory, the Public Service Commission of New York for the Second District has asserted, for an electric company to charge domestic consumers higher rates than business consumers for the same character of service, the difference being based solely upon the character of the consumer.

State-Wide Policy of Virginia Commission.—The State Corporation Commission of Virginia recently took occasion to comment on the fact that most localities in the state appeared to think that a segregation of receipts and expenses and a valuation of a public service company's property locally would result in the application of a lower rate in that locality than elsewhere. This conception, the commission said, was an erroneous one and by treating the subject on a state-wide basis the commission would at any time be in a position to compel the company to give the best obtainable service in any locality without an increase in rates.

Paying for Service Extensions.—In granting increased rates to the Southern Sierras Power Company and the Holton Power Company the California Railroad Commission said, referring to the financial demands of the companies in connection with service extensions: "It does not appear that a modification of the rule is justified at the present time because of financial difficulties existing, with the exception that, pending final decision of the commission, the Holton Power Company and the Southern Sierras Power Company should make all extensions without charge to applicants for lighting service where the cost of the same does not exceed $80 per consumer. Under the circumstances it is reasonable for the companies to call upon applicants desiring service to assist them by the advance of money, it being understood, of course, that where the entire cost of an extension is advanced the company will pay interest thereon in cases where the company would make the extension without advance were money available." The Holton company has two steam stand-by plants for service in the Imperial Valley, but conditions make continuous steam service there uneconomical. Until the growth of load in that region changes conditions the commission holds that large consumers requiring continuous service must install their own stand-by.

Sale of Municipal Power to a Public Utility.—In granting conditional approval of a contract by which the County Electric Company agreed to purchase electrical energy from the Pompton Lakes municipal plant, the New Jersey Board of Public Utility Commissioners asserted that under the statute it could not approve such an arrangement unless the municipality joins with the company in making the application or there is filed with the board a copy of the resolution authorizing or ratifying the contract.

Proper Apportionment of Coal Clause.—In granting in part a modified application of the Potomac Electric Power Company for permission to include in its rate an additional charge to cover the increased cost of coal and to vary in accordance with it, the Public Utilities Commission of the District of Columbia observed: "From the evidence before it in this case the commission is convinced that the company is entitled to an increase in revenue, due principally to the increase in the cost of coal. The commission feels, however, that a coal clause such as that suggested by the company in its first application is objectionable inasmuch as there is less incentive to secure coal at the most advantageous price when it is known that the cost, whatever it may be, is automatically passed on to the consumer. As the increase in the cost of coal affects all consumers of the company, although in varying degrees, the commission believes that such increase should be borne as nearly as possible by each class in its proper proportion."

The "Wisconsin Rule" of Going-Concern Value.—In dissenting from the valuation theories of the engineers of the Montpelier & Barre Light & Power Company the Vermont Public Service Commission has expressed the opinion that the so-called Wisconsin rule of going-concern value was never intended to be applied to reimburse an operating company for losses incurred in operation except for a limited period during the infancy of the business before it had grown to such a stage of maturity as to be expected to earn an adequate income. To attempt to apply the rule to operation over a period after the business had grown to such proportions as to call for the operation of the defendant's plants to their full capacity would be to guarantee the operating company against all losses, while to carry the theory a step further would compel future patrons of the company to pay a rate which would not only be a fair return upon the value of the property but also pay a debt which past patrons had failed to pay or make up to the company, a deficit so incurred as to have no relation to any possible theory of rate making.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Scope of Review of Facts.—Notwithstanding the declaration of the public utilities act of California that the Railroad Commission's determinations of matters of fact are not subject to review, its determination on the question whether or not the facts existing are sufficient to bring the case within the scope of its power must be the subject of review, according to the Supreme Court of California, in Trauber vs. Railroad Commission, so far as it presents a question of law bearing on that subject, and the provision that "conclusions" of the commission on the facts are final does not apply to facts necessary to the existence of the jurisdiction of the commission to act; but where the evidence in proof of such facts is substantial in character and justifies the inference or conclusion that the facts did exist, then such findings are binding and conclusive and are not subject to court review. (191 Pac. 366.)*

Negligence and Defective Insulation.—In affirming judgment against the Laclede Gaslight Company and dismissing judgment against the Union Electric Light & Power Company in a suit for damages because of the death of a lineman from electric shock (Washburn vs. Laclede Gaslight Company), the Supreme Court of Missouri found as follows: (1) That an electric lineman killed by contact with a live wire failed to wear rubber gloves provided for him did not make him guilty of contributory negligence where the regulations did not require him to wear such gloves while doing the work upon which he was engaged; (2) liability for negligence does not depend on the question whether with reasonable prudence the injury could have been foreseen but rests on anything which after the injury is complete appears to have been a natural and probable consequence of an act or omission; (3) where a lineman employed by one electric company brought his hand into contact with a dead insufficiently insulated wire belonging to another company and thereby caused a short circuit through his body from a block and tackle charged by a high-voltage wire belonging to his employer, which was also insufficiently insulated, his resulting death was not such a natural and probable outcome of the neglect properly to insulate the dead wire as to make the company owning it responsible for the fatality. (223 S. W. 725.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

Morse Dell Plain, vice-president and general manager of the Northern Indiana Gas & Electric Company, Hammond, Ind., who was elected president of the Indiana Electric Light Association at its recent convention, went to that state from Syracuse, N. Y., only about two years ago, but he has been active ever since his arrival, and his election to the presidency was a measure of appreciation of the work he has done for the utilities of the state. Mr. Dell Plain started his public utility work in the Republic of Mexico, where he was for six years with the Central & South American Telegraph Company. He returned to the United States to attend Syracuse University, where he was a member of the class of 1905. Upon leaving college Mr. Dell Plain became connected with the Westinghouse Electric & Manufacturing Company at East Pittsburgh, Pa., remaining about five years, and then returned to the public utility field as power engineer for the Syracuse Lighting Company. In January, 1918, he was promoted to the position of sales manager of the company, and in August, 1918, he was appointed to his present position. He is a member of the American Institute of Electrical Engineers, the American Society of Mechanical Engineers, the National Electric Light Association and the Indiana Electric Light Association. For the last ten years he has been very active in N. E. L. A. affairs, having been on the executive committee of the Commercial Section and being now a member of the executive committee of the Power Sales Bureau.



MORSE DELL PLAIN

Edward B. Ellicott, until recently colonel of the Chemical Warfare Service, U. S. A., has been engaged as chief engineer for A. M. Castle & Company of Chicago, in charge of building construction, operating and manufacturing activities of the company. Mr. Ellicott is a member of several engineering associations, including the American Society of Mechanical Engineers, the Western Society of Engineers and the American Association of Engineers. He is also a fellow of the American Institute of Electrical Engineers.

Prof. James T. Rood, formerly of the University of Illinois, has been appointed professor of electrical engineering at the University of Wisconsin. Professor Rood is a graduate of Worcester Polytechnic Institute, 1898, and has been nine years at Lafayette College and two years at the University of Illinois.

John T. Kelly, who formerly had charge of the publicity work of the Society for Electrical Development, has been re-engaged and is conducting the weekly editorial service to the daily newspapers. The service is in addition to the semi-monthly news items which have always been a feature of the society's activities.

J. W. Campbell, vice-president and general manager of the Iowa River Light & Power Company, has recently moved from Omaha, Neb., to Eldora, Iowa, and established headquarters of the company there. Cecil Cross, local manager at Eldora, has been transfered to Central City, Iowa, as manager.

Charles A. Dean, formerly head of the appliance sales department of the Cambridge (Mass.) Electric Light Company, has been appointed manager of the Shirley Electric Company, Hollis Electric Company, Tyngsboro Electric Light Company and Pepperell Electric Light Company, with headquarters at Ayer, Mass. Mr. Dean is well known in the New England central-station field and is chairman of the lighting division of the commercial section, New England Section, N. E. L. A. He has made a reputation during his work at Cambridge for progressive service and is one of the forward-looking younger executives in the Northeast.

A. S. Langsdorf, head of the department of electrical engineering at Washington University, St. Louis, since 1901 and dean of the Schools of Enginering and Architecture since 1910, has resigned to become production manager of the Crunden Martin Manufacturing Company of St. Louis. Professor Langsdorf was graduated from Washington University in 1898 with the degree of bachelor of science in mechanical engineering, and he took the degree of master of mechanical engineering at Cornell University in 1901. Professor Langsdorf was a member of the electrical section of the Jury of Awards of the St. Louis Exposition in 1904 and is a member and vice-chairman of the St. Louis City Plan Commission. He is a fellow of the American Institute of Electrical Engineers and a fellow of the American Association for the Advancement of Science, besides being a member and past-president of the Engineers' Club of St. Louis.

Charles R. Underhill, whose title with the Acme Wire Company was recently changed to consulting electrical engineer, has been associated with that company for more than nine years. He acquired much experience with telephone, telegraph and other signaling devices during eight years' employment by the Western Electric Company, and it was then that he gained the interest in solenoids and other forms of electromagnets which subsequently found expression in his books and in numerous articles on electromagnets, magnet wires and coils. As chief electrical engineer for the Varley Duplex Magnet Company he gained much practical and laboratory experience along this line. As a consulting engineer in New York for five years he had a wide range of experience in electromagnetic and other signaling devices, including radio-signaling, and, among other devices, he produced and patented a wireless printing-telegraph system employing the usual code. While connected with a Western manufacturer of enameled magnet wire he made improvements in enameled-wire machines which increased the output and quality of this wire, and he also installed a coil-winding department, devising the winding machinery. Mr. Underhill is the inventor of numerous other devices, including an electric gear shift for automobiles wherein a single electromagnet stores energy in a spring to shift the gears, but his training and experience in late years naturally have been in connection with the processes and products of manufacture of the Acme Wire Company. Commissioned captain in 1917, he served in the aviation section of the Signal Corps as radio officer in charge of radio tests in flight, and then in the Air Service, on flying status, receiving his honorable discharge in January, 1919. Mr. Underhill is a fellow of the American Institute of Electrical Engineers and a member of other national engineering and scientific societies.



C. R. UNDERHILL

Trade and Market Conditions

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

Jobbers Find Household Devices Becoming Less Profitable

ELECTRIC supply jobbers are less satisfied with the discounts allowed on motor-driven household devices. At a recent meeting of Middle Western jobbers the subject was rather generally discussed, and while it was admitted that washing machines, ironing machines, etc., were still desirable devices to handle, yet it was generally agreed that the business was getting less profitable.

For the past two years this business has entailed little or no warehousing expense, whereas now, it was pointed out, stocks are piling up, the investment is increased and the margin of net profit is cut down. However, the labor cost of handling these household devices in a warehouse has been found to be much less than for other goods. One concern, half of whose business was in motor-driven household devices, found that it took only two men in the warehouse to handle these goods, whereas ten warehouse men were required to handle the rest of the company's business. On the other hand, it was said that the jobber's gross profit on washing machines is only about 15 per cent, whereas on rubber-covered wire and conduit it is about 25 per cent. Whether the motor-driven household devices are going to be profitable for the jobber in the future with the present margin remains to be seen, but it was very generally agreed that the average contractor-dealer could not make any real profit with a margin of only 25 per cent.

Big Future Seen in Miniature Lamp Business

AN IDEA of the growth of the miniature-lamp business of the country can be gained from the fact that it has tripled itself in dollars and cents since 1912 and more than doubled during that time in the actual number of lamps produced, according to one of the largest lamp manufacturers. If the present ratio of growth continues, it is estimated that by 1925 the miniature lamp business in this country will surpass the large-lamp industry in number of units sold.

This expansion is said to be largely due to the introduction of tungsten as a filament and the increase in the electric lighting of automobiles. From sales thus far this year it is estimated that the business of all miniature-lamp interests in this country will reach a total of 125,000,000 lamps in 1920. These sales will be divided about as follows:

Automobile	77,000,000
Flashlight	36,000,000
Christmas tree	9,000,000
Miscellaneous	3,000,000
Total	125,000,000

It is estimated that 1921 will show a further increase of about 25 per cent over 1920 in sales.

From the foregoing table it can be seen that the automobile and flashlight interests account for nearly 90 per cent of the demand. Producers do not seem to be perturbed by cancellations in the automobile industry, however. They feel that the saturation point in sales of automobiles is far from being reached. A large proportion of this class of demand is renewal in type. Furthermore, the growing use of automobile trucks in shipping goods will make their use at night imperative, with the consequent necessity of equipping them with lights. Flashlights are also expected to produce increasing sales of miniature lamps by being brought to the point of a household necessity.

In the sales that are now classed as miscellaneous and which represent only about 10 per cent of the total business at present a big future is anticipated. The growing favor of electric toys, miniature electric railway systems, animals with illuminated eyes, etc., is now making itself felt in sales of miniature lamps. Especially is a large market opening up in the field of instruments as used by doctors, dentists, etc. At the present time there are over 150,000 portable electric mine lamps in use, it is stated. As the United States Bureau of Mines approves the use of electric lamps in mines their more general introduction is looked for. Small motion-picture machines are becoming more frequent in schools and homes.

Prospects for Farm-Lighting Plant Sales Better

PROSPECTS for farm-lighting-plant sales are brighter than they were a few weeks ago. There has been quite a slump in the sale of these plants all over the country. Now that the harvest is in and conditions look better in most crops than they did early in September, the farmer is more cheerful. Moreover, this is the month of county fairs, and evidences are at hand that sales will be pushed hard at these fairs. Where fairs have already been held business has picked up. This is particularly true in the Northwest. In the South the coming fairs are expected to stimulate interest.

There is one point in this connection, however, that is brought out in the latest reports from the large agricultural regions. There is no general rush to market this fall by the farmer. Wheat, cattle, cotton, tobacco and the other crops are being quite generally held where they were raised on the theory that prices are too low and higher prices will come in the winter. It is a fact, also, that buyers are not too active. Flour mills are buying from hand to mouth. The packers are not interested in incoming shipments to any great extent. In fact, cattle are being sent back on the ranges.

With such a condition affecting farm produce, too much in the way of purchasing cannot be expected. The farmer has money, it is true, but he is not apt to buy at high prices when the market for his own goods is dull and quotations comparatively very low.

Relation of Stock-Moving Methods to Collections

SINCE the middle of September, when the third installment of the federal income tax was payable, collections in the electrical trade have been lengthening. This is true, in cases, even of accounts receivable from large electric light and power companies. In a number of cases, more especially in the East, electrical supply jobbers with heavy stocks are trying to strengthen their own credit position by ruthlessly slashing prices.

It is doubtful, however, if this practice will prove altogether salutary. It is true that a number of jobbers are now receiving large and frequent shipments as a result of their lack of caution in buying when it was generally under-

stood that a full w[illegible] imminent, and as a consequence must in some way obtain funds with which to pay their bills. On the other hand, it would seem to be unwise at this time to obligate further the dealer or contractor who already is having trouble in meeting his bills properly.

In socket merchandise which is sold over the counter a slash in price, provided that it stimulated consumer buying, might prove beneficial in strengthening credit all along the line by generally increasing cash received. On the other hand, wiring supplies for construction work are not being rapidly absorbed by the final consumer, nor is it conceivable that any decrease will hasten their movement. To move faster there must be a general decrease in the other and larger building costs, such as labor, steel, brick, lumber, etc. It would naturally be advisable for wiring supplies to keep pace in any downward movement in building costs. But to load up contractors with electrical supplies for which the demand from new construction is bound to be smaller before it is greater hardly seems advisable as a credit proposition just now.

Brighter Prospects for Electrical Market in Montana

THE general trend of thought throughout the country in so far as the electrical market is concerned appears to overestimate the dullness of the Montana field. It is true that conditions are not what the contractors, jobbers and dealers would like to have them, but withal they are not much poorer than in 1919. Virtually no new construction work is in progress owing to the high prices of material and to labor difficulties, with the exception of two new theaters under construction at Missoula and Great Falls, both thoroughly equipped electrically. In Montana as elsewhere the tightness of the money market has had a marked effect on the electrical business. Restriction of credits has had a tendency to keep dealers' purchases close.

The future market is dependent on three factors: money, crops and labor. While it is impossible to predict with any degree of accuracy, the belief is general that the first of the year will find a gradual loosening of the tension in the money market.

Montana crop prospects are excellent; in fact, the year's yield is assured and the farming communities are beginning to take up their paper at the banks. After four successive failures this is one of the brightest spots in the immediate future.

Labor trouble appears to have passed the peak, and it is felt that the need for new buildings will bring a general resumption of construction in the spring.

The improvement of conditions in the farming districts on account of the excellent crops is expected to bring an increase in the sales of farm-lighting plants.

The average appliance sale is not expected to be much under the two preceding years in all sections of the state. In this connection it is interesting to note that the power companies are co-operating in the most friendly spirit with the jobbers and dealers to their mutual advantage, the companies evidently appreciating the assistance given by the dealers as load builders.

Electrical Jobbers Doing $50,000,000 Business Annually

MORE than 2,000 persons are employed in New England electrical supply jobbing establishments, said W. F. Abely, president of the New England Electric Supply Jobbers' Club, at the recent Kineo convention of the New England Geographic Division, N. E. L. A. More than 250 traveling salesmen are employed by these houses, not counting representatives of manufacturers traveling among the trade. Men of the highest grade, worthy commercial ambassadors, the speaker said, are in this service. New England jobbers now have an investment of about $20,000,000 and are doing an annual business of from $50,000,000 to $60,000,000. The value of the jobbers' representatives in fostering popular good will toward public utility investments and administration was emphasized at the convention.

Automobile Slump Reflected in Electrical Output

JUST how serious the slump in the automobile market has been and just what its effect on the electrical business will be will probably never be known. It is certain that there will be available a large quantity of raw materials, factory space and labor for use elsewhere in the industry. So far as is known, every pleasure car and a large number of commercial makes are now equipped with electric starting and lighting outfits which mean the use of storage batteries, generators, wire, lamps and electrical instruments. All of these are made in large quantities by electrical manufacturers making similar equipment for general use.

Storage-battery manufacturers are feeling this situation more keenly perhaps than any of the others, except some wire manufacturers who make only automobile wire, because with most battery manufacturers the automobile market represented the major portion of the business. Owing to the contract arrangement battery manufacturers have with automobile producers, no price cut is expected to follow the lower automobile prices. Batteries are purchased by the car manufacturer on a basis which gives him the best price under existing costs, and this is checked monthly.

The lamp producers are in a more favorable position, because so much of the business is local, being caused by renewals. The sale of miniature lamps for automobile use is expected to go ahead of any previous year. Early estimates place it at 77,000,000 lamps.

Of course, instrument sales are for the most part a one-time sale, and naturally the condition of the automobile market is reflected in the output of dashboard electrical instruments.

Metal Market Situation

PRODUCERS' prices in the copper market are wholly nominal at present, and it seems that orders for large tonnages must be forthcoming before it will be known what prices will be really quoted. Competition among sellers is more active because large consumers are expected to enter the market again before long. This has caused a further weakening in the general tone of the market. Producers are expected to curtail production more radically than has yet been attempted as the result of this weakness, for surplus stocks of refined copper are already considerable and current buying is small.

In the outside market several interests are quoting October shipment at 17.25 cents delivered and are shading this as much as ¼ cent for f.o.b. refinery. The price of zinc and tin further declined a fraction of a cent the past week, and copper wire base eased off to 21 cents. In the scrap-metals market the condition of stagnation continues.

NEW YORK METAL MARKET PRICES

	October 5	October 11
Copper		
London, standard spot	96 7 6	96 10 0
	Cents per Pound	Cents per Pound
[illegible]	18 50	17 75
[illegible]	18 50	[illegible]
[illegible]	17 37	17 00
[illegible]	21 50-22 00	21 00
[illegible]	7 75	7 75
[illegible]	7 00	6 62½-6 87½
[illegible]	43 00	43 00
[illegible]	12 50	12 50
Zinc, spot	7 65-7 75	7 55-7 65
Tin	42 87	42.00
Aluminum, 98% [illegible]	35.10	35 10

OLD METALS

Heavy copper and wire	[illegible] 25	14 75-15 00
Brass [illegible]	8 00- 8 50	8 [illegible] 8 [illegible]
Brass [illegible]	6 [illegible] 7 00	[illegible] 7 00
Lead [illegible]	6 25- 6 50	6 00- 6 25
Zinc, old scrap	4 50- 5 00	4 50- 5 00

THE WEEK
IN TRADE

EXCEPT in the East prices of electrical goods are well maintained. In New England and New York jobbers are trying to move large stocks by cutting prices, in some instances under cost. Manufacturers' prices, except for wire, are being well maintained. Wire, however, is lower owing to lower copper and cotton costs.

Credits and collections are receiving more attention now than they ever did before. Collections are lengthening everywhere. Even some of the large utilities are taking longer to pay their bills. Credits naturally are much tighter and few new lines of credit are being opened. Jobbers are beginning to understand the necessity for watching dealers' stocks, and except in the East are not attempting to unload their large stocks on contractors.

Deliveries are improving and stocks are excellent except for iron conduit, motors from 1 hp. to 25 hp., wiring porcelain and 100-watt gas-filled lamps.

Building is slowed up everywhere as a result of falling prices, and no material improvement is expected in this industry before next spring. Retail demand has fallen off very decidedly for all socket devices, although demand is being kept up by stimulation in certain localities.

In view of the impending market readjustment it would be interesting to see how many jobbers took heed three or four years ago and instituted a sinking fund out of profits gained by advancing prices to absorb losses when the market turns.

NEW YORK

The most important developments of the week have been the further discounting of prices and a general tightening of collections. The opinion was expressed that a recession of 7 to 7½ per cent in prices in all lines would be an average figure, while some particular items such as wire and flexible armored cable had been selling at very near cost, this with the object of quickly reducing the stocks and liquidating credits. Further reductions in prices would not be unexpected. Although the time is yet too short to accept a lower volume of business as the standard, some jobbers have stated that business has been fair, even good, during the past week. In general the volume of business is steadily slackening owing to the lack of building and to the lack of interest on the part of the public in electrical goods priced as at present. The demand for lamps and heaters has picked up somewhat; a few jobbers report sales in excess of the same period last year, but others find that the opposite is now the case.

The fact that collections have not lengthened during the past week is attributed solely to the greater activities of jobbers' credit men. A few jobbers are taking dealers' stocks back in lieu of payment. New accounts are being actively solicited by some jobbers in order to move their present stocks, but these accounts are being closely scrutinized before acceptance.

A considerable quantity of supplies has been placed in the local market by New England jobbers, it is reported, and this has had its effect on prices.

Wire.—The demand for wire is rather weak with large stocks. No. 14 rubber-covered wire is quoted at $10.50 to $11.50 per 1,000 ft., but sales are few at the higher figures and a cut to $10 per 1,000 ft. within a week or ten days is not unexpected.

Rigid Conduit.—Lifting of the Pittsburgh embargo allowed some well-assorted shipments to come through and the trade is brisk but in small volume. For ½-in. black conduit quotations range from $85 to $91 per 1,000 ft. in 1,000-ft. lots, $83 to $89 per 1,000 ft. in 5,000-ft. lots, and $90 to $97 per 1,000 ft. in small lots.

Flexible Armored Cable.—A strong buyers' market prevails, with prices made to satisfy the buyer. Two-wire No 14 cable is quoted at $92 per 1,000 ft. as against $94 quoted last week.

Schedule Material.—The manufacturers' prices are more stable than the jobbers'. The latter are in some instances selling this material at cost or less. Stocks are in fair shape, except sockets and porcelain. Shipments are improving.

Heaters.—The demand has strengthened considerably, and it is hoped that a further spurt will follow the electrical show. Stocks are in good shape and shipments are coming in satisfactorily. Prices are stable.

Socket Appliances.—The demand for most lines is weak; heating pads are selling well; deliveries in all lines are extremely poor. The high retail prices are not attracting any additional business, while the margin of profit, jobbers state, is not sufficient to cause them to have any large interest in these lines.

Lamp Cord.—Stocks are in good shape, considering the demand, which is not strong. No. 18 cotton-covered twisted cord is quoted at $30 per 1,000 ft. in 5,000-ft. lots.

CHICAGO

Slowly but steadily the electrical trade in this section is feeling the effect of reduced inquiries and lowered volume of new business caused by material price reductions in most other lines, while prices in this industry give every sign of stability. The retail trade is apparently awaiting developments, and this attitude is so marked as to limit seriously the effect of more than one carefully planned and executed sales campaign. This reduction in buying is more marked in the large cities than in the rural districts.

An encouraging feature is that farms are being equipped electrically just as rapidly as transformers and lighting plants can be turned out and every farm installation means an appliance customer. The buying pressure from the rural districts is not liable to fall off soon, as crop returns are coming in and the educational campaigns long under way are bearing fruit.

Contractor-dealers are experiencing a decided slump, as the enormous volume of repair and remodeling work put under way this summer is nearing completion and new work remains at a minimum. Building permits during September averaged about $800,000 per week. The present price uncertainty in all lines can have only an unfavorable effect on the construction industry. Jobbers in all lines are glad to see stocks getting back to normal shape.

Motors.—Fractional motors are plentiful, some makers being reported as reducing output and others as just nicely placed in regard to orders. Motors above 25 hp. are becoming more plentiful, jobbers being in good shape as regards stock on hand. Intermediate sizes, from 1 hp. to 25 hp., are as hard to get as ever, there being practically no units available for prompt shipment and makers requiring nine months for delivery. No price changes are anticipated.

Distribution Transformers.—Although demand from central-station companies is at a minimum, sales to farmers are keeping manufacturers working to a capacity. A large volume of business has recently been placed for 6,600/220/110 transformers for rural use. This class of business is steadily on the increase.

Farm-Lighting Plants.—With the harvest out of the way demand is again heavy. From all sections of the Mid-West and Northwest dealers report ready sale of all available apparatus. Makers who increased production capacity this summer find their entire output rapidly absorbed.

Second-Hand Apparatus.—Expectation of price reductions has caused an abrupt falling off in call for used equipment. The fact that most dealers had but small stocks is preventing any worry on their part. When prices are seen to be stable this branch of the trade should experience renewed activity.

Tape.—Demand from large consumers continues uniform and supply of all kinds is adequate. A standard rubber

tape is quoted, in 100 lb. lots, at 92 cents per pound, friction tape at 79½ cents per pound; broken lots, 10 cents higher.

Washing Machines.—Slump in retail trade has caused a material decline in washing-machine distribution. All dealers under contract are reported as accepting their full quota of machines to date.

BOSTON

Trade has been active within the past week, but local price reductions on wiring materials announced in the Oct. 9 issue have not stimulated buying to any great extent. The general volume of business is excellent among jobbers. Barring a cut in the price of weatherproof wire prices have been steady. Deliveries continue to reflect improved transportation conditions, except that in the porcelain and rigid conduit fields shortages exist. Collections are still rather unsatisfactory and are being sharply followed up. Some complaint is heard as to slow payments to jobbers by even large public utilities. Labor conditions tend to grow more favorable. In the textile field cuts in wages as high as 15 per cent are reported, and it is believed that reductions will soon extend to other fields, as the amount of non-employment is increasing slowly. Contractor-dealers are substantially stocked with wire materials and much needed home construction is still greatly retarded by high labor and material costs in general.

Rigid Conduit.—Larger sizes are very scarce. Railroad congestion in the Pittsburgh district is hampering deliveries. Prices are steady. Quotations on 1-in. galvanized pipe are $200 per 1,000 ft. and on ½-in. $102. Black pipe sells for $96 per 1,000 ft. in the ½-in. size and $189.50 for the 1-in. diameter.

Radiant Heaters.—Protracted warm weather has allowed jobbers' and retailers' stocks to accumulate. The early fall trade, however, was excellent, and brisk movement is anticipated later in view of the high price of coal and the rationing system in vogue. Representative heaters sell for list less 30 per cent in lots of six, with 30 per cent and 5 per cent on larger orders.

Tubes.—The Boston market is practically cleared of 3-in., 4-in. and 6-in. tubes. Prices are very unstable and deliveries of about three weeks are being promised. Unglazed cleats, two-wire type, are also very short, and three weeks' delivery is quoted.

Weatherproof Wire.—One manufacturer cut his base price to 23.75 cents last week. Weakness in the cotton-braid market is believed to be responsible. There is plenty of wire coming in now, although occasional shortages are still to be overcome.

Non-Metallic Flexible Conduit.—Steady prices rule since the local reduction announced last week. In 5,000-ft. lots, ⅜-in. loom sells for $29 per 1,000 ft., and ½-in. for $33. The demand is not very heavy.

Sockets.—Good supplies are noted, and prices are easy. Pulls bring 45 cents, keys 26 cents, and keyless 24 cents, in case lots. A tendency toward overstocks can be seen.

Appliances.—Washing machines are moving rapidly, and much interest is to be seen in motor-driven ironers and suction cleaners. Stocks are being maintained well. Active retail campaigns are in progress.

Fuse Plugs.—Stocks are substantial and the demand is fair. Up to 30 amp. the price is $4.75 per 100.

Lamps.—The New England demand holds up well, and manufacturers appear to be meeting it comfortably by careful control of shipments.

Motors.—Further moderate improvement in deliveries is to be seen.

ATLANTA

Cotton picking appears to be progressing more rapidly, the past week of excellent weather having assisted materially in getting in the crop; but this year the season is approximately two to three weeks behind that of 1919 and four weeks behind that of 1918. This is causing a delay in the liquidation of outstanding accounts in the rural districts and, coupled with the low price, is serving to slow up the receipts of orders. Building activities in the large centers continue to hold up well, and it is freely predicted that the break of $2.50 per barrel in the price of cement and the lower lumber market will stimulate building projects throughout the section. Permits for the twenty-five principal cities of the sixth Federal Reserve district for August total $4,520,000, this being a decrease of $686,000 over August, 1919. Hardware sales, however, show an increase of approximately 20 per cent for the same period.

The transportation situation has eased up considerably, and all jobbers report receipts of generous quantities of material. Nearly all jobbers report fairly satisfactory stocks in sight. There are a few lines still short, however, but indications are that they will improve quite rapidly.

Schedule Material.—Fairly respectable stocks of all wiring devices have been accumulated, and the only shortage that still exists is in the porcelain line, articles such as cut-outs, rosettes and so forth being short. The demand is holding up exceptionally well and shipments continue to improve.

Heaters.—The unseasonable cold snap of last week brought the radiant heater line to life and jobbers report an excellent retail and wholesale business as a result. Good stocks are on hand, and predictions are freely made that this will be a big year for this specialty.

Vacuum Cleaners.—This line shows a sustained popularity, due in a measure to the activities of the dealers and jobbers in pushing their sales. Stocks are reported good and shipments satisfactory.

Ornamental Lamps.—The trade anticipated this season will equal, if not exceed, that of last year and stocks are being accumulated to meet the expected demand. Jobbers already report the receipt of some orders from the retail trade. No price reductions have yet been announced, though a general reduction in furniture lines would be expected to cause a sympathetic break in these articles also.

Stamped-Steel Boxes.—Stocks are still low with shipments rather unsatisfactory. Jobbers report little let-up in the brisk demand that has existed for several months past.

Farm-Lighting Outfits.—This specialty continues to move satisfactorily and is expected to speed up as the result of demonstrations at the county fairs which will be held throughout the South within the next fortnight. Stocks are somewhat depleted, with shipments averaging approximately three weeks.

Storage Batteries.—Jobbers report fair stocks on hand, though some shortage still exists in special types. The increase in orders due to the normal fall business is already in evidence, and a big season is predicted.

ST. LOUIS

There has been very little change from last week in general business conditions, and though a quiet market has prevailed for some time small concern is manifested by either jobbers or manufacturers. The feeling is general that there is no genuine basis for a price decrease on electrical products just now, and jobbers believe that while business may be a trifle slow for a time, the price cutting in other lines will not react on electrical lines to any great extent. According to some jobbers, the quiet conditions have made themselves felt not in the number of orders received but in the amount of each order, customers ordering only for their immediate needs and in some cases stipulating that unless immediate delivery can be made the order be canceled. As a result stocks of jobbers are short or incomplete in only a few instances. Some long-continued shortages, such as large motors and small porcelain, are being overcome. On the other hand, there is little chance that even with the quiet market jobbers' stocks in most lines will be complete before the first of the year.

Building conditions have not improved in spite of a slight drop in the material market. A number of large buildings are being contemplated and construction will start in the spring if conditions warrant it.

Knife Switches.—There is a good stock in jobbers' hands and a good demand is reported also. In some parts of this territory, notably southern Illinois and the larger cities of Missouri, the safety switch is cutting in considerably on the demand for the knife switch. This is mostly for industrial work, and the small towns of the state continue to absorb a good part of the supply. Some jobbers report being about three weeks behind in deliveries but are rapidly catching up. There has been an advance of 10 per cent on knife switches made by the Frank Adam Electric Company, making the quotations 70 cents for the 30-amp. two-wire, $1.30 for the 60-amp. two-wire and $2.65 for the 100-amp. two-wire, with a 10 per cent discount on orders over $100.

Motors.—Shipments of motors from 20 hp. to 200 hp. are characterized as very good with a fairly good demand. Jobbers are scouring the market for 1, 2, 3, 5, 10 and 15-hp., 800-r.p.m., 50-cycle, three-phase motors, for which many inquiries are coming in. They also are in need of split-phase motors in fractional sizes.

Knobs and Tubes.—Practically all jobbers report heavy stocks, some saying they are overstocked. This does not apply to high-tension porcelain, of which there is still a scarcity. The demand for knobs and tubes continues subnormal, and little activity is looked for until building is resumed. The 3-in. x ⅝-in. tubes are still quoted at $9.90 in lots of 1,000, and the 5½ new code "Nail-it" knobs are quoted at $32 per 1,000.

Bells, Buzzers and Annunciators.—Stocks locally are sufficient to supply a steady demand, and jobbers report good deliveries from manufacturers.

Flashlights.—Some jobbers report good stocks, others incomplete stocks, and there is a good deal of interhandling. There has been a steady demand, and this is expected to grow better as the fall buying season advances. A large portion of the business is being done by wholesale hardware houses.

Farm-Lighting Plants.—There are large stocks on hand and jobbers can make good deliveries on almost any quantity. Demand fell off considerably during September, but October business is showing signs of recovery though demand may still be characterized as quiet.

SAN FRANCISCO

Generally speaking, business is dull throughout California. The early rains will soon remove the power restrictions on sign and street lighting and the "skip-stop" street car regulations. These rains fortunately have done no damage to the crops. Labor conditions look threatening because a complete tie-up of all building in San Francisco may result through claims made by the unions that a special rate paid some of them by certain contractors should become effective for all.

Batteries.—An intensive campaign, especially on packed assortments for use as units, has proved rather disappointing in its results. In some cases dealers have put in nice stocks which have not moved, and in other cases the public seems willing to buy but cannot locate the supply.

Sewing Machines.—Demand has picked up although it is poorer than during the same months of 1919.

Motors.—Deliveries are slightly better, but are still very poor, the greater part of a year being taken for styles that are rated as standard.

Insulating Material.—Coast stocks as a whole are maintained in good fashion in the face of excellent orders. Several large orders from the government for insulating varnish are reported.

Tools.—The large amount of power construction and the decision that the business had grown to proportions that required good service from coast stocks have resulted in excellent stocks of line-construction tools being carried by jobbers. Fine sales that have justified this practice are reported.

Ironers.—Distributers are persistently demonstrating and advertising this device. They say it is being favorably received wherever shown in action.

Cleaners.—Perhaps no electrical appliance has been sold to consumers in greater numbers than the electric cleaner. Competition among the different makes has been very sharp, and prospective customers have had opportunity to test the relative merits by free demonstrations in their homes.

Electrical Pumps.—Many farmers in the Intermountain region are turning to electric pumps as a solution of their problem of providing water.

Radiant Heaters.—Every live dealer is pushing this line and in most cases with fair success. This promises to be a profitable month.

Heating Appliances.—The trade in this field is quiet. Indications point to a boom at the approach of the pre-holiday season of buying. Stocks are ample.

SEATTLE—PORTLAND

Conditions in Seattle and Puget Sound district remain about the same, with domestic appliances moving well and an increasing call for lamps. Deliveries in most cases are improving satisfactorily, and stocks with but few exceptions are in good shape. Jobbers particularly report business good. Part of the work at the present time is filling of back orders, although the volume of new business is fair. Pipe and porcelain and certain lines of heavy equipment have been advanced recently to cover increased freight.

In Portland the general impression seems to be that buying is beginning to slacken somewhat. This appears to be the feeling in railroad circles. Wool warehouses are full and material is not moving. Lumber is about at a standstill because of excessive freight rates. Manufacturers' agents report that while they have noticed no difference in their business for the past week, yet the impression seems to be general that there will be a quiet period ahead and the movement is already setting in in some lines of business. Lamps are moving fast owing to the season of the year. Meter stocks are still behind, with little prospect of improving before the first of the year. Collections remain about the same and very few new extensions of credit are being made.

Portland jobbers report good business. Washing machines, lamps and heating appliances such as toasters and percolators are selling well. A new shipment of conduit temporarily places stocks in fair shape. Conduit deliveries from the factory are improving very materially. Contractors report that business is about the same as it has been. Residence building seems to be improving very materially, but most of the wiring work in residences is being done by the small wiremen. Retail stores report business continuing active, appreciably better than a year ago, although not materially different from the past two or three weeks. Retailers' greatest demand is for lamps and domestic appliances. Dry cells have advanced in price 5½ cents apiece recently. A part of this is increased freight rates.

SALT LAKE CITY—DENVER

A better tone prevails in the electrical market with settled labor conditions. Collections are better and money is becoming slightly more plentiful. Electrical dealers are growing optimistic about the immediate future. The harvesting of the beet crop, which puts more money in circulation than any other agricultural source of income, is now in full swing. The farmers will get their first payment for beets delivered on Nov. 15. There is more money in circulation this fall than there was a year ago, but the buying tendency is more conservative. Buyers are especially interested in electrical labor-saving devices. Washers, sweepers and flatirons are having a pretty fair sale in most quarters. People are extremely conservative and discriminating. They are not in the market for any device that is at all in the classification of a luxury. Electrical jobbers and dealers of Utah took advantage of the state fair just held at Salt Lake City. Upward of a dozen concerns had displays and conducted demonstrations.

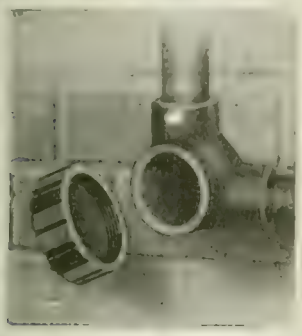
Washing Machines.—There seems to be a tendency toward the cylinder type of washers, which range in price from $150 to $190.

NEW APPARATUS & APPLIANCES

A Record of Latest Developments
and Improvements in Manufacturers' Products
Used in the Electrical Field

Angle Fittings for Conduits

A galvanized weatherproof fitting for outside conduit construction for use where a neat, short right-angle turn is necessary has been developed by the Utility Fittings Company, 812 Walnut Street, Philadelphia. This fitting can

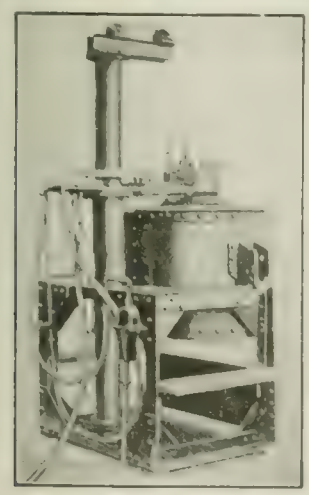


FITTINGS FOR USE ON SQUARE CORNERS

also be used for a pull box. It has a smooth interior with well-rounded corners to enable passage of wires without injury. The threads for the closure cap are on the outside of the fitting.

Repelling Arc Furnace

An electric melting and refining arc-type electric furnace with a new system of operation has been brought out by the Industrial Electric Furnace Company of Chicago. The furnace is built for direct current or single-phase or three-phase alternating-current operation, with two electrodes for the first two types and three for the lat-

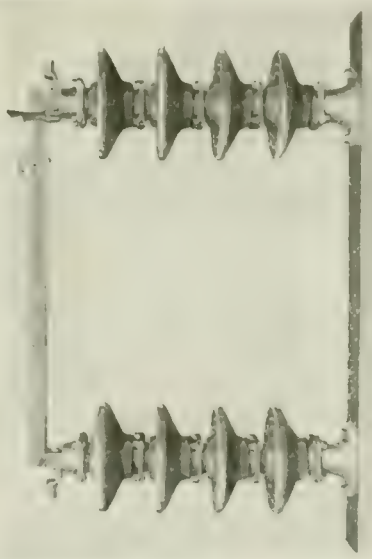


HOIST TRANSFERS ELECTRODES FROM ONE SHELL TO A SECOND

ter type. The electrodes are balanced so that they hang together when no current is flowing. The arc is formed by the mutually repelling force when current flows in the electrodes. The extent of this action is regulated by balance weights on the electrodes.

High-Voltage Unit-Type Disconnecting Switch

For 66,000 volts and higher the Delta-Star Electric Company, Chicago, has developed a new type of outdoor disconnecting switch, using interchangeable insulators and fittings. This switch can be mounted in vertical or underhung position, and, if desired, angle fittings can be inserted at the base and contact elements, placing the insulators



INSULATORS EASILY REPLACED

in 45-deg. position. Any insulator unit can be removed and replaced.

The switches are of the truss blade construction, being provided with blade guides and safety locks.

Notes on Recent Appliances

Quenched Gap for Radio Apparatus

A quench gap for radio equipment for amateur use has recently been developed by the American Radio & Research Corporation, 21 Park Row, New York City.

Electric Heater with Three Elements

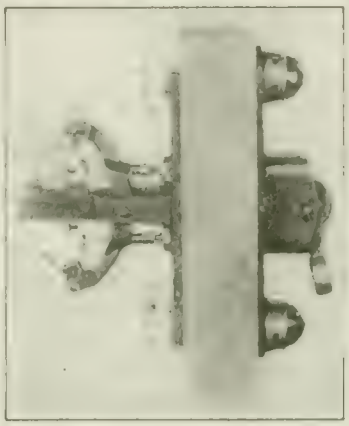
The Majestic Electric Development Company, San Francisco, Cal., has placed on the market an electric heater with a three-unit heating element.

Concentrated Filament in Small Vacuum Lamps

A spiral filament is used in the vacuum type lamp developed by the Paragon Incandescent Lamp Works, 70 West 14th St., New York City. This is the same type of filament commonly used in the larger gas-filled lamps. These lamps are made in 25-watt and 60-watt sizes for 110 volts, and in a 60-watt size for 220 volts. The bulbs are furnished in plain or daylight tinted glass.

Remote-Control Switch

A switchboard remote-control switch which indicates whether the switch controlled is open or closed by lamps, by

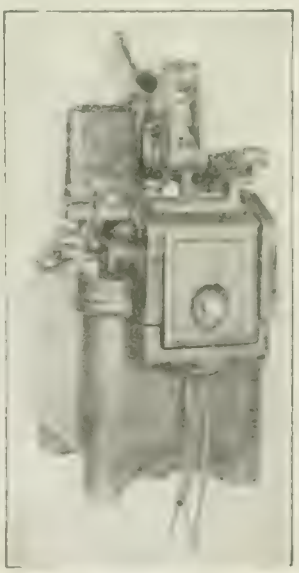


NEW TYPE AUXILIARY CONTACTS

the position of the lever and by a red or green target has been developed by the Lewis & Roth Corporation, Philadelphia.

Standardized Solenoids for Oil Circuit Breakers

A solenoid mechanism for operating oil circuit breakers made up of standard changeable units has been devel-



SOLENOID MADE OF STANDARDIZED PARTS

oped by the General Electric Company, Schenectady, N. Y. The outdoor-type solenoid is completely inclosed.

MANUFACTURERS' ACTIVITIES

Record of Changes Affecting Sales and Distribution Together with Trade Personals and Notes on Foreign Trade, Jobbers' News and New Trade Literature

MARIS BROTHERS, Philadelphia, have been incorporated and will continue business under the firm name of Maris Brothers, Inc.

THE W. R. BOSSINGER BATTERY COMPANY, Cleveland, Ohio, is building a 50-ft. x 60-ft addition to its factory, at an estimated cost of $25,000.

THE MARING WIRE COMPANY, Muskegon, Mich., has increased its capitalization from $100,000 to $200,000. The company manufactures insulated magnet wire. F. L. Messke is president.

THE BENJAMIN ELECTRIC MANUFACTURING COMPANY, Chicago, is opening up a publicity campaign on its No. 92 two-way plug through the extensive use of periodical advertising and window displays.

THE AMERICAN ENGINEERING COMPANY has opened a new office in Cincinnati for the purpose of extending Taylor stoker representation and service. M. M. Masson is in charge of this office at 207 Neave Building.

KING WASHING MACHINE COMPANY, Wolcott, Ind., has recently announced the appointment of T. R. Allen as general manager and O. B. Askren as general sales manager, effective Sept. 1, 1920. Both of these men have had a wide experience in the field, it is stated.

THE VICTORY STORAGE BATTERY COMPANY will soon open a manufacturing plant at 124 South Sixth Street, Louisville, Ky., according to a statement by Arthur Cummings, president and principal stockholder. The company is incorporated for $20,000, but plans to increase this amount considerably within a few months.

O. F. CONKLIN, president of the Remy Electric Company of Anderson, Ind., who had also been acting general manager for several months, has announced the appointment of James D. Mooney, recently of New York as general manager. Mr Mooney had been the assistant general manager for two months.

A. F. CHAMBERLAIN, manager of the New York office of the Robbins & Myers Company, has been appointed general manager of the company's Canadian factory at Brantford, Ontario. He has already entered upon his new duties. Roy Booth remains factory superintendent. For the present Mr Chamberlain is spending part of his time in Canada and part in New York.

APEX CLEANER PRICE NOT TO BE REDUCED.—Announcement has been made by the Apex Appliance Company that prices of cleaners and ironers will not be reduced prior to Jan. 1. The company states that there have been no cancellations of orders such as have been made in other lines. High labor and material prices are the reasons given for not being able to reduce prices.

THE ELECTRIC MACHINERY COMPANY, Minneapolis, Minn., on Sept. 28 was adjudicated bankrupt by the United States District Court and the first meeting of its creditors will be held in the Federal Building, Minneapolis, Oct. 19, at 10 a.m., at which the creditors may attend, prove their claims, appoint a trustee, examine the bankrupt and transact such other business as may properly come before the meeting.

CABINET AND CUT-OUT BOX STANDARDS REVISED.—The Underwriters' Laboratories have notified holders of cabinet and cut-out box standards of revisions in these standards. Data sheets [illegible] are used with or without an insulating lining. For [illegible] to be used as barriers. When the box proper [illegible] for their full length by turning them at [illegible]

WESTERN ELECTRIC SALES SHOW RECORD GAIN.—Despite difficulties experienced in obtaining raw materials, delays in transportation and shortage of labor, the volume of business reported by the Western Electric Company is running at a higher rate than at any other period in the company's history. For eight months of the current year, according to an official statement, its domestic billings showed a total volume of $119,500,000, indicating domestic sales for the year of approximately $190,000,000. This does not include its export business from America nor sales of its foreign affiliated companies. The export and foreign business will probably reach a volume of $38,000,000, bringing the total business up to more than $225,000,000 for the year. It is stated that the domestic sales will exceed the 1919 business by over $60,000,000, and are greatly in excess of the company's largest previous year, 1917, when domestic billings amounted to $142,000,000. There has been an increase of unfilled orders on the company's books from $47,400,000 on Jan. 1 to over $85,000,000 on Sept. 1, deliveries in many instances being scheduled for 1921 and 1922.

DUBILIER WINS MICA CONDENSER PATENT SUIT.—In the infringement suit of the Dubilier Condenser Company, Inc., against the Wireless Specialty Apparatus Company, a final decree was handed down by Judge Augustus N. Hand of the federal court for the Southern District of New York, on Oct. 4, 1920, holding that Patent Nos. 1,229,914 and 1,229,915 are good and valid in law as to the second, third, fourth, fifth, seventh, eighth, ninth, twelfth, fourteenth and fifteenth claims of No. 1,229,914 and as to the first, eighth, twelfth, sixteenth and seventeenth claims of No. 1,229,915. The Wireless Specialty Apparatus Company was held to have infringed these patents by manufacturing, selling and using, or causing to be manufactured, sold or used, condensers embodying or employing the inventions of said claims of said letters patent. The fourth claim, relating to patent No. 1,229,915, was held invalid in law, being anticipated by the prior use of the subject matter thereof by the United States Navy and the National Electrical Supply Company of Washington, D. C. The above cause covered mica condensers, especially the high-tension type, in which brush discharge is eliminated.

EMERSON SEES NO IMMEDIATE PROSPECTS FOR LOWER SMALL-MOTOR PRICES.—In the October issue of its monthly house organ the Emerson Electric Manufacturing Company, St. Louis, Mo., says that while no further advance in prices of small motors is anticipated at this time, there seems to be no immediate prospect of lower prices on such highly manufactured metal products as small electrical apparatus. Purchasers, the company states, must keep in mind that prices of such goods have never been advanced to levels two and three times the pre-war basis, as has been done with many staples and necessities which are now declining.

Supply Jobbers' Notes

A. E. WISE, for many years in the accounting department of the General Electric Company, has recently become associated with the Sibley-Pitman Electric Corporation as credit manager.

THE NORTHWESTERN ELECTRIC EQUIPMENT COMPANY, St. Paul, Minn., has recently made several changes and additions to its organization. Frank T. Meyer, formerly of the General Storage Battery Company, has been added to the sales force and will specialize on batteries, rectifiers and allied lines in the Minneapolis territory. C. A. Dean will handle these lines in North Dakota. Donald Napier, who has been a salesman in the battery department, has been promoted to sales manager.

Foreign Trade Notes

LISTS OF IMPORTERS IN NORWAY.—Lists of the principal importers in Norway have been prepared by the commercial intelligence section of the Bureau of Foreign and Domestic Commerce. These lists not only show the nature and character of the business but are starred to indicate the relative importance and size of each firm in its community. These lists may be obtained from the bureau or its district and co-operative offices.

WESTERN ELECTRIC'S EXPORT AND FOREIGN TRADE.—An official statement made public by the Western Electric Company concerning its foreign business says: "The export and foreign business is expanding. The New York office has recently announced the organization of a new company in the Argentine to take care of the telephone requirements of the countries in the southern part of South America. The Canadian branches have substantially increased the volume of their business over previous years. The company's factories in Antwerp and London are both running to full capacity, the London factory turning out a larger volume of material than in the pre-war days. The Antwerp factory, which was in control of the Germans during the war and has since had to be completely rehabilitated, is now gaining and should reach the pre-war rate of production by the end of the year. The Italian business has lately suffered, in common with other Italian industries, by reason of the labor troubles, but these seem to be in process of satisfactory adjustment. A separate company has recently been organized in Norway to care for the increasing Scandinavian business. The branches in Australia, Japan and China, are all running at a satisfactory rate. While the company's business in its many foreign branches throughout the world has expanded considerably in 1920, the present indications are for still further growth in 1921."

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A commercial agent in France (No. 33,820) wishes to represent, on a commission basis, manufacturers of electrical apparatus, lamps, wire and cable.

The owner of a machine shop in Spain (No. 33,815) desires to purchase a complete electric welding apparatus.

The representative in the United States of a manufacturer's agent in Colombia (No. 33,829) desires to secure the agency for electrical supplies.

An import and export agent in Jugoslavia (No. 33,838) desires to establish commercial relations with firms handling electric motors and accessories. Correspondence may be in English.

Trade Publications

CARBON ELECTRODES.—The National Carbon Company, 32 East Forty-second Street, New York, has distributed an instructive eighteen-page booklet on carbon electrodes for electric furnace use.

BATTERY CHARGING.—The H. B. 32-battery charging outfit is described in a new folder being distributed by the Hobart Brothers Company of Troy, Ohio.

STEAM INSULATION.—Under the title "Defend Your Steam," the Magnesia Association of America is distributing an eighty-page booklet telling of the advantages of 85 per cent magnesia.

WIRE SCREENS.—The W. S. Tyler Company, Cleveland, Ohio, is distributing a new catalog, No. 50, covering wire screens for various purposes.

BATTERY CHARGING EQUIPMENT.—The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has issued publication No. 834, superseding booklet R, which describes its rack for charging motors' lamp batteries.

CONTROL.—"Steel Mill Control" is the title of a new forty-eight page booklet, published by the Cutler-Hammer Manufacturing Company, of Milwaukee, Wis., telling briefly the story of iron and steel from the ore in the mine to the finished product of the steel mill, and explaining how Cutler-Hammer products have aided in mining and ore handling and in furnace and steel-mill practice.

AUTOMATIC ARC WELDER.—The General Electric Company, Schenectady, N. Y., has issued booklet No. B-3575, covering automatic arc welders.

BATTERY-CHARGING BOARDS.—The Allen-Bradley Company, Milwaukee, Wis., has issued bulletin No. 1-1210, covering unit-panel battery-charging boards for electric vehicles and trucks.

MILL AND CRANE CONTROLLERS.—The Allen-Bradley Company, Milwaukee, Wis., has issued a circular No. F-2250 covering graphite compression-type mill and crane controllers.

ELECTRIC WASHERS.—The Hurley Machine Company, Chicago, has issued a brochure entitled "You and Your Laundry," covering advantages of electric washing machines.

AUTOMATIC STARTERS.—The General Electric Company, Schenectady, N. Y., has issued leaflets Nos. 68,133 and 68,136, covering series contactor-type automatic starters for direct-current motors.

PRICE LISTS OF CAR EQUIPMENTS.—The General Electric Company, Schenectady, N. Y., has issued bulletin No. 44,001-P, to supersede No. 44,001-O, of prices on renewal parts and supplies for car equipments, mine locomotives and railway and mine line material.

FEED-WATER HEATERS.—The Griscom-Russell Company, 90 West Street, New York, has issued bulletin No. 260, covering feed-water heaters.

New Incorporations

THE GRAYS ELECTRIC LIGHT COMPANY, Grays, Ky., has been incorporated with a capital of $3,000 by J. T. Gray, J. J. Young and S. T. Weidner.

THE ELECTRICAL TRANSMISSION COMPANY OF NORTHERN INDIANA has been incorporated with a capital of $75,000 for the purpose of providing the smaller towns in the vicinity of Goshen, Ind., with electrical current. The directors are Frank E. C. Hawks, Herbert H. Gortner and Owen Cover.

THE SOUTHWESTERN PENINSULA POWER COMPANY, Seattle, Wash., has been incorporated with a capital stock of $500,000 by Frank McKean, C. P. Allison and James E. Murray.

THE DIAMOND GRID BATTERY & ELECTRIC COMPANY, Ashland, Ky., has been incorporated with a capital of $... by T. P. Owland, J. H. Brant and C. F. Higgins.

THE HART COMPANY, Williamsport, Pa., has been incorporated at $100,000 by W. Hart, H. A. Miller, L. W. Gleason, H. E. Specht, W. S. Carson, B. R. Munson and H. S. Kolb to conduct a business as brass founders and finishers.

THE BATTERY & ELECTRIC COMPANY, Greenville, S. C., has been incorporated at $15,000 by C. J. Snow, J. B. Chisolm and L. D. Chisolm.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

KITTERY, ME.—The Consolidated Construction, Power & Mining Company, recently organized with a capital of $1,000,000, contemplates the erection of a power plant in connection with its mining and quarrying operations in this locality. John O'Donnell is president.

HOLYOKE, MASS.—The New England Telegraph & Telephone Company, 119 Milk Street, Boston, contemplates the erection of a telephone exchange building at Elm and Suffolk Streets in Holyoke.

WORCESTER, MASS.—Plans have been filed by the F. L. Horton Corporation for extensions and improvements to its power house on James Street.

Middle Atlantic States

WHITE PLAINS, N. Y.—It has been reported that the power house at the plant of the Thompson Brothers, Westmoreland Avenue, has been damaged by fire.

TRENTON, N. J.—The New Jersey Tile Company, Murheid Avenue, contemplates the erection of a power plant in connection with extensions to cost about $50,000.

LANCASTER, PA.—It has been reported that plans are under way for the construction of an electric power plant on the Susquehanna River to develop an ultimate capacity of 100,000 kw. The cost is estimated at $3,000,000. Congressman W. W. Griest and others have applied for charter.

LANDSDALE, PA.—A holding company is being organized by local industrial concerns to raise $50,000 for additional equipment to be installed at the municipal electric light plant. O. W. Montgomery of the Hunter Pressed Steel Company is interested.

SCRANTON, PA.—The Scranton Electric Company, 509 Linden Street, has made arrangements for an issue of $1,000,000 in bonds, part of the proceeds to be used for proposed extensions and improvements to its electric power plant, transmission and distribution system.

BALTIMORE, MD.—The American Sugar Refining Company, 117 Wall Street, New York City, contemplates the erection of a 110-ft. x 130-ft. power plant in connection with its new plant near Baltimore.

BALTIMORE, MD.—The General German Orphan Asylum, 224-242 Aisquith Street, contemplates the erection of several asylum buildings, including a central power plant at Catonsville, to cost about $150,000. W. M. Greske, 65 Gunther Building, Baltimore, is architect.

FAIRFAX, VA.—It has been reported that an electric light representative from Washington, D. C., is interested in the proposition to install electric lights in Fairfax, the transmission line to run through West Falls Church and Vienna. The extension of this line to Herndon will also be considered.

ROANOKE, VA.—The Norfolk & Western Railroad contemplates an addition to its electric plant at Roanoke to cost about $300,000.

WASHINGTON, D. C.—Bids will be received at the office of the United States Engineer, 305 Southern Building, until Nov. 10 for furnishing and installing electrically driven centrifugal pumps, motor-generator sets, transformers and switchboards. Further information may be obtained on application to above address.

North Central States

FLINT, MICH.—The Industrial Ignition Company will have work started soon on the construction of a power house to cost about $60,000.

HURON, OHIO.—The installation of new machinery has been recommended for the old municipal light and power plant located at the New York Central Railroad tracks.

LOUISVILLE, KY.—At a recent meeting of the Engineers' and Architects' Club, a committee composed of Lewis S. Strong, engineer of the Louisville Gas & Electric Company, and others was appointed to make investigation and report as to the feasibility of harnessing the Ohio Falls at Louisville for power generation purposes.

WHITESBURG, KY.—W. C. Daniel & Son contemplate the erection of a steam power house and plan to install one 50-kw. alternating-current, 125-volt generator with switchboard complete.

CHICAGO, ILL.—The Kroeschell Brothers Company, 460 West Erie Street, is having plans prepared for a power plant to be used in connection with its proposed ice machine factory. The total cost is estimated at $800,000. Neiler, Rich & Company, 431 South Dearborn Street, are engineers.

MILWAUKEE, WIS.—Milwaukee County will be asked to appropriate $50,000 for lighting the county roads west of Grand Avenue. The county board committee on roads and bridges has suggested that the power be furnished by the county infirmary. It has also been recommended to light the Grand Avenue viaduct from the same source.

RHINELANDER, WIS.—The Rhinelander Light & Power Company contemplates the extension of a transmission line from Monico to Elcho.

STEVENS POINT, WIS.—The Chamber of Commerce is considering the proposition to install an ornamental street-lighting system.

VERONA, WIS.—The Verona Light & Power Company contemplates the erection of a transmission line to cost about $15,000. F. M. Conlee, Washington Building, Madison, is engineer.

CURRIE, MINN.—At a recent election bonds to the amount of $13,000 were voted for the erection of an electric light plant. C. A. Portmann is city clerk.

OWATONNA, MINN.—The City Council has authorized the preparation of plans for the issue of bonds for the erection of a municipal light, power, heat and gas plant. C. J. Servatins is city clerk.

JEFFERSON, MO.—A company has been organized by Arthur T. Nelson, president of the Lebanon Bank, Lebanon, Mo., for the purpose of erecting a hydro-electric plant on the Niangua River.

ST. LOUIS, MO.—The James Black Masonary & Contracting Company, Wright Building, has appointed J. C. Moore, engineer, of Seattle, to prepare plans for a power plant.

Southern States

HAINES CITY, FLA.—The Fruit Growers' Express Company, care of A. J. Nye, Orlando, has work under way on the construction of an ice plant to cost about $150,000, including machinery. The generation of its own electricity or the erection of a transmission line from Lakeland is under consideration by the company.

ROGERSVILLE, ALA.—The Rogersville Light & Power Company contemplates the construction of a plant to cost about $10,000.

SHREVEPORT, LA.—At a recent election bonds to the amount of $25,000 were voted for the construction of a fire-alarm system. Evans & Buxton, 328 Simon Building, are consulting engineers.

LITTLE ROCK, ARK.—The city officials are considering the installation of an extensive street-lighting system.

KENNEDY, TEX.—The Kennedy Oil Mill has been granted a franchise for the operation and installation of an electric light and power plant at this place.

LA PORTE, TEX.—It is reported that the plant of the La Port Light, Water & Ice Company has been damaged by fire to the extent of $26,000 and will be rebuilt.

TERRELL, TEX.—Bids will be received by the chairman of the City Commission until Oct. 25 in connection with waterworks improvements, for two 5-in. two-stage centrifugal pumps of 500, 600, 700 and 800 gallons per minute capacity against a 200-ft. head, direct-connected to two-phase or three-phase, 60-cycle, 2,200-volt electric motors; installation to be made complete, with all wiring, switches and transformers necessary to make currents interchangeable as between two-phase or three-phase.

Pacific and Mountain States

CENTRALIA, WASH.—A number of property owners on Tower Avenue have petitioned the City Commissioners, asking that a cluster lighting system be installed.

CHEHALIS, WASH.—The installation of a lighting system in Chehalis is under consideration.

DEER PARK, WASH.—Improvements to the plants of the Little Spokane Light & Power Company, including the erection of a forged dam and the installation of dynamos and waterwheels, will be made at a cost of about $15,000.

FREEWATER, ORE. Application has been made to the State Engineer by the Peacock Mill Company for permission to construct a power plant in Umatilla County. The first unit will cost about $140,000.

FRESNO, CAL. Application has been filed with the Railroad Commission by the San Joaquin Light & Power Corporation to issue $2,600,000 in bonds for paying off present indebtedness, providing for the actual construction of dams and power houses of the King River development and for the erection of dams and power houses, extension to lines, etc., during the coming year. A. G. Wishon is general manager.

LOS ANGELES, CAL. The Railroad Commission has authorized the Sespe Light & Power Company, Merchants' Trust Building, to issue $2,000,000 in bonds and $1,000,000 in stock for the construction of five hydro-electric power units on the Sespe River in Ventura County.

PASADENA, CAL.—S. P. Jewett of Alhambra has offered to enter into negotiations with the city officials to supply hydro-electric energy to the municipal light plant by impounding and utilizing the waters of the Little Rock Creek. The project will be investigated by C. W. Koiner, general manager of the light department, and S. B. Morris, engineer of the water department.

SANTA MONICA, CAL.—Efforts are being made to have modern lighting systems installed on every street where new paving is being put down. New lighting systems are also being planned for the municipal pier, Ocean Park Plaza and North Beach.

SHELLEY, IDAHO.—The Shelley Light & Power Company contemplates improvements to its plant, including the addition of another unit. H. L. Malcolm is president.

PHILLIPSBURG, MONT. — The Drummond Light & Power Company, Drummond, has plans under way for an electric lighting system at this place. H. H. Hanson is manager.

COLORADO SPRINGS, COL.—The Alamo Hotel & Garage Company has been authorized by the City Council to erect a heat and power plant to cost about $21,600.

Canada

WINNIPEG, MAN. — An expenditure of more than $1,000,000 on hydro-electric developments in rural Manitoba will be undertaken by the government. J. M. Leamy is provincial power commissioner.

CAMPBELLFORD, ONT.—The Hydro-Electric Power Commission, University Avenue, Toronto, is developing 10,000 hp. at Paneys Falls on the Trent River. Plans include a power house, hydraulic turbines, transformers, circuit breakers, power line, etc. The cost is estimated at about $50,000. F. A. Gaky, Hydro Building, Toronto, is engineer.

OTTAWA, ONT. — Arrangements have been made for the purchase of $1,200,000 bonds of the Ottawa Light, Heat & Power Company. It is understood that the proceeds of this issue will be utilized for the development of water power. Thomas Ahearn is president.

QUEENSTON, ONT. — Work is under way on the excavations for the foundation of the hydro-electric plant at Queenston. The initial installation will include five generators of 55,000 hp. each. The cost of equipment is estimated at about $4,000,000.

WARDSVILLE, ONT.—The erection of an electric light and power plant at this place, to cost about $15,000, is contemplated. Engineers of the Ontario Power Commission, University Avenue, Toronto, will be in charge.

WELLAND, ONT. — The Railway Commissioners of Canada have been requested to authorize the electrification of the Grand Trunk Railroad between Welland and Port Robinson.

COATICOOK, QUE.—The Corporation of Coaticook contemplates the erection of a dam and a power house to develop 450 kw. The cost is estimated at $65,000. E. E. Akhurst is superintendent.

Miscellaneous

ST. JOHNS, NEWFOUNDLAND. — The Lake St. John Pulp & Paper Company, Ltd., contemplates the development of 20,000 hp. from three waterfalls for the operation of its proposed new pulp mill at the mouth of the Metabetchouan River.

PANAMA.—Bids will be received at the office of the General Purchasing Officer, Panama Canal, Washington, D. C., until Oct. 26 for furnishing centrifugal and duplex pumps, steel cable, copper cable, cable end bells, conduits, split connectors, cut-outs, conduit elbows, electrical fixtures, motors, disconnecting switches, etc. Copy of Circular 1412 may be obtained at the above office or at the office of the assistant purchasing officer, 24 State Street, New York City.

(Issued Oct. 5, 1920)

14,954 (reissue). TELEPHONE TRUNKING SYSTEM; Talbot G. Martin, Chicago, Ill. App. filed Oct. 17, 1916. Automatic or semi-automatic.

1,354,476. ELECTRODE FOR ARC WELDING; Joseph W. Fay, Milwaukee, Wis. App. filed Feb. 27, 1920. Uniform deposit with any length electrode.

1,354,498. PROCESS FOR THE ELECTROLYSIS OF AQUEOUS SOLUTIONS BY MEANS OF PROPULSIVE ELECTRODES; Alphons Luib and Ewald Steinbuch, Monthey, Switzerland. App. filed Jan. 29, 1913. For obtaining alkaline hydroxide and chlorine.

1,354,503. TROLLEY-WIRE CLAMP. George A. Mead, Mansfield, Ohio. App. filed April 7, 1919. Flexible and noiseless.

1,354,505. SECTIONAL INSULATOR; John T. Morgan, Charleston, W. Va. App. filed May 24, 1919. For mines.

1,354,513. ELECTRODE FOR STORAGE BATTERIES; Robert Saville, Burras Hill, Otley, England. App. filed Sept. 29, 1917. Electrode is two concentric tubes.

1,354,524. TELEPHONE HEAD SET; John S. Timmons, New York, N. Y. App. filed Aug. 28, 1918. Aeronautical.

1,354,546. INDUCTOR GENERATOR; Harry F. Geist, Sumter, S. C. App. filed Jan. 21, 1918. Magneto.

1,354,573. COMBINED DIFFERENTIAL AND REVERSE POWER RELAY FOR THE PROTECTION OF GENERATORS AND TRANSFORMERS. Albert E. McColl, Dumbarton, Scotland. App. filed Dec. 30, 1919. Operates on leakage or reverse power.

1,354,591. ELECTRIC MACHINE. Rumford H. Wappoo, Yonkers, N. Y. App. filed Aug. 11, 1919. For developing, rectifying and distributing current of high potential.

1,354,593. METHOD OF WELDING HEAVY-GAGE TUBING; Harry H. Belmont, Cleveland, Ohio. App. filed Jan. 17, 1919. Welding longitudinal seam.

1,354,605. AUTOMATIC TELEPHONE SYSTEM; John Erickson, Chicago, Ill. App. filed Dec. 31, 1903. For automatically selecting idle trunk.

1,354,[illegible]. CHEMICAL TELEGRAPH RECEIVER; John M. Lee, Supposed to Hold to N. Y. App. filed Nov. 15, 1918. Employs standard type-writer.

1,354,664. ELECTRODE FOR ARC WELDING. Roy C. Knoll, Lockland, I. Rode and Charles Kelly, Middletown, Ohio. App. filed [illegible]. Automatic.

Record of Electrical Patents

Notes on United States Patents

1,354,708. MULTIVALUE OVERLOAD RELAY; George H. Whittingham and William T. Holmes, Baltimore, Md. App. filed July 25, 1917. Not affected by starting current.

1,354,713. CURRENT REGULATOR FOR DYNAMOS; Vincent G. Apple, Dayton, Ohio. App. filed April 23, 1917. Constant current with variable speed.

1,354,780. SANITARY ATTACHMENT FOR TELEPHONES; Jack D. Sartakoff, New York, N. Y. App. filed June 14, 1918. Disinfecting cover for transmitter.

1,354,790. SUPPORT FOR ELECTRIC CURRENT COLLECTOR SHOES; Bradford H. Whiting, Chicago, Ill. App. filed May 2, 1919. For cranes.

1,354,798. TAPER CHARGE REGULATOR; William L. Bliss, Niagara Falls, N. Y. App. filed April 29, 1911. Charges batteries.

1,354,799. STOP-CHARGE REGULATOR; William L. Bliss, Niagara Falls, N. Y. App. filed April 29, 1911. For battery charging.

1,354,803. ELECTRIC SWITCH; John F. Cavanagh, Meriden, Conn. App. filed March 13, 1919. Push socket.

1,354,[illegible]. VACUUM DISCHARGER FOR LOWER TENSION; Alberto Faranda, Milan, Italy. App. filed Jan. 4, 1919. Improved electrodes.

1,354,813. LIGHT-TREATMENT APPARATUS; Ernest C. Feyrer, Pittsburgh, Pa. App. filed Aug. 14, 1919. Medical.

1,354,814. IMPULSE-TRANSMITTING DEVICE; Joseph C. Field, Orange, N. J. App. filed July 19, 1917. Step by step.

1,354,[illegible]. DEPTH AND SPEED INDICATOR FOR SHIPS; Karl T. F. Jug, Kalmar, Sweden. App. filed Aug. 26, 1916. Indication transmitted to point of observation.

1,354,859. MACHINE FOR HEATING RIVETS, ETC.; Albertis C. Taylor, Warren, Ohio. App. filed May 1, 1920. Heats two rivets at once.

1,354,891. TELEPHONE SYSTEM WITH AUTOMATIC RINGING AND AUTOMATIC BUSY; Hiram D. Currier, Chicago, Ill. App. filed June 11, 1915. Manually operated.

1,354,897. AUTOMATIC SWITCH FOR MAIN AND AUXILIARY CIRCUITS; John J. Divo, Brooklyn, N. Y. App. filed Dec. 3, 1918. Connects auxiliary after breakdown of main circuit.

1,354,899. BRUSH HOLDER; George B. Evans, St. Louis, Mo. App. filed Sept. 18, 1918. For flat commutators.

1,354,901. DYNAMO-ELECTRIC MACHINE; Valere A. Fynn, St. Louis, Mo. App. filed July 2, 1917. Neutralizes armature reaction.

1,354,902. IGNITION-CONTROLLING SWITCH; Valere A. Fynn, St. Louis, Mo. App. filed March 7, 1918. For battery ignition.

1,354,904. INSULATING SPLICE COVER; James B. Hamilton, Hoboken, N. J. App. filed Oct. 10, 1919. Rubber cap.

1,354,908. PORTABLE TELEPHONE SET; George M. O. Jenkins, Paris, France. App. filed Nov. 3, 1917. Self-contained.

1,354,932. SECRET-SIGNALING SYSTEM; William Wilson, East Orange, N. J. App. filed Dec. 30, 1916. By apparently steady light beams.

1,354,939. VACUUM-TUBE DEVICE; Harold D. Arnold, Maplewood, N. J. App. filed Sept. 30, 1916. Electrode support.

1,354,986. ELECTRIC SOLDERING APPARATUS; Eugene Martin, Cannes, France. App. filed April 8, 1920. For seams.

1,355,002. MULTIPLE SWITCH; Pasquale J. Ruffalo, Mount Vernon, N. Y. App. filed July 5, 1917. Combined light and power plug.

1,355,041. HEAT REGULATOR; Lee H. Harlow, Galesburg, Ill. App. filed Dec. 20, 1916. No contacts.

1,355,085. DIFFERENTIALLY WOUND ELECTROMAGNET. Henry K. Bentley, New York, N. Y. App. filed July 13, 1918. Balanced opposing windings.

1,355,089. ELECTRIC TYPEWRITER. George C. Clark, Oakland, Cal. App. filed April 26, 1916. Standard keyboard.

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Public Utility Bonds

BANKERS report a remarkable improvement in the demand for public utility bonds. This is in keeping with the present firm tone of the bond market and, to use a stock market expression, indicates a gradual change from bear to bull. The bear argument that public utilities are limited to a fixed rate for a service which they now render at prohibitive cost is, of course, untenable in the light of recent advances allowed to the railroads by the Interstate Commerce Commission and to the local public utilities by the public service commissions. The utilities are therefore gradually increasing their earnings and restoring their impaired credit. Hence the attractiveness of utility stocks and bonds, particularly when the price of money and commodities is on the decline, presaging lower operating costs with correspondingly greater earnings.

The Automobile Slump

OVER-EXPANSION, credit restrictions and general reaction of business have brought the automobile industry face to face with a readjustment. At the present time production has fallen off approximately 50 per cent, so that this year the aggregate output of pleasure and business cars in this country is estimated at 1,500,000, compared with 2,000,000 last year. The extent to which manufacturers of electrical apparatus are affected by industrial crises in industries other than their own is not always appreciated. A moment's reflection will show that there is a great deal of electrical apparatus on a gasoline car. The storage battery, self-starter, lighting and ignition equipment involve, on a very conservative basis, an outlay of $50 by the automobile manufacturer, so that the drop in production of automobiles this year as compared with last represents a loss to the electrical industry of more than $25,000,000. Fortunately, manufacturers of electrical equipment have been so overloaded with business that this loss, formidable as it is, has hardly been noticed.

Service Ideals in Danger

THE electric light and power industry has prided itself, and justly so, on the high character of its service. To furnish that service has involved the building up of splendid organizations whose loyalty and fidelity have played a major part in achieving results. These organizations, however, are now facing danger due to continued attempts to accomplish more than is humanly possible. The calmness with which service troubles are accepted is but one indication. The continued strain of keeping plants operating without adequate equipment and with little hope of securing it cannot be borne indefinitely without a loss of morale and a consequent lowering of service ideals. Service may be restored in time by the installation of new equipment, but it will be a much harder task to recover that intangible thing which has been the prime factor in building up the service ideal—morale. Therein lies the danger.

Connected Load Inventories

TO DETERMINE more than approximately the total connected load on a normal good-sized central-station system at a given moment is a task of burdensome cost. One would find it almost as easy to conduct a census of the number of people on a stated mile of Broadway at a particular hour of a business afternoon. Yet connected load data are very illuminating when subdivided and used to determine the unit revenue and cost of different kinds of service. The industry does not know today how far it pays to spend time and money in taking connected load inventories. Something better than a yearly compilation of data based largely upon guesswork is clearly needed, for without well-defined limits of accuracy the statistical analysis of such information may lead the central-station manager to follow after strange gods. A beginning can at least be made by surveying the larger industrial installations minutely and establishing card-index records, to be periodically checked and brought fairly well up to date. Classified groups of residential and other commercial customers' installations can then be studied, and it may prove in time possible to limit such surveys to areas where the totals obtained by multiplying group statistics by population or geographic factors can be relied upon sufficiently to illuminate and guide different executive policies in the extension and conduct of service.

The Small Utility

THAT there is some dissatisfaction with commission regulation it is useless to deny—not that regulation has fallen down, but because the public does not fully understand. For example, the entire New Jersey commission has just been dismissed because of neglect of duty and misconduct in office. That in itself may mean nothing. As a reason for executive action it will suffice. However, discrimination against the smaller and less influential utilities is charged, and discrimination of any kind is repugnant. Now, there is none more prone to suspicious imaginings than the unsuccessful or unfortunate. Discrimination in New Jersey there probably was, because where there is much smoke there must be some fire; but that it ever became flagrant is hard to believe. What is believable is that the smaller companies have received little consideration from their bigger brothers and have had to shift for

themselves. They are, therefore, more or less out of touch with matters concerning them vitally, since they neither join organizations of their kind nor observe the trend of the times. As a chain is no stronger than its weakest link, the result is obvious. It is unwise to permit these small properties to hover between life and death for want of help and guidance. Not only must regulation be an open book to them, but the engineering knowledge and experience of more successful companies should be at their beck and call. Approximately 90 per cent of the electric light and power plants of the country are rated at 2,500 kw. and under. Small plants are, therefore, the rule and not the exception. Their managers are molders of public opinion and as such contribute an element of strength to the industry. Every effort should for that reason be made to educate them in the economics of the electric light and power business, not only for their own good but also for the good of the cause.

Alternating Currents for Submarine Cable Transmission

IN THE ordinary operation of long submarine-telegraph cables the signaling is carried on by a sort of mixture of direct-current and alternating-current methods. It is not strictly a direct-current method, because, although a voltaic battery is the customary source of emf., the applications of polarity are frequently reversed. It is likewise not strictly an alternating-current method, because the successive reversals do not occur in orderly succession. Hence there are two rival schools of engineering philosophy in dealing with the very practical subject of the speed of signaling over cables. One school insists that the attack shall be made entirely by the direct-current method, using direct-current arrival curves superposed *ad infinitum*, each new one upon the backs of all its predecessors. The other school insists that the attack shall be made entirely by the alternating-current method as fundamental basis, and that the alphabetical departures from the sober alternating-current régime shall be treated as incidental deviations to be dealt with empirically. The first method is rigidly correct, but extremely difficult to interpret. The second method is very easy to apply, but the extent of its error is somewhat uncertain. Prudence dictates respectful attention to both parties; *i.e.*, utilizing the simplicity of the one and checking the results by rigid deductions from the other.

Whatever opinion may be held as to the relative merits of these two rival schools of submarine-cable theory, there can be little doubt that the future of the theory and practice rests mainly on the alternating-current side. It is much the easier, the more pliant and the more comprehensive. For these reasons an experimental study of submarine-cable circuits by alternating-current methods is very desirable and has long been overdue.

In the last number of the *Journal* of the Franklin Institute the Chief Signal Officer communicates an interesting series of alternating-current measurements, by Dr. F. E. Pernot, on the Sitka-Seattle cable, followed by tests indicating that multiplex alternating-current signaling methods could satisfactorily be executed on this type of cable, at least up to a length of 700 km.

The measurements of linear resistance indicate that the apparent linear resistance of the conductor, instead of being a fixed quantity at a fixed temperature, as is ordinarily assumed, actually increases nearly 50 per cent between 0 cycle and 1,300 cycles, while at the same time the apparent linear inductance falls from 1.2 millihenries to 0.8 millihenry per kilometer over the range of frequency between 200 cycles and 1,300 cycles. On the other hand, the linear capacitance does not change greatly over this frequency range. The linear leakance, however, rises from about zero to 130 micromhos per kilometer, nearly according to a straight-line law with this frequency increase, or about 0.1 micromho per kilometer per cycle per second. The result is that in this type of cable the attenuation constant, or real part of the linear hyperbolic angle, increases as the four-tenths power of the frequency, instead of the five-tenths power, or square root, ordinarily assumed.

These results are of great technical importance in various ways. In the first place, they indicate that as the impressed frequency rises the return path of the alternating currents through the "ground" is not spread out so widely through the ocean and land as it is believed to spread with direct-current application, but concentrates its current density toward the vicinity of the insulated conductor. Consequently, the steel armor inclosing the core carries much more of the return current everywhere along the cable than it would carry at the very low existing signaling frequencies of a few cycles per second. This concentration of the return current toward the neighborhood of the cable increases the apparent conductor resistance as the frequency rises. It is even possible that the hysteretic loss in the steel armor wires of the cables may be an appreciable element of extra resistance in deep water, whereas it has hitherto been supposed that only at close to the shore terminals would the density of return current in the sheathing be likely to effect appreciable magnetic reversals and hysteretic loss.

It is important that these measurements and tests should be repeated and studied carefully on a number of different types of cable.

The Part of the Investment Banker

IN RECENT issues of the ELECTRICAL WORLD two more than usually significant addresses have been printed. In the first of these a representative of a utility-operating company appealed to large consumers of electricity to help finance the public service companies on which they depend for their power. In the second a representative of the investment bankers, speaking to central-station managers, dwelt on the principles of sound financing to which these managers should adhere. This week we print in part a third address, by Carl D. Jackson of the Wisconsin Railroad Commission, in which the chairman of that very influential body speaks of the functions of the investment bankers in relation to public utilities. There is no conflict between these three expressions of opinion. On the contrary, they might almost be said to form together the boundaries of an argument which, like an equilateral triangle, has its sides and angles equal and in perfect correspondence. Mr. Jackson emphasizes the point that just as utility regulation cannot be successful without the aid of utility managers, neither can it in the long run be successful without the sympathetic co-operation of investment bankers. These bankers he conceives as being not mere "security

merchandisers" but something more important and responsible. Vested in them is the "quasi-public duty" of assisting the commissions to bring about a sound financial basis for the public service corporations of the nation. We are sure that all investment bankers worthy the name, so far from desiring to shirk this obligation, will recognize it as one which they must fulfill both to maintain the high standards of their calling and to lay a permanent foundation for their own prosperity.

The Oregon Industrial Lighting Code

OREGON is to be congratulated on the adoption of the lighting code, some account of which is given in another column. Like other codes, it is based on the Illuminating Engineering Society's code of 1917, but it includes some needed improvements regarding intensities. The amount of light required for all the varied operations of manufacture can never be fully classified and much must necessarily be left to the judgment of inspectors. Besides, it appears from recent studies that the I. E. S. minimum values on the whole tend to run too low. Constant work under illumination insufficient to bring the eye to the full powers required for the task at hand is adjudged by most ophthalmologists likely to prove injurious, and while the minimum code values are in some instances sufficient, others in the same nominal class are far too low. The range of the I. E. S. code for manufacturing operations from 1.25 foot-candles to 5 foot-candles is rather small. It needs to be extended at both ends. There are operations in rough handling and working of crude stuffs which may not require the lower figure, and there are certainly others, like engraving work and embroidering on black goods, for which much more than 5 foot-candles is required.

The departures in the Oregon code are in the right direction, we are glad to observe. The most notable one is the requirement of 0.5 foot-candle as general illumination. The usual figure is just half this. Perhaps it would be better to make the general lighting at least a certain proportion of the required minimum, and certainly the Oregon figure is the better one for the higher classes of manufacture. The chief difficulty in the application of any code is the allotment of operations to their proper classes, and for this the inspector, if experienced and of good vision, can have no safer guide than the motto, "Put yourself in his place."

Unit Layout of Plants Reduces Complication

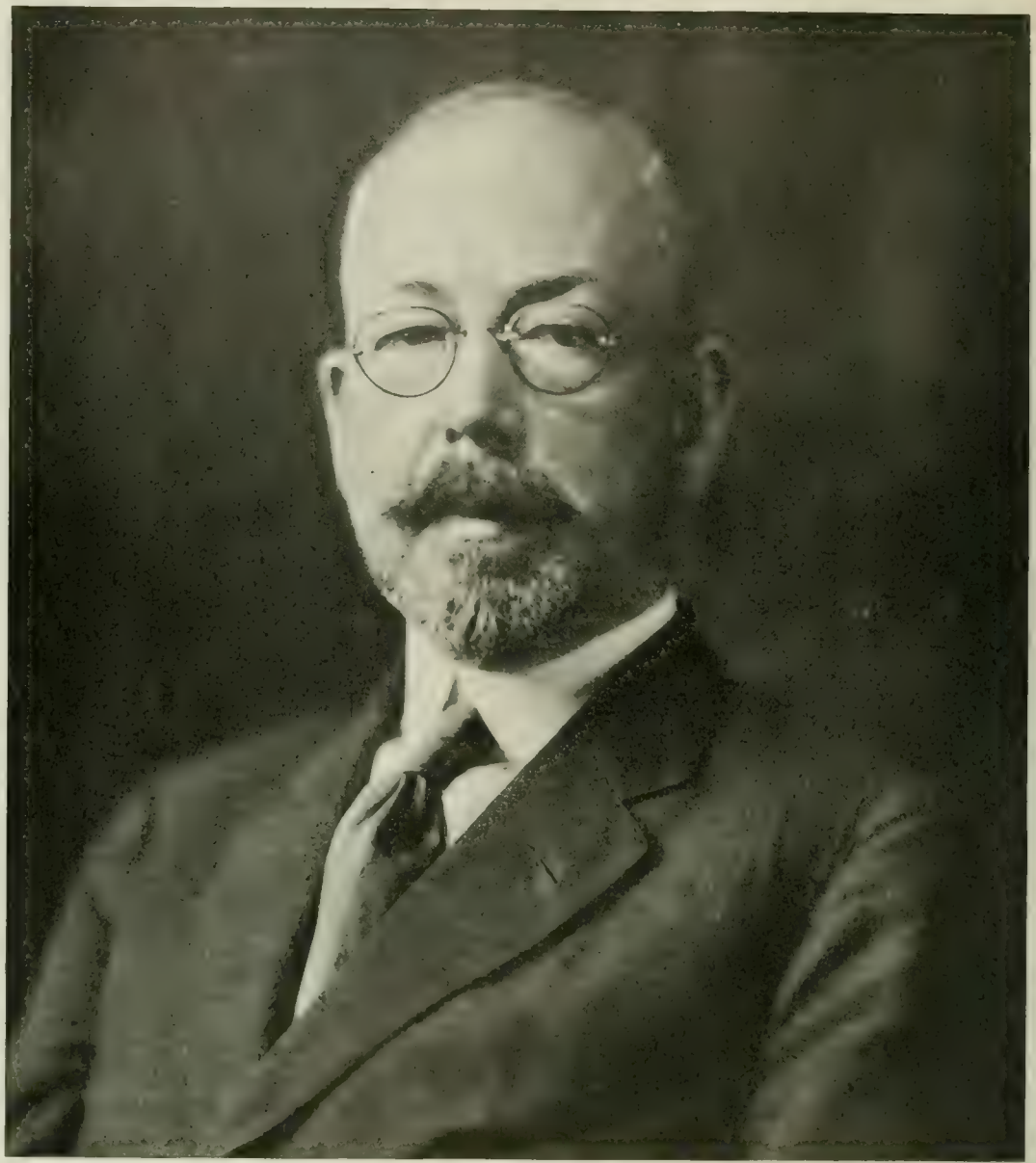
THE general arrangement of the 100,000-hp. station extension of the Niagara Falls Power Company embodies a unit scheme of operation which should be more widely used than it is. Each of the three 32,500-kva. generators may be considered as arranged to form a power plant by itself, the connection and auxiliaries being placed in a perfectly symmetrical way with respect to their several generators, which operate, however, so far as the external circuits are concerned, each as an individual. The main substation at which the paralleling is done is three miles distant, and each generator feeds to that substation over entirely independent lines controlled by individual switches, so that they function in fact like three independent plants although within the same power house. This is a wise step when such big units are concerned, and it leads both to a simplification of switching apparatus and to lessened likelihood of breakdown. The operators in the power house proper are simply concerned with stopping and starting the generators, while the control is carried to a separate control house at the top of the cliff where the operator can sit quietly and carry on his work. This arrangement compels the use of rather long cables between generators and switchboard, but since the former are automatically protected there should be little likelihood of trouble.

This unit arrangement strikes us as a very advantageous one since there is no reason why an adequately protected plant directly united to a proper switching station should have duplication of switchboard at another point. It is merely necessary to keep these machines running properly through the control station and each feeding into the substation's supply in the simplest possible manner. In the same way, where step-up transformers are used, each generator with its transformers can be considered as a single independent unit to be treated as a whole. Simplicity is greatly to be desired in electrical plants big and little, and to this the unit idea very directly leads.

Rural Service a New Central-Station Problem

WHAT is the meaning of the rural service problem that is pressing particularly in the Middle Western States? This is a question that central-station managers cannot afford to dodge. In this issue an article points out the line of thought that an extensive investigation indicates as the one which the central-station industry should be pursuing. Except in those sections where the problem has actually become pressing, the dominating nature of other problems has given central-station men a tendency to treat the rural service problem as a fad. The men who have had it forced on their attention, and have taken the trouble to investigate carefully, view it as having a basis in the economic advantage gained by the farmer in using electric service. If this view is accurate, the central station cannot escape finding a solution. To a greater extent than in other fields of central-station activity, the problem is one of sale of service. Because of experience in territory where the sale of energy is large enough in volume to absorb the service feature in large measure, it is difficult to view the rural service problem in its proper light, since the service factor due to the present relatively small sale of energy is a dominating factor which necessitates a reversal of the usual order of thinking.

The question to be faced is whether the farmer can afford to pay for the service he secures, though that service measured in kilowatt-hours may be insignificant as compared with the service in other fields. Two thousand farm consumers estimated to be connected this year in Wisconsin, 600 of whom are on one system alone, indicates that the demand is not a fad. In cold cash expense borne by the farmers the investment in lines alone, it is believed, will exceed $500,000 and may total nearer $1,000,000. This is only one state, and the problem is active in more than half a dozen states. Central-station managers cannot afford to ignore the situation. It is acute in a few states and may soon be acute in many others.



Samuel Everett Doane

Whose early vision of the future of the lamp industry and conception of the factors involved in selling illumination have been largely instrumental in laying the foundations of a new era in lighting

CLOSE application to his work, long hours and constant study, combined with engineering foresight, are accountable for the steady progress of S E Doane from the status of office boy to Elihu Thomson and E W. Rice back in 1886 in the old Thomson-Houston Company in Lynn, Mass., to that of chief engineer of the National Lamp Works of the General Electric Company and one of the outstanding figures in the field of artificial illumination. A dreamer he is, but a dreamer of the practical kind with the enthusiasm and the energy to make his dreams come true. He was among those who early saw that lamp manufacturers must make their chief effort that of selling illumination rather than lamps. In conformity with this idea he developed the now well-known engineering bulletin which gives complete technical information without selling or commercial data.

When the tungsten lamp first was brought out with an energy consumption a third that of the carbon lamp, Mr Doane foresaw the serious effect it would have on central-station revenues unless there were developed a more logical rate structure which would recognize the fixed charges and thereby protect the industry from being crippled financially by advances in the art or by changed conditions. There naturally followed the rate research committee of the N. E. L. A., of which Mr. Doane was for many years a member. As the result of an intimate study of European wiring practice he advocated a less expensive method of wiring houses in order to make electric light available in the most humble homes. He felt that, even if the wiring were not up to the highest standards, still it would be safer than the open flame lamps which he sought to displace. He has been a staunch and consistent advocate of standardization ever since he entered the industry. When a young man he voiced the need for a body which would establish standards for the entire country. This necessity was argued in a paper read before the A. I. E. E. at that time, and after the discussion an Institute committee of older men was appointed which in a certain measure was responsible for the establishment of the Bureau of Standards. He was also active in the campaigns for the standardization of lamp voltages, bases and bulbs. For some time Mr. Doane has contended that a closer study of industrial illumination would reveal startling results. Justification of this opinion is found in the recent demonstrations at Nela Park and elsewhere in connection with higher intensities on the working plane.

Mr Doane was born at Swampscott, Mass., Feb. 28, 1870, with all the traditions of a Mayflower ancestry. He is a member of most of the national electrical associations and has worked on many committees. During the past year he has spent considerable time performing the duties of president of the Illuminating Engineering Society and making plans for the rebuilding of the society into one of considerable proportions.

Demand for Rural Service Based on Economic Reasons

Central Stations Must Face Problem of Providing Service Financing Because of Present Situation Should Not Blind Central Stations to Future Forms of Rate Schedules Education of the Farmer Necessary



THE FINANCING OF RURAL EXTENSIONS LIKE THIS MUST BE CONSIDERED FROM CONSUMERS' VIEWPOINT IF THIS MARKET FOR POWER IS TO BE DEVELOPED AS EXTENSIVELY AS IT MAY BE

WHAT is the meaning of the demand of rural line extensions which, in some sections of the country, is so strong that farmers are even willing to build and turn lines over to the central station without return other than the securing of service? Is it a fad that will die out in time, or is there an economic reason on which the demand is based? These two questions need thorough consideration on the part of central-station managers, who cannot afford to let themselves be blinded, by other difficulties, to the fact that there is a growing movement looking toward electric service to the farms. Prof. A. R. Sawyer of the Michigan Agricultural College told the Michigan Section of the National Electric Light Association at its recent convention of the work being undertaken by the agricultural college to better farm-living conditions, make the farmer a better business man, and consequently a more useful member of society. That electric power will play the same relative part in this work it has played in the development of the industrial world was his belief, based on careful investigation of Michigan conditions. Personal contact with the problem leads the observer to believe that the attitude of one Wisconsin farmer who was asked what he would take for the service is indicative of what the service means. That farmer who had paid several hundreds of dollars for his connection and then deeded it to the central station without any return for his investment, other than service received, pointed to the lessened fire hazard and more comfortable and efficient working conditions in the barn and haymow, the greater home comfort and the equipment repair work during the busy season that he had been able to do, without taking time from the daylight hours so badly needed in the field, and then remarked, "That is money I never want to see again." The investigator is constantly confronted with proof that such service represents a distinct economic advance for the farmer in the improvement of his working conditions and conservation of high-priced labor. Central stations must face the problem of providing it. Another significant fact is the careful investigation being conducted by various commercial agencies to whom the development would mean a large volume of business. The plan must not be a temporary one, with no thought of the future, but one that, while it may include temporary measures, looks toward the service as a permanent part of the company business.

Financing Plans

The present situation makes financing in the ordinary way impossible and companies have devised various ways of meeting the situation. The principal methods met with are:

(a) The farmers provide the money for the construction of the lines (except metering equipment), which are built by the central station, then becoming central-station property. Maintenance is a central-station responsibility.

(b) The farmers are asked to buy sufficient company securities (preferred stock or bonds) to finance the lines. Ownership and maintenance rests with the central station.

(c) The farmers are asked to advance the money on

notes payable at some future time. The ownership and maintenance is a company responsibility.

(d) The farmers are allowed to form their own companies, build, operate and maintain their own lines, energy being sold at some definite point on a wholesale basis. This leaves the farmers to handle the cost of service as they choose.

Schemes (a), (b) and (c) take from the farmer the responsibility of building and maintaining the lines. This is extremely desirable, as farmers are no more capable of handling central-station work than the central-station man is of handling that of the farmer. The net result of the adoption of any of these schemes of financing will be the elimination of future maintenance difficulties that can prove decidedly embarrassing, even though the central station might not be legally responsible.

The scheme in (d) means the building up of rural utilities that legally are competent to carry on all classes of utility work, though they can possess neither the knowledge nor afford to employ competent staffs to accomplish the necessary results. Because of low prices offered, the most frequent happening is the falling of such companies into the hands of the curbstone contractor, whose immediate concern is the profit he secures from each job and who is not troubled by any evil effects of poor construction or improper consideration of the rights of other utilities. Such companies may also fall into the hands of the curbstone contractor on maintenance work, because the supply business which the farmer has to place presents an attractive profit, that may be secured if the contractor will take the line maintenance at a low figure. Since the farmer is not competent to pass judgment on such matters, slighting of the maintenance work for a considerable period is an easy matter. When the crash comes the contractor is usually in position calmly to step out from under and the central station and the farm utility must face the music. Some central-station companies endeavor to take over the maintenance work under a contract with the rural utility, but such a contract is for a period of years, at the end of which the work can pass out of the control of the central station. While it may not so result in all cases, scheme (d) does provide the groundwork for endless future controversies and trouble between the central station and the farmers. Because it may solve a serious financial and a puzzling maintenance problem temporarily is no reason why the industry should ignore its ultimate possible results.

Form of Rates

There should be no blinking at two facts, the first being that the rates applying to the same character of service in urban territory do not provide for a proper return on rural business, because of the scattered condition of the load and the relatively greater investment and operating expense per customer. The second is that the business must pay its own way, not only as to cost of distribution lines and customers' equipment but also as to power plant and transmission-line investment. This latter item is one that has not yet received proper consideration. Because of the relatively small demand so far, on generating and transmission facilities, central-station men have largely ignored this factor. If farm loads are to become a permanent factor in central-station business this item must receive full consideration, otherwise the future must bring troubles, embarrassing, if not serious. Two general forms of rate schedules, either one of which can be made to obtain the desired results, have been made use of. They are:

1. A rate consisting of a fixed charge, for which no energy is received, plus the rate regularly charged for the same service in the nearest city or town territory. The assumption is made that the regular rate already in use provides for the return, depreciation and other fixed charges on the power plant and transmission-line investment as well as the cost of operation and profit on the business to which it applies. It does not provide for fixed charges for line and transformer losses, cost of maintenance of the scattered rural lines, cost of meter reading or any of the other costs that for rural service are in excess of the cost of giving the same service in city or town territory. The fixed, or, as it is called in some cases, the "rural," charge is designed to cover all these items. Where the farmer has borne the cost of construction no interest has been allowed, though to cover the hazard of developing and carrying on the business a small percentage has been allowed on the investment. In the form of rate recommended by the committee of the Wisconsin Electrical Association an item of 2 per cent was allowed to cover this factor. The fixed charge form of rate has the advantage of encouraging the use of current, because the customer is brought to realize that he is paying a fixed amount for service. His kilowatt-hour rate is relatively low and there is no tendency to hold the bill down as in the minimum charge form of rate.

2. A minimum charge form in which three rate steps are provided, *viz*: A primary rate, a secondary rate and an excess rate. To this rate is added a minimum charge of a certain number of kilowatt-hours at the primary rate. The minimum kilowatt-hour requirement and the units given on each step of the rate depend on the customer's load. The disadvantage of such a rate is that the consumer ordinarily uses every effort to avoid going over the minimum bill each month. The state of mind which induces this attitude is a difficult one to combat and is the principal argument against the rate.

What central-station men must realize in this problem is that service rather than kilowatt-hours is being sold. This cannot be stressed too strongly. The argument that adjoining city or town rates are lower than those quoted to farm consumers must be met by a demonstration of the difference in conditions. This can be done on a man-to-man basis and if carefully and tactfully handled little difficulty has been encountered. Experience has so far demonstrated that the majority of farmers quickly grasp and concede the point. The idea, like all other ideas, must be sold, and failure, as in other things, more often lies in the sales man than in the idea.

Forms of Construction

Types of construction for rural service lines are not well developed; in fact, except for a few individual cases, no efforts have been made to develop specifications for such lines. Several things must be kept in mind: Low first cost is essential, but it must not be obtained at the cost of substantial construction. The lines are light and strength is easily secured by the selection of sturdy poles of possibly 30 ft. (9 m.) length, setting poles well into the ground and reasonable storm and corner guying, at little more cost than that of a line of light poles, inadequately guyed and

looking cheap. The illustrations show lines of 30 ft. (9 m.) poles set 5 ft. (1.52 m.) in the ground on straight lines and 6 ft. (1.82 m.) at strain points. Either patent anchors or 5 ft. (1.52 m.) creosoted dead men attached to ¾-in. x 6-ft. (16-mm. x 1.82 m.) anchor rods are used, while steel guy strand of not less than ⅜ in. (8 mm.) double galvanized and pole shims and hooks are used. The lines and guying are light, but in proportion to the loads carried they are as well built and will last as long as any city lines carrying heavy loads. The result is not accomplished by skimping material, but by fitting material to the demands made upon it. Cheap lines secured by skimping can be the most expensive in the long run and must be avoided. A thorough study looking toward the development of a proper specification is badly needed. The puzzling problem to most operators involved in rural line distribution is the cost of operation. City figures do not apply because of the distance that must be covered. Whether meters should be read monthly or at longer intervals is a much-debated question. Various schemes enabling the farmers to read meters monthly, with a check reading every few months by a competent meter reader, have been suggested. How fuses shall be replaced is debated, though for the service fuses on low voltages the farmer can be quickly instructed how to do it himself. Primary fuses undoubtedly must be replaced by central-station employees and cost of such service included in the fixed charge.

The difficulty at the present moment, however, is lack of sufficient records on specific installations that tell what the actual costs are. Experience will probably demonstrate that the costs are not as serious as they now appear in the absence of definite information. Intelligent study through adequate records will furnish the information eventually. The solution of the problem is up to the central station.

If the demand for service is founded on an economic reason, the central stations are facing the same problem that has pressed for solution in all other phases of the industry, *viz.*: the education of the customer in the proper use of his service. The household appliances of the city home fit the farm home as well, and the educational work necessary can be confidently outlined. Some progress has been made in the development of equipment for exclusive farm use. The milking machine, the cream separator, the churn, hay-hoisting equipment, all electrically driven, are examples, but the subject has as yet only been touched. As the demand increases more special farm equipment must be developed. The central station has had a vital part in the development of other types of equipment and the education of users in their application. There seems to be no reason why it should not have as vital an interest in the development of farm-like equipment and the education of the farmer in its use. This means careful study of the problem by central-station men.



CHEAPNESS DOES NOT MEAN POOR WORK AND FLIMSY LOOKING RURAL LINES

These views, taken on the Wisconsin-Minnesota Light & Power Company system near Eau Claire, Wis., illustrate what can be done in putting up substantial rural lines. Poles are sturdy 30 ft. (9 m.) cedars, well guyed, set 5 ft. (1.52 m.) in the ground, and everything put up in a neat, workmanlike style. At left—Transformer mounting (2,300-volt) and service takeoff. Compression type arresters are used. At top, center—Straight-away line. Telephone lines are kept on opposite side of road. Arrangements to move them are made if it is considered necessary. At right—Transposition schemes are worked out. This shows the method of making transpositions. At bottom, center—Side view of transformer mounting.

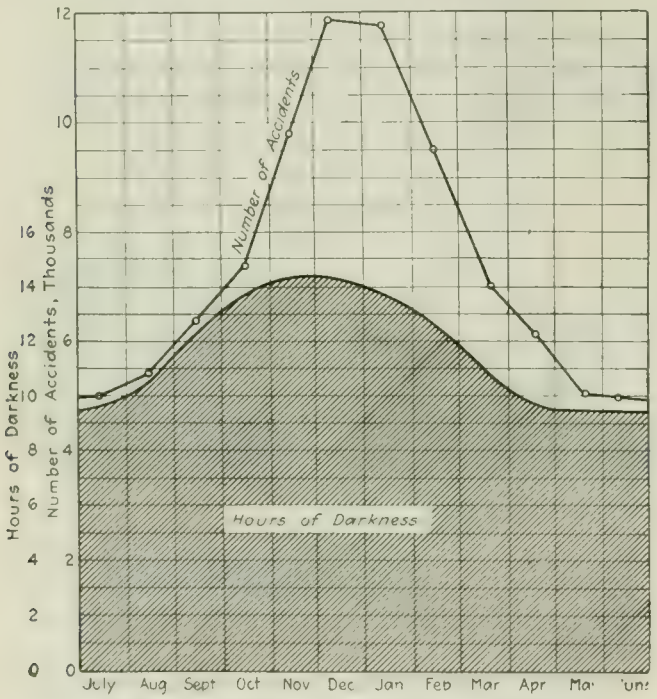
AS THE *maxim for the teacher is, "Always know more than you are required to teach," so research stands for the challenge of the open door. Teaching is not an adequate instrument of scholarship. The professor in any science in any college stands today on the shore of the great ocean of knowledge as truly as Sir Isaac Newton did, and must take cognizance of the Beyond. Lincoln said the problem of democracy is to create a Government strong enough to protect the state, but not so strong as to take away the liberties of the citizens. So the duty of the college is to get all the teaching possible out of its faculty without quenching their enthusiasm or preventing their search for new knowledge. This surely is not to be done by closing the door to research or by parsimonious equipment of the laboratories.*—HENRY A. STIMSON.

Modern Industrial Lighting for Oregon

Based Upon Experience in Other States and the Recommendations of the Illuminating Engineering Society, an Exemplary Code Was Adopted—Provision for Raising Standards as Better Lighting Practice Develops

By F. H. MURPHY
Illuminating Engineer Portland Railway, Light & Power Company

OREGON is one of the most recent recruits to the group of states having industrial lighting codes and has thus been able to benefit by experience with lighting codes in other states. An examination of the table of typical values of illumination adopted for Oregon, as compared with those of other states and with the Illuminating Engineering Society's recommendations, shows that the Oregon minimum requirements are as high as in any other state and higher in several instances. An important feature of the Oregon law provides for the revision of minimum illumination values as advances in the art may render higher values practicable. It should also be observed that the I. E. S. is recognized as authority in regard to illumination values by this state.



INDUSTRIAL ACCIDENTS DEPEND UPON LIGHTING
Monthly distribution of accidents show how they increase during darker period of year.

During the late war L. B. Marks, chairman of the divisional lighting committee, a subdivision of the Advisory Council of National Defence, urged the Oregon representative of that committee to take steps toward securing the adoption of an industrial lighting code for the state.

How Legislative Action Was Secured

At that time neither the State Bureau of Labor nor the State Industrial Accident Commission had the authority to promulgate any new safety rules. It was necessary, therefore, to secure legislative action if such a code was to be adopted. Charles H. Gram, the incoming State Commissioner of Labor, was very much in favor of a lighting code similar to that proposed by the Illuminating Engineering Society and the divisional lighting committee, as also was William A. Marshall, chairman of the State Industrial Accident Commission. At its annual convention the Oregon State Federation of Labor went on record as indorsing the proposed lighting code, and it later received the official approval of the Oregon branch of the National Electrical Contractors' Association and the Industrial Association of Oregon, the latter being a very active association of industrial organizations of the state.

With such support favorable legislative action seemed assured. The bill was entered in the Legislature as house bill 186 by Eugene E. Smith, a representative of labor, on Jan. 24, 1919. It was passed by the Legislature and became effective on May 29, 1919.

Section 1 of this law defines the terms "place of employment" and "owner" in a very conclusive manner and is herewith quoted:

> The phrase "place of employment" shall mean and include every place, whether indoors or out, or underground, and the premises appurtenant thereto, where either temporarily or permanently any industry, trade or business is carried on, or where any process or operation directly or indirectly relating to any industry, trade or business is carried on, and where any person is directly or indirectly employed by another for direct or indirect gain or profit, but shall not include any place where persons are employed in private domestic service or agricultural pursuits which do not involve the use of mechanical power.
>
> The term "owner" shall mean and include every person, firm, corporation, state, county, town, city, village, manager, representative, officer or other person having ownership, control or custody of any place of employment or of the construction, repair or maintenance of the buildings of any such place of employment or who prepares the plans for the construction of any place of employment.

These two definitions were taken verbatim from the Industrial Commission Laws of the State of Wisconsin, as it was felt that the field of action to be covered and the persons to be reached were most effectively included within this wording. At the time it was felt that the Commissioner of Labor had the authority to compel the removal of glaring lights wherever they might be a real menace to any considerable number of people as well as to require sufficient illumination to reduce materially accidents in all poorly lighted places where persons must of necessity work.

Sections 2 and 3 require that in all passageways, halls, stairs, workrooms, etc., where people are employed there must be proper and sufficient lighting.

Section 4 requires that this lighting shall be in accordance with a schedule of minimum values to be determined as set forth in section 8.

Sections 5, 6 and 7 demand the elimination of glare, the proper equipment and installation of the lights to secure reasonably uniform illumination, and installation and control of pilot and emergency lights.

There is nothing new in the above sections, as their requirements are based upon the suggestions of the Industrial Lighting Code of the Illuminating Engineer-





MINIMUM LIGHTING REQUIREMENTS IN OREGON SHOULD PROMOTE SAFETY AND HEALTH IN INDUSTRIAL ESTABLISHMENTS

At left—Lighting of a large sawmill showing one of the trimmer sections in the foreground lighted by means of deep-bowl porcelain-enameled steel reflectors hung as high as the framing will permit. The illumination immediately in front of the saws is approximately 7 foot-candles. At right—A combination of local lighting with porcelain-enameled steel reflectors and general illumination with mirrored glass reflectors in the loom room of a woolen mill. General illumination is about 1 foot-candle.

ing Society and form the basis for the general lighting rules of the various states which now have industrial lighting codes.

Because of the necessity of providing a means for changing the limiting values as may be desirable from time to time without the necessity of repeatedly invoking legislative aid, Section 8 was introduced, as follows:

The Commissioner of Labor and Inspector of Factories and Workshops of the State of Oregon is hereby authorized to establish certain minimum values for lighting, which shall be deemed proper and adequate in accordance with the conditions set forth in this act. In arriving at what values shall be used in this schedule of minimum lighting, and such other rules as shall determine definitely what shall constitute compliance with the provisions of this act, he shall be guided by the best engineering practice as set forth in the recommendations of the Illuminating Engineering Society. Before such schedule and rules, however, shall become effective, the Commissioner of Labor must, upon his own motion, appoint a commission of three persons, one to represent the manufacturing interests, one to represent the operating electrical workers, and one must be an electrical engineer. Notice of the public meetings of such commission shall be published in the leading newspapers of each county in the state, giving the time, place and purpose of such meetings. The commission shall have power, after holding these public meetings, to establish, to rearrange or to readjust the schedule or lighting values and rules as above set forth. These rulings or readjustments shall then become effective thirty days after they have been made, and the Commissioner of Labor shall serve notice, in writing or by publication in the leading newspapers of each county in the state, of the rulings thus made and of the date upon which they become effective.

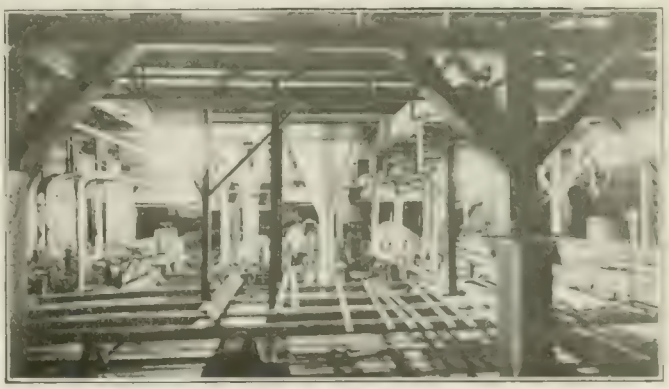
In this section it will be seen that the Illuminating Engineering Society is recognized as the standard authority on the matter of illumination values.

It was intended that the provisions of Section 8 should enable the Commissioner of Labor virtually to have the same power relative to establishing and revising safety rules for proper illumination as that with which progressive thought has empowered industrial commissions in such states as Wisconsin, California and others.

Since that time public opinion in Oregon has advanced rapidly, and owing to the very efficient action of the Oregon and Columbia Basin Division of the National Safety Council, the Legislature at a special session held in January, 1920, passed a bill authorizing the State Industrial Accident Commission to establish all necessary and reasonable safety rules, proper regulations and provisions, and providing for the enforcement of such orders and decisions by the Commissioner of Labor. This now places Oregon on the level of other states where industrial commissions have the power to initiate any necessary safety regulations.

Commissioner Gram later appointed a Lighting Commission of three persons—F. C. Knapp to represent the manufacturing interests, V. H. Haybarker to represent the operating electrical workers, and F. H. Murphy as electrical engineer. This commission prepared a set of eleven "General Lighting Rules" and held a public meeting in Portland on June 28, 1919. The Labor Commissioner, following the recommendation of the Lighting Commission, published the rules, and they then became effective on July 28, 1919.





RAISING ILLUMINATION STANDARDS, AT THE SAME TIME AVOIDING GLARE

At left—Lighting of a section of one of the public docks by means of porcelain-enameled steel reflectors. The average illumination is very uniform and without glare. At right—Lighting of the planer section of a large sawmill by means of inclosing globe units equipped with reflectors. The average illumination is approximately 3.5 foot-candles.

These rules are very similar in most respects to those adopted by other states. The first rule is devoted to the definition of terms which are used in the rules. The various terms are arranged in alphabetical order for convenient reference.

Rule 2 is general and Rule 3 provides for adequate natural light, the minimum requirements of which are twice those for artificial light. Rule 4 gives the table of minimum illumination requirements for various working conditions. These correspond very closely with the recommendations of the Illuminating Engineering Society.

In order to make a comparison of the requirements of the various states now having industrial lighting codes, the accompanying table is submitted. These data have been taken from the lighting code bulletins of the states given and are presumably correct to date. In some cases where states did not have classifications corresponding in every respect to those in the first column, but did show somewhere in their codes requirements for similar locations, these have been included in the tabulation in order to make it more complete.

The classifications (a) to (i), inclusive, are those of the Oregon code, (j) being added to care for a special division used in a number of states.

COMPARISON OF LIGHTING CODE REQUIREMENTS IN VARIOUS STATES

Classification	1917 I.E.S.	1919 Ore.	1919 Cal.	1918 Wis.	1919 Ohio.	1918 Penn.	1918 N.J.	1919 N.Y.
(a) Roadways and yard, thoroughfares	0 02	0 02	0 02	0 25	0 02	0 02	0 02	0 02
(b) Storage spaces	0 25	0 25	0 25	0 25	..	0 25	0 25	0 25
(c) Stairways, passageways and aisles	0 25	0 25	0 25 0 50	0 25	0 25	0 25	0 25	0 25
(d) General lighting for workrooms		0 50	0 25					...
(e) Toilets, washrooms, water closets, dressing rooms and elevator cars		1	0 25 0 50	0 50	0 50	..		.
(f) Rough manufacturing such as rough machinery assembling, bench work or foundry floor work	1 25	2	1	1 25	1	1 25	1 25	1
(g) Fine manufacturing such as fine lathe work, pattern and tool making and light colored textiles	3	3	3	3	3	3	3	3
(h) Office work, such as accounting, typewriting, etc	3	3	3	3	3	3	3	3
(i) Special cases of fine manufacturing, such as watchmaking, engraving, drafting and dark colored textiles	5	5	5	5	5	5	5	5
(j) Rough manufacturing, involving closer discrimination of detail than (f)	2	2	2	2	2	2	2	2

There is a striking conformity to the Illuminating Engineering Society's recommendations in most of the classifications by all the states. This is very encouraging in that it shows a tendency to follow the leadership of a recognized authority in most essentials. This tendency, if followed to the same extent by other states as they adopt lighting codes, will overcome some of the disadvantages of the lack of national legislation along these lines.

Making Minimum Illumination Values Adequate

The only case where discrepancies occur between the Oregon classification and that which the Illuminating Engineering Society has recommended is in (f), "rough manufacturing, etc." In the case of Oregon the Lighting Commission felt that there probably would be considerable difficulty in discriminating between (f) and (j) and that the requirement of 2 foot-candles for both classifications would not work a serious hardship on any industry. For that reason the two were combined and the minimum placed as 2 foot-candles.

Under (e), "Toilets, etc.," Oregon requires 1 foot-candle, while in other states where requirements are made the range is from 0.25 to 0.5 foot-candle. It was felt that better illumination in such places would encourage greater cleanliness and consequently better sanitation, which is only another method of reducing health accidents. It did not seem that such a condition could be effectively brought about with less than 1 foot-candle, neither did it seem to the Lighting Commission that the requirement of such a lighting intensity would work a hardship in any case.

Oregon requires a minimum of 0.5 foot-candle for (d), "General lighting for workrooms." This is for the purpose of avoiding the extreme contrast condition usually accompanying an installation of local lighting, which is not only an accident hazard but also the cause of severe eyestrain. Under the distribution of light ruling, California requires for the same conditions a minimum of 0.25 foot-candle, and one or two other states require that "there shall be employed in addition a modern intensity of overhead lighting."

Rule 5 requires light measurements by means of a standard photometer, while Rule 6 provides for the shading of lamps and the elimination of glare in overhead-lighting systems and Rule 7 provides for similar protection for lamps used in local lighting systems. Rule 8 requires the installation to be made so as to "secure a reasonably uniform distribution of the illumination, avoiding objectionable shadows and sharp contrasts of brightness." Rule 9 provides for emergency lighting and Rule 10 for location of switches and controlling apparatus for emergency and pilot lights.

The above rules are almost identical with those of California and Wisconsin and very similar to those of other states with the exception that they are more explicit.

Rule 11 requires that "All lighting equipment and windows shall be periodically cleaned, inspected, kept in order, and when defective replaced, so that the intensities of illumination will never fall below those specified in Rule 4."

While Rule 4, which requires certain minimum lighting intensities, might be sufficient to compel proper maintenance, yet the Lighting Commission felt that the impression upon the public would be greater by calling attention to the great need for proper maintenance and by making it compulsory. So far as the author is aware, Wisconsin is the only other state having such a rule at the present time.

The "Industrial Lighting Code Bulletin" issued by the Bureau of Labor of the State of Oregon contains in the first part the legislative acts and the general lighting rules. The second part is devoted to a detailed discussion of each rule, with the idea of making the meaning of the rule clear enough so that the average electrician will have no difficulty in either understanding or applying it. This section in addition includes a general discussion of glare, with the idea of emphasizing its importance and danger, a treatment of proper lighting equipment and also methods of using natural light to best advantage. A discussion is given on the method of determining the proper spacing and hanging heights, as well as the wattage of the units for a given installation. Believing that the easiest way for the average layman to determine the proper size of lamps to use is to reduce the data to watts per square foot, such a table was prepared, showing the wattage per

square foot for three standard types of lighting equipment and for various lighting intensities ranging from 0.02 foot-candle to 25 foot-candles.

The third part of the bulletin presents a number of illustrations showing principally good lighting installations obtained by means of various kinds of lighting equipment, while the fourth part contains a table of lighting intensities for a varied line of industrial plants. Two columns of intensities are given. The first column gives the minimum required by the general lighting rule and the second column gives the recommended value. The lower limit in each case under the recommended values represents the lowest value which will give practical results. The upper limit represents what is commonly referred to as "productive intensities."

Criticism has been made in some cases regarding the inclusion of a large table of lighting intensities with the rules, the feeling being that this tended to overemphasize the importance of illumination values as compared with certain other rules, such, for example, as the elimination of glare. In the Oregon bulletin the Lighting Commission has endeavored to overcome this objection by emphasizing the special features of the rules, such as the elimination of glare and the selection of proper lighting equipment, and, further, by placing the table of lighting intensities at the back of the bulletin, where it does not tend to overshadow the other features of the code.

The Bureau of Labor expects soon to make a survey of the lighting conditions in industrial plants of the state, and an educational campaign will be carried on as the best means of securing compliance with the law.

Remodeling Ignition Arches

Importance of Properly Proportioning Ignition Arches to Combustion Rates Desired Stoker Dimensions Materially Influence Ignition Arch Design, on Which Capacity, Efficiency, Responsiveness and Fuel Range Depend

By T. A. MARSH
Chief Engineer Green Engineering Company

THERE are two possible capacity limitations in furnace operation—first, the ability to ignite fuel; second, the ability to burn it when once ignited. The first is dependent very largely on design of the furnace and the stoker arch; the second is dependent on the draft in the furnace.

With the present-day knowledge of fuels, their ignition temperatures and characteristics, there is no reason for furnaces designed with insufficient arch to ignite all the coal that the draft will burn, and it should therefore never be necessary to slow down or stop the stoker in order to permit the coal to ignite at the front.

The height, slope and length of ignition arches have been discussed, but have unfortunately been very loosely treated in the design of furnaces. For example, some combustion engineers may recommend arches 6 ft. (1.8 m.) long, regardless of the combustion rate desired and the length of stoker or igniting characteristic of the fuel. There are, however, certain known performances of ignition arches with certain coals which serve as a basis of design of furnaces in so far as arch height, slope and length are concerned. It is therefore the purpose of this paper to set forth the principles involved and to establish a basis of standardization of arch designs for various grades of coal.

Before an analytical discussion of arch design can be made it is necessary to consider the principles involved and the variables affecting the problem. First of all, arches or furnace roofs serve the double purpose of igniting the incoming fuel and of directing the products of combustion into the lower portion of the heating surface of the boiler. Variables affecting arch length:

(a) Ignition rate.
(b) Percentage of volatile combustible in the fuel.
(c) Calorific value of the fuel.

"Ignition rate" as used in this article is the product of the combustion rate in pounds of coal as fired per square foot of grate surface per hour and the stoker length; in other words, it is the amount of coal which must be ignited per foot of stoker width per hour.

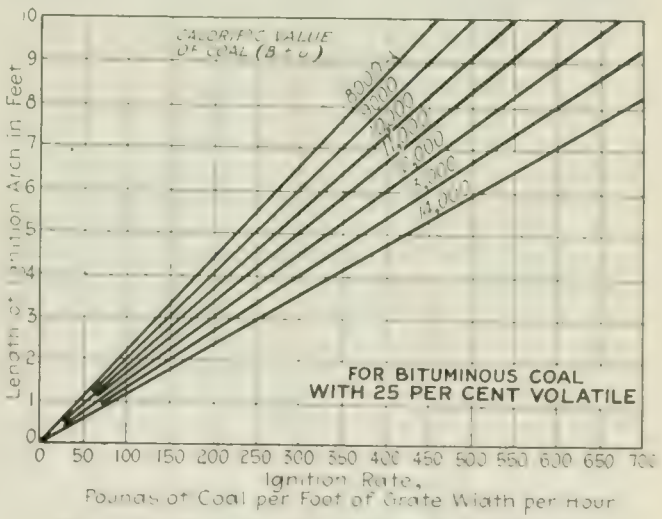


FIG. 1—RELATION OF ARCH LENGTH TO IGNITION RATE

Obviously, the higher the combustion rate desired, the greater must be the provision for igniting the fuel; also the longer the stoker with a given combustion rate, the greater must be the provision for igniting the fuel. Therefore, all other items remaining constant, longer arches must be provided for higher combustion rates and for longer stokers.

As the percentage of volatile combustible decreases extra provision must be made to ignite the fuel. Fuels containing as low as 12 per cent of volatile have been successfully handled on chain grates, but the problem of furnace design becomes highly special in this region.

The higher the calorific value of the fuel the higher the furnace temperature and the more intense the ignition become. In regard to stoker length, for many years arches were rather promiscuously applied in furnace.

and frequently stokers 11 ft. (3.4 m.) and 12 ft. (3.7 m.) long were equipped with arches no longer than those provided for stokers 9 ft. or 10 ft. (2.7 m. or 3 m.) long. The result was that there was insufficient ignition effect to keep the grates properly covered, and in consequence long stokers fell into disrepute, many engineers contending that a length of 10 ft. (3 m.) was close to the limit and that additional grate length was ineffective. Recent practice, however, of making arches proportionately longer with increase in the stoker length has rendered the grate area of stokers 15 ft. to 18 ft. (4.6 m. to 5.5 m.) long just as effective as that of shorter stokers and has resulted in very much improved capacity on larger units.

Ignition arches should be designed for their ability to ignite coal at certain rates per hour. The ignition

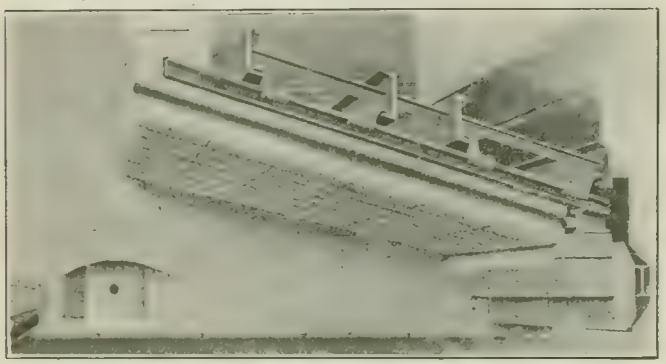


FIG. 2 — TYPE OF MODERN ARCH FOR USE WITH CHAIN-GRATE STOKER IN WHICH GENERAL OUTLINES, IN SIDE ELEVATION, ARE SIMILAR TO THE PARABOLA

rate, therefore, is independent of the grate length, but to obtain similar combustion rates on longer stokers the arches must be designed proportionately longer.

The accompanying chart takes these variables into account and gives the arch length with the corresponding ignition rates possible with a variety of bituminous coal containing at least 25 per cent of volatile combustible. There is, of course, some latitude obtainable with bridge walls of various designs which may aid ignition effects; moreover, it is recognized that the size of the fuel can be such that the figures will not apply. However, for usual commercial cases the proportions as charted come very close to the requirements, and unless some unusual conditions are imposed the designer is safe to follow the chart.

The method of use of this chart is as follows: Suppose it is desired to obtain a combustion rate of 35 lb. (15.9 kg.) of 10,000 B.t.u. (5,520 cal.) coal per square foot of grate surface per hour (as fired basis), on a chain grate having an active grate length of 10 ft. (3 m.). The ignition rate in this case is 35 lb. × 10 or 350 lb. (159 kg.) per hour. In order to determine the length of arch required for this ignition rate it is necessary only to read upward on the chart to the point where the ordinate 350 intersects the 10,000 B.t.u. coal line, and then read on the corresponding point on the left-hand margin the length of arch required. In this case it is 6.3 ft. (1.9 m.); in other words, an arch 6.3 ft. long will ignite 35 lb. (15.9 kg.) of 10,000 B.t.u. coal per square foot of grate surface on a stoker 10 ft. long.

The curves shown are based on actual performance with fuel of high volatility. There is a margin of safety due to the fact that some of the combustion rates on which this chart is based were obtained with low-set arches and designs which have been materially improved since the data were obtained. From this it is evident that furnaces designed in accordance with the accompanying chart will have a comfortable margin which will take care of irregularities of fuel and of operating conditions.

The height and slope of ignition arches has also been much discussed. In early practice arches were set close to the fuel bed, many being only 9 in. (22.9 cm.) above the grate, which would leave only 3 in. or 4 in. (7.6 cm. or 10.2 cm.) between the top of the fuel bed and the bottom of the arch. Nearly all arches were set parallel to the grate or nearly so. Recent practice has shown that the effectiveness of the front portion of the fuel bed can be increased by setting arches higher and pitching them up steeply toward the rear. Experiments have been made at all heights from the top of the fuel bed up to 24 in. (60.8 cm.) above the grate, and for the average condition a height of 15 in. (37.7 cm.) above the grate produces best general results.

SLOPE OF ARCH NOT DEFINITE

As to slope, experiments do not seem to have determined the limit. This much is determined, that 2 in. per foot (16.4 cm. per m.) is better than 1 in. (8.3 cm.), and 3 in. (25 cm.) is better than 2 in. Arches pitched 4 in. to the foot (33.4 cm.) give results apparently the same as those pitched 3 in. except perhaps a slightly greater tendency to permit smoke to be made. Average conditions therefore call for ignition arches set 15 in. (37.7 cm.) high in front, pitched 3 in. per foot and of length to be determined as outlined from the chart.

There is a theory among combustion engineers that the ideal form of furnace would have the outline of a parabola with the focus at the point of the entering fuel. The theory is based on the fact that the parabolic outline gathers all rays from side walls, bridge wall and fuel bed and concentrates these rays at the focus or point of entering fuel. This theory has not been disproved in practice, but it should be stated that it was developed by the use of a trowel rather than by the use of analytical geometry. Certain furnaces were found to give better results than others, and, the facts tabulated, the theory of design was formulated.

Some arches, such as the one shown, have outlines very similar to the parabola, and by properly proportioning the height, length and pitch of these arches very intense ignition results. No modern chain-grate installation should be limited in capacity by the ability to ignite coal. Prompt, strong, deep ignition is the secret of furnace and stoker success. The more intense the ignition, the quicker will be the distillation of the volatiles and the earlier will the combustion of fixed carbon start.

Strong ignition therefore means high capacity (provided ample draft is provided), high efficiency due to high furnace temperature and ash low in carbon. Strong ignition also gives responsiveness to the furnace and widens the range of fuels which can be burned.

The arch therefore is the pivot on which capacity, efficiency, responsiveness and fuel range depend. Practically all furnaces installed prior to five years ago can be redesigned with remarkable improvement. Many more recent designs permit much improvement. Coal from year to year gets no better in quality, while demands for steam and higher ratings increase daily.

Unit Idea in 100,000-Hp. Electrical Layout*

To Assure Reliability of Service and Simplicity of Operation Each 32,500-Kva. Generator in Niagara Falls Extension Has Been Dealt with as a Separate Plant Logical and Orderly Grouping Given Careful Attention

By J. ALLEN JOHNSON
Electrical Engineer Niagara Falls Power Company

IN THE design of the Niagara Falls extension careful attention was given to the logical and orderly placing and grouping of apparatus. On account of their large size each unit was, to a great extent, considered as a complete plant in itself, being provided with its own individual auxiliaries conveniently grouped about it. Thus, if one stands upon the operating gallery on the center line of a unit, in front is the passage to the thrust-bearing deck of the generator, with bearing thermometers and oil flow indicators in plain view. At the right hand, near the front of the gallery, is the turbine governor, with tachometer and pressure gages, and to the right of that a pedestal for the control of the penstock valve, which pedestal also carries an illuminated turbine gate-opening indicator. At the left hand is the exciter switchboard, containing exciter and fan-motor starting equipment, generator protective relays and generator field-circuit breakers. To the left of this switchboard stands the motor-generator exciter. Thus practically all devices requiring constant oversight or frequent manipulation are concentrated at one level where a minimum number of operators can attend them with a minimum of labor.

On the main floor under the gallery, directly beneath the governor, are the governor accessories, comprising tanks, valves, piping, etc., and beneath the switchboard are the electrical switches for exciter and fan control, and beneath the exciter the ventilating fan. Below the main floor the hydraulic passages, valve, penstock, etc., occupy one side and the passages for electric wiring and ventilation the other. Piping connections for oil, water and compressed air are on the right, all electrical connections on the left.

The first of the three generators, known as No. 16, was supplied by the Allis-Chalmers Manufacturing Company, the second, No. 17, by the General Electric Company, and the third, No. 18, by the Westinghouse Electric & Manufacturing Company. The three generators are similar in design, dimensions and characteristics, each manufacturer, however, having been allowed considerable liberty in mechanical design and in the treatment of details. (These will be discussed in separate contributions by F. D. Newbury, W. G. Foster and R. B. Williamson.) The units are of the vertical-shaft type, three-phase, 25 cycles, 12,000 volts, 150 r.p.m., Y connected. They are given two ratings, one corresponding to the point of maximum efficiency of the hydraulic turbines, called the "normal" rating, and in addition a "maximum" rating. The ratings follow:

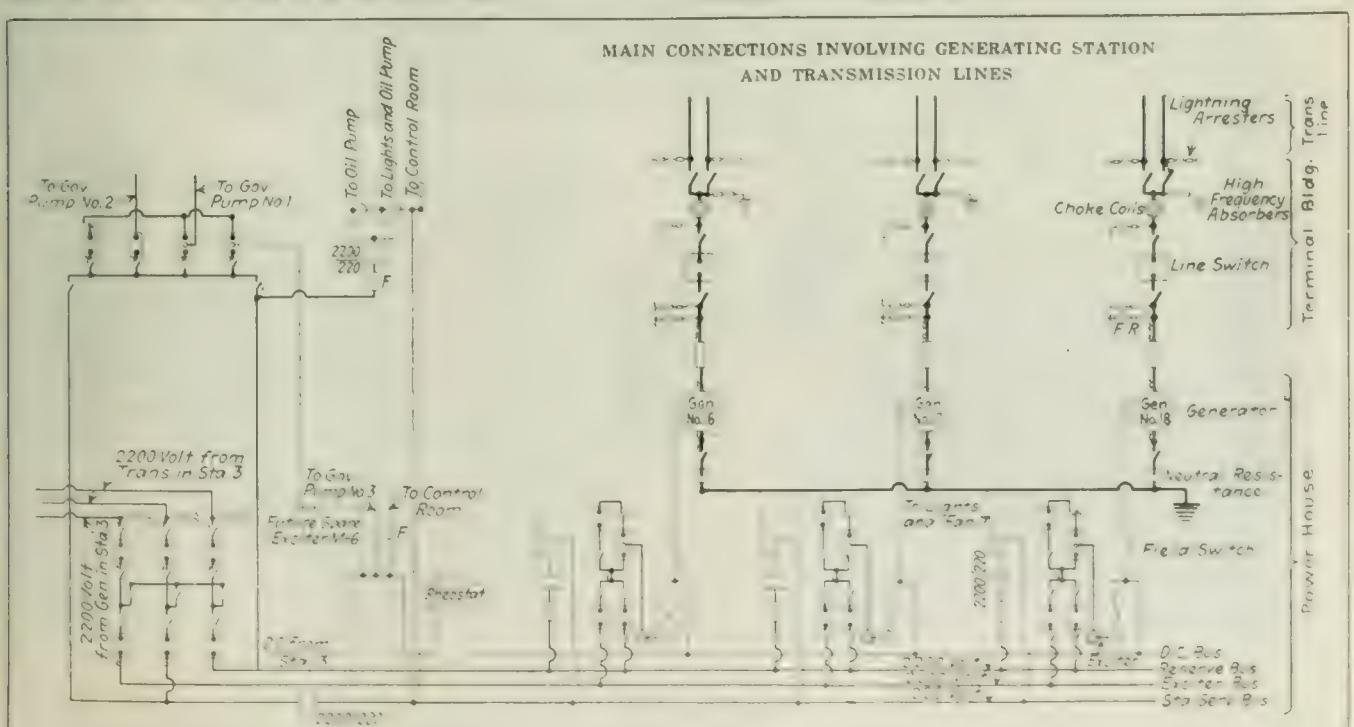
Rating	Kw.	Pf.	Kva.	Amperes
Normal	24,000	.9	26,700	1,285
Maximum	26,000	.8	32,500	1,564

In addition it was specified that the generator should be capable of absorbing 36,000 hp. from the turbine.

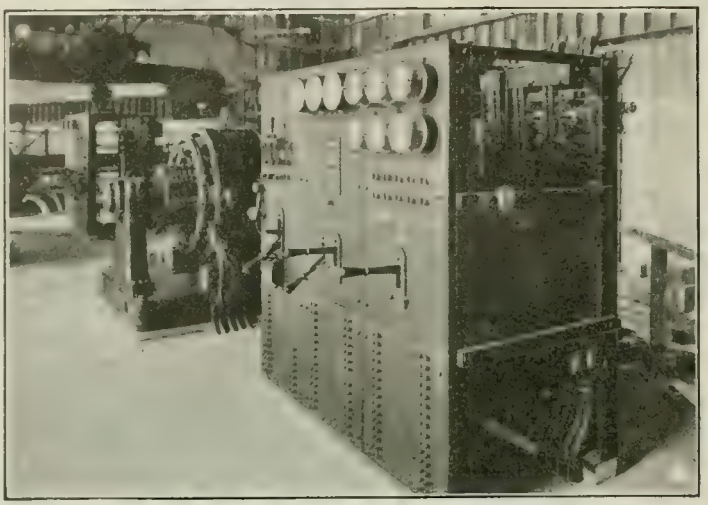
The principal dimensions of the generators are as follows:

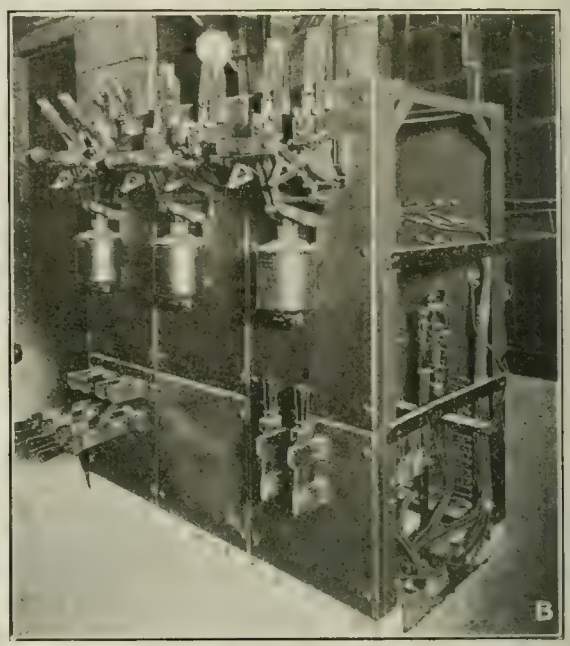
Outside diameter of frame	21 ft. 6 in. to 21 ft. 9 in.
Height to top of frame	9 ft. 5 in.
Height to thrust-bearing deck	13 ft. 2⅜ in.
Height over all	20 ft. 2½ in.
Rotor diameter	16 ft. 2¾ in. to 16 ft. 5½ in.

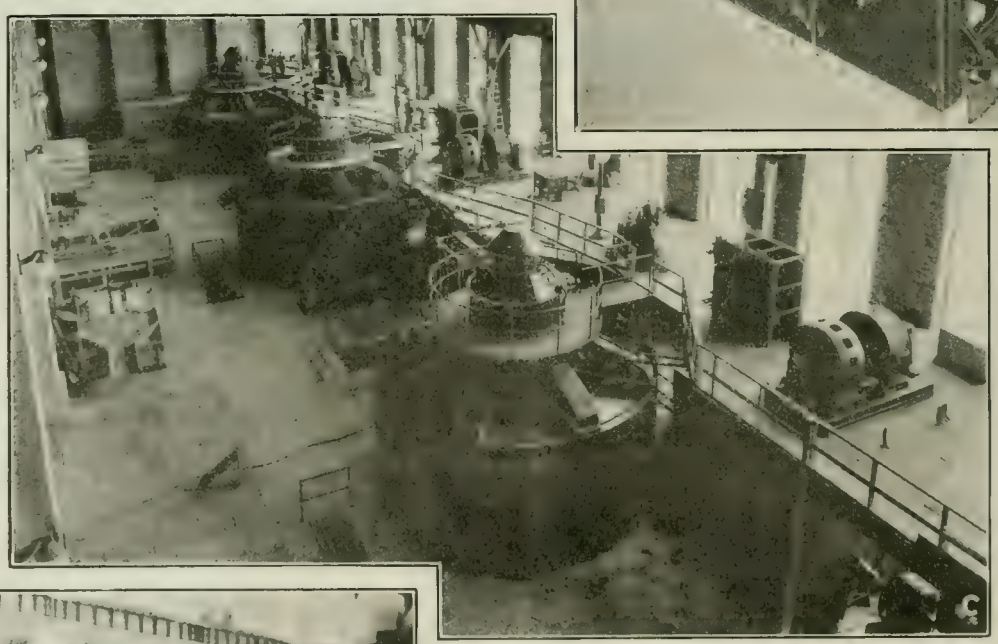
*Fourth installment of a symposium on the 100,000-hp. extension to Station No. 3 of the Niagara Falls Power Company; see Sept. 18, Oct. 2, etc., issues of ELECTRICAL WORLD.

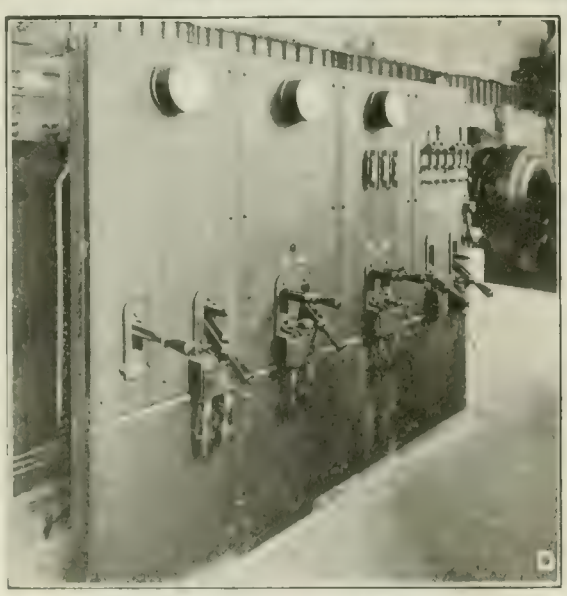


Only Equipment for Starting and Stopping Is in Operating Room—Control Apparatus Is in Control Room









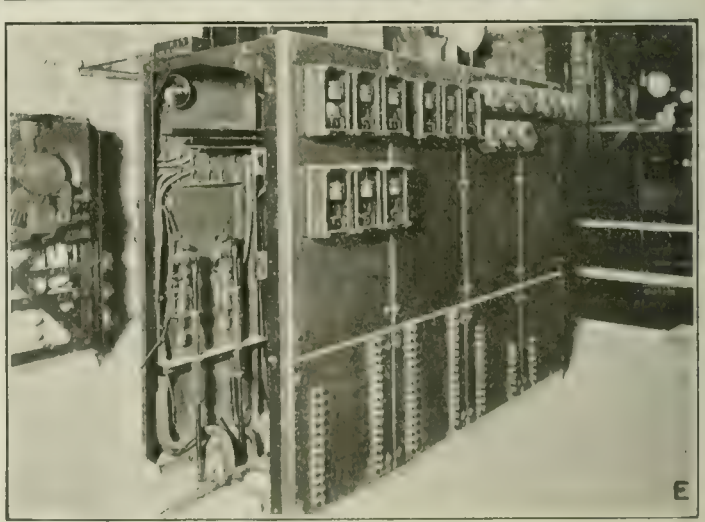


FIG. 2—SOME OF THE EQUIPMENT ON THE OPERATING GALLERY

A, Exciter-motor panelboard back to back with B, which carries field circuit breakers. C, General view of operating gallery. On it are the governor heads, motor-driven exciters, field circuit and station service panelboards and related equipment. D, Oil and governor fluid pump motors are controlled from this board. Back to back is E, station-service relay board.

The estimated weights of the principal parts in pounds are as follows:

	No. 16	No. 17	No. 18
Stator with core and winding	224,000	251,000	291,000
Rotor with shaft	271,000	311,000	318,000
Miscellaneous parts	90,000	53,000	41,000
Total	585,000	615,000	650,000

In each case the weight of the revolving part is carried by a Kingsbury thrust bearing mounted upon a massive spider on the top of the generator. These bearings are identical in all three machines.

Mica insulation was used for the armature windings of all three machines. Rotors were all designed for 100 per cent overspeed. Guaranteed efficiencies at normal load were 97 to 97.25 per cent and armature reactances not less than 18 per cent at maximum rating. The degree of uniformity of characteristics obtained by the three manufacturers is indicated by Fig. 5, which shows the saturation and short-circuit curves of the three machines.

Alternative Sources of Excitation

An individual motor-driven exciter is provided for each generator. The motors are 2,200 volt, three phase, 25 cycle, 750 r.p.m.; the exciters 220 volt, 225 kw. shunt wound, with series interpoles.

There are two alternative sources of supply for the exciter motors. (See the general wiring diagram.) One of these comes from a special 2,200-volt waterwheel-driven generator installed for this service; the other is connected through transformers to the 12,000-volt buses of Station 3. Provision is made for a third connection to the present 2,200-volt distribution circuits in Station 3 gate house.

As a further reserve, there is also an auxiliary field circuit connecting to the direct-current buses of Station 3, capable of supplying the field of any one of the three new machines through a single field rheostat and direct-current bus. A controller for this rheostat is placed on each generator-control board in the control room.

All of the exciter circuits with the exception of the motor-starting equipment are controlled from the control room at the top of the cliff back of the power house. The exciter motors are started from the unit switchboards on the gallery.

Eighteen Temperature Detectors in Each Generator

Each machine is equipped with eighteen embedded temperature detectors, whose leads are brought to terminals on the exciter switchboards, from which any six can be connected to temperature indicating devices in the control room. Cooling air is taken by the generators from the generating room at both top and bottom of the machine. The hot air discharging through the ventilating ducts is collected by a plate steel housing completely surrounding the generator frame and connecting to the inlet of a large motor-driven blower which exhausts the hot air, discharging it through a duct below the power house floor to an uptake leading to the outer air at the roof. Thus the hot air delivered from the generators is not permitted to enter the generator room. Means are provided, however, for recirculating any desired portion of this air during cold weather for the purpose of maintaining the temperature of the generator room at any desired point.

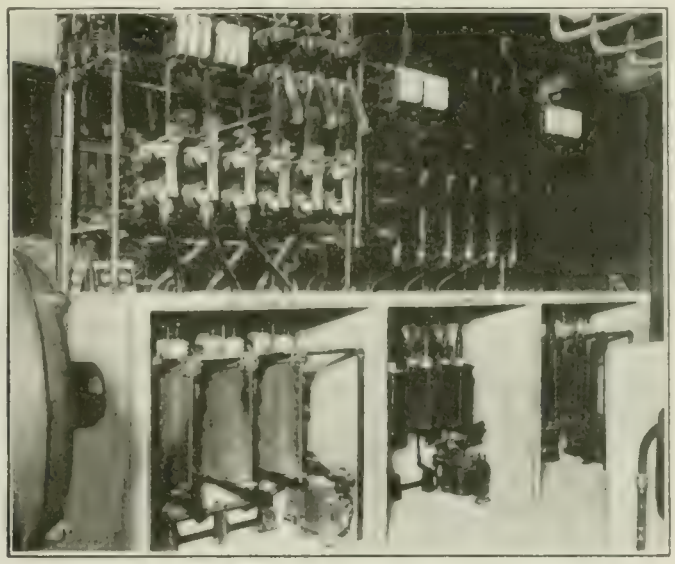
The generators are protected as to internal breakdowns by means of the Merz-Price system of relays operated from two sets of current transformers, one installed at the neutral point and one in the phase leads, these relays being arranged to trip the line and field circuit breakers simultaneously. Overcurrent relays are also provided to trip the line circuit breakers in case of short circuit. All relays are of the inverse definite time type.

Alarm signals are arranged to give warning of the failure of oil or governor fluid supply or the supply of water for the lubrication of the lignum vitæ turbine bearing.

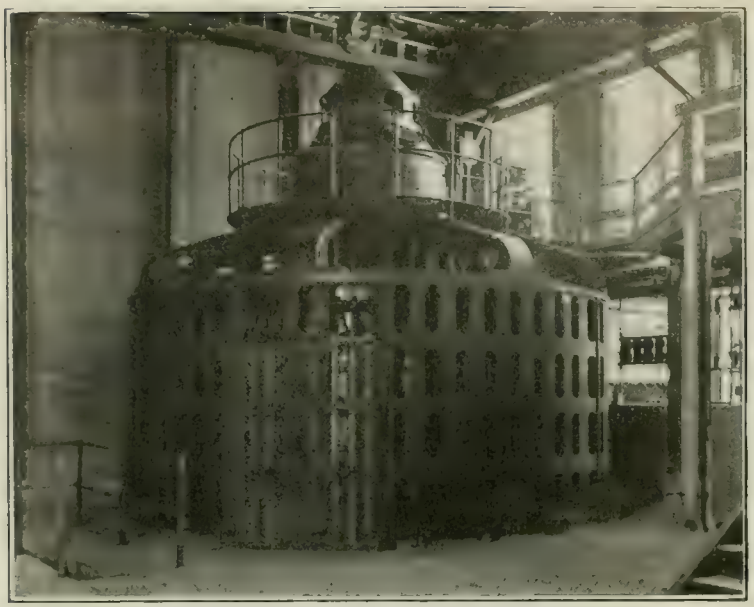
Generator Auxiliaries

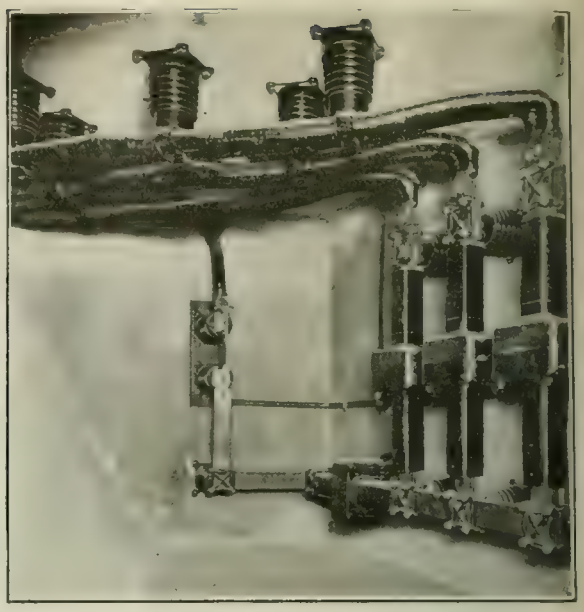
"Turbo-conoidal" ventilating fans made by the Buffalo Forge Company and rated at 90,000 cu.ft. per minute are directly connected through Franke flexible couplings to Allis-Chalmers 40-hp., 220-volt, 25-cycle, 288-r.p.m. induction motors. Starter handles are mounted upon the exciter switchboard on the gallery.





FIGS. 3 AND 4.—END VIEW OF OPERATING GALLERY AND SECTION OF EQUIPMENT BELOW IT





FIGS. 5 AND 6—METHOD OF CONDUCTING LEADS FROM GENERATORS

Six leads leave each generator. Three are phase leads running to the buses, while the other three are the opposite ends of each phase and go through current transformers under the floor and thence to a neutral grounding switch as shown at the right. These current transformers are for differential relay protection, and there is also another set in the phase leads.

There are three governor fluid pumps, centrifugal type, two of which are driven by 75-hp. 2,200-volt induction motors and the third by a 220-volt direct current motor. One of the alternating-current motors is manually started from the operating gallery. The second is equipped with automatic starting actuated by a float switch in the sump tank. The direct-current pump is also operated by a float switch adjusted to follow the automatic alternating-current pump. With these arrangements failure of governor fluid supply is practically impossible.

Bearing oil for all three units is handled by two 220-volt alternating-current motor-driven centrifugal pumps, both manually started. Provision is made for the addition of a third pump to be direct-current operated. Oil storage is provided sufficient for one hour normal operation of the entire plant, by means of tanks supported in the roof trusses above the generating station.

The 220-volt supply for lights and pump and fan motors is furnished either by a central bank of 100-kva. 2,200/220-volt transformers or by an individual bank of 15-kva. 2,200/220-volt transformers for each unit. Energy for lighting is distributed to panel boxes at 220 volts, single phase, a balancing coil of 1.5-kw. capacity being installed at each box to supply the 220/110-volt three-wire branches, all lamps being 110 volts.

From the terminals of the generators cables lead to the top of the cliff, where the wires enter a terminal building containing switching, metering and protective equipment and from which lead the overhead transmission lines. A control building, also located at the top of the cliff, houses the control switchboards, space being provided here for the control of possible future units and also for the control of the units in Station 3, which are now controlled from a switchboard in the old generating station.

Terminal Building on Cliff Above Station

Owing to the fact that all of the power from the new generators was to be transmitted to a new substation at Echota (three miles distant), where complete paralleling arrangements were to be provided, it was not considered necessary to parallel the generators at the generating station, with the duplication of switching equipment and building involved therein. Each generator therefore feeds directly, without interconnection, to its own individual transmission line leading to the Echota substation, a single oil circuit breaker being interposed between the generator and the line. Arrangements are made for synchronizing at this breaker, but it is anticipated that the synchronizing will usually be done at the substation.



FIG. 7—CONTROL CABLES ARE RUN IN CONDUIT AS SHOWN

The terminal building is a long narrow structure located on the brink of the cliff above the generating station and was designed to house the generator oil switch and protective equipment, to serve as a terminal structure for the transmission lines and to form part of a future step-up transformer station.

On the first floor of the terminal building are installed current and potential transformers for metering purposes and the line circuit breaker. Choke coils and static absorbers for lightning protection occupy the second floor, and lightning arresters are situated on the roof. A somewhat unique feature of this installation is the location of the circuit breaker in an opening in the wall of the building in such a way that the tanks and mechanism communicate to the outside of the building, while the terminals and high potential connections are inside. This is primarily for protection against oil fires and explosions. The switch is a Westinghouse type CO-2,

the choke coils also being of Westinghouse construction. The static absorbers and lightning arresters were furnished by the General Electric Company, the latter being of the oxide-film type.

The main leads from the generators, after passing through the current transformers for the operation of differential relays, which are located in the basement of the generating station, enter 1,250,000 circ.mil, single-conductor, varnished-cambric insulated, lead-covered cables, two for each phase, leading to the power house roof. At this point the conductors emerge from the lead-covered cables and pass out of the building through bushings and connect to open wires leading to the terminal building at the top of the cliff. The lead-covered cables are installed in slots in the concrete construction of the power house, and where these slots are vertical the weight of the cable is supported by cast-iron wedges inserted between the cable and the sides of the slot, which for this purpose are provided with beveled pockets at intervals of 8 ft. This method of supporting vertical runs of cable has been very successfully used in the Hydraulic Power Company's previous installation.

The terminal building, at the top of the cliff, is constructed with a cantilever extending out over the edge of the cliff, forming a platform, to the under side of which are attached the open wires leading up from the power house. From this point the leads enter the terminal building through bushings under the overhanging platform. The open wiring between the power house and terminal building is supported on suspension-type strain insulators and is protected against lightning by overhead ground wires. Provision will be made for circulating low-voltage current through these ground wires in winter to prevent the accumulation of sleet.

Arrangements for Control Wire Runs

The control wires from the power house apparatus are first brought to link terminals mounted upon the exciter switchboard on the power house gallery. From this point multiple-conductor control cables carry the control wires to similar terminals on the relay boards in the control building. The control wire passage, which joins the rear power house wall at the level of the roof trusses, is of concrete, built upon the sloping rock surface between the power house and the bottom of an old tailrace shaft which is used to carry the control wiring up the cliff. In this control-wire passage and shaft the cables are inclosed in steel conduit, which, in the vertical portion, is clamped to a steel tower. This tower is supported from the bottom and is free from the side walls of the shaft in order to protect the cables against seepage. A stone wall has been erected across the open side of this shaft, which originally was merely a slot in the vertical face of the cliff.

From the top of the shaft the control wires are carried on steel work through existing excavation to the basement of the control building and thence to terminals upon the relay boards above described. An underground passage also leads to the terminal building. These passages will be utilized both for control wiring and as a subway connecting the control and terminal buildings.

Wherever the concentration of control wiring would result in congestion if placed in conduit the control wiring is carried in steel pans or troughs, arranged one above another, each pan being assigned to an individual unit. In this manner the congestion of conduit, so often seen in power plant construction, is entirely avoided, with, at the same time, a distinct gain in accessibility. Wherever necessary for protection, or where the use of the pan construction is undesirable, control wires are carried in steel conduit. Control wiring is made up in cables of seven to fifteen conductors, each conductor being covered with rubber and cotton braid, the cable being covered with flame-proof braid. No lead sheaths were used on the control cables.

New Control Building for Entire Plant

The control building is located upon the brink of the cliff, overlooking the lower gorge, at a point immediately above the junction of the old and new generating stations, where it is most conveniently situated to control both the old and new plants. The building stands directly over the discharge from the ice gates of Station 3, and use was made of some old waterways, dating from days prior to the art of electrical generation, for control wire passages to the generating and terminal stations.

The main generator control switchboards, which are located in the control building, are of the utmost sim-

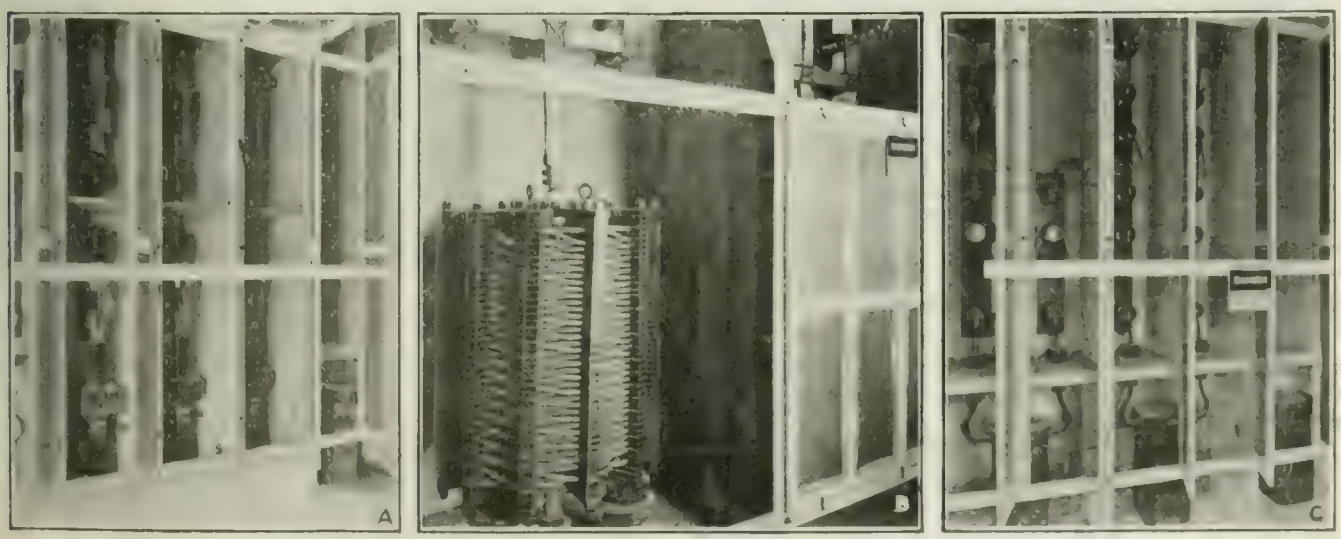


FIG. 8—CELL CONSTRUCTION INSIDE TERMINAL BUILDING ON CLIFF ABOVE STATION

A—Current transformer compartment. Observe that the compartment doors are hinged at base in same phase group are attached to bar so that when oil switches are closed the doors cannot be opened, and hence the maximum protection is afforded workmen. B—One of the choke coils in the generator circuit. C—Potential transformer compartment.

plicity. Vertical panels are used, of natural, dull-finished black "Linstun." Each unit control consists of three panels, one containing the voltage regulators and temperature indicating devices, the second the main generator instruments and control switches for 2,200-volt exciter-motor circuits and governor speed control, and the third, the generating station signal system and control switch for the line circuit breaker. The boards are arranged upon a circular arc, space being provided both for considerable extension of the new station and for the entire control of the old, which it is intended ultimately to relocate at this point.

On the lower floor of the control building, directly beneath the generator control boards, are panels for control wire terminals, relays and recording instruments. Here are also mounted the exciter rheostats operated from the control boards above. A storage battery rated at 120 amp.-hr. capacity at 220 volts for control circuit operation occupies a battery room in one corner of this floor, and immediately adjacent thereto is installed a 16-kw. motor generator set for charging purposes.

In addition to the main generator control switchboards in the control room there is also a six-panel service switchboard for storage battery control and charging and for direct-current control and alternating-current lighting and heating circuits in the control and terminal buildings and a three-panel board for the control of the 2,200-volt circuits for the supply of power for excitation and service in the generating station. All switchboards were furnished by the Westinghouse Electric & Manufacturing Company, after plans and specifications of the power company.

From the foregoing description it will be noted that the entire control of both main generator and exciter circuits, with the sole exception of the exciter motor-starting equipment, is in the hands of the control room operator. First, he may select the source of 2,200-volt power for excitation, *i.e.*, 2,200-volt generator, Station 3 bus, or gate-house service bus. Second, he may select the source of power for driving the exciter for each generator, *i.e.*, exciter bus or reserve bus. Third, he may select the source of direct-current power for each generator field, *i.e.*, individual exciter or direct-current bus. Fourth, he has full control of generator fields, either through the individual exciter field or through the common main field rheostat, and of the field switch. Fifth, he has control of the turbine governor for varying the load and synchronizing, and, finally, of the main generator oil-circuit-breaker connecting the generator to the transmission line.

The duties of the generating station operator are, therefore, confined to starting and stopping the apparatus and attention to its proper mechanical operation, on which function he is able to concentrate his attention.

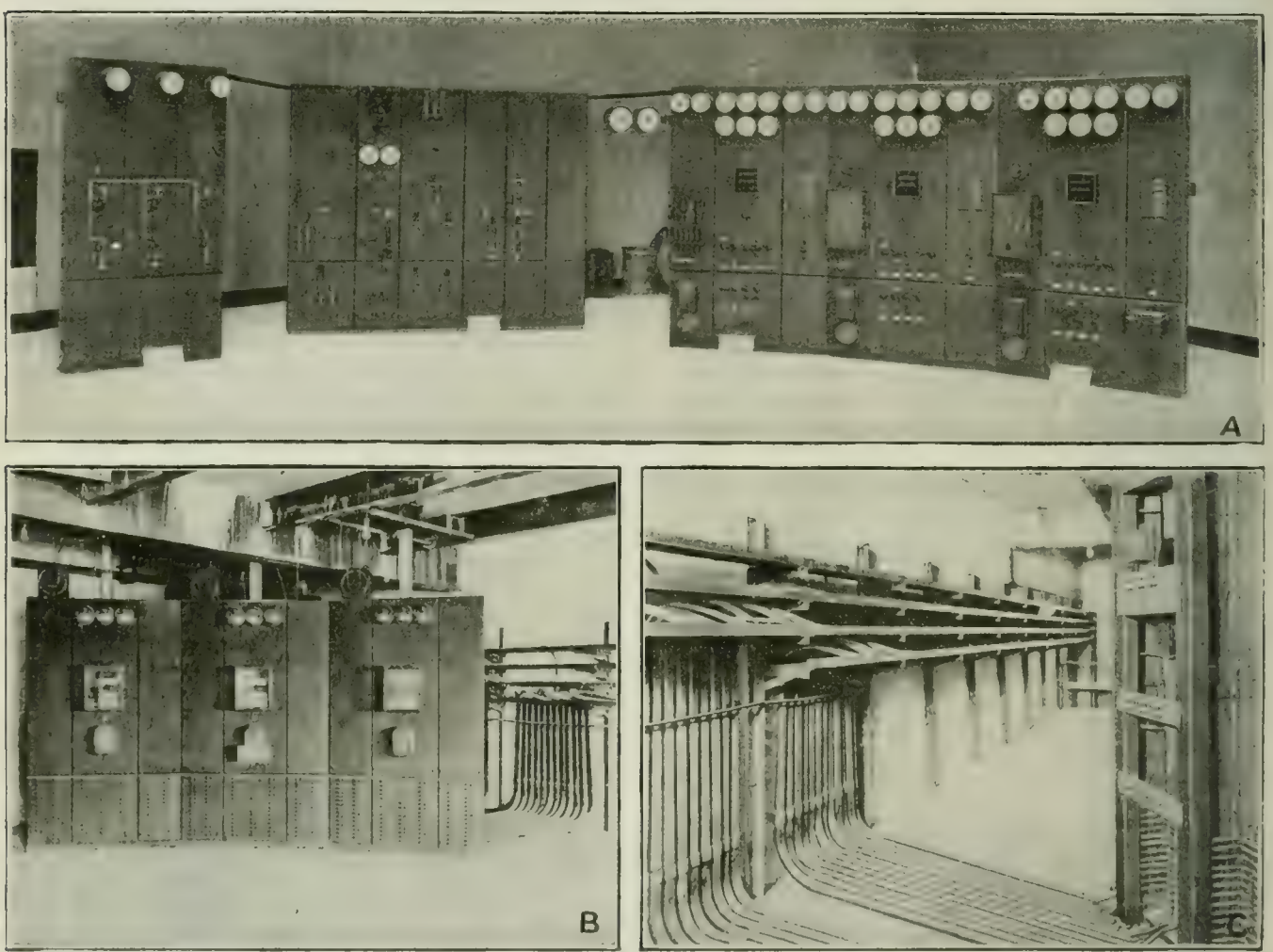


FIG. 9—SIMPLICITY OF LAYOUT AND ACCESSIBILITY OF EQUIPMENT ARE EVIDENT IN DESIGN OF CONTROL HOUSE

A—Main control room showing oil-switch control levers, instruments for operating units, signal apparatus, Tirrill regulators and annunciators which indicate location of trouble. On the left side of the desk is a roll chart on which are plotted station-log. Below this room is the board shown in B, which carries relays and recording and integrating meters. The cables coming to this board are supported in troughs along the walls, as shown in C. Back of the panels to which the cables lead are conduits

Strengthening the Utilities*

Co-operation Among Public Service Corporations, Commissions and Investment Bankers Will Promote Company Welfare—Regulation Has Justified Itself—The Banker's Part—Public Willingness to Invest Growing

By CARL D. JACKSON
Chairman Wisconsin Railroad Commission

IT HAS taken many years and the vast economic changes of the world war to bring to full public realization the simple fact that the true relationship between the public and the public utilities is reciprocal in its nature, demanding not only the public right to adequate and efficient service at reasonable cost, but also adequate return to insure the utility stability, prosperity and credit, without which it cannot long perform its public functions. For the last four years we have been passing through revolutionary economic conditions from which public utilities were no more exempt than was any other field of business endeavor. This resulted in emergency conditions that were treated often as such, but as it became clear that the conditions arising out of the war would not be overcome for many years, if ever, and that revolutionary economic changes had actually taken place, the utility commissions, in general, throughout the country endeavored frankly to meet the situation. This has been an enormous task. The work is still being prosecuted, but sufficient has, in my opinion, already been accomplished fully to justify commission regulation and assure its continuance as a matter of wise public policy in the public interest. Not only have the commissions had to meet the greatly increased expenses strictly operative in their nature, but they have had to provide rates which will meet the increased fixed charges for taxation and for the higher interest rates now prevailing for new capital.

How the Commissions View Their Responsibility

IN SUPPORT of the view that regulation of utilities by public service commissions has been justified by its results, Mr. Jackson made a number of citations from utility decisions. These were selected at random and could be paralleled in almost every state. The following excerpts from the citations exemplify their spirit:

The public is the first to suffer from inadequate service. The city cannot continue to grow to advantage unless the utility system continues to grow as well and keeps abreast in all respects with the community which it serves.—*Maryland Commission.*

It must be borne in mind that to give proper and satisfactory service a company must receive sufficient revenue to meet the demands made upon it. If it fails in this respect, some one must suffer. It may be the stockholders and it may be the public. This should not be the case. Both should be properly provided for, the public by having good service and the stockholder by having a fair return upon his investment.—*New York Commission, Second District.*

It is time to realize that good service can be obtained only by just and equitable treatment of the utilities.—*Oregon Commission.*

Anything which interferes with the attraction of capital to a public utility handicaps the development of the territory served. That to increase rates enough to attract capital will increase the cost of living is in a measure true, but the refusal to grant sufficient rates is 'penny wise and pound foolish' and inadequate service will result, which, through indirect costs, will increase the cost of living many times the increase necessary to attract capital.—*New Jersey Commission.*

A publicly regulated monopoly is helpless in times of mounting costs unless it is given relief by the regulatory authority.—*Virginia Commission.*

It is vitally necessary for the continued growth and prosperity of the vast territory in southern California supplied by applicant with electrical energy that its full program of development go forward without serious interruption. We believe it in the interest of the consumers that they pay rates sufficiently reasonable to enable the company to earn a fair and reasonable return upon the actual investment. Unless this is done it is plain that the utility cannot borrow sufficient funds to carry forward the necessary developments.—*California Commission.*

The regulatory commissions have been well aware of this condition. I believe they can be relied upon to meet the situation frankly and wisely. I believe that on the whole regulation has justified itself and has come to stay. It is wholly in the public interest that utility problems should be dealt with in a broad spirit, with full recognition of economic laws and social conditions. State commissions have the machinery for this work and bring to the problem a close knowledge of local conditions and a staff equipped for broad study and scientific investigation.

But the responsibility for the prosperity and continued development of utilities by no means rests alone upon commissions and regulatory bodies. Commissions are established by the mandate of the people and their continued existence depends upon the consent of the people. In the long run the public must approve and acquiesce in commission regulation if it is to continue. This means that commission action must reach a high standard of economic and social usefulness and the public must understand that this is so. Utility managers and investment bankers must co-operate to make regulation a success not only for investors but for the consuming public, who also must be able to see the advantages coming from that regulation. The benefit both to the public and the utility must be mutual if the system of regulation properly functions.

First in importance along this line besides the question of reasonable rates is the matter of public relations and service. I believe that more and more those active in the public utility field have come to realize their prime

*Part of an address delivered before the American Investment Bankers' Association at Boston on Oct. 5, 1920.

obligation in the matter of service. Good service is one of the keys that will unlock the door to public confidence and public approval. It will lighten your burdens in the performance of your function of financing. It will vastly lighten the burden of regulatory bodies in their field.

It would be well if every one would learn that the owners of public utilities cannot be looked upon or mentally segregated as a class distinct and apart from the general public. The owners are the public. It is the innumerable individual investors and the entire public represented through banks, insurance companies and trust companies that have actually supplied the investment and money to create these utilities. From any point of view, therefore, public utilities are public in every sense of the term, a fact often not realized by the very owners of these utilities.

On the whole, I believe that the time is not very distant when the public will again be glad to have recourse to safe and stable public utility securities for investment. The future of such utility securities appears, generally speaking, to be bright and should be faced in a spirit of optimism.

Relations Between Commissions, Utilities and Bankers

You will pardon me if I have the temerity to make some suggestions upon the relationship which should prevail between the regulating commissions, the utilities and yourselves as representative both of the investing and consuming public. The successful development of public utilities and their ability to meet the ever-growing public needs and demands depends not alone on wise and public-spirited management of the public utilities and fair treatment by their regulatory bodies, but is also dependent upon the securing of capital for this necessary development and expansion, and that capital can be secured from the investing public economically and efficiently under present conditions only through investment bankers.

The investment in a public utility is not intended to be nor is it generally amortized. From time to time therefore the underlying issues mature and must be refinanced. Before the present financial stringency and before the partial impairment of public utility credit a large proportion of the investment was in the underlying securities, usually running for long terms of years. During the war period much of the financing has been on short-term notes at very heavy expense, both in interest rates and commissions, and these, of course, must be taken care of in the next few years. The greatest demand, however, will arise from the necessity of securing new capital for expansion and better service in all classes of utilities. The railroads, if they are to function properly and meet the great transportation needs of this country, will absorb several billion dollars. Utilities have not kept pace with the increased growth of cities and communities, and it has been estimated by those familiar with the utility situation that somewhere in the neighborhood of one billion dollars a year will be required if the utilities are to expand and properly perform their public functions and meet the public demands. New investment at this rate will probably be necessary for four or five years. Assuming, therefore, that it is reasonable to anticipate that the consuming public, which to a large extent is also the investing public, will fully realize the necessity for placing the credit of public utilities upon a firm basis, and that the public utilities as a whole may be assured of fair treatment, the problem is not solved without the complete co-operation of those organizations represented by yourselves and especially established for the purpose of securing the necessary capital for the legitimate and proper development of the country.

I note that at times those engaged in the business of investment banking refer to themselves as "security merchandisers." I trust you will pardon me if I suggest that I do not think this definition of your occupation properly expresses the ideals or ultimate objects of investment bankers. While it is a fact that you are merchandisers of securities, it appears to me that you are also, and especially in relation to public utilities, performing a quasi-public duty with certain quasi-public obligations. So far as the public utilities at least are concerned, the responsibility for financing is not a mere present one, but one that must be with you in the future. It is a responsibility that will be with the investment bankers for all time so far as we can see. Utility regulation cannot be successful without the co-operation of utility management. Neither can it in the long run be successful without the sympathetic co-operation of investment bankers. This can be accomplished much more easily and successfully if the investment bankers will discourage any attitude that their functions are merely related to a specific series of securities and assume that their duty is also to assist the commissions in endeavoring to bring about a sound financial basis of the utility which will look toward its future prosperity and possibilities.

A large part of the financing can be most easily accomplished through the issuance of primarily secured bonds. If a proper ratio between total investment and the secured investment is maintained, not only is a large part of the money obtained for the enterprise at the lowest possible rate of interest (sound investment rates) but the stock financing will be encouraged and the rewards will be increased to those who have taken the greater risk of unsecured issues. This will make it possible to attract further capital in stock issues and adequately maintain that relationship between secured and unsecured issues which alone can assure future growth. The most discouraging situation in the public utility field is found in those instances where only the bonds, and those at high interest rates, will be accepted by the investing public. Such a condition is inimical to future growth. If holding companies are in themselves unwilling to maintain the proper margin of equity by further investment in capital stock, they should then give the public a chance to share in that stock, which is often very attractive.

Rewards Should Come from Operation

The rewards for utility enterprise should be found wholly in the results of operation. I believe it the plain duty of investment bankers to discourage absolutely the financing of public utilities where the rewards are not to be gained from operation and from public service but are attempted to be secured through financing itself. While temporarily there may be more than ordinary profits in this sort of financing, there is also a direct assurance of future trouble for the real investors, the utility and the public.

In spite of the revolutionary times through which we are passing, which have threatened at times the

credit of many of the soundest public utilities in the country, it may be safely said that the utilities are in general weathering the storm and on the road to more prosperous conditions. Many of the utilities are today on as sound or a sounder basis than in pre-war times. This may not be so in general, but that is unquestionably the trend of the times, especially so where regulation has been able to meet the situation. While there are exceptions to this rule, especially in some of the larger cities and where the matter has become a question of politics rather than a question of business and public good, these exceptions do not represent the trend as a whole. The time is also rapidly approaching when wildcat or speculative schemes for enormous profit with no security will not attract the ordinary investor.

POPULAR SPIRIT OF INVESTMENT GROWING

It is not to be overlooked either that the spirit of investment is growing among the people. Liberty bond investment has taught many of them to invest who never before considered this matter. The public utilities themselves under the stress of the war were in many instances obliged to go directly to the people with preferred stock and other securities in order to weather the financial stringency. I am told that in the electrical field alone there are 1,200,000 individual investors—a greater number of investors than can be found in any other field.

Utility development must meet with sympathetic encouragement from the people. This is a field in which the investment bankers can assert a very great influence for the public good. They can assist the public in coming to understand the problem and the situation. They can make the situation easier for the utility and for the commissions. At the same time, the benefit which will come from a better public understanding of the problem and situation will not only be for the benefit of the utility and for the general good but will be in the interest of the investment bankers themselves. The public also should come to learn that regulation is an assurance of stability, that the hazard is perhaps at a minimum and that the safety of the better investments is only exceeded by that of government securities.

The solution of all problems connected with public utilities is one to be reached by the utilities, the utility commissions and the investment bankers. All matters connected with the problems must be handled in a co-operative spirit and one which will appeal not only to the consuming public but to the investing public, and for my part I think that I can freely assure you that the utility commissions will welcome your wholehearted co-operation.

Languages Eliminated from Engineering School Curricula

IN ORDER to devote more time to technical matters the faculty of the California Institute of Technology, at Pasadena, has eliminated modern languages from the required curricula of the engineering classes. Under the new program students may take special courses in languages if they desire, but the hours that were formerly devoted to such subjects have been given to electricity and kindred matters. English and current topics will also be insisted upon more than previously. The departure was made, it is said, after consultation between the faculty and technical authorities.

Readers' Views and Comments

Interconnection with Industrial Plants

To the Editor of the ELECTRICAL WORLD:

SIR: The interconnection of industrial plants and power companies to conserve fuel and money offers possibilities well worth thorough investigation. The smaller and more uneconomical plant can often purchase power to better advantage than to attempt to generate it. The use of steam for process purposes will modify conditions and each case must be considered on its merits. The large power consumer, however, presents a different case, and where interconnection is advantageous one of three classifications will apply:

(1) The industrial plant should purchase all or a portion of its power from the power company.

(2) The industrial plant has surplus power to sell at certain periods while it may or may not purchase power at certain other periods.

(3) The industrial plant has excess power to sell at all times.

In order to make an attractive contract agreement the manufacturer must be able to furnish power at a price to compare favorably with that generated by the central station. This may be accomplished in several ways. The load factor may be so high that the kilowatt-hour cost is comparable even though the generating units are not so economical. Many industrial plants operate with hydro-electric power and are in a position to compete on price with power companies.

The greatest opportunities in this line would appear to be in those industries in which waste heat can be utilized for generating excess power. In the smelting and working of iron, steel, copper and other metals, in the manufacture of Portland cement and in many other industries large quantities of waste heat can be developed. Where these developments have been made they have covered only the requirements of the industrial plant. By the installation of more complete apparatus for the recovery of the heat and by larger and more efficient generating units large blocks of power can be made available at low cost. This power can be wholesaled to power companies for distribution.

The installation of waste-heat boilers in connection with industrial processes involves modification in operating methods. These require careful planning and close co-operation with the operating forces. A properly designed plant, operated under careful supervision, will usually give beneficial results from both the manufacturing and power departments.

Under existing conditions of finance among the utility companies it is possible that the installations can be financed more readily by the industrial companies. A careful analysis should be made by competent engineers in order to obtain the utmost benefits to both parties. In some cases a mutual benefit will result from a change in status of a few large consumers to producers of power. This should not work a hardship in view of the present shortage of power supply.

El Paso, Tex. T. H. ARNOLD.

Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Exploring Coil Outfit Locates Grounds on Distribution Circuits

AN EXPLORING coil outfit such as that shown in the accompanying photograph provides a simple and reliable means of quickly locating accidental grounds on low-voltage overhead circuits. The outfit consists of an exploring coil, a reactance coil and a pair of head telephones such as are used in wireless telegraphy. The exploring coil is made by winding 5,000 turns of No. 36 wire on an ordinary wooden bicycle rim. The reactance coil consists of 600 turns of No. 15 magnet wire wound on a laminated iron core having a closed magnetic circuit of 6 sq.in. (38.7 sq.cm.) cross-section. Taps are brought out about every 100 turns so that the current may be varied. Connections are made as shown in Fig. 2, and a tap is selected on the reactance coil that will allow about 5 amp. to circulate through the ground to be located.

If the circuit is normally ungrounded, a temporary ground connection must be made. If the circuit has a number of ground wires, they must be disconnected from ground while making the test. The receivers are placed on the head and the exploring coil is held with its plane parallel to the circuit. With the coil in this position a distinct humming or singing sound is heard. This sound is generally of a high pitch and is produced by the harmonics in the magnetizing current of the reactance coil.

In the case of an overhead line the tester then walks

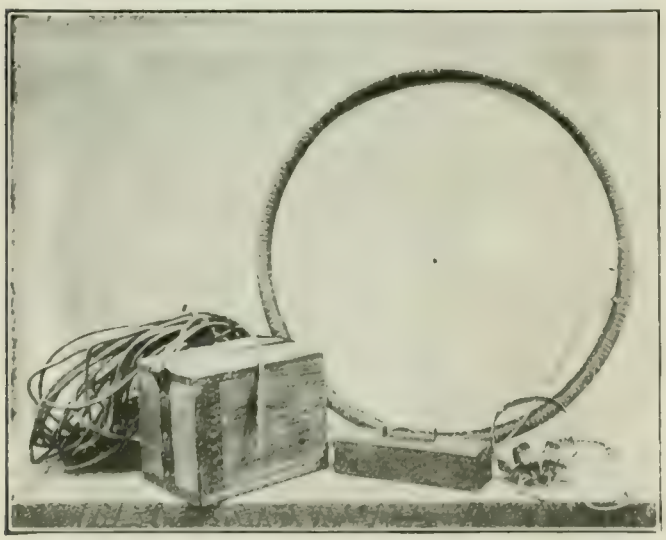


FIG. 1—EXPLORING COILS AND REACTANCE USED FOR LOCATING GROUNDS

along the line until the hum ceases and he knows that the ground is on some customer's premise feeding off the pole at this point.

After the tester has located the service carrying the ground current, the small exploring coil shown in the picture is used inside the building on the various branch circuits to locate the circuit where the trouble exists.

To locate grounds on direct-current circuits, if a source of alternating current is not available, an interrupter is substituted for the reactance and direct current is used instead of the alternating current.

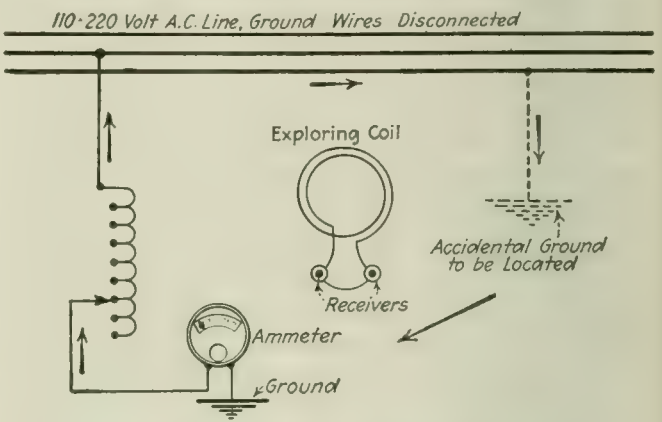


FIG. 2—CONNECTION FOR LOCATING GROUND ON DISTRIBUTION CIRCUIT

This outfit is particularly valuable in locating accidental grounds on secondary circuits where it is desired permanently to ground the transformer. It can also be used to locate underground pipes and other metallic structures.

W. C. HESTON,
Industrial Power Engineer.
Portland Railway Light & Power Company,
Portland, Ore.

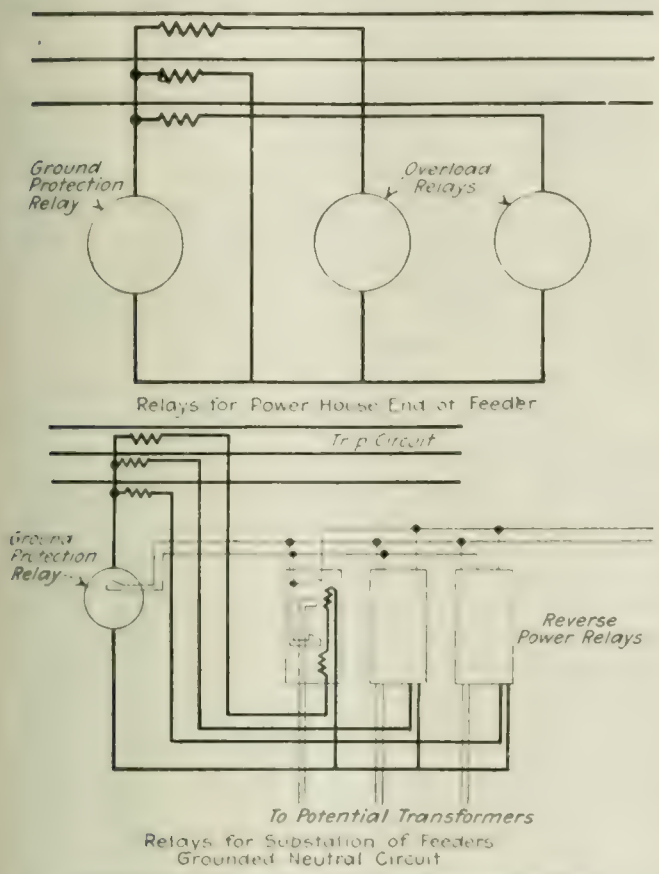
Special Relay Permits Use of High Resistance in Neutral Grounds

THE use of high resistance in neutral grounds has become possible through the development of a special ground relay which will operate on a much lower current value than regular overload relays. Resistance is ordinarily used of so low a value that a ground causes operation of the overload relays. Systems using these ground relays have been successfully operated when they are set for current values of 10 per cent to 20 per cent of that for which the main relays are adjusted. For example, in a certain 6,600-volt circuit with protection dependent entirely upon overload relays set at 100 amp. more than 38 ohms could not be put into the neutral as more resistance than this would not permit sufficient current to flow in case of a ground to operate the overload relays.

For safety it was necessary to reduce the resistance to half that value to make sure that no ground could occur without tripping the overload relays. With

the system illustrated the ground relay was set for 10 amp., which allows the use of 100 ohms in the neutral and yet will pass sufficient current under conditions of a higher resistance accidental ground to operate the ground relay.

Three current transformers at the power house end give complete protection, while two would leave a chance that a ground occurring on one leg would not operate the



GROUND RELAY OPERATES AT LOW CURRENT VALUE

relay. With this system there are two overload relays which give protection against short circuit and the third relay gives selective action and fast tripping will take place on grounds. The current setting of the third relay places the limit which must be put upon the ground-line resistance.

At the substation end of the line three ordinary reverse-power relays and one ground-protection relay are used as shown. The reverse power relays have two independent elements with contacts in series. The upper element is a watt relay and closes its contacts on any reversal of power; the lower element is a current relay and closes its contact when a given current flows irrespective of direction. Both elements must operate in order to trip the breaker, the upper element giving directional selection and the lower giving current selection. The fourth relay is a low-current relay similar to the one at the powerhouse end. Its contacts bridge the contacts of the lower elements of the reverse-power relays and therefore take the place of the lower element when a ground occurs.

This system can be applied on systems both with multiple power stations and with multiple substations.

A. W. COPLEY,
General Engineer.
Westinghouse Electric & Manufacturing Company.
East Pittsburgh, Pa.

Trailer Reduces Central Station's Hauling Expense

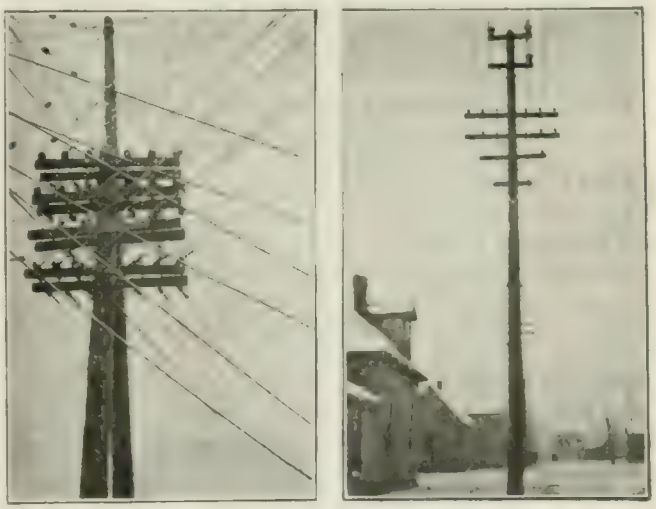
THE usefulness of autotrucks for hauling heavy and bulky central-station apparatus has been greatly increased by the purchase of a 6-ton trailer by an Illinois company for special hauling jobs. The trailer has been the means of reducing the number of special truck trips almost 50 per cent. The company operates in a number of towns fairly close to each other, and in many instances it has been found to require only two or three more truck hours to ship by truck direct than it would to send by freight with truck delivery at each end. The trailer greatly increases the economic possibilities of these through truck shipments.

The trailer has also proved useful for moving heavy machinery, poles, etc., where unloading facilities are not available. The load is simply left on the trailer and the truck is free to do other work until the trailer is unloaded. No difficulty has been experienced in loading twenty-five 35-ft. (10.5-m.) poles on the trailer. The first layer of poles is laid with the butts slightly overhanging the front end of the trailer body but clearing the rear end of the truck so as not to cause interference in turning. The succeeding layers of poles are then above the truck so they are allowed to overhang the truck body about 4 ft. or 5 ft. (1.2 m. or 1.5 m.).

This size of trailer was decided upon because it was large enough to haul heavy transformers, motors and other generating and substation equipment and was not too heavy for hauling light, bulky loads. The trailer can be loaded up to and above its rated capacity on level paved roads when drawn by a 2-ton truck, but on soft roads and in hilly country a larger truck should be used or a smaller trailer load carried. It is not necessary to have any one on the trailer to steer as it tracks with the trucks. The trailer is coupled to the truck by means of a pintle hook such as used by the United States army.

G. GENUNG,
Inspector of Transportation Equipment.
Public Service Company of Northern Illinois.

Safety Considerations in Line Construction



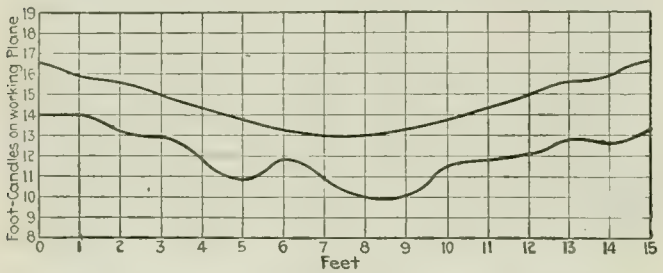
Ample climbing space is provided in the line on the right, while that on the left has scant space for the linemen to climb. The difference between proper and improper vertical clearance between cross-arms is also shown.

Industrial Applications

The Economical Utilization of Electrical Energy in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

Lighting Efficiency Decreased 20 per Cent by Pulleys and Columns

LIGHT lost by interference of belts and pulleys was found to be about 20 per cent of the theoretical output of the lamps in the motor plant of the Oakland Motor Car Company, Pontiac, Mich. The lighting equipment consists of twelve 300-watt bowl-enameled type



ACTUAL AND THEORETICAL LIGHT DISTRIBUTION IN AUTOMOBILE PLANT

Upper Curve—Theoretical distribution of light from twelve 300-watt lamps without interference. Lower Curve—Actual distribution with belt and column interference.

C lamps mounted in R. L. M. reflectors 13 ft. 4 in. above the working plane and spaced 13 ft. 4 in. x 15 ft. (4 m. x 5 m.) in a rectangle three lamps wide and four long.

Illumination intensities were measured at each foot on a line between the two most central lamps, which were 15 ft. apart. These intensities were first calculated from the manufacturer's distribution curves, the values being shown by the top curve of the accompanying drawing. The actual distribution as found by measurement with a foot-candle meter with all lights burning is shown in the lower curve. It is seen by comparing these curves that the columns, pulleys and belts cut down the average intensity from 14.8 foot-candles to 12.

Poor Alignment Causes Most Troubles of Centrifugal Pumps

BAD alignment is the cause of most of the operating troubles of centrifugal pumps used for power-house and industrial purposes. Especially is this true for the smaller-sized pumps. One of the most common signs of this defect is vibration. When this is noticed the pump should be checked up for alignment with the motor or engine by which it is driven. A centrifugal pump and motor may be lined up perfectly on a cast-iron bed plate, but if this is screwed down firmly on an uneven foundation it is an easy matter to pull the pump and motor out of line. For this reason the alignment of centrifugal pumps should be checked up after they are bolted down in position, even if they were in line when there was no strain on the bed plate. The alignment can be checked by placing a straight-edge across the coupling at four or five places around the perimeter and by passing a distance gage between the two halves of the coupling to make sure that they are the same distance apart all around.

Centrifugal pumps are sometimes thrown out of line by the disintegration of concrete foundations. When there is any chance of a foundation becoming oil-soaked stone should be used in preference to concrete.

Iowa Railway & Light Company, Marshalltown, Ia. JOHN M. MAY, Traveling Engineer.

High Speeds Obtained in Routine Work by Automatic Welding

WELDING speeds considerably in excess of the speed of manual welding have been found practicable with the automatic-feed type of welding machines, particularly where a considerable amount of routine duplicate welding has been done. The average speeds for different classes of work are given in the accompanying tables. This machine has been successfully applied to building up worn motor shafts and worn crane-wheel flanges and to welding the seams of tanks, etc. It is necessary to move either the material to be welded or the welding machine at a uniform speed in order to feed the metal along the weld. This necessitates specially setting up each different job, and it is for this reason that the principle field for the machine

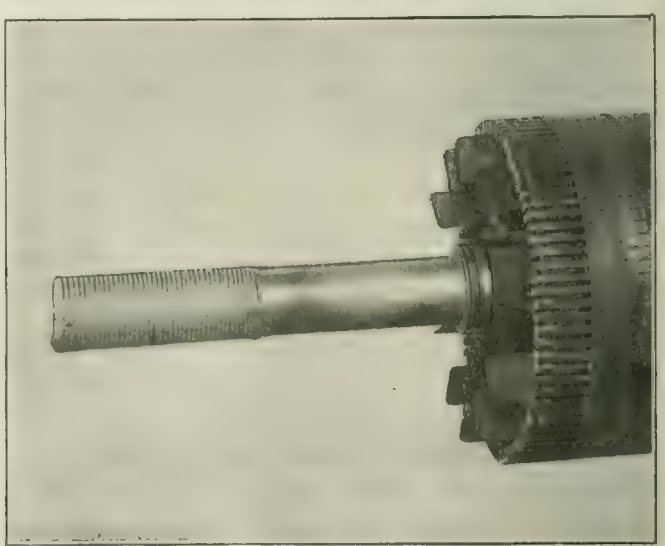


FIG. 1—WORN SHAFT OF MOTOR BUILT UP BY AUTOMATIC ARC WELDING

is where a continuous repetition of duplicate welds is required.

In case straight seams are required a lathe or planer is used to carry the weld along, and for circular work a lathe or boring mill is used. In some cases clamping jigs are employed to hold the work and to

facilitate putting it in position and removing it. Another use where the machine has proved economical is on large jobs such as that of reclaiming a 14-in. (36-cm.) shaft by building up ⅜ in. (1 cm.) of metal. This shaft had been inadvertently machined too small for its flywheel, and it was therefore built up to size.

It was 14 in. (36 cm.) in diameter, and the seat was about 21 in. (54 cm.) long. About ⅛ in. (5 mm.) of metal was deposited on this seat in one layer and in one continuous operation. The flywheel seat was later machined to the proper diameter. The welding figures are as follows: Current, 190 amp.; arc voltage, 18; electrode, ⅛-in. (3-mm.) diameter; travel, 4 in. (10 cm.) per minute; rate of deposition, about 4 lb. (18 kg.) per hour. Time required: Welding, sixteen hours; machining, four hours.

WELDING SPEEDS OF AUTOMATIC ARC WELDING

SEAM WELDING

Thickness of Material, In.	Amp.	Speed, In. per Minute
0 04	45 to 50	20 to 30
1 16	50 to 80	15 to 25
¼	80 to 120	6 to 12
3 16	100 to 150	4 to 6

BUILDING UP (WHEELS OR SHAFTS)

Diameter or Thickness, In	Electrode Diameter, In	Amp.	Speed, In per Minute	Lb Deposited per Hour
Up to 1	1 16	60 to 90	11 to 13	1 04 -1 56
1 to 3	3/32	90 to 120	6 to 8	1 59—2 1
Over 3	⅛	120 to 200	4 to 6	2 5 4 5

In reclaiming worn motor shafts, pulley and pinion seats and bearings are built up without removing the armature and usually without taking off the windings. In welding pinion or pulley seats the keyway is first filled either by hand-depositing or by welding in place a section of metal, after which the entire seat is covered (Fig. 1). Worn flanges on cranes may also be repaired. In the case of the 22-in. (55-cm.) wheel shown in Fig. 2 the actual welding time was two hours, compared with twelve hours for hand welding. A comparison of welding on smaller objects where jigs were used showed that welding the straight seams on ten small oil-switch tanks required two hours with the machine against four hours and forty minutes by hand.

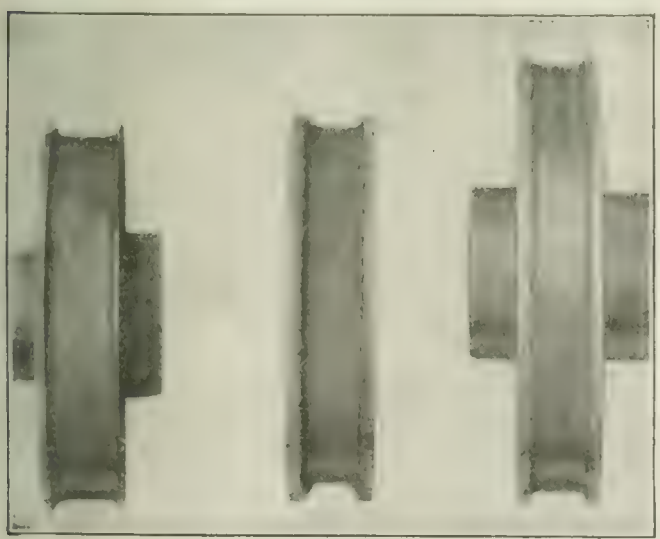


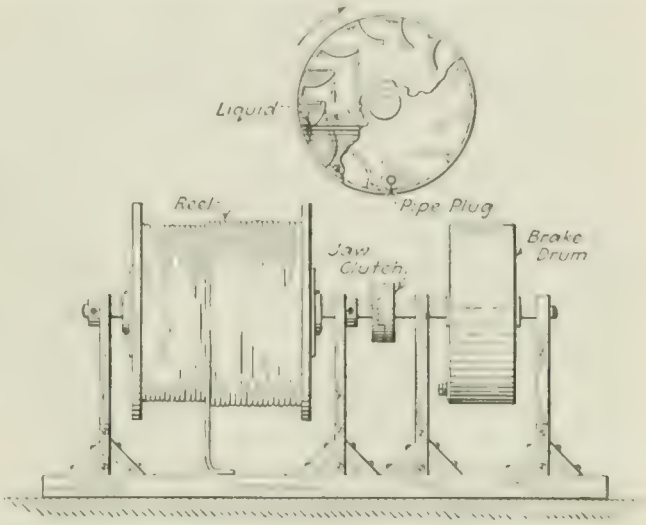
FIG. 2—CRANE-WHEEL FLANGES REPAIRED IN TWO HOURS BY AUTOMATIC ARC WELDING

Schenectady, N. Y. H. L. UNLAND.

Elastic Brake for Unreeling Wire

TO OVERCOME the difficulty experienced with most friction brakes used to maintain a tension on wire while being unreeled for the purpose of winding electrical devices the writer has designed and used a water brake, similar to the one illustrated in this article, which not only maintains a uniform tension but will also take up slack when more wire is unreeled than is required at the moment.

The brake consists essentially of a galvanized-steel drum into which are fastened curved buckets as shown.



LIQUID BRAKE FOR WIRE REEL

The braking effect depends upon the kind and amount of liquid placed in the brake drum. The liquid is lifted into the bucket in such a manner as to afford an eccentric loading of the drum at all times for a given direction of rotation. Should a sudden pull on the wire cause the reel to turn further than desired, and thereby produce slack, the brake will cause a reversal of rotation and again tighten the wire.

Old grain elevator buckets about 2½ in. x 2½ in. (65 cm. x 65 cm.) were used in this particular case, and the drum was 2 ft. in diameter by about 3 in. wide (56 cm. x 7.5 cm.). A ½-in. (12-mm.) pipe with suitable flange arrangement was used for a shaft, and a pin served to couple the brake to the reel shaft. A plug near the circumference of the drum is used for filling or removing the liquid. Water is used in the brake drum for wires up to about No. 12 B. & S. (3.31 sq.mm.). For heavier wire the brake should be filled with lead shot mixed with oil. This gives the brake a much wider range and permits a smaller-sized brake drum to be used for a given-sized wire. Adjustment of the tension is accomplished by adding or removing the liquid through the plug. The same design of brake can be used for unreeling textile goods, cotton, silk and heavy cables.

Vaughn & Meyer, Milwaukee, Wis. CORNELIUS G. WEBER.

Dust on Lighting Fixtures Reduces Light 25 per Cent

WHEN figuring on the installation of new lighting equipment it must be remembered that when the lamps become old and more or less dirty between cleaning periods the emitted light falls off about 25 per cent. Consequently for a desired foot-candle illumination the rating of the lamps must be about 33 per cent higher than that found necessary from calculations based on the efficiency of new clean lamps.

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

Northwest Utility Sells $1,000,000 Issue Locally in Eleven Days

IN ELEVEN working days in September the Puget Sound Power & Light Company, Seattle, Wash., disposed of an issue of $1,000,000 in five-year 8 per cent gold coupon notes. This is said to be a record in security selling in the Northwest, as twenty days had been assigned to the sale. The notes were in denominations of $100, $500 and $1,000. An executive of the company, in commenting on the sale, says:

"An interesting example of the tendency toward co-operative ownership of large corporations is shown in the subscription list. The entire issue was oversold in less than eleven working days. Through the efforts of the organization itself, and without any underwriting by bond houses, it was distributed over all the territory served by the company.

"More than a thousand employees of the company (more than half the total number of persons employed) became interested in the company's securities in this short time, and purchases by employees alone absorbed more than 40 per cent of the total issue. Participation by customers and employees in ownership of the property is bound to benefit all concerned by retaining the income from the securities in the Puget Sound district and in broadening the interest and understanding of the company's operations and problems in the 147 communities served."

Cost of Rural Line Construction in Ohio

RURAL lines radiating from Greenville, Ohio, single-phase and carrying 2,300 volts, cost on the average about $750 per mile, exclusive of transformers, meters and overhead expense, when built by the farmers in accordance with the specifications of the Greenville Electric Light & Power Company.

The company requires the farmers to use 25-ft. (7.5-m.) poles set forty-two to the mile, 3-ft. (91-cm.) Washington fir cross-arms, galvanized braces and bolts and No. 6 B. & S. (13.3-sq.mm.) bare copper wire. The detailed costs are given in the accompanying table. These figures vary a little with local conditions, for instance, when 30-ft. or 35-ft. (9-m. or 10.5-m.) poles have to be used to cross telephone wires or highways.

In cases where the farmers do not include the cost of their work in hauling the poles and digging the holes, the cost of the line may be as low as $550 per mile in actual cash expended.

It is said that if the farmers will follow the central station's specifications and instructions no engineering advice will be needed, and the company, therefore, does not charge the farmers any engineering or overhead fee. The utility company inspects the line after it has been completed and does not switch on the service until the line has been built according to its specifications.

One of these 2,300-volt lines extends out for 6 miles (9.6 km.) and has branches totaling about 3 miles (4.8 km.). All customers on the main line and branches are being given satisfactory service. A 6,600-volt line built to extend out about 12 miles (19 km.) cost about $1,000 a mile, including a 50-kva., 2,300-volt to 6,600-volt, 60-cycle step-up transformer.

Rural customers in this section of Ohio average only about five per mile, though the line construction is of ample capacity for ten to twelve customers per mile, consequently there has been no trouble from overloaded lines. None of the farmers in the district use motors or devices which call for a transformer capacity in excess of 1 kva., the size used for each individual customer on all 2,300-volt lines. For customers on 6,600-volt lines 1.5-kva. transformers are used. However, with this size it is sometimes possible to serve two farmers from the one transformer. The customers must purchase the transformers from the central station, and if desired, the central station company will install the transformers at the customers' expense. Each customer's service meter is furnished and installed by the utility and at its expense.

COST PER TYPICAL MILE OF 2,300-VOLT RURAL LINE

Forty-two poles, at $4.50 each	$189.00
850 lb. bare copper wire, at 25 cents per lb.	212.50
Forty-two 3-ft. cross-arms, at 65 cents	27.30
Eighty-four insulators, at 7 cents each	5.88
Hardware, at 50 cents per pole	21.00
Eighty-four pins at 5 cents each	4.20
Labor erecting, digging and hauling	290.12
Total	$750.00

The absence of any appreciable power load makes the energy consumption of these rural customers small, and the average for 300 farmers in the district is only 15 kw.-hr. per month. The rates for service consist of a fixed charge of $1 per kilovolt-ampere of transformer capacity per month plus an energy charge of 10 cents per kilowatt-hour. No discount is allowed for prompt payment.

The high cost of reading meters for these rural customers has made it necessary to have the meter reader make out and deliver the bill at the time the meter is read. A man in a Ford car can cover about 35 miles (10.5 m.) and read 125 meters in one day. The meter reading in this case also includes making out and leaving the bills on the customers' premises. The total cost of reading and billing under this plan is 7 cents per customer exclusive of overhead charges, against only 2 cents per customer in the cities.

This information was given by D. L. Gaskill, president of the Greenville Electric Light & Power Company, in the course of a discussion on farm-lighting business before the last convention of the Ohio Electric Light Association at Cedar Point, Ohio.

Employees Instructed in All Operations of Company

BELIEVING that members of the various department forces could do better work if they knew more of the problems and work of other departments, the Oklahoma Gas & Electric Company has undertaken a series of studies known as "information courses." The first course has been finished and the second is about half completed.

Lectures are given by department heads at 1 p.m. each Tuesday and Friday. Where practical demonstrations are made forty minutes of the period is devoted to the lecture and twenty minutes to the practical demonstrations. It was found that more than two-thirds of the office employees had never seen the power house, meter-department shop and other parts of the property. Clerks handling work orders, material sheets, etc., did not know the physical appearance of the items with which their work was concerned and therefore could not judge whether cost figures were reasonable or not. The course is laid out with a view to familiarizing employees with all the operations of the company and thus increasing efficiency and interest. Attendance is entirely optional and classes are limited to twenty as this number has been found most convenient to handle at one time. Employees have manifested keen interest in the courses and at a number of meetings have brought members of their families. Applicants for the second course were double the number that could be accommodated in one class.

Salvaging Municipal Plants When Utility Takes Over System

AN INTERESTING solution of some municipal-plant problems involving the discarding of obsolete systems and starting afresh has been worked out in the territory of the Wisconsin-Minnesota Light & Power Company. Originally several plants and distribution systems were purchased, but interest charges, cost of reconstruction or heavy maintenance charges on the old systems imposed a handicap on the company in giving service at reasonable cost.

As most of the plants involved were either direct-current or obsolete alternating-current systems, it was decided to proceed on the basis of abandonment of systems that were badly depreciated, the municipality to sell the salvaged equipment to the best advantage. In several instances proper presentation of the situation at special elections has resulted in a vote as high as 90 per cent to scrap the obsolete system, give the company a franchise and permit it to construct a new distribution system. In most communities the municipal plants were able to supply night service only, while the Wisconsin-Minnesota company could give twenty-four-hour service from its transmission system. Such a plan must, of course, be carefully worked out before an attempt is made to apply it. When a municipality is asked to scrap its old plant, the reasons that lie back of the request must be sound and the community must be shown that such a course is a real economy.

Since utility financing in the usual manner has been practically impossible, it was decided to ask these communities to appoint a committee on electric light subscriptions to raise sufficient money for the new construction, including connection to the transmission system.

This money was advanced to the company on its 7 per cent promissory notes at par. One-year or where possible five-year notes, payable one-fifth each year, have been issued, the approval of the Wisconsin Railroad Commission for the issuance of such notes having been secured.

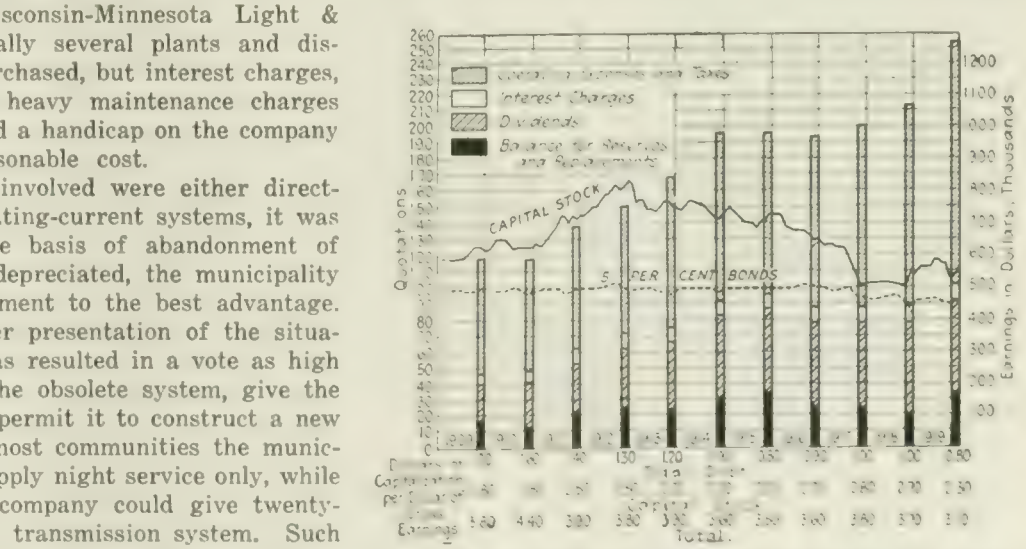
The financial plan, while a temporary one, gives the community a direct interest in the property and opens the way to the sale of other company securities. To the 5 per cent first and refunding bonds of the company an additional coupon has been attached in the form of a promissory note, paying 3 per cent additional and payable at the same time as the bond interest coupon, making the purchase of such bonds an 8 per cent investment.

It is expected that the temporary 7 per cent notes will be the means of interesting customers in either these bonds or company preferred stock. These securities are sold at par. The whole plan results in securing par value for securities, which is a decided advantage.

P. D. KLINE,
Vice-President and General Manager.
Wisconsin-Minnesota Light & Power Company,
Eau Claire, Wis.

Utility Chart Shows Many Facts in Small Space

THE importance of avoiding undue complication in plotting statistical data was emphasized at the Kineo (Me.) convention of the New England Geographic Division, N. E. L. A., in an address by W. H. Blood, Jr., of Stone & Webster, Boston. An example was given by the speaker of a chart which has been used by the securities department of Stone & Webster for a number of years to give bankers and investors the information which they wish in regard to the companies concerned.



RELATION OF EARNINGS TO OUTSTANDING CAPITAL AND EFFECT ON SECURITY VALUES AS REFLECTED IN MARKET QUOTATIONS

Such a chart for the Tampa (Fla.) Electric Company is reproduced herewith. While many facts are shown in this single diagram, they are so presented that one can readily study a single item at a time, and the mind is not confused by extraneous matters.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generation, Transmission and Distribution

Surface Leakage as a Factor in Insulator Design.—T. M. FEDER.—The various factors influencing surface resistance and methods of increasing it are discussed. It is shown that the most economical way of decreasing the leakage is the addition of properly proportioned corrugations on the underside of the flange or skirt. Typical computations are given, showing the approximate increase to be expected when corrugations are added.—*Journal A. I. E. E.*, September, 1920.

Method for Computing the Dimensions of Wooden Transmission-Line Poles.—P. NEUMANN.—The author criticises present German standards for designing wooden poles and presents a graphical method permitting a rapid determination of the necessary dimensions for given load of ordinary line poles as well as of corner poles and of anchoring poles made of single or double-log. A more extensive use of double-log poles is recommended, a double-log pole being good for five times the top pull permissible with a single-log pole of the same diameter and height.—*Elektrotechnische Zeitschrift*, May 27, 1920.

Power Alcohol.—ERIC SINKINSON.—It is said that during the war it was found that benzole could be distilled from gas, and it is obvious that alcohol could be produced within the British Empire. The author states that it is possible to mix benzole and alcohol in equal proportions and thus make an admittable fuel for consumption in the internal combustion engine at present in use.—*Beama*, August, 1920.

Power Transmission Equipment.—WILLIAM CROOKS.—This paper deals with the general problem of transmission-line construction and equipment. There is a discussion of the standardization of voltages for transmission lines, with a suggestion as to the maximum values toward which current practice is approaching. The relation between distance of transmission and voltage and the relation between spacing of the wires and voltage are also considered. There is in addition a brief discussion of the principal factors to be considered in the location of the line.—*Proceedings of Louisiana Engineering Society*, August, 1920.

Power-Station Design.—This subject is discussed under the following divisions: Drive of auxiliaries, maintenance of efficiency, condensing plant, feed-water system, guarantees and testing, and over-all thermal efficiency of power station.—*Beama*, August, 1920.

Installations, Systems and Appliances

Self-Exciting Mercury-Arc Rectifier.—A difficulty with ordinary mercury-arc rectifiers is their tendency to go out if the load drops below a certain point. The A. E. G. therefore has put on the market a kind of "self-exciting" rectifier, which will keep going even if the load is completely shut off. The new rectifier type is of glass, quite similar to current models, but is provided with two auxiliary anodes fed from a special winding on the input compensator. This winding has a mid-point tap which is connected to the cathode, and in the auxiliary-anode connections are inserted two resistors, so that the auxiliary system forms, as it were, a small rectifier within the power rectifier. This auxiliary rectifier system takes about 100 watts, is started in the ordinary way and is always kept running. It will then automatically excite the power arcs so that the main rectifier starts as soon as the direct-current output circuit is closed, and the rectified current thus is perfectly stable down to very small current strength.—*Elektrotechnische Zeitschrift*, June 3, 1920.

Feed Heating for Land Power Stations.—K. BAUMANN.—It is said that while the economizer improves the efficiency of the boiler plant, in practice its adaptation is considerably limited owing to the danger of sweating of the tubes and consequent corrosion when the temperature of the water entering the economizer is below the dew point of the flue gases leaving the economizer. For this reason the temperature of the feed water entering the economizer should not be less than 90 deg. to 110 deg. Fahr. (32 deg. to 43 deg. C.), depending upon the amount of moisture contained in the gases of combustion. In order to raise the feed water to this temperature very different methods of heating the feed water are discussed. The various methods of feed-water heating are considered with a view to getting at the best over-all plant efficiency.—London *Engineer*, July 30 and Aug. 6, 1920.

Electrophysics and Magnetism

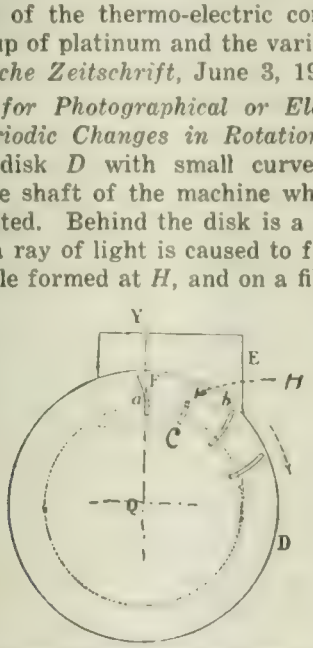
Electrical Discharges from Pointed Conductors.—JOHN ZELENY.—The discharge between pointed conductors is investigated with reference to any possible surface action, to the use of coated points for recording, which may be of various salts; to the influence of the curvature of the surface, and to the material of which the points are made.—*Physical Review*, August, 1920.

Artificial Sensibility of Rectifying Galena Contacts.—FLORISSON.—The writer has found that crystals of galena, whether originally rectifying or not, almost always obtain a high rectifying power if heated in a current of nitrogen containing vaporized sulphur. The rectification is of the same sign (direction from crystal to point) as in naturally sensitive samples, while non-sensitive samples before the treatment usually have a feeble rectifying effect in the opposite direction. During the process of making them sensitive there is formed on the surface of the crystal a thin layer of some sulphurous material of about 1/20,000 mm. thickness. The author assumes that naturally sensitive crystals also have such an active layer, formed under the influence of sulphur, deposited at the same time as the galena crystals.—*Comptes Rendus*, July 12, 1920.

Units, Measurements and Instruments

On the Use of Thermocouples of Iron and Nickel Alloys, at High Temperatures.—HOFFMANN and SCHULTZE.—A comprehensive study made at the German Reichsanstalt to find out what service couples without platinum and other expensive metals will give when used for high-temperature measurements. The article contains a great deal of tabular material from which may be gathered that several of the tested couples would give readings accurate within 10 deg. C. even after a 100-hour heat run at 1,000 deg. or 1,200 deg. C. Thermocouples of nickel-chrome alloys and of a 66 per cent nickel steel were particularly resistive against abuse, as were also those with a carbon tube for one electrode. In the carbon-tube type the other electrode was a nickel wire, carried inside the carbon tube in an insulating tube of porcelain, and the connection was made by a screw clamp. On a curve sheet is shown the thermo-electromotive force from 0 deg. to 1,200 deg. C. with respect to the platinum of the carbon tube and the ten metal samples used for constructing the investigated couples. On another curve sheet is shown the temperature variation of the thermo-electric constant for the couples made up of platinum and the various samples.—*Elektrotechnische Zeitschrift*, June 3, 1920.

Instrument for Photographical or Electrical Registration of Periodic Changes in Rotational Velocity.—BLONDEL.—A disk *D* with small curved windows is fastened on the shaft of the machine whose hunting is to be investigated. Behind the disk is a screen *E*, with a slot *ab*, and a ray of light is caused to fall on the disk, through the hole formed at *H*, and on a film or sensitive



SLOTTED DISK FOR OPTICAL REGISTRATION OF HUNTING

paper suspended on a drum behind the screen. The illumination of the slot is intermittent, caused by periodic sparks, or else by means of an arc and a shutter which rotates at a constant speed. Now, if everything moves in synchronism, there will come a flash of light every time the disk *D* passes through the position in the figure, and a beam of light will each time fall on the film. If there is the same number of flashes of light per revolution of *D* as there are little windows along the circumference, there will result just as many spots on the sensitive film, and all these spots will lie in a straight line on the film. However, if the shaft carrying the disk *D* does *not* revolve quite uniformly, the flash of light will come when the disk is in a slightly different position from that shown in the figure, and the spot will appear displaced on the film. If the shaft *Q* is carrying out a regular hunting motion, there will be on the film a wavy line of spots, indicating the deviations from uniform rotation. Screen *E* may be omitted if cylindrical lenses are substituted.—*Comptes Rendus*, Aug. 9, 1920.

Telegraphy, Telephony and Signals

Page-Printing Telegraph Receiver, System Morkrum.—This apparatus is an American invention and is used in this country for receiving telegraph messages on multiplex, the message being directly printed in ordinary type, on a telegram form, instead of on long ribbons. The article gives a detailed description of the mechanism of the Morkrum printer.—*Archives des Postes*, June, 1920.

Note on the Input Impedance of Vacuum Tubes at Radio Frequency.—JULIUS WEINBERGER.—It is shown experimentally that the input impedance of a three-element vacuum tube at radio frequency is not infinite, as heretofore supposed, but that because of the capacitive coupling between input and output circuits within the tube itself the input impedance greatly depends on the character of the output circuit. Experiments with resistance in the output circuit are given and a theory is advanced to explain the results observed.—*Proceedings of the Institute of Radio Engineers*, August, 1920.

Miscellaneous

Method for Locating Buried Conductors.—DIECKMANN.—A long-buried conductor, for instance a cable or a pipe line, will tend to direct and concentrate electromagnetic waves traveling over the ground where the conductor lies buried. This is utilized for determining the location of such conductors in a method patented by the Gesellschaft für drahtlose Telegraphic. A big coil antenna excited from an ordinary spark station on a motor car serves as a transmitter, and a similar coil antenna is used for receiving. The two antenna frames are carried along the ground, and the man receiving the message has to direct the carriers till a maximum of sound is heard in his headphones. A wave length of 1,500 m. is employed, and using a 200-watt transmitter, the antenna frames must be kept 40 ft. or 50 ft. (12 m. or 15 m.) apart to avoid direct induction. Even a thin lead-covered single-pair telephone cable 5 ft. or 6 ft. (1.5 m. or 1.8 m.) deep could be located within a few feet by means of this outfit.—*Elektrotechnische Zeitschrift*, June 3, 1920.

Greatly Increased Use of Electricity in the Production of Various Metals.—Disregarding electrochemical processes, electricity is used in the metallurgy of the following metals, either as a heating agent or for its electrolytic effect: Pig iron, steel, cast iron, the ferro-alloys, aluminum, copper, brass, lead, zinc, gold and silver. The power used in these processes in the United States and Canada is estimated as approximately 1,300,000 kva., not including motor load. The following table gives information regarding electric furnaces for smelting of iron ore:

Country	Type of Furnaces	Number of Furnaces	Size of Units, Kva.	Transformer Capacity
Sweden	Shaft	19	2,000 to 7,000	64,000
Norway	Pit	3	1,200	3,600
Norway	Shaft	1	3,000	3,000
Switzerland	Shaft	2	3,000	6,000
Japan	Shaft	2	3,000	6,000
Italy	Shaft	6	3,000	18,000

It should be noted that the shaft furnace appears to be especially adapted for the production of low carbon and silicon iron, and not foundry iron. It operates best with charcoal as a reducing agent.—Toronto *Electrical News*, Sept. 1, 1920.

A DECISION declaring discriminatory all existing special power contracts of the Utah Power & Light Company has been rendered by the Utah Public Utilities Commission, which has ordered standard schedules applied to these contracts. The contracts under investigation were with copper-mining companies, and their abrogation will add approximately $1,000,000 to the revenue of the electric company.

JOHN W. LIEB, M. S. Sloan, Frank Hedley and five other men prominent in utility management have been appointed by Public Service Commissioner Lewis Nixon of New York to form a committee to supervise and police coal distribution to public service companies in that city.

NEBRASKA may give its State Railway Commission full power to regulate all public utilities as the result of the adoption of a constitutional amendment by the voters.

BOND and note issues of electric light and power companies for the past week totaled $9,000,000, three companies being represented. Interest under 8 per cent is borne by two of these issues.

THE ENTIRE Board of Public Utility Commissioners of New Jersey has been dismissed by Governor Edwards, who alleges undue favor to the bodies under its control. The State Senate has refused to confirm the new appointees, and the courts will probably have to pass on the legality of the Governor's action, the old board meanwhile continuing to exist.

AN ESTIMATE made by the Geological Survey of bituminous-coal reserves as of March 1 and June 1 of this year places the amount in storage by electrical utilities as three weeks' supply on the former date and three weeks and one day's supply on the latter. This was only about 44 per cent of the supply eleven months previous to March 1.

EXORBITANT rates charged for demand loans by New York City banks are declared by the Controller of the Currency to play a large part in the high price of new capital. As much as 30 per cent, he asserts, has been paid for such loans.

OREGON is considering the establishment of an industrial court along the lines of the one now functioning in Kansas.

THE ST. LAWRENCE waterway plan has received the indorsement of the Hydro-Electric Power Commission of Ontario.

LITTLE change is reported in the market, though prices are stiffening in a measure in New England and along the Atlantic seaboard. Elsewhere there is a slight tendency in the opposite direction. Transportation is generally improving and stocks are commonly large, though a shortage in rigid conduit still obtains. Collections are reported no better, except in the Chicago district. Retailers are holding back Christmas orders. Building is at what is perhaps its lowest ebb.

News in Brief

Summary of Market Conditions and of Recent and Approaching Happenings of Importance to the Industry

WIRE prices are following raw material down. The demand for copper wire, both bare and insulated, is at a low level and cancellations, especially from automobile manufacturers, have been received.

CUBA affords an important field for the sale of electric fixtures, according to a recent report of foreign trade promoters. Use of electricity on the island is asserted to be increasing fast.

THE FIRST flat-rate increase in the history of the Worcester (Mass.) Electric Light Company has been announced, its commercial lighting rates rising from 7½ cents to 9 cents per kilowatt-hour, owing to the cost of coal, which has lately increased to $15 per ton. Power rates are unaffected.

MANUFACTURING interests in New England will seek early legislation establishing fuel commissions in their several states.

SEGREGATION of the scenic areas of national parks to prevent their exploitation while permitting the development of non-scenic areas is to be urged before the next session of Congress.

AN ACCOUNTING system for the Federal Power Commission is to be worked out by the Corps of Engineers, and a chief accountant will be chosen in the near future.

THE QUESTION of private development versus state ownership and operation of the water powers of New York has become an issue in the pending election, Governor Smith favoring the latter policy.

MANY technical societies were to take action this week or will take action in the near future on the question of joining the Federated American Engineering Societies.

CO-OPERATIVE electrical campaigns have been launched at Winnipeg and Montreal to cover the Canadian provinces of Manitoba and Quebec respectively.

STATION-OPERATING men of the Ohio Electric Light Association met at Dayton to consider the need for investigation of boiler refractories.

POSSESSION of certificates of inspection by the policy holders is to be insisted on more strictly by fire insurance companies in cases of fire supposed to have been caused by electrical defects.

SHORT-TERM notes backed by long-term bonds were advised for the current financing of public utilities in the address made by Harry E. Mendes before the American Electric Railway Association at its Atlantic City convention.

WITH the partial replenishment of the streams by rain in California, the Power Administration restrictions on the use of electricity for sign and display lighting and in industry have been rescinded.

SIX NEW advertisements of water-power projects have been made by the Federal Power Commission, all except one being for Pacific Coast developments.

THE FAILURE of the Swiss Electro Bank as a result of the foreign exchange situation is announced.

STATE utility commissioners will meet in Washington on Nov. 9-12, when round-table discussions on various phases of commission work will take place.

SUIT against the Simplex and Westinghouse companies by the Majestic Electric Development Company for infringement of heater patents has been won by the defendants in the United States District Court in Idaho. The plaintiff company will appeal the case.

EXPORTS of electrical materials for the first eight months of 1920 were $61,022,347, comparing with $62,294,672 in 1919. A great jump in exports of rheostats in August is reported.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Special Power Rates in Utah Held Discriminatory

THE Public Utilities Commission of Utah has just rendered a decision, effective Oct. 22, whereby all existing special power contracts of the Utah Power & Light Company with customers in Utah are declared discriminatory and this business is ordered placed on standard schedules. This finding is the result of the hearing which has been going on for some time before the commission in a special contract case. The order means an additional revenue to the power company of approximately $1,000,000 annually. The special customers will probably appeal to the State Supreme Court.

These special contracts date back many years to a time before the present company was organized. They were made at an extremely low rate with copper-mining interests which were represented on the controlling board of the power supply company.

To Urge Laws Preventing Exploitation of Scenic Areas of National Parks

SEGREGATION of the scenic areas within the national parks almost certainly will be asked of the next session of Congress. The boundaries of most of the national parks include vast areas of non-scenic lands. It is believed that power and irrigation development can best be carried on if there is an absolute separation of the scenic from the non-scenic land. Under such conditions legislation prohibiting any class of exploitation of the scenic areas would be final. On the other hand, as long as the present boundaries exist there will be a constant effort to secure legal authority to permit of certain types of exploitation.

The matter is of special importance at this time when a number of new park areas are under consideration. It is believed that the public is in sympathy with an absolute prohibition of exploitation on areas of outstanding scenic value, but it is equally probable that the public does not want to see commercial developments halted on non-scenic lands.

Fight on State or Private Control of Water Powers in New York

WHETHER the state or private interests shall own and develop the water-power resources of New York is becoming one of the dominating issues of this year's gubernatorial contest in the Empire State. Governor Smith is running for re-election on a state development-ownership-control-platform, while Judge Miller, the Republican nominee, takes the position that greater benefits will accrue to the people of the state through private development and operation.

Governor Smith very clearly stated his position on water-power development this week as follows: "I am for state development, state ownership and state control because I am sure that is the only way in which the people will themselves get any benefit from this God-given resource, because under private development the price of electricity is exactly the same in Buffalo, where it is developed from the Falls, as it is in the city of New York, where every bit of it is developed from coal which is dragged all the way from Pennsylvania."

Lower Yields on New Utility Financing

BOND and note issues of electric light and power companies for the past week total $9,000,000, with three companies represented. Of this total, $2,500,000 is in fifteen-year, 8 per cent secured gold notes of the Middle West Utilities Company offered at 96 to yield the investor 8.5 per cent.

Of the two bond issues, one is $5,000,000 in 7½ per cent sinking fund gold bonds of the Wisconsin Electric Power Company. These bonds, which are offered at 99 and mature Oct. 15, 1945, yield but slightly more than 7.5—a return that is below the average for this class of securities in the last six months. The remaining $1,500,000 is in thirty-year, first mortgage 7 per cent gold bonds of the Kentucky & West Virginia Power Company, Inc., sold at 91½ and yielding 7¾.

Co-operative Campaigns Launched at Winnipeg and Montreal

CO-OPERATIVE campaigns for the intensive development of the local electrical markets in the Canadian provinces of Manitoba and Quebec have been launched as the result of great meetings of all branches of the electrical industry held at Winnipeg Oct. 13 and 14 and at Montreal Oct. 19 and 20.

Nearly four hundred electrical men attended the Winnipeg banquet at the Royal Alexandria Hotel Oct. 14, when W. L. Goodwin, M. C. Turpin and others outlined a plan for co-operation in Manitoba. The guests of honor at this dinner included many Manitoba notables, among them the Premier, the Mayor of Winnipeg, J. G. Glassco, manager of the city lighting plant; J. M. Leamy, power commissioner, and others. As the result of several enthusiastic meetings a co-operative campaign was undertaken by the local Electrical Development League, with J. E. Gilmour, Northern Electric Company, as chairman, and J. G. Smith, Great West Electric Company, as secretary-treasurer.

More than five hundred electrical men of Montreal and the Province of Quebec attended the series of meetings culminating in that of the Montreal Electrical League Oct. 20, when plans were outlined by a local committee of the industry for the institution of an electrical co-operative campaign in Montreal and the Province of Quebec. W. L. Goodwin, S. A. Chase and others told of the results of the electrical co-operative campaign in California and the organization of similar

campaigns in Oregon, Washington and British Columbia. After adopting a plan of organization the Electrical Co-operative Association of the Province of Quebec was formally organized to begin work with officers as follows:

Honorary president, J. S. Norris, vice-president Montreal Light, Heat & Power Consolidated; president, K. B. Thornton, general manager Montreal Public Service Corporation; vice-presidents, J. B. Woodyatt, general manager Southern Canada Power Company; J. W. Pilcher, Canadian General Electric Company; M. K. Pike, general sales manager Northern Electric Company; F. J. Parsons, manager McDonald & Willson; N. Simoneau, Simoneau Electric Contracting Company; Dr. L. A. Herdt, McGill University.

An advisory committee was elected with these members:

Power company representatives: W. O'Brien, chairman, Montreal Light, Heat & Power Consolidated; L. C. Haskell, secretary-treasurer pro tem., Southern Canada Power Company; R. J. Beaumont, Shawinigan Water & Power Company; N. L. Engel, Montreal Public Service Corporation; W. J. Lynch, Quebec Railway, Light & Power Company.

Manufacturers' representatives: C. Duncan, manager Duncan Electrical Company; George Wight, Monarch Electric Company; C. F. Nedbury, general manager Canadian Westinghouse Company.

Jobbers' representatives: J. W. Pilcher, general manager Canadian General Electric Company; M. K. Pike, general sales manager Northern Electric Company; S. W. Smith, president Electrical Equipment Company.

Contractor-dealers' representatives: J. A. St. Amour, Montreal; F. Parsons, McDonald & Wilson, Montreal; A. Doddrige, manager Quebec Electric Company, Quebec; J. Nault, Nault & Brown, Three Rivers; W. Wiggett, Electric Repair & Contracting Company, Sherbrooke.

Consulting engineers: J. M. Robertson, J. M. Robertson & Company; DeGaspe Beaubien.

Bell Telephone Company representative: W. H. Winter, general superintendent of plant Bell Telephone Company of Canada.

Ohio Operating Men See Need for Investigation of Refractories

ABOUT forty Ohio central-station operating men met at Dayton on Wednesday of this week under the auspices of the station-operating committee of the Ohio Electric Light Association. C. D. Zimmerman of the Cleveland Electric Illuminating Company reviewed the results obtained with powdered coal in central power stations and outlined the conditions under which pulverized fuel firing and stoker firing may each be used to the best advantage.

A round-table discussion on boiler furnace linings seemed to indicate the need of an investigation to determine the conditions for which different available refractories are best suited. George A. Orrock of New York read a paper on the development of power-plant efficiency.

Short-Term Notes Backed by Long-Term Bonds Advised for Financing

WITHOUT necessarily desiring to lay down a fixed rule under the present abnormal conditions, it is probably the best policy for public utilities to issue short-term notes at market rates, secured by long-term treasury bonds at normal rates deposited as collateral for the short-term notes. This was the assertion made by Harry E. Mendes of Touch, Niven & Company, New York, last week before the annual convention of the American Electric Railway Association. The underlying assumption, of course, the speaker said, is that upon maturity of the short-term notes conditions in the financial world will have adjusted themselves to a more normal basis and that it will then be possible to issue the long-term bonds in substitution for the notes.

California Contractors Continue "More Outlets" Campaign

REALIZING the benefits of the installation of sufficient convenience outlets, the California State Association of Electrical Contractors and Dealers has appointed a committee to assist further in the work that the California Co-operative Campaign has done along this line. Invitations have been given the American Institute of Electrical Engineers, Illuminating Engineering Society and the American Society of Mechanical Engineers to appoint unifying committees.

New Jersey Governor Having Trouble Ousting Utilities Commission

THE Board of Public Utility Commissioners of New Jersey has been dismissed by Governor Edwards on the ground that the commission had been too favorable to the utilities. A new commission has been appointed by the Governor, but the State Senate has refused to confirm the appointments, so that for the present the old board will continue in existence.

In taking this action the New Jersey Senate adopted a resolution to the effect that as there was grave legal doubt as to the power of the Governor to oust the commission and to appoint a new body, nominations of all prospective members be referred to the Senate judiciary committee and the Attorney-General be directed to take steps to institute legal proceedings to determine the legality of the Governor's action.

The names of the nominees for the new board as submitted are: Representative J. A. Hamill; Arthur A. Quinn, president of the New Jersey State Federation of Labor; Walter F. Whittemore, State Highway Commissioner and a civil engineer; Treadwell Cleveland, member of editorial staff of Newark *Evening News* and before that assistant in the Forestry Service; ex-Senator James A. C. Johnson.

State Utility Commissioners to Discuss Public Relations

A VARIATION in the program of the convention of the National Association of Railway and Utilities Commissioners will be made this year in that considerable time will be devoted to round-table conferences on topics not covered by the standing committees. Four topics have been selected for discussion, including "Enforcement of Service Standards" and "Public Relations."

The thirty-second annual convention of the association will be held in Washington, D. C., Nov. 9-12, in the main hearing room of the Interstate Commerce Commission, in the commission building.

Reports of the following standing committees will be of particular interest to the public utilities: Safety of operation of public utility companies, service of public utility companies, public utility rates, statistics and accounts of public utility companies (at which time the uniform classification of accounts will be presented for final action), valuation committee, capitalization and intercorporate relations, state and federal legislation.

Fuel Distribution Committee Appointed for New York

TO SUPERVISE and police the coal situation of the public utility companies in New York City a committee to be known as the New York Fuel Distribution Committee has been appointed. The members of the committee are J. W. Lieb, vice-president of the New York Edison Company, chairman, with Frank Hedley, president of the Interborough Rapid Transit Company; M. S. Sloan, president of the Brooklyn Edison Company; Walter R. Addicks, of the Consolidated Gas Company; C. Andrade, Jr., of the Wholesale Coal Trade Association; W. J. Welsh, of the New York & Richmond Gas Company; R. H. Nexsen, electrical engineer of the Public Service Commission, and C. W. Wilder, of the New York Edison Company, secretary.

Government Estimate of Coal Reserves of Electric Public Utilities

AN ELABORATE report on consumers' stocks of bituminous coal as of March 1 and June 1, 1920, prepared by the Geological Survey in co-operation with the United States Bituminous Coal Commission and the Council of National Defense, has the following statements under the heading of "Electric Public Utilities":

Electric public utility plants consume between 5 and 6 per cent of the country's output of fuel. In 1917 they required 31,693,000 net tons of soft coal. Two years later their combined consumption of bituminous and steam sizes of anthracite was 35,000,000 tons. The reserves at electric utility plants are therefore an important item in the total quantity of coal in storage. The average reserve on July 15, 1918, was sufficient for five weeks and four days' operation. From Nov. 11, 1918, to Jan. 1, 1919, stocks averaged about seven weeks' supply. During the first quarter of 1919 the average decreased from seven weeks to six weeks and six days. On March 1, 1920, the average had dropped to three weeks' supply, or only 44 per cent of what it had been eleven months before. The percentage of decrease during those eleven months was greater for the electric utilities than for any other general class of consumers except the steel plants and the railroads. One reason for this condition appears to be that the very large group of electric plants in the industrial Northeast was especially affected by the coal strike of November-December, 1919.

During the period from March 1 to June 1, 1920, stocks at electric plants increased slightly, amounting on June 1 to three weeks and one day's supply.

Broad Program Laid Out for Southeastern N. E. L. A. Convention

THE annual convention of the Southeastern Geographic Section, National Electric Light Association, will be held at Miami, Fla., on Nov. 16, 17, 18 and 19, with the Urmey Hotel as headquarters. From the outlook at the present time this convention promises to be one of the most successful meetings that the section has ever held. Papers expected are: "Regulation of Public Utilities," by A. J. Maxwell of the North Carolina Public Service Commission; "Public Policy," by Z. V. Taylor, president Southern Public Utilities, Charlotte, N. C.; "Safety Work," by W. R. Lloyd, manager casualty department Alabama Power Company, Birmingham; "Steam-Plant Operation," by C. A. Greenidge, chief engineer J. G. White Management Corporation; "Design and Construction of 2,300-Volt Distribution Lines," by T. H. Rice, engineering department Henry L. Doherty Company; "Labor and Employment Methods," by J. T. Trazzare, manager employment and public relations department Georgia Railway & Power Company, Atlanta; "Accounting," by F. B. Culley, assistant treasurer Augusta-Aiken Railway & Electric Corporation; "Association Activities," by M. H. Aylesworth, executive manager National Electric Light Association; "Automatic Generating Stations and Substations," by T. F. Barton, engineer General Electric Company, Schenectady, N. Y.; "Electrical Merchandising," by S. A. Chase and W. L. Goodwin.

The social side of the program has not been neglected. The first night's entertainment has been turned over to the manufacturers and jobbers. The evening of the eighteenth there will be a trip to Bimini Island, returning to Miami on the next afternoon.

The Florida Ice and Public Utilities Association will meet at Miami on Nov. 15 and 16.

Rain Comes and Restrictions Go in California

RECENT rains in California have replenished the streams to a limited degree and have released the electric power that was being used for irrigation pumping. As a result Power Administrator Butler last week issued an order eliminating restrictions on the use of electricity for sign and display lighting, and prohibited lamps in stores, theaters and streets came into use again. The restrictions on the industrial use of electricity have also been removed. Steam plants must still be operated to their full capacity.

Many Societies to Take Action on Federation Soon

IN ADDITION to the thirteen societies that have already become charter members of the Federated American Engineering Societies, seven societies to which an invitation to become charter members has been extended were to have considered the question this week and ten others at later dates, as indicated below:

American Institute of Architects.—Favorable report of committee will be considered by board of directors at November meeting.

American Society of Civil Engineers.—Ballot in progress to be canvassed Nov. 8.

Albany Society of Civil Engineers.—Oct. 26.
Associated Engineering Societies of St. Louis.—Oct. 20.
Brooklyn Engineers' Club.—Nov. 11.
Engineers and Architects' Club of Louisville.—Oct. 19.
Engineers' Club of Cincinnati.—Oct. 21.
Engineers' Club of Columbus.—Oct. 29.
Engineers' Club of Philadelphia.—Nov. 13.
Engineers' Club of St. Louis.—Oct. 20.
Engineering Society of Wisconsin.—Feb 11-12.
Engineering Society of Western Pennsylvania.—Nov. 4.
Grand Rapids Engineering Society.—Oct. 25.
Iowa Engineering Society.—Oct. 20.
Louisiana Engineering Society.—Nov. 8.
Mohawk Valley Engineers' Club.—Nov. 4.
National Fire Protection Association.—Oct. 21.
Washington Society of Engineers.—Oct. 20.

The following societies have referred the matter to a special committee for report at an early date: Associated Engineers of Spokane, Boston Society of Civil Engineers, Colorado Society of Engineers, Illinois Society of Engineers, Illuminating Engineering Society (by its council), Oregon Technical Council, Rochester Engineering Society, Society of Automotive Engineers and Western Society of Engineers.

Commonwealth Edison Company Issuing $5,000,000 of Stock at Par

THE Commonwealth Edison Company is offering a new capital stock issue of a little more than $5,000,000 par value to present stockholders at par. Each stockholder may subscribe for an amount equal to 10 per cent of his present holdings. If stockholders desire, they may surrender their subscription rights, for which the company will pay $2.50 per share of new stock. Such stock will be offered to customers and company employees.

Accounting System Being Worked Out by Federal Power Commission

AN ACCOUNTING system to be used by the Federal Power Commission in its handling of applications and preliminary permits, licenses and valuations, and in its relationship with the states, is to be worked out by the Corps of Engineers. The power commission will choose its chief accountant in the very near future. He will work with the engineer accountants, and as it is probable that an Interstate Commerce Commission accountant will be selected, he will bring to the engineers the experience gained in I. C. C. valuation work. The National Electric Light Association has been asked to co-operate in the preparation of this system of accounting. The commission is very anxious that other organizations contribute such ideas as they may have on this subject. Private interests and individuals generally also are being looked to to supply suggestions in this connection.

Intensive work on the remainder of the regulations to be issued in connection with the water-power act has been begun by the Federal Power Commission. Those portions of the regulations which have not been issued are those which present the greatest difficulties, but as the time is rapidly approaching when they must be used every effort will be made to complete them in satisfactory form at an early date.

The Federal Power Commission has taken possession of its permanent quarters in the Interior Building at Washington.

Electrical Inspectors Discuss Grounding of Secondaries

RULE 15 A of the National Electrical Code, relating to the grounding of secondaries, received the most attention at the meeting in Philadelphia last week of the Electrical Conference and the National Association of Electrical Inspectors. The meeting, which was presided over by Washington Devereux, president of the association, was very largely attended. W. J. Canada, engineer of the National Electric Light Association, who was largely responsible for the writing of Rule 15 A into the code, explained it in great detail. Numerous points relative to this rule and grounding generally were brought up in the question box which was the feature of the meeting.

It was generally admitted that the grounding of secondaries had proved very beneficial, but on the subject of individual service grounds there was considerable debate. Other points that were discussed extensively were multiple grounds, the justification for long grounds to the nearest water source and ground clamps.

A. R. Small and Dana Pierce, both of the Underwriters' Laboratories, told of the history of approved devices and spoke of the inspection work of the laboratories. Dr. M. G. Lloyd of the Bureau of Standards spoke on safety with especial reference to the Safety Code of the bureau and its relation to the National Electrical Code.

Investigating Internal Temperatures of Large Generators

THAT a large number of recently built generators are provided with embedded temperature detectors for the purpose of furnishing actual data upon which to base estimates of hot-spot temperatures in large machines was brought out at a meeting of the standards committee of the American Institute of Electrical Engineers held in New York last week. This will prove particularly useful, it was said, in connection with the effort to show that the American method of rating electrical machinery should be adopted by the International Electrotechnical Commission. It is the present expectation that the next meeting of the advisory committees of the I. E. C. will take place in Paris early in December of this year.

West Virginia Utility Association Again Operative

FOR the first time since the war the West Virginia Public Utility Association became operative on Oct. 5, when the first annual meeting since 1917 was held. During and immediately after the war the association was inoperative, but the meeting on the fifth foreshadowed a resumption of activities on a broad and permanent scale. One of the most important decisions of the conference was that embracing the maintenance of state headquarters permanently in Charleston and the employment of a paid secretary, who is to be appointed later. The gathering of men from over the entire state represented invested capital to the amount of $46,000,000 in public utilities which employ 3 000 men. The morning meeting was almost entirely confined to the discussion of ways and means of co-operating effectively with the Public Service Commission.

The following officers were elected: President, Herbert Markle of Bluefield, of the Appalachian Power Company; first vice-president, C. P. Billings of Wheeling; second vice-president, M. Hetzer of Moundsville; third vice-president, E. W. Alexander of Charleston; treasurer, A. M. Hill of Charleston.

Oregon Industrial Court Is Proposed

SETTLEMENT of all industrial disputes and the regulation of industries by three judges who will constitute a court of industrial relations and who will be appointed by the Governor is the purpose of a bill which will be presented for consideration at the next session of the Oregon Legislature. Although the proposed bill will be copied to some extent from the industrial court law enacted in Kansas, the feature of that measure which provided for the abolishment of the Public Service Commission will probably not be followed. It is likely, however, that the bill, if enacted, will merge the affairs of the present Public Service Commission with the tribunal of industrial relations.

Additional Water-Power Projects Being Advertised

ADDITIONAL water-power projects are being advertised by the Federal Power Commission as follows: Crown Willamette Company, at Oregon City, Ore.; Washington Irrigation & Development Company, Columbia River, Priest Rapids, Washington; Luther Hill project on Sawmill Creek, California; Pit River Power Company, Pit River, California; Davis Power Company, White River between Arkansas and Missouri, and Columbia Valley Power Company, Deschutes River, Oregon.

Nebraska May Have Complete Utility Regulation

THE recently adopted amendment to the Nebraska constitution requiring utilities to report to the State Railway Commission on such matters as may be directed is construed as making it possible for the Legislature to pass a measure enlarging the scope of the present commission to include electric light and power and gas utilities. The wording of the old constitution was ambiguous and there was some doubt whether the Legislature had the right to enlarge the powers of the commission. The amendment clears this up, and it is expected that the Legislature will soon act.

Forty-Million-Dollar Construction Plans of Southern California Company

PLANS for the expenditure of more than $40,000,000 in the extension of its Big Creek and San Joaquin River hydro-electric projects in the High Sierras have been announced by the Southern California Edison Company in its application for a certificate of public convenience and necessity. The items include the construction of a dam to form Florence Lake, a tunnel from that lake to Huntington Lake, a dam to form Shaver Lake, a tunnel and penstocks from that lake to Power House 2-A, of which the capacity is to be 300,000 hp.; a tunnel and penstocks from Power House 2 to Power House 8, which is to have a total capacity of 120,000 hp. Other details of this project were given in the ELECTRICAL WORLD, Sept. 11, 1920, page 513.

Comptroller of Currency Ascribes Dear Money to Wall Street Manipulation

IN CONNECTION with the high rates that public utilities all over the country have to pay for new capital a statement issued last Monday by John Skelton Williams, Comptroller of the Currency, is pertinent. Mr. Williams, while disclaiming any intention to attack Wall Street interests, blames the high money rates in large measure on the exorbitant prices charged for demand loans by New York City banks. The rates for these loans, he asserts, are fixed by a small coterie of Stock Exchange brokers and are subject to frequent change.

At rates varying from 15 to 30 per cent the national banks in New York City lent more than $600,000,000 from Oct. 1, 1919, to Aug. 1, 1920, Mr. Williams charges, while more than 11,000 loans aggregating $1,400,000,000 were made in the same period at rates more than 10 but less than 15 per cent. The total amount of demand loans made by the national and state banks and trust companies of New York City plus the loans placed for their correspondent banks is put at more than a billion dollars.

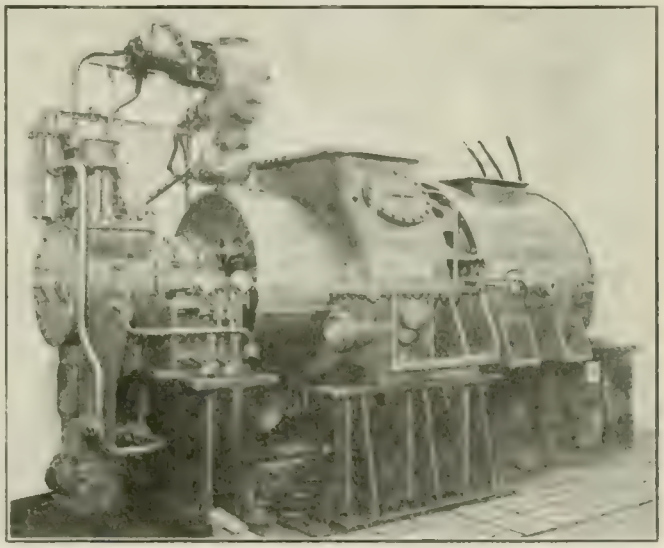
"It is my belief," the Comptroller declares, "that if the call money rates in New York had been maintained at 6 per cent or at the maximum rates which are charged in other money centers, as I believe could have been done with a reasonable degree of co-operation upon the part of the New York banks, the unprecedented shrinkage in security prices in the past twelve months would not have taken place and the apparent loss of billions of dollars in values would have been avoided."

Overhead Receives Attention of Missouri River Jobbers

A WELL-ATTENDED annual convention of the Missouri River Electrical Distributers, held at St. Louis, Oct. 14 and 15, was marked by the general discussion of the jobbers' problem in maintaining profit under increasing expense and of the probable 1921 business. It was agreed that overhead expenses would have to be watched more carefully than ever before.

Interesting papers on current market conditions and the realignment and balancing of stocks through co-operation among jobbers were presented by George Corroa of the Western Electric Company, St. Louis, and F. D. Phillips, Central Telephone & Electric Company, St. Louis, respectively. The question of bonuses to salesmen, based on gross profits and volume of business, and of straight salary without bonus, was also discussed. Kansas City was chosen as the place for the next meeting, probably about the first of next year.

First Electrically Propelled Ocean Freighter Has Trial Trip



THE *Eclipse*, the first general-cargo merchant vessel to be electrically propelled, was given its trial trip on Tuesday, Oct. 19, in and about New York Harbor by the United States Shipping Board. The ship is 440 ft. long and has a deadweight capacity of 11,868 tons. Its propulsion machinery consists of an adjustable speed (20 to 110 per cent) marine turbine-generator set (shown in the accompanying illustration) and a 3,000-hp., three-phase induction motor which drives a single propeller. The electrical equipment was furnished by the General Electric Company and installed by the Vulcan Iron Works.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Large Consumers Voluntarily Pay More Than Scheduled Rates.—An encouraging example of co-operation between a central station and its large power customers is reported from Sandusky, Ohio, where the four largest consumers of electrical energy have voluntarily agreed to pay an increase of 25 per cent over the new rate allowed by the City Commission.

Dutch Engineers Visit Portland Power Plants.—The five engineers from Holland now in this country on a tour of inspection recently visited the various power generating plants and the electric lines of the Oregon Electric and the Southern Pacific companies at Portland, Ore. The party was in charge of J. B. Cox of the General Electric Company of Schenectady, N. Y. The visitors were Barnet Lyon and H. Doyes of The Hague, Leonen Martinet of Utrecht, H. J. Vanlessen of Voorburg and W. J. Burgerdyke of Haarlund.

Puget Sound Company Sells Million-Dollar Note Issue to Local Public.—The Puget Sound Power & Light Company announces that the five-year 8 per cent coupon-note bond issue of $1,000,000 recently offered by the company was oversold in less than eleven working days. The sale was made through the efforts of the corporation itself, without any underwriting by bond houses, in small sizes and in hundreds of subscriptions. Employees of the company to the number of 1,000, constituting more than one-half the total number, absorbed more than 40 per cent of the issue.

Shakespeare's Town in Danger of Losing Its Electrical Supply.—That Mecca of literary tourists in England, Stratford-on-Avon, where for many years the light of the twentieth century has been shed over the relics of the seventeenth, is in danger of reversion to the semi-darkness of the mid-Victorian period. Depreciation of equipment owing to the inadequate rates prescribed by the authorities has brought the electric company to the point where, in the words of a local paper, it "can stand the strain no longer." "If something be not promptly done," the paper continues in a moving strain, "the undertaking will soon be defunct. Our present brilliantly illuminated shops will have to return to their former somberness, the fragile mantle will again come into vogue, artistically decorated rooms will be subjected to discoloration, ceilings darkened with impure emanations, and local machinery made dependent upon spasmodic gas power—when this is available."

Shareholders in Byllesby Utilities Number 40,000.—Figures recently compiled show that the Standard Gas & Electric Company and its utility subsidiaries now have a total of approximately 35,000 preferred and common shareholders, in addition to which about 5,000 individuals have contracted to purchase stock on the partial payment plan. These properties, under Byllesby management, serve 500 cities and towns with 2,200,000 population in sixteen states. Upward of one-half of the total number of shareholders reside in the communities provided with electric and gas service by the organization.

Rate Advances in Many Places.—Increased rates due to higher cost of fuel have been announced by the Municipal Light Board of Concord, Mass. The Vermont Hydro-Electric Corporation of Rutland has also increased its rates for the same reason. Among other places not previously mentioned where increases in some or all schedules have gone into effect recently are Oshkosh, Wis.; Jefferson City, Mo.; Fort Smith, Ark.; San Antonio, Tex.; Boise, Idaho; Binghamton, Jamestown, Clifton Springs and Rouse's Point, N. Y.; Williamstown and Lynn, Mass.; Pawtucket and Woonsocket, R. I.; Rockville and Willimantic, Conn.; Sioux City and New Hampton, Iowa; Rochester, Ind.; Grand Rapids, Mich.; Middle Yuba, Cal., and Nephi, Utah.

Aeroplane Lamps Controlled by Radio.—In connection with obtaining electric power from the Utah Power & Light Company for the operation of the radio station to be established in Salt Lake City, it was stated by Col. John A. Jordan, superintendent of the Western division of the air mail service, that small electric lamps operated by wireless placed on the front of the machines will guide the planes at night on the transcontinental air mail route between Cheyenne, Salt Lake and San Francisco. "The lights will be tuned to the wireless instruments of the three cities in such a manner that they will shine only when the planes are within a certain radio path about 200 ft. in width," said Colonel Jordan. "When a plane strays from this path the lights will go out and the pilot will be obliged to determine by the wind on which side of the route he is traveling. Approach to the destination will be signified by flashing the lights on and off. The process has proved a success in thorough tests and is owned by the government."

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Electrical Supply Jobbers' Association.—The next meeting of this society will be held at the Cleveland Hotel, Cleveland, Ohio, on Nov. 17, 18 and 19.

Pacific Coast Section, N. E. L. A.—Nov. 4, 5 and 6 have been selected as tentative dates for the next meeting of committees of this section, to be held in the Edison Building in Los Angeles.

St. Louis Section, A. I. E. E.—At the September meeting of this section a resolution in favor of the Associated Engineering Societies of St. Louis joining the Federated American Engineering Societies as a local organization was carried unanimously.

Association of Iron and Steel Electrical Engineers.—The Pittsburgh and Birmingham sections of this association meet tonight (Oct. 23). At the meeting of the Pittsburgh Section Arden B. Holcomb will present a paper on "Sheet and Tinplate Mills."

St. Louis Electrical Board of Trade.—James N. Fenton of the St. Louis Fire Prevention Bureau and Fred L. Bock of the Missouri Inspection Bureau addressed the members of the St. Louis Electrical Board of Trade at their weekly luncheon Oct. 5. H. T. Bussman presided.

Syracuse Branch of A. I. E. E. Started.—Edward T. Moore has been made chairman and Frank Simpson secretary and treasurer of the newly organized Syracuse (N. Y.) Section of the A. I. E. E., which will take in the territory from Geneva to Watertown and to Utica, in which there are about eighty-five electrical engineers.

Public Service Company of Northern Illinois Section, N. E. L. A.—Samuel Insull, president of the company, will address the annual meeting of the section at the Morrison Hotel, Chicago, on Oct. 25 and 26, speaking on both days. The officers elected for the ensuing year are: Chairman, F. N. Leonard, Chicago; vice-chairman, W. H. Knutz, Evanston; secretary, M. L. Wright, Chicago; treasurer, E. A. Luney, Evanston.

Coming Meetings of Electrical and Other Technical Societies

Association of Railway Electrical Engineers—Chicago, Oct. 28-30.

Association of Iron and Steel Electrical Engineers—Pittsburgh Section, Oct. 23; Birmingham Section, Oct. 23; Philadelphia Section, Nov. 6; Cleveland Section, Nov. 8.

Institute of Radio Engineers—New York, Nov. 3.

National Association of Railway and Public Utilities Commissioners—Washington, Nov. 9.

Society of Naval Architects and Marine Engineers—New York, Nov. 11-12.

American Institute of Electrical Engineers—Chicago Section, Nov. 12.

Electric Power Club—Hot Springs, Va., Nov. 15-18.

National Electric Light Association—Southeastern Geographic Division, Miami, Fla., Nov. 17-19.

Electrical Supply Jobbers Association—Cleveland, Nov. 17-19.

Jovian Order—St. Louis, Nov. 18 and 19.

American Engineering Council—Washington, Nov. 18-20. (For program, see issue of Sept. 25, page 651.)

American Physical Society—Cleveland, Nov. 27; annual meeting Chicago, Dec. 28-29.

American Society of Mechanical Engineers—New York, Dec. 7-10.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Twenty-Cent Rate Disapproved. — A monthly rate of 20 cents per kilowatt-hour for commercial lighting by an electric utility with eighty-five consumers was considered by the Missouri Public Service Commission as likely to result in a decrease in revenue because of curtailed use of energy, and a rate of 15 cents, with minimum and service charges, was therefore substituted.

Long Hours' Use. — Electric rate schedules, the Missouri Public Service Commission holds, should recognize customers who make use of the service a large number of hours, but where business houses do not afford a more favorable load factor than residences the raising of the existing rates in such a way as to favor the former class of customers proportionately is not justified.

Lower Rates for Combined Service Discriminatory.—Schedules which make a lower rate for a combined service for heat and electricity than the aggregate of the rates in effect for such services rendered separately are contrary to the provisions of the California law, according to a decision of the Railroad Commission of that state ordering a contract entered into on this basis by the Pacific Gas & Electric Company canceled. Such agreements are held by the commission to constitute discrimination against other customers.

Powers of New York Commission Over Street-Lighting Contract.—The New York Public Service Commission for the Second District held that it had no jurisdiction in a complaint against the street-lighting rates charged to the village of Horseheads by the Elmira Water, Light & Railroad Company because of the existence of a contract between the company and the municipality, the Public Service Commissions law exempting "state, municipal or federal contracts" from the commission's regulatory powers.

Private Contracts Disapproved.—The New York Public Service Commission for the Second District has refused to approve the continuance of a contract entered into by the Warsaw Gas & Electric Company with its largest consumer at a rate lower than the filed schedule of the company, holding such procedure to be contrary to the statute even where it appears to be good business policy. In determining the true income of an electric utility the amount which would have been produced by the filed rates should be charged against the company rather than the amount actually received by it according to the terms of a private contract.

Theory of Rate Making Subject to Varying Conditions.—The Vermont Public Service Commission has asserted that it has never laid down any rules relative to the basis on which rate making should be placed, whether on original cost, fair return upon prudent investment, sale value, reproduction new less depreciation, or upon any of the other theories which have been considered by the courts and commissions of other states, and considers it doubtful whether any fixed rule applicable to all cases could be formulated owing to the great variety of different conditions presented by the facts.

California Rate Increases.—The Railroad Commission of California has authorized the Southern Sierras Power Company and the Holton Power Company to increase their rates for electric energy to an amount which will return 8.4 per cent. Consumers of the former company will pay an added cost of approximately 19.2 per cent, while consumers of the Holton line will pay an increase of about 10.4 per cent. As these companies are jointly owned, the increase to the public on the combined systems will approximate 16.5 per cent. At the same time the Sierras Power Company was directed by the commission to charge the Nevada-California Power Company 1 cent per kilowatt-hour for all energy delivered for resale to the Nevada customers of the utility. The commission has also authorized a revision in the rates of the Amador Electric Light & Power Company, operating in Jackson, which on the average will amount to an increase of lighting service of about 20 per cent and on power service of about 10 per cent.

Company Forbidden to Borrow from Depreciation Funds for Indefinite Period.—In denying an application from the Northern Indiana Gas & Electric Company for permission to borrow from the depreciation funds for an indefinite period of time rather than for a period of one year, as provided in the original depreciation clause, said money to be used for additions and betterments and not to be capitalized, the Public Service Commission of Indiana said: "The record does not disclose any situation peculiar to this company which would warrant the commission in modifying its general policy with respect to the handling of the depreciation reserve. If, for example, the petitioner were able to show the commission that in the past all realized depreciation had been taken care of and the property kept up to its theoretical perfect state of efficiency, then there might be some reason for the commission permitting money to be diverted temporarily from this depreciation fund for a period of more than one year and, in fact, for an indefinite period, provided, of course, it never were capitalized. The evidence, however, indicated that such was not the condition. On the other hand, the evidence was general and cumulative that not only realized depreciation has not been properly met but that maintenance even was deferred."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

House Moving and Poles in Street as Nuisances.—In reversing a verdict awarding damages to a house mover (Ashwork vs. Birmingham Railway, Light & Power Company) because of the existence of poles belonging to the company in the street, which interfered with his plans, the Court of Appeals of Alabama held that the plaintiff should have alleged facts to show that his own proposed use of the street was not a nuisance. He should also have alleged that the poles were erected along the street without the consent of the municipality, or, if erected by its consent, were placed so as to constitute an abuse of the right granted, plaintiff's mere contention that the poles constituted a nuisance being insufficient. If, however, a house mover was prevented from the reasonable use of a street by the fault of the defendant power company in placing its poles, he was entitled to recover the reasonable difference in the cost of removing a house in the manner in which he did have to remove it over what it would have cost to remove it but for the power company's poles, not being entitled to any damages for delay, loss of time or use of tools or equipment. (86 So. 82.)*

Employer Held Responsible for Death Supposedly Caused by 110 Volts.—A verdict awarding damages because of the death of a workman from electric shock (Snyder vs. Wagner Electric Manufacturing Company) has been affirmed by the Supreme Court of Missouri, despite the contention of the defendant company that the man could not have died from this cause inasmuch as, even admitting a defect in insulation, only 110 volts could have passed through his body. In a similar case the Alabama courts recently decided in the company's favor. (See ELECTRICAL WORLD, Sept. 18, page 594.) In the Missouri action the workman, who was not an electrician, was in the act of removing a plug from a socket on a drop cord, in the course of his duties, when he dropped to the ground, expiring almost instantly. The court held that it was not essential for the petition charging negligence to show the source of the current and the course and means by which it reached the socket. It also found from the testimony of electrical experts that there were instances where death had been caused by the low voltage in question. (223 S. W. 911.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Henry Harris, who was elected president of the Pennsylvania Electric Association at its recent convention at Bedford Springs, Pa., has filled the office of vice-president of that association during the past year and been a member of its executive committee for the past five years. Mr. Harris is now president of the United Electric Light Company of Wilmerding, Pa., which was organized by him. He became identified with the electrical industry some twenty years ago and in the capacity of commercial manager for the Duquesne Light Company became well known as



HENRY HARRIS

a student of merchandising methods and an originator of efficient plans for selling electrical goods. Mr. Harris has been identified with the work of the National Electric Light Association as vice-chairman of the Commercial Section for two years and as chairman of the committee of co-ordination of advertising in the electrical industry. He has also served for five consecutive years as chairman of the rate committee of the Pennsylvania Electric Association.

Bert Dunkin, who has been cashier of the Albia (Iowa) Light & Railway Company, Albia, has been appointed acting manager to succeed Ralph W. Boyer, who has been general manager and treasurer. Mr. Boyer has been connected with the Guy M. Walker properties for the last eleven years and leaves to enter another line of business.

J. G. Lancaster of Sydney, N. S. W., has left Australia to become chief electrical engineer for Hay & Vickerman, consulting engineers, Wellington, N. Z., where he will have charge of some hydro-electric developments for the New Zealand government. Mr. Lancaster is a graduate of Canterbury College, New Zealand. He completed the engineering apprenticeship course of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., and for the last eight years has been engaged on industrial consulting work and on the design of the proposed city tube and suburban electric railways in Sydney, Australia.

Men of the Industry

Changes in Personnel and Position— Biographical Notes

P. T. Sealey, formerly captain 37th Engineers, U. S. A., combatant electrical and mechanical regiment, has been appointed general manager for the receiver of the Texas Gas & Electric Company, Houston, Tex.

J. A. Whitlow, heretofore general manager of the Pine Bluff (Ark.) Company, which is controlled by the Arkansas Light & Power Company, and also operating superintendent of the latter company, has been made traffic manager in charge of rates, appraisals and similar matters for the Arkansas company's properties. The duties of general manager at Pine Bluffs have been assigned to J. L. Longino, chief engineer, and those of operating superintendent to F. M. Wilkes, formerly commercial manager.

Lieut.-Col. William Kelly, who has been chosen chief engineer of the Federal Power Commission, is familiar with water-power matters on all navigable streams from his work for the chief of engineers. Colonel Kelly spent a year at the front during the war with Germany. After the armistice he was detailed by the Peace Commission to make a preliminary survey of the rivers internationalized by the treaty. This



LIEUT.-COL. WILLIAM KELLY

made it necessary for him to make a personal trip along the entire navigable course of the Rhine, Danube, Elbe and other rivers. He made a preliminary report and was succeeded by Walker Hines, formerly Director-General of Railroads, who was chosen to act as arbiter. Congress awarded a distinguished-service medal to Colonel Kelly. He was born in New York Jan. 8, 1877.

C. A. Semrad, who was elected president of the Colorado Electric Light, Power and Railway Association at its recent meeting at Glenwood Springs, Col., is general manager of the Western Light & Power Company, Boulder, Col. Mr. Semrad was born July 3, 1885, at Highland, Wis., and was graduated from the University of Wisconsin, College of Electrical Engineering, June, 1908. The following year he was an instructor in hydraulics and water power at the University of Wisconsin. He was then employed by the Union Light & Power Company, St. Louis,



C. A. SEMRAD

and in 1910 became cadet engineer of the Northern Colorado Power Company, receiving the appointment of general manager of the Cheyenne (Wyo.) Light, Fuel & Power Company, which is a subsidiary company of the Western Light & Power Company, in 1914.

Obituary

Elvin L. McGrew, purchasing agent and general traffic manager of the Standard Underground Cable Company, died Friday, Oct. 8, at the Imperial Hotel, New York City. Mr. McGrew became connected with the Standard Underground Cable Company in 1900. A few years ago he was a leader in the formation of the Purchasing Agents' Association of Pittsburgh, and he was its first president. Later he became prominent in the national organization. Mr. McGrew was born at New Alexander, Ohio, fifty-seven years ago.

Charles S. Davis, counsel for various public utilities before the Massachusetts commission in the past decade, died recently at Plymouth, Mass. He was born at Plymouth sixty-three years ago, was educated at Harvard College and was a member of the firm of Davis, Peabody & Brown of Boston.

Charles Sibley Gage, formerly attorney for the American Bell Telephone Company in New York City, died recently at Concord, N. H.

Trade and Market Conditions

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

Increasing Jobbers' Stock Turnover by Manufacturers' Co-operation

PYRAMIDING or duplication of orders by many jobbers during the past year produced a rather confused situation among the manufacturers and the trade. The jobbers could not absorb the orders they placed nor could the manufacturers fill them. One result was a low rate of turnover for the jobbers. It became necessary for the closest co-operation to be effected in order to control the situation. The plan devised by the Edison Electric Appliance Company to meet the situation has been outlined by W. B. Pierce, Eastern sales manager of that company. Briefly it consists of a jobbers' stock and requirement survey which makes the status of the jobbers' stock perfectly clear to the manufacturer, thereby permitting him properly to prepare to meet the actual needs of the jobbers and so increase the rate of turnover of the latter's stock.

It is necessary for the manufacturer to relate his sales and anticipated sales to his production and to his raw-materials orders. His manufacturing schedule is carefully prepared for several months ahead and his materials are ordered accordingly, but the actual deliveries of the furnished product must follow the schedule or else the manufacturer will find himself with an overstock of undeliverable orders which would demoralize his business because of a low turnover. It was the desire to apply the scheduling principle to the jobbers' business that led the Edison Electric Appliance Company to devise the survey chart which was adopted.

Columns are provided on the chart to list the names of the various separate kinds of appliances and the following data regarding each: Stock on hand, in transit and total; dealers' orders being held; orders placed but not shipped, and requirements during various future periods. These charts are filled out quarterly.

The plan has been proved sound and well regulated. It provides for the manufacturer and his distributers acting as a unit and operating on the basis of carefully prepared quarterly sales estimates. It enables the manufacturer to work more closely to the requirements and permits him to obtain the maximum result from his production efforts. The jobbers have gained because their stocks move more rapidly and their rate of turnover, on which their profits depend, has been increased.

Simplex and Westinghouse Companies Win Heater Suit

ELECTRIC heater production by the Simplex Electric Heating Company, Cambridge, Mass., and by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., will continue without hindrance, according to a decision recently handed down by Judge F. S. Dietrich, United States District Court, District of Idaho, and entered in the Northern District of California. The issue was heard in the case of the Majestic Electric Development Company vs. Holbrook, Merrill & Stevens, distributers of Simplex radiators, the Westinghouse Company also being a defendant. The plaintiff contended that the invention of the reflector-type heater was fundamental. The court holds that nowhere in his patent application did the plaintiff suggest the view that he had discovered the principle of a "beam heater" or any fundamental idea in relation thereto, and the opinion points out at length that this principle was recognized and indeed utilized in the art before the plaintiff's patent was sought. The invention of nichrome wire solved the problem of a dependable and efficient heating element. When the right to its use was established heaters were put on the market in increasing numbers, and doubtless the plaintiff was to some extent the beneficiary of its competitors.

R. P. Ingalls, sales manager Simplex Electric Heating Company, stated to a representative of the ELECTRICAL WORLD on Monday that the decision had been fully expected by the defendants, and that it opens the way toward healthful competition. Distributers all over the country may now purchase freely from the manufacturers, Mr. Ingalls said.

The Majestic company, however, is advising the trade that the case will immediately be appealed to the United States Circuit Court of Appeals. Furthermore, this company states that these cases do not involve all of its patents and that it has still other patents which it thinks are being infringed by Simplex and Westinghouse and that suits will soon be brought on these patents. The trade is likewise informed by the Majestic company that this decision does not cover other than Westinghouse and Simplex devices and that with respect to other manufacturers the company intends to proceed with the protection of its rights. The Majestic company first brought suit for infringement by the Hotpoint heater and won on design patent. The Edison Electric Appliance Company, which manufactures the Hotpoint line, as a result has become licensed under the Majestic patents.

Lower Cotton Reflected in Prices of Insulation

LOWER prices of raw material have reacted upon the market for insulation of all kinds, according to representative manufacturers in this line and jobbers. The price of tapes, webbing, sleeving, cambric, both varnished and plain, and silk material has dropped slightly owing to lower cotton. Varnish, too, is a little easier in price. On the other hand, insulating papers, pressboard, etc., show no signs of a reduction, and in some quarters it is said that even higher prices may prevail there in view of the great scarcity of paper. No fluctuation is evident on mica. Opinions differ as to the probable tendency of prices on that material. One distributer reports that prices quoted from England are being slightly shaded, but on the other hand it is said that European countries have entered into competition as buyers of mica in India so strongly that the supply does not exceed the demand. One large company which does considerable business in built-up mica used in fractional motors and automobile ignition sets states that there is little or no demand from that quarter.

Questioned whether or not insulation prices have reached their bottom level most manufacturers state that the trend is almost entirely dependent upon raw material prices. It is pointed out in some cases that cotton has been contracted for some time in advance and that it requires from about eight to ten weeks before a drop in raw cotton is reflected in prices of finished insulation. For this reason some producers state that if cotton remains at its present low level or drops further, some additional softening of prices may result, but this readjustment will come about gradually if at all. Demand, while fair at present, is considerably less

than it was a few months ago, probably owing to price uncertainties, it is said. Some cancellations have been received, but outside of the automobile industry these have not been alarming. There have been requests for extensions of time on filling orders in a number of instances, however. Manufacturers agree that the present dullness is only temporary and that a good volume of business should develop after the first of the year. This optimistic tone seems to be quite prevalent in the field. One of the large interests reports that in spite of the recent decrease in demand the present year will show a volume of business one-third greater than ever before. Even at present, though individual orders are smaller, this company reports that the actual number of orders and inquiries is increasing. The most active buyers of insulating material just now are said to be the repair shops, and cable manufacturers are also ordering varnished cambric fairly well. Foreign demand is conceded to be on the increase, and prospects for orders from abroad are brighter. Inquiries are coming in from England, France Germany, Australia and the Scandinavian peninsula it is said.

Raw material, except for paper, is plentiful, but not all producers have been able to catch up with back orders, which in one representative instance are still piled up one to three months ahead. Deliveries are improving, however, and on some classes of material orders can almost be filled from stock. Paper material, both treated and untreated, is said to be in the worst supply.

Wire Prices Show Downward Trend

DEMAND for copper wire, both bare and insulated, is at a low level at present, according to manufacturers. This condition is attributed to the falling market, which automatically curtails buying until price readjustments are completed. Foreign demand is also light at present, though the exchange situation is partly to blame there. In some quarters it is stated manufacturers are curtailing production to guard against overstocking.

As a result of lower cotton, rubber and copper prices, there has been a general easing off of prices on the whole line of bare and insulated wire. This reduction has been gradual and varies according to type and size. One producer estimates the extent of the price drop to be from about 10 to 15 per cent. Opinions differ as to whether prices have reached their lowest level. In many cases manufacturers have contracted in advance for cotton. Copper prices are also held to be close to the margin of producing cost. In view of these facts one large wire producer at least is buying copper at the present time. On the other hand, a great many interests seem to feel that still lower wire prices may prevail, provided that raw materials remain at their present level or drop further. This view holds that lower raw-material cost, especially of cotton, has not yet had time to make itself felt fully. Bare wire base at present ranges from about 20 cents to 20¾ cents, compared with about 22¼ cents two months ago.

In general the view is expressed that demand will remain light for the rest of this year, but that starting next spring a good volume of business will develop. Buying may even start heavily before then, one manufacturer says, if copper and cotton should start to move upward. In the opinion of this company, a rush to place orders would then ensue that would tax the capacity of wire mills and leave many consumers who have waited "out in the cold."

A number of cancellations and requests for extensions have been received, especially from automobile manufacturers, but outside of that industry the number does not seem to be great. The chief reason for cancellations is felt to be the overbuying that has taken place in an effort to insure deliveries. Stocks, on the whole, are not large. One company has unfilled orders ahead for three months on certain sizes of weatherproof wire, and another is quoting deliveries of from six to twenty weeks on some sizes of insulated wire and four to six weeks on bare. Many sizes are available from stock, however. Magnet wire stocks are generally short and deliveries cannot be made from stock. One representative producer is quoting eight to ten weeks. Another manufacturer presents the exception to the rule by reporting a good stock of finished insulated wire but a short supply of the large sizes, which in that case are meeting a stronger demand.

Prices generally are very unstable and, as one manufacturer puts it, are "all over the lot." No prices can be quoted on going to press which can reasonably be expected to hold over publication date.

Washing Machines Entering Strong Buyers' Market

REPORTS from many of the washing-machine manufacturers are to the effect that all orders may be immediately filled, which would indicate that orders are not at this time exceeding the production capacity. At the September meeting of the association of American Washing Machine Manufacturers the expressed opinion was that prices would not quickly recede, and it is reported that the feeling at the meeting was that not before Jan. 1, 1921, would there be a change in prices. One manufacturer's representative has stated that his company is now willing to guarantee present prices for six months.

That prices are not stable, however, is indicated by a very recent recession in the prices quoted on two machines. No reasons were given for this, as it is claimed that there has been no change in labor costs, which constitute a very large proportion of the factory expense. Other manufacturers, while admitting that a strong buyers' market is apparently setting in, would not admit that lower prices could be expected in the near future.

Metal Market Situation

COPPER prices within the past week have declined from 1 cent to 1¼ cents per pound on all positions. Offerings as low as 16 cents are reported in the outside market, but sales even at this figure are small. Consumers apparently believe that 16 cents will be shaded and are holding off buying. For prompt shipment, f.o.b. refinery, from 16 to 16¼ cents is generally quoted by second hands, and 16¼ to 16½ cents f.o.b. refinery, covering the first quarter of next year. This is equivalent to ¼ cent more for these same positions delivered. Copper at 16 cents is the lowest level touched by the metal since early in 1919, when it sold down to 14⅝ cents. The present price is said to be only 4 per cent above the average for the past ten years and nearly 38 per cent below the prevailing prices during the war.

Producers' prices are entirely nominal. It is reported that orders would be accepted at 17 cents, but the large interests take the stand that since there is no demand it is useless to quote in competition with the outside market prices. Foreign demand remains off. Standard spot copper at London broke more than £3 in price the past week under the disquieting effect of the coal miners' strike in England.

The official price of lead has been further reduced ½ cent. A cut of 2 cents per pound also occurred in the price of aluminum last week. Straits tin declined 4½ cents, while antimony and zinc followed suit with drops of a fraction of a cent each.

NEW YORK METAL MARKET PRICES

	October 11	October 4
Copper	£ s d	£ s d
London, standard spot	96 10 0	93 5 0
	Cents per Pound	Cents per Pound
Prime Lake	17.75	16 50
Electrolytic	nominal	nominal
Casting	17 00	15 75
Wire base	21 00	19 00–19 50
Lead, trust price	7 75	7 25
Antimony	6 62½–6 87½	6 50
Nickel, ingot	43 00	43.00
Sheet zinc, f.o.b. smelter	12 50	12 50
Zinc, spot	7 55–7.65	7 50
Tin	42.00	37 75
Aluminum, 98 to 99 per cent	35.10	33.10

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	14 75–15 00	14 50–15.00
Brass, heavy	8 00– 8.25	7 50– 8.00
Brass, light	6 50– 7 00	6.50– 7.00
Lead, heavy	6 00– 6 25	5 75– 6 00
Zinc, old scrap	4 50– 5 00	4 50– 5 00

THE WEEK
IN TRADE

NOT much change is noticed in the market this week. In New England prices are again stiffening and also in a measure along the Atlantic seaboard. Elsewhere prices have, if anything, been softening. Wire is dropping rapidly in price following the raw-materials market. Transportation is generally improving and stocks as a result are commonly large. Rigid conduit, however, is still somewhat short, especially galvanized. In fact, all galvanized products seem to be hard to obtain.

Except for the Chicago district, there is no improvement in collection, and in some places it is taking still longer to collect outstanding accounts.

Retailers still are hesitant about ordering their Christmas stocks, in spite of the fact that it is difficult to obtain stocks of many of the smaller socket devices.

Building is slackening very rapidly and is now probably as low as it ever was, with no prospects of any immediate improvement.

NEW YORK

During the past week the volume of business has undergone no material change over the previous week. A checking of the actual sales billed in some instances has shown that the market has stabilized to a considerable extent, and this has encouraged a spirit of conservative optimism for the immediate future. Prices are still unstable to the extent that quotations are being adjusted to meet the demands of the buyers. Wire has shown marked price recessions.

Transportation continues to improve as both receipts and shipments are being handled quite satisfactorily.

Collections have not shown any great improvement, yet there is a decided feeling that it would be unwise further to tighten up collections at this time as such a program would probably work a great hardship on a good many customers.

Schedule Material.—Demand has weakened and stocks are spotty. Sockets and other items which contain porcelain continue scarce.

Rigid Conduit.—Stocks are spotty; a few jobbers report stocks up to five carloads, although the larger sizes are hard to obtain. Quotations vary widely; ¼-in. black pipe is quoted at $85 to $92 per 1,000 ft.; 1-in. black pipe is quoted at $170 per 1,000 ft. The demand continues good.

Wire.—The past week has seen marked recessions in wire. Base prices have been reduced to 21½ cents for bare wire, rubber-covered to 25 cents, and weatherproof is quoted by one large producer at 24 cents. Jobbers' quotations on No. 14 rubber-covered range from $10 to $11.50 per 1,000 ft. Further reductions are anticipated.

Christmas Business.—No strong demand has been felt, although such supplies as have been received have been quickly taken.

Lamps.—The fall demand is running at the expected rate. Shipments are coming through in good shape with the exception of some of the larger sizes which are rather difficult to keep in stock.

Washing Machines.—The electrical show has apparently caused a slight increase in sales. Prices in general have held steady, although one or two manufacturers have dropped their prices toward those quoted prior to the middle of July.

Heaters.—The rush of sales during the cool weather of a few weeks ago has flattened out and sales are steady Deliveries are fair and stocks good.

Flexible Metallic Cable.—The market is weak. One jobber reports a ten weeks' stock with sales coming in in small lots only. Prices have dropped off a bit to $85 to $90 per 1,000 ft. of No. 14 two wire.

CHICAGO

The exact condition of the construction industry in this district is shown by the fact that during September, 1920, building permits in Chicago were issued to the extent of slightly less than $4,000,000. This compares with $13,500,000 in September, 1919. With the coming of winter, when but few construction undertakings are normally begun, contractors and contractor-dealers are facing a dull season. This is being reflected in demand on jobbers. At the present rate of business adequate stocks on all lines of electrical construction materials will soon be in hand.

Retail demand continues light. The average buyer, reading that the delegates to the National Convention of Purchasing Agents stated that prices were due for a drop of from 20 to 50 per cent, is withholding purchases, looking for that drop. It is a queer fact that the electrical industry is now a sufferer merely because it refused to profiteer during the period of prosperity. The public, not familiar with conditions, feels that electrical goods should share with other lines in the price cutting and will have to be educated to the fact that radical cuts are impossible.

Collections are slightly improved. In a measure this is because billing is not proceeding at so high a rate as formerly and customers are getting a chance to catch up.

Fractional-Horsepower Motors.—Decreased consumption by household-appliance manufacturers and increased output due to superior labor efficiency are causing the supply of small motors to exceed demand by almost 100,000 a month, according to the estimates of several interests in a position to know. No announcements have been made of price reductions, but it is stated that offers to buy in quantity would probably induce shading of lists. Some few special types are still hard to get.

Black Conduit.—Orders are materially reduced through stagnation of construction, and supplies are approaching normal in most sizes. Contractors report a greatly lessened demand. So far as can be learned lists are strictly adhered to.

Non-Metallic Flexible Conduit.—Adequate supplies are being received from manufacturers, and jobbers' stocks are well filled. Some price cutting is reported, but not of sufficient extent to affect the market in general.

Poles and Cross-Arms.—Demand from municipalities continues at a good rate. Public service corporations also remain in the market and, as their expenditures have been kept at a minimum for a long time, will probably be forced to keep up buying at a steady rate to maintain their lines. Steadily improving transportation is making itself felt in greatly improved deliveries. Stocks in the various pole yards throughout this section are being built up to normal.

Galvanized Strand.—Supply condition is materially relieved. Not all jobbers have stocks and none have full stocks, but strand can now be obtained in thirty days or less on almost all sizes. Business should be good on this item for some time to come, as all factors including the consumer have been very short for some time.

Electric Ranges.—Unusual interest, previously noted, continues in this line. Appealing principally to the highest class of retail trade, the popular idea of waiting for a cut has affected it but little. Prices are firm.

Washing Machines.—Manufacturers, three of whom have advanced their prices during the past few weeks, state that actual sales by makers have been better each month this year than in the corresponding month last year. Several plants, recognizing the fall-off in retail sales, have curtailed production, while others are still running at capacity and finding no difficulty in disposing of production.

Christmas Goods.—Retail dealers seem uncertain as to how heavily they want to buy for the approaching season. Most of the big stores already have their stock in and report encouraging inquiries from their customers at this early date, but the volume of business to be done by the small dealer is still a question. Jobbers' stocks are good.

BOSTON

An active upward swing in wiring material prices is the leading feature of the Boston electrical market during the past week. The price-cutting movement of a fortnight ago appears to have run its course. Some overstocks have been relieved, but the lower quotations stimulated little business in comparison with the volume of orders going through, which is still holding up extremely well. Collections are fair and are being followed very closely. Most of the jobbers in Boston are buying very conservatively at present and are reducing their stocks as much as possible before replenishing. All evidences point to the largest yearly gross business ever handled in this section.

General business conditions are somewhat unsettled. The labor market bears signs of improvement. Building and engineering contracts in New England from Jan. 1 to Oct. 13 totaled $261,876,562, against $171,074,000 for the same period last year. For the quarter ended Sept. 30 the value of building construction in twenty-three Massachusetts cities totaled $19,216,582, compared with $22,476,096 for the quarter ended June 30. The indications are that the peak of building has passed for this year.

Heaters.—Intensive production at the manufacturing plants is yielding excellent deliveries, and the volume of orders going to the jobbers is excellent. Prices are firm and raw materials plentiful. Mild weather has held back the retail trade somewhat. List less 30 per cent is quoted on lots of six or below. The Majestic patent suit against the Simplex and Westinghouse interests was not sustained.

Wire.—Rubber-covered wire has advanced slightly. No. 14, in 5,000-ft. lots, is selling at $10.50 per 1,000 ft. Stocks are in good shape. Weatherproof base is now ranging from 26 cents to 27 cents. No complaint is heard about getting orders filled.

Rigid Conduit.—Stocks are spotty, with vigorous demand. The supply of ¾-in. pipe and of some large sizes is very low. Quotations are steady, representative prices being: Galvanized, 1-in., $200 per 1,000 ft., and ½-in., $102; for 1-in. black pipe, $189.50 is charged and for ½-in. black, $96.

Non-Metallic Flexible Conduit.—Quotations are up from last week's level. Good stocks are in hand, and the ⅜-in. size brings $33.50 per 1,000 ft., in 5,000-ft. lots. For ¼-in. loom the buyer is paying $36.50. A fair demand exists.

Ranges.—Business is rather dull. Ranges are being made up for stock against the expected demand of next spring.

Heating Pads.—Brisk trade is being handled, with very active production at the factories. Reductions in the cost of cotton have not found their way into heating pads to any extent, owing to the small amount of this material represented in the total manufacturing cost.

Sockets.—Prices stiffened during the week to 47.5 cents net on pulls, 28 cents on keys and 26 cents on keyless, in case lots. Plenty of sockets are obtainable for current needs. A healthy demand prevails.

Motors.—Sizes below 10 hp. in so-called standard makes are hard to obtain complete with pulleys. A slow improvement in deliveries, however, is apparent from week to week, taking the trade by and large. Prices are firm.

Knobs and Tubes.—Stocks are somewhat spotty. "Nail-it" knobs are plentiful, and steady at $32 per 1,000 in lots of 4,000 or over. Tubes are in better supply but cleats are very short.

ATLANTA

The report of the Department of Agriculture shows that only one-half as many bales of cotton have been ginned up to date this season as was the case in 1919 and that a large percentage of these bales are not being marketed by the owners. A number of heavy cancellations of tire-fabric orders by the automobile tire manufacturers have caused several of the large mills in the section to curtail hours of operation materially and are also causing a hold-up in mill construction. Jobbers, as a result, report very few new orders from the textile trade. The agitation in the rural districts in connection with the marketing of the new cotton crop is causing considerable uneasiness and is reflected by the falling off in orders from these districts and the collection of outstanding accounts.

The transportation situation continues to improve, and all jobbers report the accumulation of satisfactory stocks in nearly all lines. The general underlying tone is that business will continue to be satisfactory, even though grave fears are being expressed of the permanent bad effects from the sharp break in the price of cotton. A few price reductions are to be noted during the past week.

Washing Machines.—Jobbers report the past month as being the best in some time, the demand having shown considerable increase while shipments of stocks are reported very satisfactory.

Wire.—A change in the discounts on rubber-covered wire has caused a reduction in price. Jobbers report excellent stocks with practically no back orders on hand. The goods are moving briskly and shipments are reported satisfactory. Weatherproof is quoted at 27 cents and rubber-covered at 26 cents base.

Dishwashers.—This specialty continues to increase in popularity, and jobbers anticipate a brisk sale during the coming winter months. A price reduction of $25 off the list is just announced.

Heating Devices.—Jobbers continue to complain of their inability to accumulate stocks for Christmas trade. There is a general shortage, with the exception of irons, and apparently little prospect of better conditions in the next few weeks.

Conduit.—A reduction of 15 per cent in price is announced by one of the largest jobbers, despite the fact that stocks as a whole continue very spotty. Fair supplies of some sizes of black pipe are in the market, but galvanized continues short.

Steel Reflectors.—An unusually good season is reported on reflectors and accessories. Heavy orders continue to be received and shipments are quoted at twenty-four weeks.

Flexible Non-Metallic Conduit.—Stocks are in excellent shape, one or two firms really reporting a supply in excess of their requirements. The normal demand continues, with prices on ⅜-in., $30 per 100 ft.; ½-in., $32 per 100 ft.

ST. LOUIS

In spite of the tendency to cut prices reported from other sections of the country, St. Louis jobbers report very few cases of price shading. These particular cases are on items which have become overstocked through the delivery by the manufacturer of large back orders which cannot be disposed of normally. This situation is causing a number of cancellations by jobbers. On a good many other items jobbers are instructing the manufacturer to hold their orders until further notice.

A practice which is helping to balance stock and demand here is that of interchange of stocks by jobbers. A meeting of jobbers from St. Louis, Kansas City, Omaha and Des Moines held this week brought out the fact that this practice has had a large part during the past few months in keeping down overstocks and catching up on back orders. An instance in point was the shipment of a large number of heaters by an Omaha jobber with an overstock to a St. Louis jobber who was behind in his orders.

Market conditions have changed very little during the last week. Jobbers' stocks in most lines are good, with only a few shortages, most of which are common to the country at large and which have been caused by general economic conditions. Buying is very conservative, particularly retail buying. Industrials and utilities are buying more freely than the retail trade, but it is not expected that the volume of business for October will be any larger than that of September, which was a subnormal month. Collections are difficult and have lengthened on an average by fifteen days.

Rigid Conduit.—There is a fair stock of 1-in. and 1¼-in. black, but stocks of 1½-in. black have become spotty. Demand is fair. One-half inch and ¾-in. black are still very short, a small supply of ¾-in. reported several weeks ago having become exhausted. Stocks of galvanized are spotty.

One-half-inch is quoted at $80 per 1,000 ft., ¾-in. at $110 per 1,000 ft., and 1-in. at $148 per 1,000 ft., all in lots of 5,000 ft. or more.

Guy Wire.—Stocks have shown no sign of improvement in the last six weeks, and St. Louis manufacturers are still having difficulty in getting the galvanized-steel wire from the mill with which to make the strand. No time for the termination of the shortage can be predicted. Prices have stiffened, but because of the inability to promise any specific delivery there is no basis for a standard quotation, prices ranging from $1.75 to $1.90 per 100 lb. for galvanized stranded-steel wire according to the order.

Twin Lead-Covered Wire.—There are good stocks here and immediate deliveries can be made. Manufacturers are quoting one month delivery on direct shipment. A representative price is $67.86 per 100 lb. of 600-volt, duplex, No. 8, in lots of 1,000 lb.

Porcelain Insulators. — The 33,000-volt insulators are scarce and in good demand. Stocks of 6,600-volt insulators are somewhat better but are far from complete. Demand for these is good also.

Schedule Material.—Stocks of some items are spotty, but there is an abundance of pull sockets and some jobbers are reported to be willing to shade prices on these to cut down their stocks. The demand for schedule material is spotty and on the average much below normal.

Radiators.—Stocks in the whole territory are in good shape, numbers of jobbers and dealers having carried over quantities from last year. Demand is shaping satisfactorily, according to the retailers, and the several short cold snaps experienced so far have shown a good movement. This past week the demand has been slow.

Bare Copper Wire.—Very few jobbers carry stocks, but they can quote shipment from the factory with delivery in a few weeks. The current price on No. 8 in 200-lb. lots is $26.50 per 100 lb., and on No. 10, $29.50 per 100 lb. These prices are felt to be high owing to the movement of the electrolytic copper market and are not firm.

SALT LAKE CITY—DENVER

There is little or no improvement noted in the electrical market. Consumer demand is at a low ebb. Dealers buy only as they sell and jobbers are trying to reduce their stocks. The public is still in a waiting attitude, holding for a decline of prices that dealers and jobbers cannot foresee. Prevailing prices in all lines of electrical merchandise seem the big obstacle to larger sales.

Consumers are suspicious of exorbitant prices and refuse to buy until there is a decided recession. Consequently only such commodities as are absolute necessities are in demand. Dealers and consumers alike would welcome a reduction in price schedules and freely admit that it should come. There is no indication, however, that the immediate future will see a substantial decline. In fact, some manufacturers are advising their jobbers that present prices, if not higher prices, will obtain for the next few months.

The labor market is settled. There is little agitation and no strikes imminent. Building remains somewhat at a standstill. Contractors find times rather dull, with little promise of immediate improvement. Transportation is slow and vexatious. L. c.l. shipments that normally require three weeks from the Atlantic seaboard now take from four to six weeks. Even carload shipments drag out from three to four weeks. In Salt Lake City electrical interests have effected a co-operative organization and will soon launch an intensive advertising campaign. Great interest centers in the projected canalization of the Lower Snake River, which will afford a deep water inlet to Lewiston, Idaho. Representatives of the United States Board of Engineers have already made a preliminary survey. If the project is carried out, great power plants will be established at the dams to supply energy for manufacturing industries.

Wiring Materials.—Conduit, porcelain, sockets, etc., are selling very well. Stocks are not ample to meet the demand.

Lamps.—Trade is brightening, which of course is the expected thing at this season. Dealers are well stocked to meet a wide diversity of demand.

Irons.—Consumer demand is steady, though not brisk.

Washers.—The market is decidedly a consumers' market. Sales are made only through intensive methods of advertising and selling. Liberal time payments are the rule.

SEATTLE—PORTLAND

Jobbers in Seattle and Puget Sound cities as a whole report good sales, especially in domestic appliances and lamps. Heaters, toaster stoves, ironers and washing machines are moving especially well. Sales of heavy power apparatus are negligible and house-wiring device sales are light. Dealers report increasing counter sales, especially in washing machines and heaters. Stocks, generally speaking, are in good shape and shipments from the East are coming through satisfactorily with but few exceptions. The exceptions are ranges, percolators and porcelain material, although in the case of latter demand is very light owing to building slackness. A recent hail and rain storm in the "Inland Empire" section—eastern Washington—damaged the wheat crop being harvested approximately 25 per cent. The same storm damaged the prune crop in parts of Oregon to considerable extent. It is authoritatively stated that this will have no small effect on sales of farm-lighting outfits and appliances in these districts.

Portland manufacturers report that business is quieting down somewhat. Credit is tightening and collections are slowing up, although they are not bad at present. There is a general feeling that considerably quieter business, which will endure for a short time, is approaching. Jobbers state that business continues good, although it is not picking up as much as has been expected. The lamp and reflector business is increasing very materially. Another small drop in the price of wire is reported for the past week. This makes a total of approximately 13 per cent drop within two weeks. Electric ironers have increased in price, otherwise there are very few price changes of note. There is a tendency by the dealers to withhold buying, awaiting lower prices. Partly as a result of this there is some uncertainty in regard to the matter of increasing prices due to freight increases. One very prominent line of farm-lighting sets has recently lowered its price $600. There is some feeling that the cut may perhaps be of a temporary nature.

SAN FRANCISCO

Business continues quiet, and hand-to-mouth buying seems again to be the rule. Outside of certain large building jobs and certain urgently needed residence building, there is little new work reported in San Francisco, although building continues very large in volume in southern California. What may be called the valleys in the building load are partly filled by such missionary work as range wiring and improved industrial lighting. The threatened strike of all building trades in San Francisco is being arbitrated and has probably been averted. All lighting and power restrictions such as have been effective in the bay cities for the past month have now been abrogated.

Collections are averaging just short of fifty days, principally because of the activity of credit men in getting in long-standing accounts and the way in which they keep tabs on dealers' customers, instructing dealers to be cautious over the contracts into which they enter with consumers. The "Morris Plan" people report many new accounts, resulting from intensive device campaigns.

Appliances.—Appliance shipments from Eastern factories are very poor, and many customers, even those who have long-outstanding orders, will be disappointed in their Christmas stocks. Generally speaking, jobbers are not soliciting orders for percolators, toasters, etc., realizing that they will be hard put to it to care for their regular customers.

Conduit.—Local flexible metallic conduit stocks are very poor with little relief in sight. Stocks of fittings are slightly better but uneven in quantity. Flexible non-metallic conduit stocks on the contrary are too large.

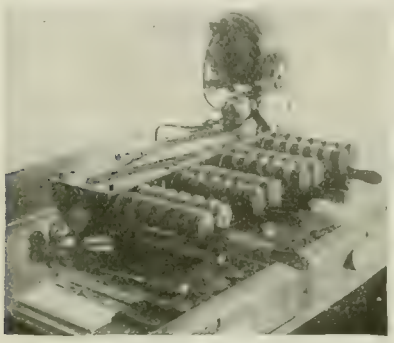
Boxes.—The decreased demand for roughing-in material and better shipments from the factory are the causes which are creating surplus stocks of boxes.

NEW APPARATUS & APPLIANCES

A Record of Latest Developments
and Improvements in Manufacturers' Products
Used in the Electrical Field

Motor-Driven Razor Sharpener

In the machine for resharpening safety razor blades developed by F. W. Cochrane, 3917 South Western Avenue, Los Angeles, Cal., a departure from the usual type of such machines is made in

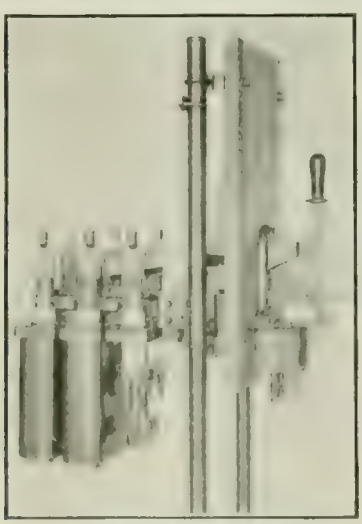


FAN-TYPE MOTOR DRIVES NEW RAZOR SHARPENER

that the blades move laterally with reference to the sharpening rollers, of which there are four sets, the first being faced with felt, the second being the honer, the third the stropper, and the last faced with horsehide. The machines are in two sizes, for twelve blades and for six blades, and are driven by Westinghouse motors.

Standardized 7,500-Volt Oil Switches

Two new types of standard unit oil circuit breakers for use on systems up to 7,500 volts have been developed by



TRIPLE-POLE BREAKER MADE UP OF STANDARD UNITS

the General Electric Company, Schenectady, N. Y. These breakers, known as FK-35 and FK-35-Y respectively, are so constructed that single, double, triple or four-pole breakers can be made up by combining the required number of units—one for each pole, plus frame, breaker mechanism and operating mechanism.

Adjustable Ground Clamp

An adjustable ground clamp of tinned copper which conforms to the latest requirements of the code has been brought out by the Gillette-Vibber Company, New London, Conn. This "Gee Vee" clamp is made in three sizes to accommodate pipe from $\frac{3}{8}$ in. to 3 in. It is claimed that the tighter the bolt which holds the clamp onto the ground pipe is screwed the more securely is the ground wire held to the pipe.

Small Amplifier and Detector

Of unusually small dimensions is the single-stage amplifier developed by the Acme Apparatus Company, 27 Windsor Street, Cambridge, Mass. The apparatus contains all the essential parts except the vacuum tube and batteries, and nevertheless measures only about $3\frac{1}{2}$ in. x $3\frac{1}{2}$ in. x $5\frac{1}{2}$ in. An "Acme" transformer is included in the unit. A detector has also been developed by the same company, of the same dimensions. The binding posts on these pieces of apparatus, the maker says, are so arranged that a detector and two-stage amplifier can be made with separate filament control and the same batteries.

Unit-Type Geared Turbine and Generator

The Steam Motors Company, Springfield, Mass., has developed a geared turbine for mounting on the same base with a generator, thus producing a rugged unit-type outfit. The set, known as a "Steamotor" unit, has a two-row impulse turbine wheel of standard construction, a gear manufactured by the Fawcus Machine Company, and is complete with all the usual steam-turbine auxiliaries such as governor, emergency governor, pressure lubricating system and oil cooler. The units are in capacities ranging from 59 hp. to 300 hp., with turbine speeds ranging from 2,000 to 5,200 r.p.m. A typical unit of 100 hp., having a two-to-one ratio and a 3,200 to 4,000-r.p.m. turbine, has an over-all length of the steam end only of 36 in., an over-all height of 35 in. and a width of 28 in. The height from the base to the center line of the low-speed coupling is 11 in.

Laboratory Sterilizers

A combination sterilizer for instruments and dressings made in three sizes has been developed by the Prometheus Electric Company of 511 West Forty-second Street, New York. The heaters are for 110 volts to 250 volts and are equipped with fusible members designed to open the circuit in the event of abnormally high temperatures resulting from absence of liquid. Two compartments are provided in each of the three sizes, one compartment for instruments and the other for dressings.

Porcelain Base Switch

A 6,600-volt, 200-amp. switch which has a porcelain base to decrease the weight and improve the insulation between the switch and the support has been placed on the market by the Lewis

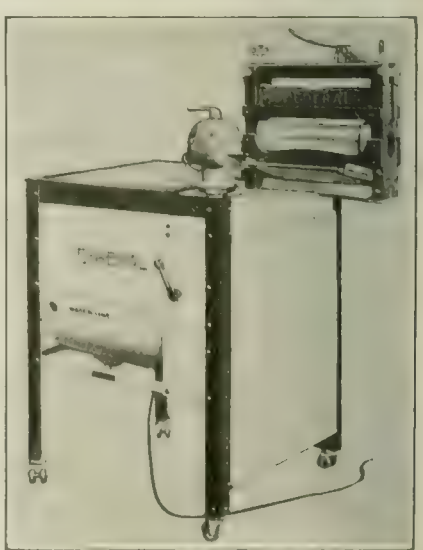


THE PORCELAIN BASE IS HOLLOW

& Roth Corporation, Philadelphia. The large creepage distance is held to be an advantage where great attention to maintenance cannot be given.

Rocker-Type Washing Machine

A new washer was displayed by the Federal Electric Company, 8700 South State Street, Chicago, Ill., at the recent New York Electrical Show. The "Roto-Phor" swinging wringer with which the washer is equipped is reinforced by a "T" iron brace across the bottom. The washer employs a rocking wooden tum-



COVER OF TUMBLER ALWAYS STOPS ON TOP

bler, suspended in a tub full of soap-filled water. The tumbler always stops with the cover on top.

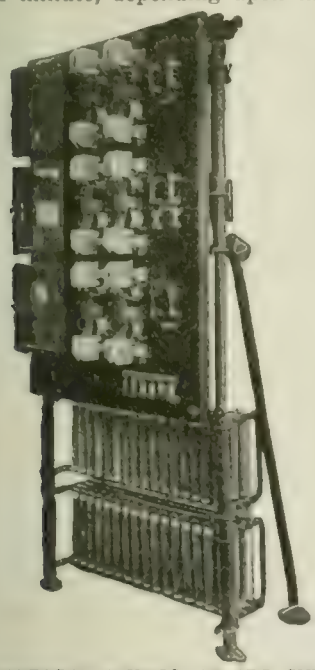
Household Dishwasher

A new electric dishwasher for household use has recently been designed by G. S. Blakeslee & Co., Cicero, Ill., with a capacity of 100 dishes besides silverware. It occupies a floor space of 22 in. x 36 in. and is 35 in. high. At the side is an opening for adding water, and the machine can be attached to a waste pipe if desired. It is run by a ¼-hp. motor and is attachable to any lamp socket.

A leaf at one end of the washer may be raised when the machine is not in use, making an aluminum-top kitchen table, 22 in. x 54 in. The washer is also made in a smaller size with a capacity of sixty pieces.

Electric Arc Furnace Regulator

High electrode operating speed and close precision of regulation, with absolute freedom from hunting, are the two important features of the electric arc-furnace regulator just placed upon the market by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. Speeds of 2½ ft. to 3 ft. per minute, depending upon the degree of divergence from normal in the quantity under regulation, and 5 per cent precision are claimed. The ability of this regulator to incorporate high speed with a narrow current zone is due to the fact that the electrode speed tapers all the way from full to zero as the regulated current approaches its normal value.



ARC VOLTAGE AS WELL AS ARC CURRENT CONTROLS MOTORS

Radio Tube Panels

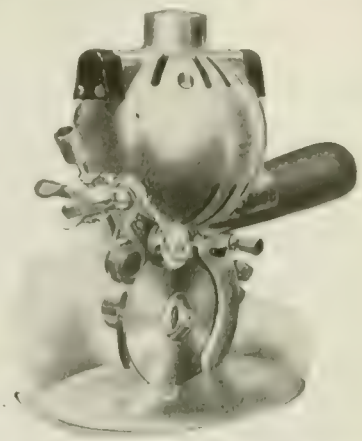
Uniform in size, arranged for easy connection to make a set, and yet flexible enough to permit any desired groupings, is the series of panels recently developed by the Clapp-Eastham Company, 139 Main Street, Cambridge, Mass., manufacturer of radio apparatus. Each panel is of bakelite, ¾ in. thick, 4½ in. wide and 5¼ in. high. Type "Z. R. D." tube control or detector panel includes, in addition to the panel and base, a filament rheostat of special design, two pairs of rubber binding posts for connection to "A" battery and inductances respectively, a special plug connector for telephones which will take regular telephone cord tips, and a high-grade tube socket complete with all wiring. Type "Z. R. A." one-stage amplifier panel includes, in addition, an amplifying transformer and a pair of binding posts for connection to "B" battery. A pair of binding posts is provided, however, for telephone connection in place of the plug connector, making it a simple matter to connect two of these amplifiers side by side to make a two-stage amplifier.

Insulating Cloths

Treated cloths for insulation purposes are being placed on the market by the General Electric Company, Schenectady, N. Y. It is stated that these cloths are woven from long fibered yarn treated to remove the nap. These cloths are made in both yellow and black and in linen, silk and canvas.

Electric Cloth Cutting Machine

A light-weight cloth-cutting machine driven by a small motor which will run on direct or alternating-current, the whole weighing 4½ lb., has been brought out by the Eastman Machine Company, Buffalo, N. Y. The machine will cut up to ¼-in. thickness of cloth at a time and is said to be very easy to operate.



FOR LOW THICKNESSES OF CLOTH

Notes on Recent Appliances

Fruit Juice Extractor

A motor-driven fruit-juice extractor has been placed on the market by the Blessing Manufacturing Company, 1834 Broadway, New York City.

Sterilizer

An electrically operated sterilizer for the use of drug stores and sode fountains has been brought out by the Steroelectric Company, Muncie, Ind.

Motor-Driven Ironer

A motor-driven ironer has been brought out by Gould Appliance Company, 7 West Forty-second Street, New York City.

Shade Holder

The E. H. Freeman Electric Company, Trenton, N. J., has placed on the market an attachment for supporting a shade from a standard receptacle.

Renewable Fuse

A renewable plug fuse has been placed on the market by the Ree-Nu-It Electric Manufacturing Company, New Bedford, Mass.

Appliance Cord

A portable appliance cord has been placed on the market by the R. W. Lillie Corporation, 30 Church Street, New York City.

Two-in-One Plug

The Union Appliance Company, 103 Mott Street, New York City, has placed on the market a double-service plug.

Light for Theater Aisles

A lighting unit for theater aisles has been placed on the market by the Chicago Electric Light Company, 2219 West Grand Avenue, Chicago, Ill.

Radio Oscillator

A constant-frequency radio oscillator has been brougt out by the General Radio Company, Cambridge, Mass.

Spotlight

A small incandescent lamp spotlight was recently placed on the market by the Chicago Cinema Equipment Company, 820 South Tripp Avenue, Chicago, Ill.

Electric Boiler

An electric boiler in 5-gal. to 20-gal. sizes is being offered by the Riverside Boiler Works, Inc., 491 Main Street, Cambridge, Mass.

Vacuum Clothes Washer

The Splitdorf "Aurora" electric washer is a new machine sold by W. B. Hart, 46 East Forty-first Street, New York City.

Electric Washer

The Pittsfield Machine & Tool Company, Pittsfield, Mass., has placed on sale an electric washer under the trade name of "Berkshire."

Incandescent Lamp Hanger

A lamp hanger is being offered by the Thompson Electric Company, 226 St. Clair Avenue, N. E., Cleveland Ohio.

MANUFACTURERS' ACTIVITIES

Record of Changes Affecting Sales and Distribution
Together with Trade Personals and Notes on Foreign Trade,
Jobbers' News and New Trade Literature

MERRILL, SWEENY & COMPANY, 50 State Street, Boston, have recently changed their corporate name to M. H. Merrill & Company.

THE C. W. HUNT ENGINEERING CORPORATION, with offices at 143 Liberty Street, New York City, has been formed for the purpose of handling all sales entailing engineering in connection with the Hunt products and all engineering services previously performed by this company.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY has added a new foundry building, 120 x 120 ft., to its South Philadelphia works to make castings that weigh a half pound up to a half ton. Other additions recently finished there are a three-story warehouse, with 86,650 sq. ft. of floor space, and two pattern storage buildings, 30 ft. x 256 ft. The extensions will practically double the employed force at South Philadelphia, which now numbers 3,500.

LANDERS, FRARY & CLARK, New Britian, Conn, has called a stockholders' meeting for Nov. 2, for the purpose of authorizing an increase in the capital stock from $6,000,000 to $7,000,000, as recommended by the directors it is announced. Funds derived from the sale of the stock, which is offered at $25 a share, will be used for plant extensions and working capital.

REORGANIZATION OF UNIVERSAL PRODUCTS COMPANY.—Announcement is made of the completion of plans for an increase in capitalization of the Universal Products Company of Sandusky, Ohio, and Oshkosh, Wis., to $500,000. The plans include the purchase of the H. C. Doman Company of Oshkosh and the removal of the main offices from Sandusky to Oshkosh. The new company will continue to manufacture the Universal Products electric lighting and power plants and the Doman marine engines. The company will immediately go on an increased production schedule, made necessary by the large field organization developed during the last year. The officers of the new company will be: President, L. E. Willson; vice-president, R. K. Schriber; secretary, Charles H. Eichinger; treasurer, Louis Schriber.

GEAR MANUFACTURERS TO MEET NEXT WEEK.—Standardization and costs are closely related and for this reason will be the principal subjects discussed at the semi-annual meeting of the American Gear Manufacturers' Association, which will be held at Mohonk Lake, N Y., Oct. 27, 28, 29. Among the speakers will be P. G. Agnew, secretary of the American Engineering Standards Committee, whose subject will be "Standardization from the Point of View of the American Engineering Standards Committee"; Calvin W. Rice, secretary of the American Society of Mechanical Engineers, who will speak on "Standardization"; C. L. Collens, II, president of the Reliance Electric and Engineering Company and past-president of the Electric Power Club, whose subject will be "Industry Organization," and Christopher Haigh, supervisor of costs General Electric Company, who will describe the "Machine Rate Method of Distributing Expense." At an informal banquet to be held Thursday night, Oct. 28, Charles W. Woodward, vice-president in charge of personnel for the Hydraulic Pressed Steel Company, will be the principal speaker, taking as his subject "The Human Element in Industry." The American Gear Manufacturers' Association has received requests from Canada, England and Australia for copies of standards and recommended practices for the gear industry.

THE ELECTRIC APPLIANCE COMPANY, Pittsburgh, Pa., has applied for an increase in capitalization from $300,000 to $400,000. The company is incorporated under a Delaware charter.

THE WILLIAM A. CORRAO ELECTRIC COMPANY, St. Louis, Mo., has increased its capital stock from $11,000 to $22,000.

THE NATRONA POWER COMPANY, of Casper, Wyo., announces an increase in capital stock from $500,000 to $1,000,000.

CHARLES S. BEARDSLEY has accepted the position of sales manager of the Apex Electrical Distributing Company, Cleveland, Ohio, after a very successful connection with the United Electric Company, Canton, Ohio, where for three years he was general manager.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., is contemplating an addition to its Lynn (Mass.) plant to cost $150,000. The building is to be of brick, concrete and steel and will be 300 ft. x 160 ft.

Supply Jobbers' Notes

CHARLES H. BAY, at present appliance manager for the Detroit Edison Company, has been appointed household sales specialist for the Western Electric Company, Chicago. He will assume his new duties on Oct. 15.

JULIUS ANDRAE & SONS COMPANY, of Milwaukee, has begun a campaign of newspaper advertising which will cover eight cities in the Middle West, from Mason City, Ia., to Green Bay, Wis. The purpose of the series is to develop good will and "sell" to the public an appreciation of the service which the eelctrical jobber performs for the community he serves.

R. S. MITTEN, formerly assistant general sales manager of the Electric Appliance Company of Chicago, has been promoted to be general sales manager, succeeding P. R. Boole, who has become a partner in the Greusel-Quarfot Electric Company of Milwaukee, Wis.

THE MOHAWK ELECTRICAL COMPANY has leased the Cox Building, a six-story structure at 529-531 South Clinton Street, Syracuse, N. Y. It will be utilized by the Mohawk Electrical Company for its wholesale business. The present store on Warren Street will be retained. A. M. Little, president of the company, has announced that acquisition of larger quarters was imperative by the expansion of the concern's business. All labor-saving devices will be installed in the new building.

BINNINGS BROTHERS, Clarksdale, Miss., are moving into their new three-story building and are expanding their stock to include more electrical lines.

THE ERNER ELECTRIC COMPANY of Cleveland recently entertained a group of more than seventy-five of the leading northern Ohio electrical dealers and contractors at a dinner which featured the launching of an Eden washing-machine campaign. The dinner was cooked electrically and served in the company's club room by the young women of the Erner organization. Harry Seiber, vice-president and general manager of the Gillespie Eden Corporation, and Frank B. Rae, Jr., advertising counselor of the Erner Electric Company, were the speakers of the evening. It is announced that similar rallies will inaugurate the various special sales campaigns scheduled by the Erner Electric Company through the coming season.

MICA INSULATOR COMPANY has just completed a new four-story addition to its plant at Schenectady, N. Y., it is announced. The building is of concrete fire-proof construction and will add from 50 to 75 per cent to the factory capacity.

THE PIEDMONT ELECTRIC COMPANY, Asheville, N. C., is pushing the idea of ordering goods in unit package quantities. An item in the October issue of "The Peco Contact," house organ of the company, urges this method of purchasing goods as a means for offering customers a better price, greater promptness in filling orders and less chance for error.

Foreign Trade Notes

ELECTRIC LAMPS IN JAPAN.—The electric lamp trade in Japan is a very prosperous one, according to *Reuter's Trade Service*, published in Tokyo. The consumption of electric energy for lighting in 1917 as compared with 1912 showed an increase of 250 per cent. Accordingly the demand for electric lamps has increased steadily and for this year is estimated at 23,000,000 bulbs. The value of bulbs exported rose from 160,284 yen in 1912 to 2,847,187 yen in 1917, when approximately 8,000,000 bulbs were exported. The total for this year is estimated at 14,000,000. Between 80 and 90 per cent of all electric lamps manufactured in Japan are, according to this authority, made by the Tokyo Electric Works, which is a branch of the General Electric Company.

AMERICAN ELECTRICAL TRADE IN CHILE.—From a summary made by the London *Electrician* of the report of the commercial secretary to the British Legation at Santiago, Chile, on the demand in that country for electrical goods, it appears that the part of Great Britain and other exporting nations in this trade is very much smaller than that of the United States. Sixty per cent of the electric lamps are of American manufacture and 30 per cent come from Japan. The American lamps are described in the British report as "not very good" and the Japanese as poorer yet. Electric wire comes mainly from the United States, Japan and Spain and fixtures and battery cells from America. Chile has periods of extreme cold, and electric stoves are becoming more and more popular. Nearly all of these are of American manufacture, though two types of English stoves are on the market. Sales of 4,000 heaters are reported, prices as nearly as can be ascertained varying from $5 to $6 (American) for 600-watt stoves up to $9 and $10 for 2,000-watt stoves. The terms on which they were sold were against acceptance of ninety days' sight drafts, cash, with 2 per cent discount for cash payment.

GOOD PRICES FOR ELECTRIC MOTORS IN UNITED KINGDOM.—At a sale held by direction of the Ministry of Munitions near Glasgow, Scotland, recently, says the *Electrical Review*, there was a keen demand for electric motors and machinery and unusually high prices ruled. Buyers were present in large numbers from all parts of the United Kingdom. Altogether more than £4,000 was realized by the sale of forty-one electric motors, the highest price obtained being £260 for a 35-hp. motor.

ELECTRIC METERS FOR NEW ZEALAND—The *Board of Trade Journal* of Great Britain prints some particulars given in an official report concerning the types of electric meter found suitable to the New Zealand market. It is stated that the maximum-demand instrument is well adapted for hydro-electric systems and would be used more widely if a cheaper and more accurate instrument were available. A serviceable maximum-demand indicator, costing £2 to £4 without wattmeter dial or £3 to £6 with wattmeter dial, would find ready sale. A satisfactory commercial maximum-kva. meter suitable for service on demands of 5 kva. up to 500 kva., graduated for 400, 3,300 and 11,000 volts, is required. So far no suitable instrument for measuring maximum kva. has been available, and consequently it is necessary to take the maximum kilowatts averaged over half an hour and deduce therefrom the maximum kva. from the power factor observed during heavy loads. This system is obviously unsatisfactory if a suitable maximum-kva. or maximum-current measuring instrument is available. The standard frequency at which energy is distributed in New Zealand is 50 cycles.

BIDS FOR ELECTRIFICATION OF CHILEAN RAILWAY.—The Chilean government has called for bids for the electrification of the first zone of the state railways. This zone comprises the line which runs from Valparaiso to Santiago. The bids, which will be received up to March 31, 1921, are of two classes—those proposing to furnish the electric power and those proposing to furnish the actual equipment and rolling stock of the line to be electrified. The Latin American division of the Department of Commerce has booklets containing the conditions on which the bids must be based, and the address of the department from which plans and specifications may be obtained by those who are interested.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A merchant in India (No. 33,870) invites manufacturers and exporters of electric washing machines to submit literature and terms on these appliances.

An importer in Italy (No. 33,871) desires relations with manufacturers of supplies used in electrical and insulating establishments.

An export agency in America (No 33,872) with representatives in Australia and Japan desires sole agencies in these countries for vacuum cleaners and other household appliances.

A commercial agent in Brazil (No 33,888) desires to represent American exporters of electrical goods.

Trade Publications

CABLE JOINTS.—The Standard Underground Cable Company, Pittsburgh, Pa., has issued bulletin No 740-I, covering cable joints and jointing material.

HOIST CONTROLLERS.—The Allen-Bradley Company, Milwaukee, Wis., has issued a circular No. F-2200, covering small hoist controllers.

INSULATING BRICK.—The Armstrong Cork Company, Pittsburgh, Pa., has recently issued a seventy-two-page book covering "Nonpareil insulating brick," used for the insulation of high temperature industrial equipment such as boilers, furnaces, stills, ovens and kilns.

INSULATED WIRE.—The Standard Underground Cable Company, Pittsburgh, Pa., has recently issued a forty-page bulletin describing its lines of insulated wire.

CONVEYORS.—The Godfrey Conveyor Company, Elkhart, Ind., has ready for distribution a new catalog covering its conveyors and illustrating various installations.

ELECTRIC IRONS.—The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has recently issued leaflet No. 866, describing the "C-H Electric Tailor's Irons."

New Incorporations

THE CONGRESS ELECTRIC COMPANY, Lynn, Mass., has been incorporated with a capitalization of $100,000 by George O. Willey, M. F. O'Mealey, C. H. Gilmore and J. B. Wellman.

THE APPLE ELECTRICAL MANUFACTURING COMPANY, Dayton, Ohio, has been incorporated by V. G. Apple and H. Apple.

THE GRAYS ELECTRIC LIGHT COMPANY, Grays, Ky., has been incorporated with a capital of $3,000 by J. T. Gray, J. J. Young and S. T. Weidner.

THE JAMES C. GIPE COMPANY of Indianapolis has recently been incorporated at $100,000 to sell electrical appliances and fixtures. The directors are James C. Gipe, Arthur R. Baxter and Wilbur Johnson.

THE EMPIRE WELDING & AUTO REPAIR COMPANY of Wheeling, W. Va., has been incorporated with a capital stock of $5,000 to do a general welding and repair business. Incorporators: W. M. Cole, J. D. Wiles, F. T. Wiles, A. H. Cole and W. E. Cole, all of Wheeling.

THE POWER COMPANY has been incorporated at Charleston, W. Va., to operate anywhere in the state. Capital stock, $25,000. Incorporators: S. W. Elwell, B. C. Eakle, O. L. Hall, J. A. Jones and P. A. Hamrick, all of Clay, W. Va.

THE BLACK RIVER VALLEY POWER CORPORATION of Jefferson County, N. Y., has been incorporated with a capital stock of $10,000. The incorporators are D. M. Anderson, F. L. Carlisle and F. A. Empsall, all of Watertown, N. Y.

THE SMYRNA ELECTRIC LIGHT COMPANY, Smyrna, N. Y., has recently been incorporated with a capital of $25,000 by J. Nelson, L. Nelson and L. J. Nelson of Sherburn, N. Y.

THE UNIVERSAL SYSTEM OF ELECTRIC ALARMS has recently been incorporated with a capital of $500,000 by W. G. Andrew, V. R. Modorn and O. M. S. Greaves, 130 Claremont Avenue, New York.

THE WORDEN ELECTRIC COMPANY of Utica, N. Y., has just been incorporated with a capital of $10,000 by S. A. Hagan, B. C. Madden and L. E. Worden of Whitesboro, N. Y.

THE WAGNER ELECTRIC CORPORATION, Delaware, has filed articles of incorporation, capital $250,000, to manufacture electrical supplies. The incorporators were T. L. Croteau, M. A. Bruce and S. E. Dill.

THE FEDERAL ELECTRIC SAFETY APPLIANCE COMPANY, 317 East Fourteenth Street, New York, has been incorporated with a capital of $100,000 by M. Lyons, W. Lyons and K. Scherer.

C. R. KIERULFF & COMPANY, 757 South Los Angeles Street, Los Angeles, Cal., has been organized to manufacture electrical specialties. C. R. Kieruliff is head of the organization.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

BOSTON, MASS.—The Thomas G. Plant Company has plans under way for extensions and improvements to the power plant at its shoe factory at Jamaica Plain to cost about $50,000.

SPRINGFIELD, MASS.—Bids will be received by the Board of Education, until Nov. 3 for the construction of a junior high school to include a special lighting system on State Street. The cost is estimated at $800,000. H. Sprague, 310 Main Street, is architect.

Middle Atlantic States

ALBANY, N. Y.—The Public Service Commission, Second District, has directed the Murray Electric Light & Power Company of Monticello to extend its line from Centerville or some other convenient point to Mountaindale to supply light, heat and power.

BUFFALO, N. Y.—The Buffalo City Service Corporation, capitalized at $10,000, has been organized to erect an electric plant and distribute electrical energy in Buffalo, Niagara Falls, Lockport, Lackawanna, Batavia, Rochester, Jamestown, Syracuse, Dunkirk and other western New York municipalities. E. C. Randall, Iroquois Building, is interested.

NEW YORK, N. Y.—The United Electric Light & Power Company, 130 East Fifteenth Street, will soon award the contract for the construction of a power house on 134th Street and the East River. The cost is estimated at $4,500,000. T. E. Murray, Inc., 55 Duane Street, is engineer.

PENN YAN, N. Y.—J. T. Andrews & Company plans the installation of two 26-in. Trump hydraulic turbines, total hp. 220, and one 50-hp. hydraulic turbine, belt connected to a 50-kw. Westinghouse alternator and a 3-kw. exciter to replace the present hydraulic turbines; also the installation of two blowers on two boilers for the purpose of burning hard-coal screenings.

CAMDEN, N. J.—The MacAndrews & Forbes Company, Third and Jefferson Streets, contemplates improvements and extensions to its power plant to cost about $150,000 including equipment.

BAKERSTOWN, PA.—The Pittsburgh Cut Flower Company, 116 Seventh Avenue, Pittsburgh, contemplates the erection of a power house to cost about $70,000. Fred Burke is president.

BATH, PA.—The Bath Portland Cement Company contemplates improvements to its power house to cost about $200,000.

PHILADELPHIA, PA.—Bids will be received by the Department of Public Safety, City Hall, until Oct. 28 for furnishing municipal and police telephone service and equipment for the year 1921, to cost about $104,000, and also for furnishing electric lamps and lighting, extinguishing, cleaning and repairing such lamps for lighting the streets, avenues, boulevards and other public places for the year 1921, at a cost of $1,300,000.

BALTIMORE, MD.—Arrangements have been made by the Consolidated Gas, Electric Light & Power Company, Lexington Building, for the removal of buildings at 501-29 East Madison Street, clearing the site for the erection of its proposed electric power plant.

WASHINGTON, D. C.—Bids will be received at the office of J. A. Wetmore, supervising architect, Treasury Department, until Nov. 11 for conduit and wiring and lighting fixtures in the Butler Building.

WASHINGTON, D. C.—Bids will be received by the Commissioner of Indian Affairs, Indian Bureau, Washington, until Oct. 25 for furnishing hardware, electrical supplies, etc.

WASHINGTON, D. C.—Bids will be received by the Chief of Engineers, U. S. A., room 2717 Munitions Buildings, until Nov. 6 for furnishing one switchboard feeder panel. (Adv. No. 50.)

North Central States

DETROIT, MICH.—Bids will be received at the office of the City Bridge Department, Municipal Courts Building, until Oct. 30 for furnishing labor and material, including electrical work, for the construction of the Belle Isle Bridge across the Detroit River, to cost $2,000,000. Esselstyn, Murphy & Hanford, Marquette Building, are engineers.

OXFORD, MICH.—Bids will be received by H. V. Rahm, village clerk, until Nov. 16 for furnishing and installing two 350-gal.-per-minute, 70-lb.-pressure, 30-hp., alternating-current-motor centrifugal domestic service pumps and one 750-gal.-per-minute, 100-lb.-pressure, 75-hp. alternating-current-motor centrifugal fire pump.

ZANESVILLE, OHIO.—The Boston & Ohio Railroad, Market and Second Streets, has preliminary plans under way for the construction of an electric and heating plant at the railroad shops on Lee Street, to cost about $300,000. H. A. Lane, Baltimore, Md., is chief engineer of construction.

HARRODSBURG, KY.—The proposition to install a municipal electric light and power plant and water supply system at a cost of $200,000 will be submitted to the voters at an election to be held Nov. 2. The power plant installation is to consist of three 72 in. x 18 ft. high pressure boilers, one 350 hp. engine, one 200 kw., 2,300 volt, three phase, 60 cycle generator, two 200 hp. engines, direct connected to two 100 kw. generators. Design is in charge of Greeley, Pearce & Hansen, 39 West Adams Street, Chicago, Ill.

RICHMOND, IND.—The Board of Public Works has authorized the purchase of additional equipment for the city lighting plant.

BIRCHWOOD, WIS.—The erection of a new plant at this place by the Wisconsin-Minnesota Light & Power Company, Eau Claire, is contemplated.

MADISON, WIS.—The Eastern Wisconsin Electric Company contemplates making extensions to its transmission lines.

HIBBING, MINN.—The Water & Light Board plans to extend its electric light system. Charles Foster is superintendent of Public Utilities.

ST. PAUL, MINN.—The Diocese of St. Paul is conducting a campaign to raise $5,000,000 for schools and colleges. The building plans include the construction of a power house at the College of St. Thomas, Mernam Park.

IOWA CITY, IA.—Business men contemplate forming a company for the purpose of installing an electric light and power plant at this place.

SIOUX CITY, IA.—The Commissioners of Woodbury County are considering the purchase of equipment to electrify the gravel-pit plant in Kedron Township. R. S. Taylor is county engineer.

MEXICO, MO.—The name of the Mexico Power Company has been changed to the Missouri Utilities Company and the capital stock increased to $1,000,000. The company plans to enlarge its plant and extend the distribution system.

MOUNTAIN GROVE, MO.—The Mountain Grove Creamery Ice & Electric Company has increased its capital from $150,000 to $500,000 and is contemplating the construction of a hydro-electric plant to furnish power to Mountain Grove, Willow Springs, Cabool and other points.

PAXTON, NEB.—Bonds to the amount of $60,000 have been authorized for the construction of a municipal water and light system.

Southern States

BELMONT, N. C.—The Sterling Spinning Company, recently organized with a capital of $800,000, is planning for the installation of considerable electric equipment, including motors, at its proposed local mill. R. C. Riberstein, Charlotte, is engineer.

NEWTON, N. C.—The Blue Ridge Development Company is having estimates prepared by R. E. Wysor, chief engineer, Dublin, Va., for the construction of 106 miles of electric railway from Charlotte to Blowing Rock.

YADKIN, N. C.—The Yadkin Finishing Company, Lexington, plans to install an electric lighting system in the mill village. Melton S. Erlanger is president.

MILNER, GA.—Bonds have been voted for the installation of an electric lighting system at this place.

APALACHICOLA, FLA.—At an election to be held on Oct. 26 an issue of $50,000 in bonds will be submitted to the voters for the erection of a municipal electric light and power plant.

DYERSBURG, TENN.—Bonds to the amount of $25,000 have been voted for the installation of electric light and water systems.

AMARILLO, TEX.—Improvements and additions to the plant of the City Light & Water Company, to cost $100,000, are being made. The installation of considerable new equipment is contemplated.

JACKSONVILLE, TEX.—It is reported that the Jacksonville Electric Light & Ice Company contemplates the erection of a plant to replace the one recently destroyed by fire at a loss of $100,000.

LAPORTE, TEX.—It is reported that the electric light and water plant of the Laporte Light, Water & Ice Company, which was recently destroyed by fire, will be rebuilt at a cost of about $20,000.

Pacific and Mountain States

ASTORIA, ORE.—The North Shore Power & Light Company is considering laying a submarine cable from here to Ilwaco, to cost about $75,000.

PORTLAND, ORE.—Bids will soon be received by the Emanuel Hospital for the construction of a hospital building, power house, etc., on Commercial and Stanton Streets, to cost $300,000.

THE DALLES, ORE.—A modern street-lighting system, covering nine blocks in the main business district, will be installed at a cost of $9,000.

PALO ALTO, CAL.—The Board of Public Works is considering the matter of placing electric wires underground and has directed the city engineer to prepare plans for recommendation to the Council.

SALT LAKE CITY, UTAH.—The Utah Granite & Marble Company of Salt Lake City has filed application with the state engineer for the use of ten second feet of water from the Little Cottonwood Creek in Salt Lake County to develop 270 hp.

SALT LAKE CITY, UTAH.—Permission has been granted to the Utah Power & Light Company by the Public Utilities commission of Utah to extend its lines to Millville and in Juab county.

NAMPA, IDA.—The city officials contemplate the installation of an ornamental street-lighting system.

PLANET, ARIZ.—The Stone Consolidated Copper Company has filed surveys with the state authorities for one of the largest hydro-electric and irrigation projects in the Southwest. Plans include the construction of a dam across the Big Williams fork of the Colorado River to impound a sufficient supply of water to irrigate 276,000 acres of desert land. The storage supply of water also will be used for generating electric power for operating the mines and industries of a big scope of territory.

Canada

HAMILTON, ONT.—The Provincial Board of Health has ordered the erection of an isolation hopsital to cost between $750,000 and $900,000. X-ray and other electrical equipment will be required. J. H. Pratt is chairman.

TORONTO, ONT.—The Dominion Envelope & Carton Company, 150 Duchess Street, is contemplating the construction of a 300 ft. x 400 ft. factory, to cost about $500,000. Considerable electric light and power equipment will be required.

TORONTO, ONT.—The Welland Automobile Storage Battery Company, East 131st Street and St. Clair Avenue, Cleveland, Ohio, has purchased a 3-acre site on Weltshire Avenue and plans the erection of a storage-battery plant to cost $500,000.

WINDSOR, ONT.—The Board of Education plans to erect a school to include an electrically operated ventilation system. Cost is estimated at $550,000.

1,353,748. ELECTRICAL CONNECTION; Ellesworth A. Hawthorne, Bridgeport, Conn. App. filed Feb. 14, 1918. Socket.

1,353,783. DIRECTION INDICATOR; John W. Patterson, Memphis, Tenn. App. filed March 14, 1917. For automobiles.

1,353,815. CONTROLLING AND REGULATING APPARATUS; Friedrich W. Meyer, Milwaukee, Wis. App. filed Jan. 13, 1917. For speed or voltage.

(Issued Oct. 12, 1920)

1,355,116. ELECTROLYTIC CELL; Herbert I. Allen, Portland, Me. App. filed Feb. 5, 1918. Electrolysis of sodium chloride.

1,355,124. ELECTRIC WELDING METHOD AND APPARATUS; Alexander Churchward, New York, N. Y. App. filed Feb. 18, 1920. Improved current control.

1,355,126. X-RAY TUBE; William D. Coolidge, Schenectady, N. Y. App. filed Dec. 16, 1916.

1,355,147. NETWORK-SELECTING DEVICE; Oliver B. Jacobs, East Orange, N. J. App. filed May 17, 1919. Automatic selection of trunk.

1,355,153. ELECTRICITY METER OF THE INDUCTION-MOTOR TYPE FOR THREE-PHASE ALTERNATING CURRENT; Absalom Larsen, Gentofte, Copenhagen, Denmark. App. filed March 10, 1919. Simplified.

1,355,163. HEAD CONSTRUCTION FOR ELECTRIC LAMPS; Morris Ozlek, Philadelphia, Pa. App. filed Sept. 17, 1917. Shade easily removed.

1,355,164. CLUSTER TOP FOR LAMPS; Morris Ozlek, Philadelphia, Pa. App. filed Feb. 26, 1920. Easy connection to conduit wires.

1,355,191. SIGNAL SYSTEM FOR TELEPHONES; Kizo Tsukamoto, Tokyo, Japan. App. filed June 12, 1919. Long-distance.

1,355,259. SIGNAL SET; Frank B. Perry, Newton Center, Mass. App. filed Feb. 23, 1918. Telegrahic instructor.

1,355,283. MOTOR; William Sparks, Jackson, Mich. App. filed March 16, 1917. For signal horn.

Record of Electrical Patents

Notes on United States Patents

1,355,301. ELECTRICAL RECEPTACLE; Reuben B. Benjamin, Chicago, Ill. App. filed May 29, 1917. Screw socket.

1,355,334. ELECTRIC ARC LAMP; Haydn T. Harrison, Westminster, England. App. filed Feb. 4, 1919. Carbons kept cool.

1,355,347. POLE CONSTRUCTION; Soren H. Mortensen, Milwaukee, Wis. App. filed July 18, 1918. Pole piece mitered to yoke.

1,355,382. THERMO-THERAPEUTIC APPLIANCE; Aaron Blume, New York, N. Y. App. filed Jan. 16, 1919. Heated shoe.

1,355,433. PROCESS OF MAKING BATTERY SEPARATORS; Harry S. Stronach, Oak Park, Ill. App. filed June 5, 1920. Wood.

1,355,447. APPARATUS FOR CONTROLLING THE OPERATION OF WORK PRODUCERS OPERATING IN PARALLEL; Frederic R. C. Boyd, Boston, Mass. App. filed April 21, 1916. For controlling output of alternating-current generators.

1,355,448. INDICATING AND RECORDING INSTRUMENT; Richard P. Brown and Charles P. Frey, Philadelphia, Pa. App. filed Dec. 9, 1919. For temperature or pressure.

1,355,475. SYSTEM OF CONTROL; Rudolf E. Hellmund, Swissvale, Pa. App. filed March 14, 1917. For regenerative motors.

1,355,477. MEANS FOR SEPARATING MIXTURES; Sylvester S. Howell, Chicago, Ill. App. filed Nov. 4, 1918. Separates chaff from grain.

1,355,515. ELECTRICAL MEASURING INSTRUMENT; Benjamin H. Smith, Turtle Creek, Pa. App. filed July 19, 1917. Direct-current watt-hour meter.

1,355,524. SPRING MECHANISM FOR VIBRATING RECTIFIERS; Alfred L. Atherton, Wilkinsburg, Pa. App. filed Dec. 29, 1915. For variable frequencies.

1,355,529. VACUUM-TYPE CONVERTER; Wilfred T. Birdsall, Montclair, N. J. App. filed Oct. 9, 1915. Free from short-circuiting.

1,355,549. SYSTEM OF CONTROL; Ralph E. Ferris, Swissvale, Pa. App. filed July 19, 1917. Control during motor regeneration.

1,355,551. MEANS FOR AND METHOD OF PRODUCING ETHERIC DISTURBANCES; Charles Le G. Portescue, Pittsburgh, Pa. App. filed April 5, 1917. Vacuum tubes.

1,355,575. TROLLEY-WHEEL; John E. Sederholm, St. Paul, Minn. App. filed Oct. 6, 1919. For cranes.

1,355,594. TELEPHONE-EXCHANGE SYSTEM; Bert G. Dunham, Hawthorne, N. J. App. filed Dec. 27, 1918. Rotary line switch.

1,355,605. TROLLEY-WIRE SUPPORT; Walter W. Hunzicker, Mansfield, Ohio. App. filed Nov. 6, 1918. Clamped by single operation.

1,355,614. TROLLEY-WIRE CLAMP; Samuel S. Matthes, Mansfield, Ohio. App. filed Dec. 28, 1918. Readily removable.

1,355,622. MAGNETIC INTENSIFIER; Charles B. Russell, Brockton, Mass. App. filed Aug. 15, 1919. Reciprocating motor of long stroke.

1,355,634. TELEPHONE-EXCHANGE SYSTEM; Samuel B. Williams, Jr., Brooklyn, N. Y. App. filed Dec. 27, 1918. Semi-mechanical private branch.

1,355,635. TELEPHONE-EXCHANGE SYSTEM; Samuel B. Williams, Jr. App. filed Dec. 27, 1918. Semi-mechanical.

1,355,644. ELECTRIC WATER HEATER; Leon H. Beaufet, Montreal, Quebec, Canada. App. filed May 20, 1919. Heated in passage.

1,355,672. ELECTRIC GENERATING PLANT; George W. Howden, Holly, Mich. App. filed April 12, 1916. Windmill driven.

Electrical World

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Daylight Saving and Its Drawbacks

"THANK heaven, the damn thing will soon be over!" Blunt English to be sure, and inelegant, but nevertheless the earnest ejaculation of a suburbanite who has had to arise in the pitchy darkness of a late October morning because of daylight saving. That the thought is echoed by millions of others goes without saying. Even ardent advocates of daylight saving realize the formidable opposition to it and are now willing to have the clock pushed ahead an hour on May 1 instead of April 1 and turned back again in September instead of October. As for confusion between cities that observe daylight saving and those that do not, any traveling man will voice an opinion as frank as it is profane. Indeed, public morality and business in general would gain much if daylight saving as now practiced were abolished altogether. Its merits, for daylight saving is not without merit, are manifest only when it is observed nationally. When, however, every community can have a time all its own, daylight saving becomes a farce and should be done away with.

Unnecessary Tax on Industry

COMBINING the National Electrical Code with the National Electrical Safety Code is like consolidating the fire and police departments of any city government. The best one can say of it is that it is fraught with possibilities. As every one knows, the National Electrical Code, dealing entirely with fire hazards, has been in existence some thirty years or more and has been effective in eliminating unsafe practices and in standardizing electric wiring appliances. On the other hand, the Safety Code, dealing with hazards of life and limb, has hardly been in existence long enough to give it stability. In time no doubt it will be big and strong, but even then its consolidation or incorporation with the fire code is questionable. The two codes differ so radically in character and objective that it would seem as if the best interests of the country would be conserved in keeping them absolutely free from each other. Moreover, the requirement of both characters of protection in each device, regardless of its use, is likely to place an unnecessary and unwarranted tax on industry without compensating advantages in immunity from hazards. Dual codes have been proposed locally and by some state governments, but even should they be enacted that would be no excuse for a national code which has not received the indorsement of those most vitally and directly concerned and which has not as its foundation long experience and trial in actual practice. This the Fire Underwriters' Code has and the Safety Code has not. To be successful any code must deal with realities and not with theories. The combination proposed is doubtless ideal in the abstract, but lacking nevertheless in detail. As Aristotle said of Plato, "It is beautiful, but is it practical?"

Industrial Heating Engineering

THE rapidly increasing use and future possibilities of industrial electric heating appliances make essential a thorough engineering analysis of the problems involved, together with adequate test data and operating records from installations in commercial service. Heating units adapted to liquid containers or to the heating of spaces confined to particular processes can often be well selected and applied with very little scientific analysis in emergency cases. Full and accurate quantitative data, however, are essential in order to secure the utmost service possible for the outlay required. Too often fragmentary data only are maintained by the users of concentrated electric heat, and even the industrial service departments of central stations are none too well supplied with information. Where highly developed devices suited to unique applications are used, the manufacturers are likely to possess data in fair amount, and much good should come from the dissemination of this information. The more complete it is the more rapid will be the growth of the heating load, with all its economic advantages to the user and the public utility company.

Deflation in the Electrical Industry

IN THE transition from a sellers' to a buyers' market the electrical industry needs the same type of leadership which the exigencies of the war brought out. For some time now the banks have withheld credits and insisted upon deflation in many industries. In addition, there has been a gradual slowing up of demand which nothing short of intelligent stimulation of business can bring back. It is therefore immaterial whether the goods are in the hands of the manufacturer, jobber or retailer, the important problem is to effect their distribution to the ultimate consumer and their conversion into cash. Where adequate sinking funds have been established such conversion can be made with equanimity. However, it is too much to expect that every manufacturer, jobber and dealer has been foresighted enough to provide sinking funds, notwithstanding numerous admonitions to do so; so that liquidation of stocks cannot take place without entailing some loss. Here is where intelligent leadership is required, since these losses may be kept at a minimum by a gradual and orderly price reduction which will not impair credit. This, after all, is the problem—the maintenance of

credit of the entire electrical trade. Fortunately, there has been very little profiteering in electrical goods, and money was never plentiful enough in the industry to cause over-expansion. The shock of contraction and deflation will, therefore, be slight, and if the industry will keep its wits it will hardly be felt at all.

The Facts About Railroad Electrification

THE discussion of railroad electrification at a combined meeting of the American Institute of Electrical Engineers and American Society of Mechanical Engineers in New York last week served as a reminder of battles that have been fought on the floor of the Institute over the electrification problem in the past. This problem has advanced to a new stage, however, in that it is now a question of when steam roads shall be electrified and not so much whether the direct-current or the alternating-current system is the better. The valuable test and operating data that were presented by the advocates of both steam and electric locomotives point to improved fuel economy of modern superheated and mechanically stokered steam locomotives on the one hand and justification on the other of the contention that practically two-thirds of the coal now used by steam roads could be saved by electrification. The discussion and the supporting data made it clear that railroad electrification has reached the stage where it must be solved not by engineers or railroad executives alone but on a broad economic basis. The general test which must be applied to each case is: Will the admitted advantages and economies of the electrical system pay for the added capital required to make the change?

Opportunity for Electrical Manufacturers

THERE has been evidence on every hand that American manufacturers are not taking advantage of the present opportunities for the extension of our business in foreign countries. This seems to be partly due to lack of interest in the problem of developing foreign markets. Once aroused, there is no doubt that our manufacturers have the initiative and the products to hold business and to extend it abroad. Electrical manufacturers, in particular, have an opportunity during the next year or so of doing some truly constructive work in laying a foundation for business relations with other countries by taking an active part in telling European engineers what American practice is in various branches of the electrical industry and why it is suitable as the basis of international rules.

The work of the International Electrotechnical Commission is proceeding rapidly, and the American representatives are doing all they can to show their associates from other countries what great progress has been made in the United States toward the adoption of suitable standards through such agencies as the American Institute of Electrical Engineers, the National Electric Light Association and the Electric Power Club. They need the co-operation, however, of every available agency in expounding our methods. This matter is of extreme importance to our electrical manufacturers, since they can only sell machinery or apparatus with difficulty where other standards are being adopted and put into extensive use. It may be said, however, that representatives from other nations are approaching the subject with open minds, and if they can be convinced that American standards are best they are ready to adopt them for international use.

Certainly there is at this time a ripe opportunity for an intensive educational campaign which should be backed to the utmost by our manufacturers. The president of the I. E. C. is an American who is well and favorably known abroad. During his régime, if ever, the case of the United States should be put squarely up to the international congress. It is also possible that a plenary meeting of the I. E. C. may be held in this country during Dr. Mailloux's term of office, and it should be evident to all interested that now is the time to "strike while the iron is hot."

Practical Demonstration of Industrial Lighting

PROGRESS in illumination as in everything else is a beautiful demonstration of the quantum theory. It goes by jumps which in fact are very much larger than Planck's quanta but far less frequent. Thus it is that that branch of illumination which has to do with productive industry, though it is true that it has gone ahead in the last five-and-twenty years, has not progressed oftener than once in about five years, and not always then. Except in a few lines of work which still stick to the so-called standards of twenty years ago, the introduction of gas-filled lamps and standard steel reflectors has gone a long way toward improving matters. Nevertheless, there are many cases in which the old and inefficient methods of illumination still persist—bare lamps stuck in the operator's face, ancient sputtering arcs deep hid in the gloom of the rafters, or shades, when there are any, so battered and ill adapted to their use as to be of little service. It is hard to explain courteously to a works manager that he is twenty years behind the times and harder still to persuade him that some competitor is far ahead on lighting for production.

The move now being made by the National Electric Light Association to make demonstrations on a country-wide scale for the purpose of showing how industrial lighting should be accomplished is an extremely important one, and we trust that it will be pushed to the limit. The demonstration plant built up at Nela Park under the direction of Ward Harrison and shown at the Pasadena convention and elsewhere is of unique value in scratching through the surface of even the case-hardened mind of the believer in ancient standards. It has an enormous advantage over any reference to model plants as a demonstration of the benefits of intelligently installed lighting. One cannot persuade a group of manufacturers to visit half a dozen plants in scattered territory for the purpose of seeing how much better lighting can be than that which they themselves employ. Yet in three-quarters of an hour, sitting together in the demonstrating room, the same group of men can be shown the comparative results of half a dozen methods of lighting in quick succession, and with the clearest possible showing of the differences between them, difference to which one can recur at will.

Briefly, the standard exhibit consists of a room of adequate dimensions, preferably not less than two ordinary factory bays square, lighted by all the methods, good and bad, in common use, with sufficient objects for inspection and foot-candle meters to give practical demonstration of the effect of each individual system.

The nature of the exhibition is one somewhat startling even to the experienced engineer, since he never gets the opportunity to compare so quickly and definitely one method with another. To the works manager it is a revelation, and it has been the uniform experience in the cases to which the demonstration has already been applied that the immediate result is betterment of the lighting conditions by those who absorbed the information. Such a demonstration should be of particular use in connection with the industrial lighting codes established in various states since it affords the most direct evidence of the real purpose and effect of the code provisions. The central station or the local board of trade can conduct no more useful propaganda for the betterment of industry than by staging this sort of demonstration, which can be readily adapted to show the conditions pertaining to any particular group of industries which may be locally important.

Re-establishing International Communication

THE international conference on electrical communications now being held at Washington is one of the most important that have ever taken place in this country, not merely from an electrical standpoint, but also from the viewpoint of international relations. Instructions have been received by the Washington conference from the Versailles conference to consider certain questions arising out of the war and out of the treaty of peace, such as the disposition of the German submarine cables seized by the Allies during the war and ceded by Germany in the peace settlement. Probably the conference will be followed at a comparatively early date by a still more comprehensive international conference on communications, in which many other nations will doubtless participate and at which worldwide communication regulations will probably be adopted.

The international importance of communications, and of their *modus operandi*, is so great that it can only with difficulty be exaggerated. It may be said indeed that "electrical communication" is but an alternative rendering for "peace on earth and good will toward men." When peace reigns communications grow and ramify. When nations war their communications cease. The more thoroughly we can weld and develop the interchange of world communications, the more enduringly we may hope to sustain the world's peace.

Altogether, aside from the larger aspects of international communication agreements, the importance of such agreements on the art and sicence of electromagnetic-wave generation, propagation and reception is manifestly very great. If such agreements are well drawn, they may be expected to stimulate the development of electrical knowledge, literature, invention, discovery and construction throughout the world. If, by unfortunate mischance, they are not well drawn, international progress in any or all of these directions may easily be retarded.

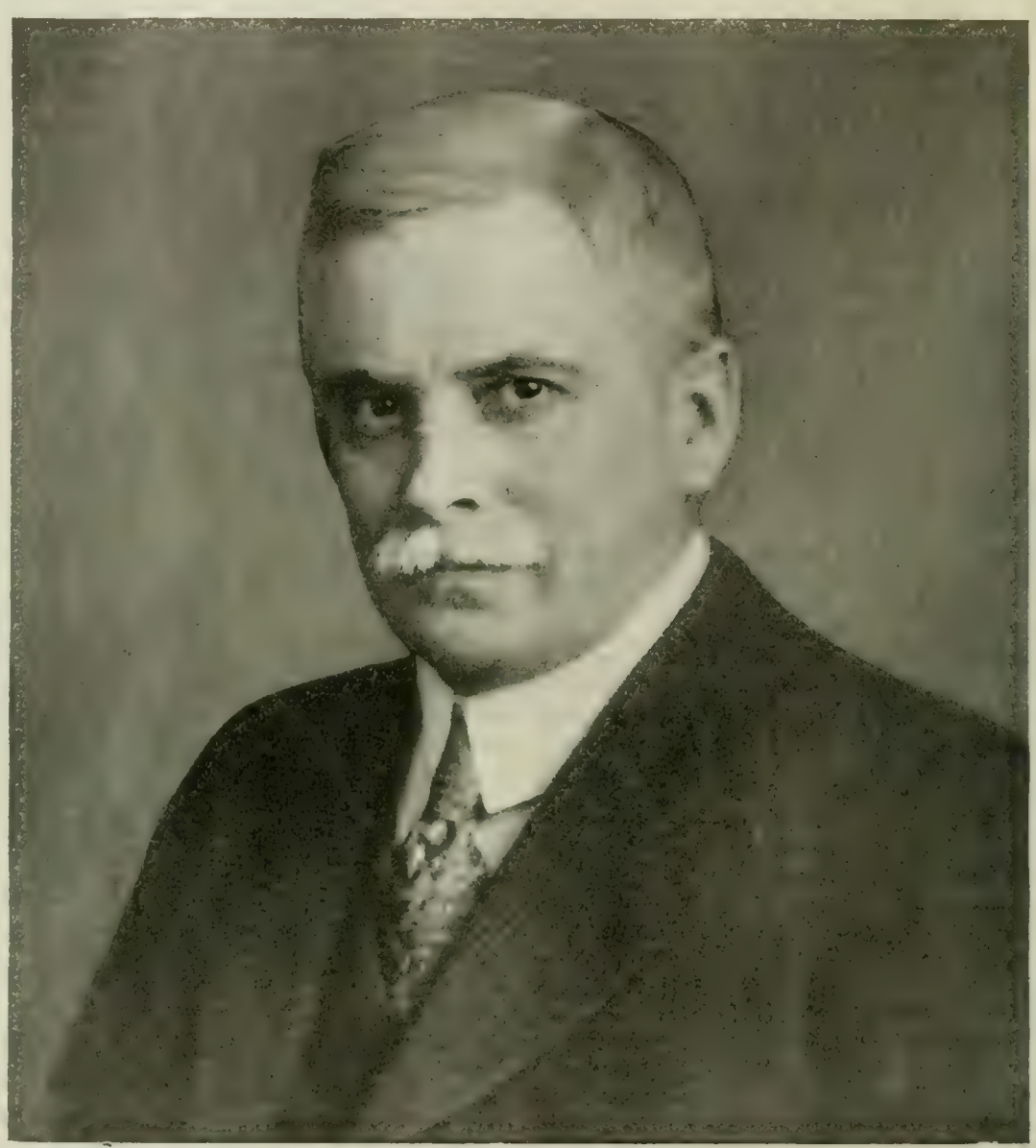
Many years ago the nations of Europe entered into a telegraphic convention at Petrograd. Ever since that time there have been international telegraph regulations regarding wire communications, but the United States was not represented at Petrograd. The advent of radio-communication and the events of the world war have powerfully affected the history of the subject. It is to be hoped that the return of peace may enable the whole subject of electrical communication to be dealt with internationally in a comprehensive way. The task is so large that it may take a long time to work out in detail. We may, however, rest assured that the final outcome will be one that the world at large will confidently indorse.

In the meantime we heartily join in the welcome extended by America to the distinguished delegates who have come to Washington from the Allied Powers in order to attend this auspicious international conference on electrical communications.

Actual Measurement of Reflection Factors

A RATHER interesting feature of the recent Illuminating Engineering Society convention was the report of new and important results in the measurement of the reflection factors of surfaces. Two papers, one by Dr. Clayton H. Sharp and W. F. Little and the other by A. H. Taylor, elucidated simple methods of employing the sphere photometer to measure directly the reflection coefficient of any surface. The two investigations hit upon almost identically the same method, leading with beautiful precision to the same results. The scheme adopted is to make the sample to be tested a small bit of the surface of a little integrating sphere and then to throw upon it a small concentrated beam of light. The entering light must thus be reflected once from the test surface and again from the sphere walls before it can reach the observation point shielded from the test surface proper by a little opaque screen. The same incident beam projected on the sphere surface somewhere else gives the standard illumination reading at the photometer, and the ratio of the two values thus measured gives the reflection coefficient of the test surface directly. The apparatus of the two investigators differed only slightly in detail and seems to be of quite the same precision and facility.

It is not in the least necessary that experiments should be made on a detached sample since a small hole in the sphere can be placed against any material *in situ* as a wall or a block of stone. Nor is it of any consequence whether the test surface is perfectly diffusing or substantially specular, the fact that this does not matter being of still more importance from the practical standpoint since the mixture of diffuse and specular reflection is a very common source of difficulty in estimating reflecting powers. The results obtained in both investigations so far as they could be compared are exactly the same, agreeing to within the reasonable limits of experimental error, and they also check with high precision investigations made by the point-to-point method. Incidentally, attention should be sharply drawn to the fact that the substance commonly taken as the standard of reflecting power, magnesium carbonate, has an actual coefficient of reflection of between 98 and 99 per cent at its topmost value instead of about 88 per cent as indicated in earlier researches. It is to be hoped that the present investigators will extend their studies to determining the standard conditions under which magnesium carbonate may be depended upon to have a closely definite value of reflectivity, so that it may be made directly useful as a comparison standard in the same sense that the cadmium cell may be used as standard of electromotive force. Certainly the simultaneous and beautifully coherent researches before us have gone far toward clearing up the whole matter of reflection factors and their easy measurement.



Bion Joseph Arnold

A pioneer in drafting service-at-cost franchises and an authority on traffic matters, yet withal an engineer of wide reputation in heavy traction installation who has devoted much attention to special engineering problems

A PRACTICAL theorist who has probably done more than any one else to solve the complicated franchise and rehabilitation problems of the electric railways—this characterizes B. J. Arnold. Although the son of a lawyer, he followed the lure of his boyhood ambition to be an engineer, for in early life his love for the mechanical stood out strong. Later, when a young man at college, he showed, especially in mechanics and science, that concentration which brings the highest honors.

He spent a few years after being graduated from Hillsdale College in 1884 in securing a general engineering experience, after which he decided to specialize in electricity and in preparation spent the college year 1888-89 at Cornell. For a short while after leaving Ithaca he was in charge of the St. Louis office of the Thomson-Houston Company, and later in 1890-93, when this company had been merged with the Edison interests into the General Electric Company, he was consulting engineer for the new organization. It was in this capacity that he did his first electric traction work which was to be of lasting importance—the design of the Intramural Railroad at the Chicago World's Fair, the forerunner of the present elevated electric railway. His success in this undertaking caused him to open an office in Chicago in 1893 and from that time his name has been inseparably linked with the progress of electric transportation.

Mr. Arnold, who has made extensive electric railway traffic studies, was a pioneer in the advocacy of service-at-cost franchises and advanced greatly the idea of the necessity for co-operation between the traction interests and the cities. He was prominent in the rehabilitation of the Chicago surface lines under the 1907 ordinance and was named therein as chairman of the board of supervising engineers to take charge of the work. He has also advised the city of New York on subway and street-railway matters, and was consulting traction engineer for Pittsburgh, Providence, Los Angeles, San Francisco, Toronto and Cincinnati. In the field of railroad electrification he is equally eminent. He was a member of the electrification commission of the New York Central appointed in 1902, electrified the St. Clair tunnel of the Grand Trunk, and was one of the early experimenters in the use of single-phase energy for transportation. One other very important phase of Mr. Arnold's engineering was pioneer work in the application of automatic substations to electric railways.

While Mr. Arnold, who is a past-president of the A. I. E. E., is affiliated with engineering societies too numerous to mention, no sketch would be complete without reference to his war record, which is symbolic of the best in American engineering tradition. Although a member of the Naval Consulting Board, he was one of the first to receive a commission under the Officers' Reserve Corps act—that of major of engineers. In December, 1917, he was transferred to the regular army, with rank of lieutenant-colonel. Here he did very valuable work in the aviation section of the Signal Corps in the development and production of aërial torpedoes.

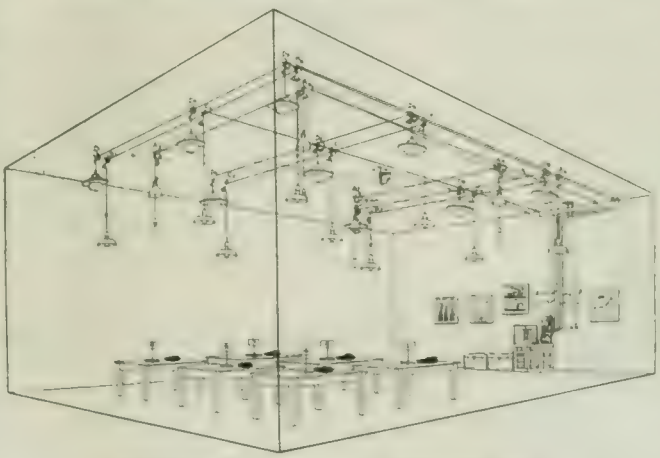
Demonstrating Effective Lighting

How Central Stations Can Convince Industrial Plant Engineers that Higher Intensity of Illumination Is a Paying Proposition — N. E. L. A. Has Started a Country-wide Campaign to Show What Good Lighting Really Is

THE past year marks a turning point in the lighting industry. The status of artificial illumination, especially in the industries, has changed from a service which has always been considered more or less an item of necessary expense to be grudgingly met into one which takes its place as a definite part of the producing and safety equipment of a plant. Old standards are passing into the discard and in their place new and higher standards are coming. There is a growing appreciation of the value of illumination on the part of the man who uses it and also a new conception on the part of the lighting industry as to the bigness of the product it has to offer.



PORTABLE LIGHTING DEMONSTRATION EQUIPMENT BEING USED WHERE A PERMANENT ARRANGEMENT IS NOT FEASIBLE



PERSPECTIVE OF PORTABLE DEMONSTRATION

DATA ON EQUIPMENT

System	No. Units	Lamp	Reflector	Spacing	Height
A*	4	200-w. clear	Deep bowl	15 ft. x 15 ft.	10 ft. 6 in
B†	4	200-w. b.e.	R.L.M. dome	20 ft. x 20 ft	10 ft. 6 in
C‡	5	200-w. b.e.	R.L.M. dome	10 ft. x 10 ft	10 ft. 6 in
D¶	9	500-w. C-2	Glass-inclosed	10 ft. x 10 ft	14 ft.
E§	1	200-w. frosted	Projecting	....	14 ft

* Reflectors on cords. † Units on cords to raise to 14 ft. ‡ Supplements B system. ¶ One piece diffusing and reflecting unit. § Directed on platform, apparatus and connected through a rheostat to vary the illumination.

The central station, whose business it is to sell light, is naturally responsible for the lighting education of the community, and the National Electric Light Association has embarked upon a program to show by actual demonstration in the larger cities throughout the country the new idea of adequate lighting for industrial plants. Experience so far with demonstrations of this kind has yielded remarkable results wherever they have been made. Repeated statements of the effect of light upon the safety and welfare of employees, the results of tests showing the marked effect of illumination on the earnings of industrial establishments, and the popularization of an instrument whereby illumination can be measured and compared have been important influences contributing to this new status of artificial illumination. These factors, in conjunction with a standardized illuminant—the RLM reflector and the bowl-enameled lamp, which answers the vast majority of industrial lighting requirements and therefore greatly simplifies lighting design—have resulted in a wave of enthusiasm for better light spreading over the country. This has already taken tangible form in a considerable number of lighting installations of intensities two and three times what was considered good practice several years ago. Appreciation of what good lighting will do is more pronounced than appreciation of what good lighting really is. There are a great many cases of industrial lighting where the plant manager realizes fully the importance of lighting and takes pride in an installation which he thinks is good, but which may in reality be far from good. To the vast majority of individuals, including lighting men who in installing lighting systems have thought of them in terms of outlets, sockets, switches, etc., illumination as a final product at the working plane is a new thought. Experience has shown that the printed story or even verbal statement of the story is inadequate to carry the message of what good lighting is and what it will do. During the past year the industry has been shown on a big scale what actual demonstration of lighting results can accomplish in this respect. An elaborate demonstration of industrial lighting at the Pasadena convention of the National Electric Light Association brought forcibly to the minds of those in attendance the importance of different aspects of illumination design and gave a new conception of the kind of lighting which is being recommended today—a kind of lighting which must be seen and felt to be appreciated. This demonstration, originally used at Nela Park by the National Lamp Works under the direction of Ward Harrison and since installed in a number of cities throughout the country, has not only been instrumental in convincing industrial managers who have seen it of the advantages to be gained from modern illumination but has also

been the means of imparting to the electric industry itself enthusiasm for the marketing of a standard of illumination so different from what has prevailed in the past as to constitute virtually a new product.

So important does the National Electric Light Association consider demonstrations as a means of advancing the cause of better lighting that it has inaugurated a lighting department controlled by a committee, of which Clarence Law is chairman. This committee has instituted a program to make available permanent demonstration installations in all the larger cities. The services of Ward Harrison, well known for his work in lighting circles, have been loaned by the lamp companies to act as field director to co-operate with the central stations installing the demonstration equipment. It is believed the demonstration method is so effective in bringing about a proper understanding of lighting that every city of considerable size should have a permanently equipped room in which different types of lighting systems, ranging from bad to good, can be shown. In smaller cities it may not always be practicable to have a permanent demonstration, and in these cases central stations are encouraged to obtain portable demonstration equipment to be used in better lighting campaigns.

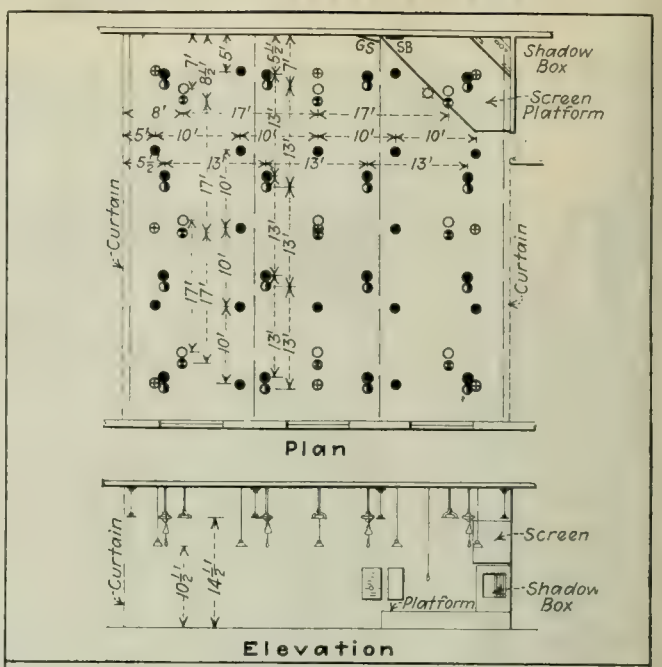
How the Industry Benefits by Lighting Demonstrations

All interests connected with the lighting industry will find a common advantage in this better lighting program. As a result of advancing the standards of illumination the central-station business will be greatly increased and considerable new installation work will be called for. It is therefore to the interest of all branches of the electrical industry in a given community to co-operate in making the local demonstration a success. In a given locality, for example, the central station may father the establishment of a demonstration installation to which other branches of the industry will be invited and a general co-operative program can be inaugurated to improve lighting conditions. The contractor and the electrical jobber, as well as the central station, will be encouraged to delegate some one in their respective organizations who will be qualified to make proper illumination layouts—in short, be a lighting specialist.



DEMONSTRATING MODERN LIGHTING AT BALTIMORE

This photograph was taken by the actual light of the demonstration equipment about 75 foot-candles on the tables. The room is the cafeteria of the Consolidated Gas, Electric Light & Power Company, and it may be observed that the wiring is completely concealed. The guests are the National Electrical Contractors and Dealers' Association delegates at the recent Baltimore meeting.



CIRCUIT	NO. UNITS	LAMPS	REFLECTORS	SPACING	HEIGHT	REMARKS
◑	16	100-W. cl.	Deep Bowl	13'x13'	10½'	Reflectors on Strings
⊕	9	200-W. B.E.	RLM Dome	20'x20'	10½'	
●	16	200-W. B.E.	RLM Dome	10'x10'	10½'	Supplements Circuit ⊕
⊕	9	200-W. B.E.	Glass Top Dome	17'x17'	14½'	
○	9	500-W. B.E.	RLM Dome	17'x17'	14½'	
◉	16	500-W. C-2	Glass encl.	13'x13'	14½'	Daylight Lamps in one-piece diffusing and reflecting Units
□	1	300-W. cl.	None	As Shown	7'	On String. To show glare
GS	1	500-W. AF	None	As Shown		Behind glare Sign
SB	Switchboard for Control of all Circuits					

ACTUAL LOCATION AND ARRANGEMENT OF LAMPS FOR A PERMANENT DEMONSTRATION

Owing to the variation in local conditions, it is impossible to submit a design for a demonstration room which would be universal in its application. For this reason the National Electric Light Association is prepared to furnish assistance in making a design suitable in each case for the best space that is found to be available. The accompanying illustrations show demonstration equipments for both the permanent and portable type which have been used with great success.

The following example illustrates what can be done in a community where the central station accepts its responsibility for leadership in promoting the new standard of illumination. A certain central-station manager, who had previously considered the industrial lighting field in his little city pretty well developed, chanced to attend a "modern lighting" demonstration. He was absolutely convinced of the possibilities in this direction and immediately arranged for a number of factory managers and superintendents in his city to attend a similar demonstration. They were all responsive and eager to learn, and they gladly consented to make the trip at their own expense to a nearby city to attend the demonstration. To quote a number of men, "We learned more about illumination in one day than we had learned in a lifetime." Seeing is believing.

One plant manager immediately analyzed his own lighting conditions. He was in the process of having a new lighting system put in at the time, and it was already pretty far along. It consisted of 100-watt clear lamps in glass reflectors and would have provided about 1½ foot-candles. He had this system taken out completely and accepted the recommendations from the central station for a complete modern system giving about 14 foot-candles, and he has since acknowledged his complete satisfaction with the change. Others who at this time made no alterations in their lighting systems instituted regular maintenance schedules and repainted the interiors in good light-reflecting colors.

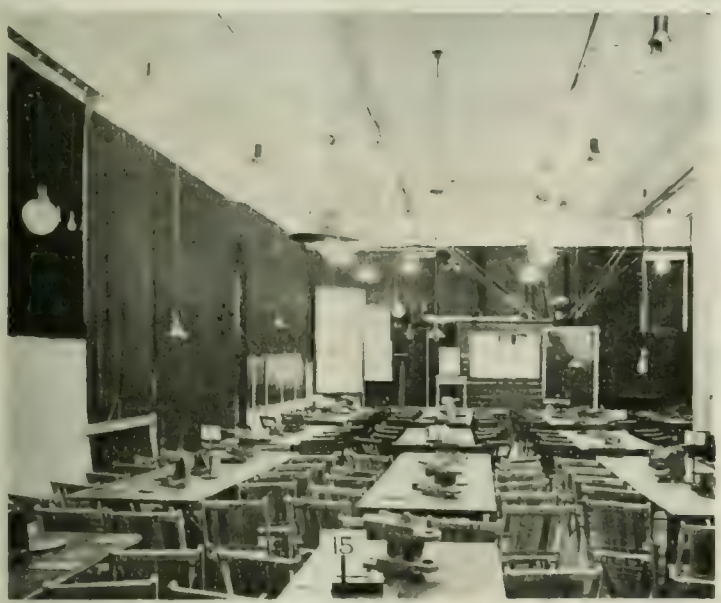
The central-station manager reports as shown in the accompanying table.*

As already mentioned, where it is impracticable to arrange for a permanent demonstration a portable demonstration outfit may be obtained and used with good results. A perspective drawing shows the equipment and wiring used in one of these portable outfits. The apparatus is compactly arranged, with all wiring, switches and equipment ready to install at any location where a suitable room is available.

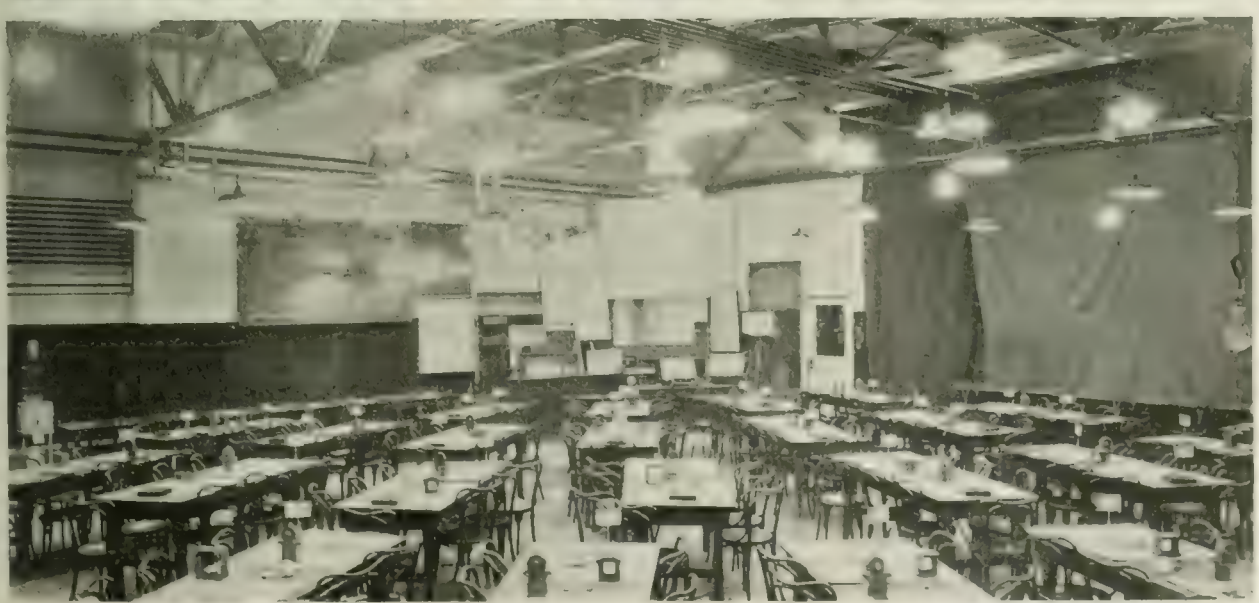
This demonstration apparatus has been installed in a number of cities, and although its capacity is some-

January to July, 1919, by old, costly method of local installation:	
Added lighting load	68.5 kw.
Added revenue, per year	$10,800
January to July, 1920, direct method of one day at a lighting demonstration:	
Added lighting load	431 kw.
Added revenue, per year	$62,944
First seven months of 1919, fixtures sold, 39; total price	$535.72
First seven months of 1920, fixtures sold, 1,038; total price	$6,916.00

*Paper presented at I. E. S. convention, Cleveland, Oct. 4-7, 1920.







TYPICAL ARRANGEMENTS THAT ARE BEING USED TO DEMONSTRATE THE NEW STANDARDS OF ILLUMINATION

Top, at left, how a demonstration was worked out at the Pasadena convention of the N. E. L. A. Note the easiness for observing effects of various lighting combinations. Top, at right, permanent room at Harrison, N. J. This room has been used with good effect in connection with factory inspectors of New Jersey and other large groups. At bottom, permanent demonstration room at Nela Park, out of which has developed the present movement for good lighting.

what limited, it has been used effectively for previously organized educational campaigns for better lighting. As an example, the demonstration recently conducted in Columbus, Ohio, might be cited.

In this case the electric interests of the city decided to stage a big educational campaign for better lighting. The demonstration was made under the auspices of the Columbus Electrical Contractors and Dealers' Association, the industrial department of the Y. M. C. A., the department of electrical engineering of Ohio State University, the Manufacturers and Jobbers' Association, the Chamber of Commerce and the Ohio Industrial Commission during the week of Sept. 20. Each day was given over to a certain class of persons, such as electrical contractors, engineers and architects, manufacturers, retailers and finally the general public. Invitations to attend the demonstration were sent out to each group within a radius of 50 miles as well as within the city, and in this way a good attendance was secured. The whole program, which carried the slogan "Better Lighting Week," is an example of what can and ought to be done in all of the industrial centers of the country. As a result of the backing which the project attracted it is safe to predict an added impetus toward better lighting in Columbus and the surrounding district.

A display in demonstration of good lighting has been installed by the Edison Lamp Works at Harrison, N. J., and used effectively for instructional courses given to all of the district office salesmen. The factory inspectors of the Department of Labor in New Jersey have also been shown the possibilities of good illumination at this demonstration, a photograph of which is shown.

The demonstration method of promoting better lighting is a means of bringing all branches of the industry together on a common ground and selling a single product, which is illumination of the proper quality and quantity at the work. It provides a display of this ultimate product in comparison with inferior products and not only enables those in the electrical industry to judge this finished product but also educates the consumer in the matter of purchasing illumination and being in a position to judge what he has purchased.

Applying Construction Accounting

A Material and Labor Classification Keyed to General Property Accounts Necessary—Field Forces Should Not Be Brought Into Contact with Technical Accounting

A CONSTRUCTION accounting system conforming with the principles outlined in the previous article* must contain the following principal factors:

1. A form for reporting labor performed. This may be either the ordinary form of time book or the time slip, though the time slip is preferable.

2. A method of reporting material issued from the storeroom. Any form of storeroom acquisition is satisfactory.

3. A weekly report in which the labor performed and material used is summarized. This is for the information of the construction department in checking costs and the executives who may be interested in the progress of the work.

4. A special form on which material and equipment removed from service must be reported.

5. A variation of the storeroom requisition to care for the materials returned to stores for credit or transferred to other jobs is desirable though not indispensable. It aids materially in checking a form of carelessness construction forces are peculiarly afflicted with.

6. A form on which a final report of the completion of the job, including an inventory of the material actually used, must be submitted. This is important, as it is a final check on the accuracy of the other material records and gives the construction accounting department the means of eliminating the big errors of failure to report unused material for credit or transfer to another job that are so often met.

7. A construction classification. The formation of this and its application determine the success of the system. Because of its importance and the fact that the other items mentioned are pretty thoroughly worked out in general use the discussion will be confined largely to this subject.

8. Any construction force will find it necessary to make emergency purchases of material and use a petty cash fund. Methods of handling these are so well known that no discussion here is needed.

*Sept. 18, 1920, issue of ELECTRICAL WORLD.

In the formation of a construction classification three things must be kept in mind: (a) The classification must not be overextended, and (b) it must be standardized; a new classification for every job cannot be tolerated, as it produces endless confusion; (c) it must be keyed to match the general property classification.

As an example of construction classification formation the following transmission and distribution line classification is submitted and the reasons for its form pointed out.

This form of classification is used because in field work it has been found much less liable to error than a decimal system and easier for field forces to grasp.

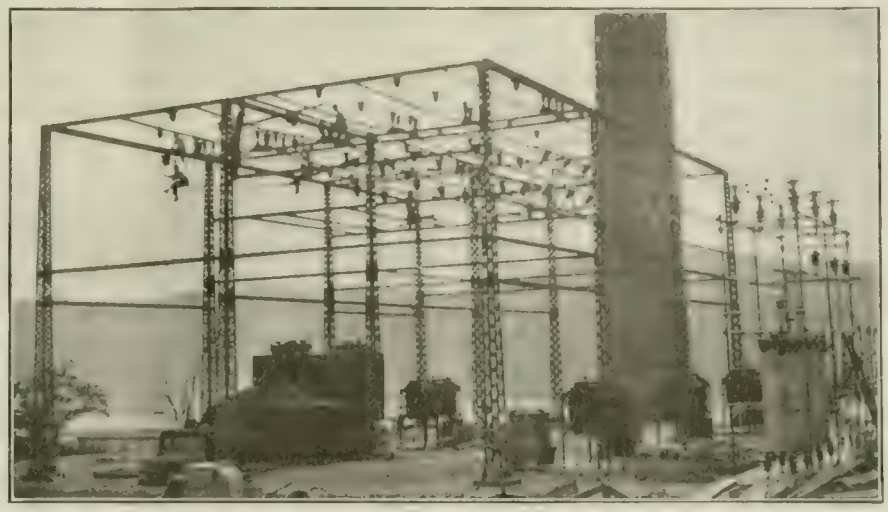
A three-group form rather than a two-group is used, because it permits standardization with almost unlimited possibility for any necessary expansion.

It will be noted that the cost items are the same for all groups, viz.: (a), (c) or (d) stand for the same wherever they appear. In the second group it will be noted that the capital letter is followed in all cases by a numeral in order to maintain the form and prevent confusion between the capital and small letters.

In the use of the classification the erection labor on a wood pole would appear on a time slip as 61—A1—d, while a steel tower item would be 61—A2—d. A significant fact is the note preceding the pole group in which the labor items on cross-arms, hardware and insulators are specifically forbidden for use because such a procedure means an impractical attempt at subdivision. This is an important fact to keep in mind in formulating a classification. Keep groupings to the main items and do not attempt minute subdivisions.

In the classification of which this is a part an entire

state property account classification was covered without repetition of construction classification groups. This was accomplished by segregating the construction classification into general and specific groups. The general groups cover real estate, rights of way, construction equipment, overhead groups and all items that might apply to any one of the specific groups. The specific groups covered those things that were peculiar to power plants, transmission or distribution lines, etc., and confusion was avoided by assigning job numbers so that a single job did not cover more than one property division, such as a steam-electric plant, a transmission line or a hydro-electric plant. The proper sheets for any job should be selected from the classification. The numbering of the overhead groups in the illustration indicates how this was accomplished. Certain groups of numbers were assigned to each general classification group, and while the numbers run to over 600 the actual numbers used to cover the entire state classification totaled thirty-six, the remainder being left open for future expansion, though very little of the room left can be used except to insert entire new groups.



A PROPER COST ACCOUNTING SYSTEM IS REQUIRED IN CONNECTION WITH SUBSTATIONS AS MUCH AS WITH LARGER JOBS

The entire classification is also cross-referenced with the state property account groups, so that with a job complete and corrected in the construction accounting department the transfer to the general property accounts becomes merely a clerical job. The organization for handling the work should consist of a field force, who are merely timekeepers and material men handling payrolls and original vouchers, and an office construction accounting force, who are responsible for the construction ledgers and preparing the cost records for transfer to the general property accounts, which should be handled by the general accounting department. The general accounting department should also keep a set of control accounts by job numbers, against which the construction ledgers must be balanced monthly, thus making the construction records an integral part of the entire accounting record.

With such a system worked out accurate accounts are available for checking or appraisal purposes.

Overhead Transmission and Distribution Lines

61. Poles, Towers and Fixtures

NOTE: In using this group please note that under no circumstances shall labor charges be made to Groups A4 and A8 inclusive. All labor charges for these groups except those for handling and hauling to the point of use shall be made to (f) framing under A1, A2 or A3, depending on the class of poles or towers being used.

A—POLES, TOWERS AND FIXTURES
- 1—Wood poles.
- 2—Steel towers.
- 3—Wood towers.
- 4—Wood crossarms.
- 5—Steel crossarms.
- 6—Hardware.
- 7—Pin-type insulators and pins.
- 8—Suspension insulators and fittings.
  - (a) Cost of materials and freight.
  - (e) Handling and hauling.
  - (d) Labor of erection.
  - (e) Digging holes.
  - (f) Framing.
  - (p) Painting.
  - (w) Wrecking.

B1—GUYS
- (a) Cost of materials and freight.
- (c) Handling and hauling.
- (d) Labor of erection.
- (e) Digging holes.
- (w) Wrecking.

C—POLE-TOP SWITCHES
(Used for line sectionalizing only)
- 1—Pole-top switches.
- 2—Supporting framework.
  - (a) Cost of materials and freight.
  - (c) Handling and hauling.
  - (d) Labor.
  - (w) Wrecking.

62. Overhead Conductors.

A—CONDUCTORS AND GROUND WIRE
- 1—Conductors and tie wire.
- 2—Ground wire.
  - (a) Cost of materials and freight.
  - (c) Handling and hauling.
  - (d) Labor.
  - (w) Wrecking.

63. Overhead Telephone System

NOTE: All labor of placing A1 crossarms and A2 insulators and pins in position shall be charged to 61 A1, A2 or A3, depending on the class of poles or towers being used.

A—TELEPHONE EQUIPMENT
- 1—Crossarms.
- 2—Insulators and pins.
- 3—Conductors.
- 4—Instruments and protective devices.
- 5—Booths.
- 6—Other equipment.
  - (a) Cost of materials and freight.
  - (c) Handling and hauling.
  - (d) Labor.
  - (w) Wrecking.

64. Customers' Equipment

A—CUSTOMERS' TRANSFORMERS AND INSTALLATION
- 1—Transformers.
- 2—Material.
  - (a) Cost of materials and freight.
  - (c) Handling and hauling.
  - (d) Labor.
  - (w) Wrecking.

B1—CUSTOMER'S SERVICES
- 1 (a) Cost of materials and freight.
  - (c) Handling and hauling.
  - (d) Labor.
  - (w) Wrecking.

C—CUSTOMERS' METERS
- 1—Meters.
- 2—Materials and erection.
  - (a) Cost of materials and freight.
  - (c) Handling and hauling.
  - (d) Labor.
  - (w) Wrecking.

65. Municipal Lighting System
- 1—Wire.
- 1—Incandescent lamp supports and fixtures.
- 3—Arc.
- 4—Arc lamps.
- 5—Incandescent lamps.
  - (a) Cost of materials and freight.
  - (c) Handling and hauling.
  - (d) Labor.
  - (w) Wrecking.

66. Reconstruction of Foreign Properties

A—ACCOUNTS OF PHYSICAL INTERFERENCE
- 1—Telephone Lines.
- 2—Other properties.

B—ACCOUNT OF ELECTRICAL INTERFERENCES
- 1—Inductive interference.
- 2—Other interference.

OVERHEAD

601. Engineering

A1—ENGINEERING

B—SUPERINTENDENCE AND TIMEKEEPING
- 1—Superintendent's salary and expenses.
- 2—Timekeepers, checkers, etc., salaries.
- 3—Inspectors' salaries.
- 4—Construction accounting.
- 5—Miscellaneous supplies and expenses.

602. General Expenses

A1—General officers' salaries.
- 2—General office clerical salaries.

B EXPENSES
- 1—General officers' salaries.
- 2—General office clerical salaries.

C—SUPPLIES AND EXPENSES DURING CONSTRUCTION
- 1—General office supplies and expenses.
- 2—General office stationary and printing.

603. Legal Expenses and Damages

A LEGAL EXPENSES
- 1—Attorneys' fees.
- 2—Traveling and living expenses.
- 3—Recording and notary fees.
- 4—Miscellaneous expenses.

B INJURIES AND DAMAGES
- 1—Damage claims paid.
- 2—Court costs and fees.

604. Insurance, Taxes and Interest
- A—1. Insurance during construction.
- B—1. Taxes during construction.
- C—1. Interest during construction.

605. Other Expenditures During Construction
- A—1. Storeroom expenses.
- B—1. Purchasing department.
- C—1. New business expenses.

629. Contingencies (estimating only)

630. Total

The routine from construction force to general property records will work out about as follows:

Field Force.—Will handle and distribute to the construction classification all time slips and other vouchers. All charges will carry the designation "Ncn" or "Rcn." Make up all payrolls for payment of men. Prepare a physical inventory when the job is complete.

Construction Accounting Department.—Will receive from the field force all payrolls and vouchers, check field distributions and enter in construction ledgers under proper job numbers and construction accounts. Each construction account should be cross-indexed to the proper general property account. To secure the payroll distributions and check them the field force should be required to furnish copies of the time slips with detail distribution, which will be summarized by the construction accounting office. When a job is complete a summary of the costs will be drawn from the record, checked against a summarization of the weekly reports, errors corrected and vouchers prepared for transfer to general property accounts.

General Accounting Department.—Will maintain control accounts for the construction ledgers and enter the transfer vouchers from construction ledgers in the general ledger.

In this routine a discussion of payment of bills, handling of petty cash accounts and the other items that must complete the system from an accounting standpoint hardly needs mention, as they are well understood.

One final item that is not touched is the writing off of equipment removed from service. The construction force reports the physical property taken out. The construction accounting department should secure from the records the original cost of installation, or, in the absence of records, the engineer's estimate, and the engineer's estimate of the salvage value. From this the necessary vouchers for the retirement of the equipment can be prepared.

It will be observed that the whole routine is laid out in such a manner that the construction forces do not come into contact with technical accounting. They deal only with a material and labor classification which is within their understanding and which can be kept with little knowledge of accounting.

The construction accounting department deals with the technical problems and is the tie between the construction and general accounting departments.

The objection that the forces required to carry out such a routine are excessive will be raised. As a matter of fact they will be no larger than those required to carry out any method that secures accurate records and will be little larger than those required to carry out similar work in many places where results are not secured. Proper study will simplify the routine and cut the work to the minimum.

Basic Theory of Electron-Tube Amplifiers—II

Various Arrangements of the Tubes Are Analyzed to Show What Conditions Are Necessary for Maximum Amplification—Historical Development of the Three-Electrode Tube Is Discussed

By MARIUS LATOUR
Consulting Engineer, Paris, France

THE development of the three-electrode tube was treated historically in the first part of this article, published in the ELECTRICAL WORLD for Sept. 11, 1920, and equations were set up indicating the most favorable proportions for various circuit constants. In this concluding portion of the paper two methods of amplification are dealt with, namely:

(1) Operation of a single tube near the critical condition at which oscillations start.

(2) Use of a number of tubes for successive amplification, resulting in a "multistage" amplifier.

It is pointed out that in either case great care must be taken not to carry the amplifying effect to such extremes that violent, uncontrollable oscillations will be set up. The important fact is also brought out that it is possible to amplify not only watt power but reactive power as well.

All the circuit arrangements included in the first method correspond necessarily to those used for generation of free oscillations.[1]

Fig. 9, in which the transformers T_1 and T_2 are connected in series through the source S and capacity C, represents one such arrangement.

The expressions for current I in resistance R, of current j in the grid circuit and of current J in the plate circuit are derived with particular ease, if one regards the tube simply as a generator of internal voltage $Kr_g j$ and internal resistance R_p. The grid current j can be said to exert an irreversible action on the plate circuit causing the appearance in that circuit of the internal voltage $Kr_g j$.

Let us take for the origin of phases that of the voltage $e \sin \omega t$ of the source S, and let I_1, j_1, J_1, be the current components in phase with $e \sin \omega t$ and I_2, j_2, J_2—the components in quadrature.

Let L, L_g, L_p be the self-induction coefficients of the circuits: resistance R, grid and plate; and finally, let M_g and M_p be the mutual induction coefficients of the transformers T_1 and T_2. The following equations express these important relations:

[1] These circuit arrangements were described by Meissner (*Telefunken*) in 1913 and 1914. Gutton also gave some interesting special forms. In my patent No. 491,186 (May, 1915) I have very explicitly described the principle of operation of three-electrode amplifiers near the critical point at which oscillations start. This type of amplifier having been indirectly described in Meissner patent No. 467,747, the originality of my patent exists only for arrangements not derivable from Meissner's and also for arrangements utilizing two-electrode vacuum tubes.

$$RI - \left(L - \frac{1}{C\omega^2}\right)\omega I_2 - M_g\omega j_2 + M_p\omega J_2 = e$$

$$\left(\lambda - \frac{1}{C\omega^2}\right) I_1 + RI_2 + M_g\omega j_1 - M_p\omega J_1 = 0$$

$$r_g j_1 + L_g\omega j_2 - M_a\omega I_2 = 0$$

$$-L_a\omega j_1 + r_g j_2 + M_g\omega I_1 = 0$$

$$-R_p J_1 - L_p\omega J_2 M_p\omega I_2 K r_g j_2 = 0$$

$$L_p\omega J_1 - R_p J_2 - M_p\omega I_1 + K r_g j_2 = 0$$

All circuit arrangements comprising a three-electrode tube which are capable of generating oscillations lead to a system of equations of the above kind, since there are always at least three circuits (the output circuit, the grid circuit and the plate circuit). The treatment can be simplified by neglecting the power in the grid-filament circuit and consequently the direct inductive effect of the grid circuit on the output circuit R. In any case the solution of the system of equations involves nothing more than the work of calculation. The following conclusions are arrived at:

(1) For a certain relation between the constants L, C, L_a, L_p, M_a, M_p, the component I_2 becomes zero (the reactance of the system is nul).

(2) For a certain relation between the same constants compatible with the one required by (1) I becomes infinite; in other words, the relay effect becomes infinite. The apparent resistance of the output circuit becomes zero.

When this apparent resistance becomes negative spontaneous oscillations are of course generated, as has been pointed out at the beginning of this article. From a physical point of view the theoretically obtainable unlimited amplification can be given the following interpretation:

Let us first imagine that the voltage e of the source S is the only one impressed and disregard the reaction of the grid voltage on the plate circuit and all its consequences. The voltage e creates a current I in the R circuit (the induced currents through resistances R_p and r_g being of course taken into account). The flow of current I will in its turn result in a certain voltage drop u between the grid and the filament.

Let us now consider this voltage u by itself and assume the voltage e of source S suppressed. The voltage u will establish a voltage ku in the plate circuit and as a consequence a current I' through the source S in the circuit comprising resistance R.

Let us first assume that the constants of the circuit are such that I' is in phase with I. It is seen immediately that I' allows us to reconstitute I. For instance, let I' return us a fraction $\frac{m}{n}$ of I. The source S will have to supply only the reduced voltage $\frac{n-m}{n}e$ in order that the corresponding current $\frac{n-m}{n}I$ added to I' shall reconstitute the total current I.

In other words, without amplification a voltage e from source S was needed to force a current I through resistance R; with amplification, the smaller voltage $\frac{n-m}{n}e$ is sufficient. This amounts to saying that for the same voltage e the current I is multiplied by the factor $\frac{n}{n-m}$, which becomes infinite for $n = m$.

I have assumed that I' was in phase with I. For the general case, I' not in phase with I, the exact formulation is as follows:

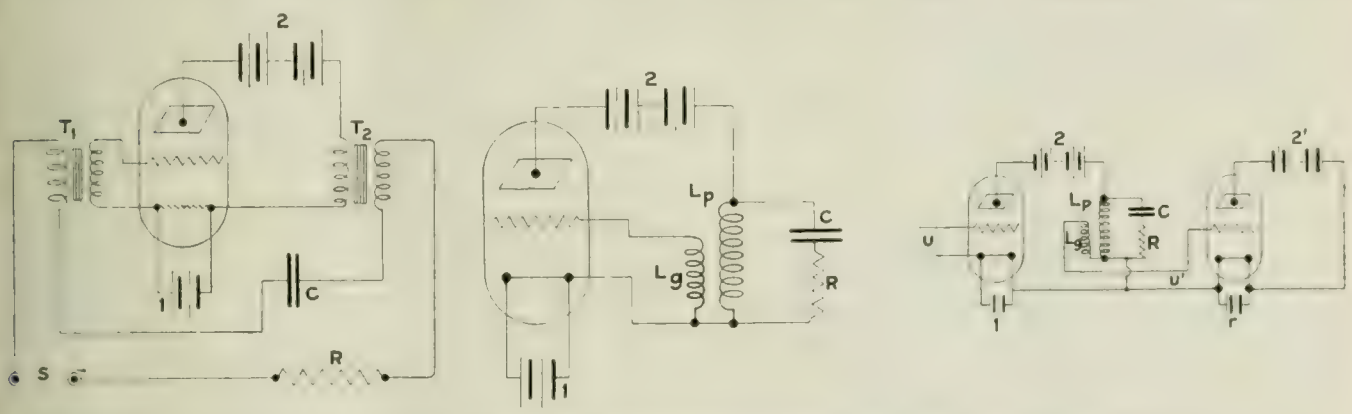
The effective current I in the circuit R is the geometric sum of the two currents: (1) Current I' produced by voltage ku, which is related to the circulation of current I. (2) Current I'' due to voltage e considered as acting alone.

To have at our disposal the current I, it is thus necessary to give the voltage e a value that would supply only I''—the geometric difference between I and I'. The amplification is I/I'', provided $I'' < I$. The infinite amplification discussed above is, of course, purely theoretical, because too close an approach to the critical conditions involves the danger of uncontrollably violent oscillations.

The amplification can, however, be made the greater, at equal stability, the more powerful the tube; *i.e.*, the stronger the thermionic emission.

Connections such as shown in Fig. 9 have in general the disadvantage that the amount of amplification varies with the frequency. The reason for this is that the current I' differs in phase from current I more or less according to frequency. To reproduce current I it is therefore necessary to change not only the magnitude of e but also its phase. Nevertheless, it is possible to devise connections which give a constant amplification over an extended interval of frequencies.

Having been led to the discussion of the generation of oscillations by means of three-electrode tubes, a few words may be added to explain its very simple mechanism: The connections most frequently used for the



FIGS. 9, 10 AND 11 —VARIOUS ARRANGEMENTS FOR THE PURPOSE OF PRODUCING HIGH AMPLIFICATION

generation of oscillations are represented by Fig. 10. Let L_p and L_g be the self-induction coefficients of the plate and grid circuit respectively and M their mutual-induction coefficient.

Let us imagine that we have two identical tubes (Fig. 11) and that the grid inductance is not placed in the grid-filament circuit of the tube connected to the oscillating circuit, but is made to act on the grid-filament of the second tube. A voltage u is applied between the grid and the filament of the first tube; this causes a voltage u' to appear immediately between the grid and the filament of the second tube. The possibility of self-excitation—*i.e.*, of generation of oscillations by means of the first tube alone—obviously depends on such a choice of constants that $u' = u$ (in phase and magnitude). This reasoning is perfectly analogous to that adopted in the treatment of self-excitation of electrical machines. I adopted this mode of treatment in an article which appeared in the London *Electrician* of Dec. 1, 1916. The required mathematical conditions are derived from examination of the circuits.

Under the assumption that the power consumed in the grid circuit (the exciting circuit) is small, it is permissible to neglect in the calculation the reaction of the grid circuit on the plate circuit. The conditions of self-excitation are then as follows:

(1) Condition of phase identity between n and n':

$$\frac{L_g \omega}{r_g} = -\frac{R_p}{L_p \omega} \frac{1 - \omega^2 C L_p + \omega^2 C^2 R^2}{1 - \omega^2 C^2 R^2 + \omega C R}.$$

(2) Condition of equality between n and n':

$$M = -\frac{L_p}{K} - R_p \frac{R_p (1 - \omega^4 C^2 L_p^2 + \omega^2 C^2 R^2) + \omega^4 C^2 L_p^2 R}{\omega^2 L_p (1 - \omega^2 C^2 R^2 + \omega C R)}.$$

The frequency $\omega/2\pi$ in self-excitation is mainly determined by condition (1). A small capacity introduced into the grid circuit and giving a negative value to the circuit reactance considerably affects the frequency.

M being given, the region of self-excitation with regard to current is such as to give k an average value satisfying condition (2). The average k diminishes as the current increases. When the power taken by the excitation (the grid circuit) is considerable, the reaction of the grid circuit upon the oscillation circuit can no longer be neglected. It can be shown that this reaction causes a supplementary damping which retards the self-excitation and may even prevent it entirely. An excessive increase of M may therefore make self-excitation in some cases impossible.

Amplification by Using Several Tubes in Cascade

In the second method for increasing amplification recourse is taken to the use of a number of tubes in cascade (see Fig. 12, where three tubes are shown). This arrangement requires no additional explanations. The intermediary transformers T' can be calculated by applying the same reasoning as before. Their ratio is $r_t' = \sqrt{r_g / R_p}$.

In the first method an amplification limit was imposed by the danger of uncontrollable oscillations. This is equally true of the cascade method. Even when the greatest precautions are taken to avoid inter-reactions between the plate and grid circuit of each tube, a point is always reached when sufficient coupling between the input and output circuits is established to limit the practically obtainable amplification; in spite of all precautions free oscillations of uncontrollable magnitude finally make their appearance. These oscillations often have a frequency out of all proportion with the capacities and inductances used and give rise in the telephone to periodic noises rather than musical tones.

It is important to emphasize the important fact—one that does not seem to have been brought to light as yet—that an amplifying system in accordance with Fig. 12 can amplify not only watt-power but also magnetizing or reactive power.

In such a system, if one admits any inter-reaction between the entering and the outgoing circuit, it is no more true in theory that leading current cannot be produced without the intervention of a capacity (as is true in any system of ordinary circuits[2]) so that Boucherot's principle of conservation of reactive power is no longer valid. Self-excitation thus becomes conceivable even in circuits devoid of the capacity needed to compensate the effect of the inductances; it becomes conceivable also in circuits devoid of inductance and possessing only capacity.

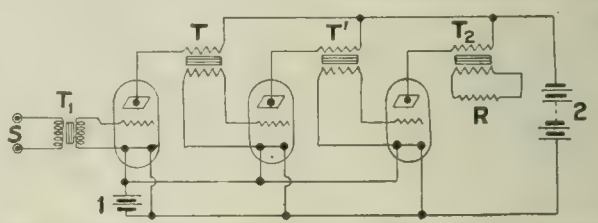


FIG 12—AMPLIFICATION BY SEVERAL TUBES IN CASCADE

In such a system the capacity or inductance is needed only in very small amount solely for the purpose of assuring some stability. In accordance with this I have developed amplifying systems which permit obtaining negative inductance from positive inductance and negative capacitance from positive capacitance.

This important question will be treated in a later study of the conditions of generation of oscillations in multistage amplifiers. It can be shown that even the smallest capacity in the grid circuit exerts a great influence on the frequency of the oscillations, which increases with the resistance of the grid-filament circuit.

YOU *have just the kind of an organization necessary to protect and advance your interests, and the time was never more propitious in which to reason with the public about your rights. The demonstrated folly of the past neglect of the railroads has left the public mind open for a fair consideration of the rights of other utilities. The only thing to consider is whether you are fully alive to your own needs and are asserting them with the vigor and earnestness requisite. Your annual convention is, of course, an ideal and effective time at which to exchange views and experiences, to the end that each of you may benefit by the other's knowledge. You cannot, however, get results through well-sounding resolutions, in convention assembled, but only through constant well-planned efforts 365 days a year. In short, it is entirely up to you men just how effective you make your organization. But if you are to profit by the very dear experience of the railroads, you will work together and thoroughly acquaint the public with your needs.*—J. A. C. Kennedy, General Counsel of Nebraska Power Company, before Nebraska Section, N. E. L. A.

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[2]See the author's article in the *Lumiere Electrique* of April, 1907, p. 5, "On Some General Theorems Relating to Electrical Engineering."

Power Needs on the Pacific Coast

Extent of Power Shortage in California—Feasible Sites and Prospective Developments in Washington and Oregon—Future Opportunities Seen for Electrochemical and Electrometallurgical Loads

By F. H. FOWLER
District Engineer U. S. Forest Service, San Francisco

THE utilization of our water powers has become a vital question. The estimate of the potential water powers of the United States prepared by the Geological Survey for the National Conservation Commission in 1908, published by the Commissioner of Corporations in his report on "Water Power Developed in the United States, 1912," and later revised and republished in Senate Document 316, Sixty-fourth Congress, first session, is still the most authoritative estimate of potential power for the entire country. Funds should have been provided long since for a detailed study, covering the United States, in the manner that is now proposed for the North Atlantic States.

The accompanying condensed tabulation from Senate Document 316, compiled on a basis of 70 per cent efficiency, will bring to mind the regional distribution of our potential water-power resources:

POTENTIAL WATER POWER OF THE UNITED STATES

	Minimum		Maximum	
	Horsepower	Per Cent	Horsepower	Per Cent
New England	868,000	3.11	1,605,000	2.98
Middle Atlantic	1,357,000	4.86	2,488,000	4.62
East North-Central	832,000	2.98	1,604,000	2.98
West North-Central	902,000	3.23	1,956,000	3.63
South Atlantic	2,346,000	8.39	4,257,000	7.90
East South-Central	1,087,000	3.89	1,964,000	3.64
West South-Central	353,000	1.26	822,000	1.52
Mountain	8,694,000	31.11	16,131,000	29.92
Pacific	11,504,000	41.17	23,078,000	42.81
United States	27,943,000	100.00	53,905,000	100.00
Segregation of potential power in Pacific States				
Washington	4,932,000	17.65	8,647,000	16.04
Oregon	3,148,000	11.27	6,613,000	12.27
California	3,424,000	12.25	7,818,000	14.50
	11,504,000	41.17	23,078,000	42.81

In no section of the United States does topography so greatly influence not only climate and power resources but also the distribution of population and industries as in Washington, Oregon and California. The great Cordilleran mountain system extending along the west coast of both Americas, and locally known as the Sierra Nevada Mountains in California and as the Cascade Range in Oregon and Washington, not only protects the western coastal strip in these states from the more rigorous climate of the interior but also presents a barrier against which drift the storms and moisture-laden winds of the Pacific.

In California the distance from the ocean to the main crest of the Sierras is about 175 miles (280 km.), in Oregon the average distance from the ocean to the crest of the Cascades is about 120 miles (190 km.), while in Washington the distance from the ocean proper to the crest of the main ridges is about the same but the distance from the eastern shore of Puget Sound to the crest is not more than 50 to 60 miles (80 km. to 96 km.). The storms drifting from the ocean landward are deflected upward and cooled, first by the Coast Range, which robs them of a portion of their moisture, and then by the main Cordillera, on the slopes of which they drop most of their watery load. Records show a more or less uniform increase of precipitation with elevation on the western slopes of the Sierras to a certain elevation, which in California appears to be about 7,000 ft. (2,100 m.), east of which there is a gradual decrease in mean annual precipitation to the crest of the ridge and then a very rapid decrease.

Mean annual precipitation at different points in the Pacific States varies between the widest limits found in the country. At certain points on the coast of Washington and Oregon the mean annual rainfall runs as high as 133 in. (338 cm.), but as one proceeds southward along the coast there is a continuous decrease until in the vicinity of San Diego the mean annual rainfall is but 9.56 in. (24 cm.). The lowest mean seasonal precipitation in the region is found in the desert country of southeastern California, where at times no rain has fallen for several years in succession. The mean recorded at one of the stations in this area is but 2.34 in. (5.8 cm.) as compared with 133 in. on the northwest coast.

Loads Carried by California Water-Power Stations

California hydro-electric systems are now operating water-power plants with a combined capacity of about 543,000 kva. and steam auxiliaries with an additional capacity of 285,000 kva., a grand total of 828,000 kva., or 1,110,000 hp. The combined installation in hydro-electric plants of Washington and Oregon is about two-thirds that in California.

The average load carried by most of the hydro-electric plants is under 60 per cent of their rated capacity, and an annual increase of 35,000 kva. in mean load would therefore necessitate an annual installation of at least 60,000 kva. in hydro-electric generating machinery after the present deficiencies are made up. In short, California should have a total installed hydro capacity of 800,000 kva. by 1921 and an annual increase of 60,000 kva. each year thereafter to handle adequately the normal increase in load. If large electrochemical, electrometallurgical or railway loads are developed, the rate of increase will be proportionally greater.

Detailed figures for the growth of load in Washington and Oregon are not now available but are being collected by the National Electric Light Association. Unless new power uses are developed within the two states, the growth in lead will hardly be as rapid proportionally as in California.

The estimates given in the table serve merely as a basis for regional comparisons of potential power. Far more detailed studies have been completed on certain drainages by the federal and state governments, municipalities and engineering and public utility companies. Most of the Puget Sound streams and those in southern Washington have been studied in detail by the United States Geological Survey in co-operation with the State of Washington. Results already published show a total of 282,000 hp. without storage and 391,000 hp. with storage for the Cowlitz, Nisqually, Puyallup, White,

Green and Cedar Rivers, draining the territory between Portland and Seattle, north of the Columbia and east of Puget Sound. Similar studies show an average minimum of 389,500 hp. (since found to be somewhat higher) for the Klickitat, White Salmon, Little White Salmon, Lewis and Toutle Rivers, draining into the Columbia from the north, between the mouth of the Cowlitz and The Dalles. The Yakima, which drains the basin east of the Columbia, will produce only 12,000 hp. continuously, but 105,000 hp. may be developed during the irrigation season. Natches River, principal tributary of the Yakima, will yield 57,530 hp. continuously without, and 97,950 hp. with, storage, while its mean for the irrigation season, with storage, is 160,500 hp. Clealum River, another tributary of the Yakima, will yield 4,770 hp. without, and 21,560 hp. with, storage.

POWER POSSIBILITIES AT THE DALLES

Developments at Priest, Kettle and Rock Island Rapids and The Dalles, on the main Columbia, have been proposed from time to time, but investigations of power possibilities at The Dalles appear to have been carried farther than for the other sites. A detailed report of power available at The Dalles was prepared by co-operation between the state and federal governments, in 1913.*

The project contemplated the development of power at Five-Mile Rapids near the Dalles, 90 mi'es (144 km.) east of Portland and 187 miles (300 km.) above the mouth of the river. The minimum recorded flow at this point was 41,900 sec.-ft. (1,170 cu.m. per second) and the maximum 1,170,000 sec.-ft. (32,700 cu.m.). At an average low-water discharge of 50,000 sec.-ft. (1,400 cu.m.) the estimated net head was 105 ft. (3.15 m.), and at a high-water discharge of 800,000 sec.-ft. (16,800 cu.m.) it was 45 ft. (14.5 m.). It was estimated that 480,000 hp. could be developed continuously, and that there would be 120,000 hp. more available for eleven months, an additional 100,000 hp. for ten months, and still another 100,000 hp. for eight months, giving a total development of 800,000 hp. that might be considered economically justifiable by stream-flow conditions.

It was estimated that the cost would be $104 per horsepower for a development of 480,000 hp., $62.50 per horsepower for 800,000 hp., or $46.30 per horsepower on the basis of the total rated capacity of generators (1,080,000 hp.) that would have to be installed in order to obtain the continuous output of 800,000 hp. The plant would operate at its full capacity during only four months of the average year.

The State Engineer of Oregon has made tentative studies of other large projections on the Columbia, Snake, Deschutes, Rogue and Klamath, capable of continuous output of 2,401,000 electric horsepower.

A tabulation of proposed developments in California prepared by the writer in October, 1919, showed a combined proposed installation of 2,100,000 kva. Many well known possibilities were not included. It appears, therefore, that the state's potential supply is ample for years to come.

THE ELECTROCHEMICAL OUTLOOK

That the very large water powers of the Pacific Coast will eventually be utilized as a source of energy for electrochemical and electrometallurgical industries none can doubt, but the date of their utilization is highly uncertain. Were unit cost of construction the only possible deterrent, many large developments would be under way today. Availability of raw materials and the market for the finished products are the most serious handicaps.

The results of investigations carried out in connection with the Columbia power project are unfortunately general in their application. In connection with that project industry after industry was investigated as a possible outlet for large blocks of power, only to be abandoned as probably unprofitable under prospective market conditions. That the site is one of the most wonderful in the country cannot be denied, but its development is for the future and not the present.

The earliest development of extensive electrochemical and electrometallurgical industries on the Pacific Coast will probably be on Puget Sound, where there is ample water power susceptible of development at relatively low unit cost, in moderate-sized units, and in such close proximity to tidewater as to minimize transmission costs and losses. The Columbia River and lower Willamette near Portland, offering similar advantages but in a less conspicuous degree, may be expected to follow in turn.

LONG DISTANCE TRANSMISSION A HANDICAP TO CALIFORNIA ELECTROCHEMICAL DEVELOPMENT

The writer does not anticipate that California will ever compete with her northern neighbors on a large scale in electrochemical manufacturing for export, especially in those branches of the industry where power cost is a large percentage of the total cost. Its manufacturing for the local market will probably far exceed that in the other two states. Natural conditions in California lead to high unit costs in hydro-electric installations, especially where long trunk transmission lines are included. In order to get the most favorable power rate it would therefore be necessary to establish the electrochemical industry near the generating station, which may be from 90 to 175 miles (145 km. to 280 km.) from tidewater, with consequent higher freight charges and shipping difficulties. If, on the other hand, these transportation difficulties are avoided by establishing the industry on tidewater, the cost of power will be considerably greater. Market alone will determine whether a given industry can flourish despite these conditions which affect the final selling price of the product.

Probably the lowest power rate yet quoted in California is $2.50 per kilowatt per month for twenty-four-hour power based on the maximum average demand for a fifteen-minute period. This rate was established for the encouragement of electrochemical and electrometallurgical industries other than remelting. It is granted at the option of the power company or upon order of the California Railroad Commission. The base rate is subject to an additional charge of 6 cents per kilowatt maximum demand for each 1 per cent that the average power factor falls below 90 per cent. A general surcharge since allowed by the Railroad Commission to take care of increase in all generating costs permits an additional charge of 0.2 cents per kilowatt-hour. The net cost per horsepower-year, therefore, ranges from $35.45 for 90 per cent power factor and 100 per cent load factor down to $32.84 with 90 per cent power factor but only 80 per cent load factor.

*"The Columbia Power Project," Bulletin No. 3, accompanying Fourth Biennial Report of State Engineer John H. Lewis, Jan. 11, 1913, by L. F. Harza, project engineer.

600,000-Hp. Line Delivers Niagara Power*

Six Circuits Spaced for 88,000 Volts Are Supported on Cantilevers Overhanging Hydraulic Canal—Special Precautions Taken to Guard Against Failure

By J. ALLEN JOHNSON
Electrical Engineer Niagara Falls Power Company

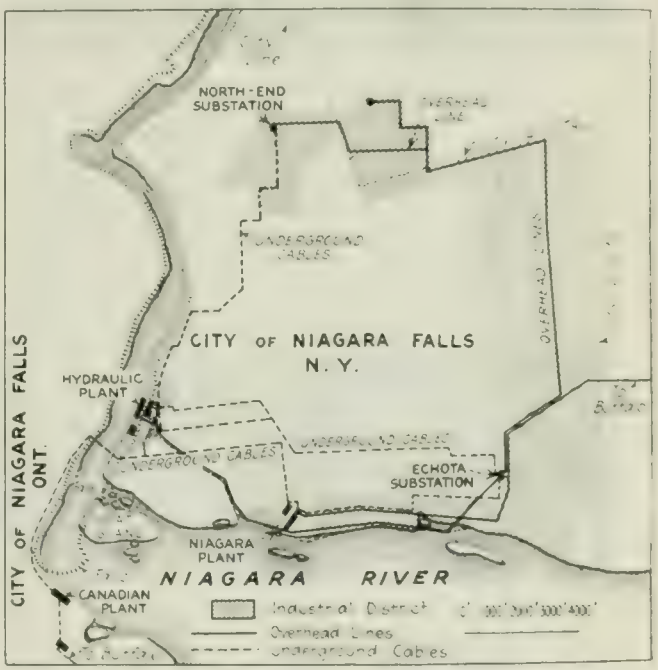
THE problem of transmitting the 100,000 hp. generated in the Niagara Falls extension was complicated by many factors. In the first place the prospective load for this development was concentrated within a comparatively narrow area adjacent to the upper river, so that it was necessary that the entire output should be transmitted in a single direction. The city has few available streets leading in the desired direction, and most of these were already occupied by conduit systems.

As a second consideration, the character of the load, which has a daily load factor of over 95 per cent (the power being mostly used for electrochemical and electrometallurgical purposes), is the worst possible for underground transmission because the constant generation of heat in the cables causes a considerable reduction in their transmitting capacity compared with that on a system of low load factor.

As a third consideration, a glance into the future indicated the probability of a much larger transmission of Niagara power to Buffalo in the not distant future, requiring a much higher voltage than that used for local distribution. In this event the proper location for the step-up transformers would be close to the generating station. A 3-mile (4.2-km.) underground transmission to Echota, the center of load, at generator voltage before stepping up would be economically unsound. Furthermore it appeared very probable that additional development of power at this point would be required in order to meet the double demand for more power on the one hand and increased economy in use of water on the other. Overhead transmission would permit the necessary high voltage for long-distance transmission and would also provide the necessary flexibility to care for future increases in power development, either by adding more circuits or by raising the transmission voltage. In addition to all other considerations, cost estimates showed a differential in favor of overhead transmission of about one to three, which under the existing conditions of high costs was an extremely important consideration. Fortunately, the company already possessed in its canal right-of-way through the city a possible outlet for overhead lines if a way could be found to utilize it without interfering with its use as a waterway. As finally constructed the transmission line has a length of 16,000 ft. (4,800 m.) and runs from the terminal building up the canal to the river, thence following the bank past the plant of the old Niagara Falls Power Company (now known as the Niagara plant) and finally turning away from the river again at Echota to connect with the Echota substation.

The solution of the transmission problem was greatly facilitated by the consolidation of the two power companies inasmuch as land for the location of the line for the greater part of its length was already in possession of one or the other of them. For a distance of approximately 4,000 ft. (1,200 m.) through the heart of the city, however, it was necessary to make use of the property already occupied by the hydraulic canal. The accompanying halftone illustrations show clearly how this was accomplished by means of steel cantilevers anchored into massive concrete foundations on one bank of the canal, upon which were erected the six-circuit transmission towers.

For the greater part of the distance it was only found necessary for the narrow bases of the towers to be placed over the canal right-of-way, easement being obtained from abutting property owners for the overhanging portion of the construction. At the large



ROUTES FOLLOWED BY PRINCIPAL TIE LINES AND FEEDERS OF NIAGARA FALLS SYSTEM

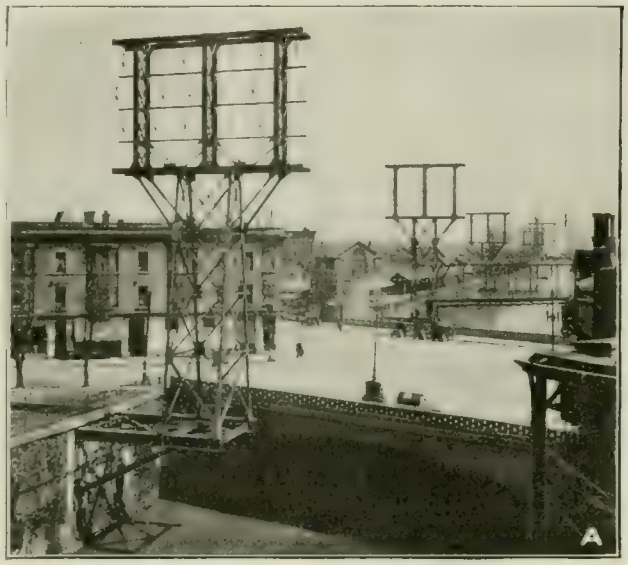
bridge spanning the canal at the junction of Third and Niagara Streets, however, this was not possible, and it was necessary to place two towers entirely over the canal. This was accomplished by means of cantilevers extra heavily braced.

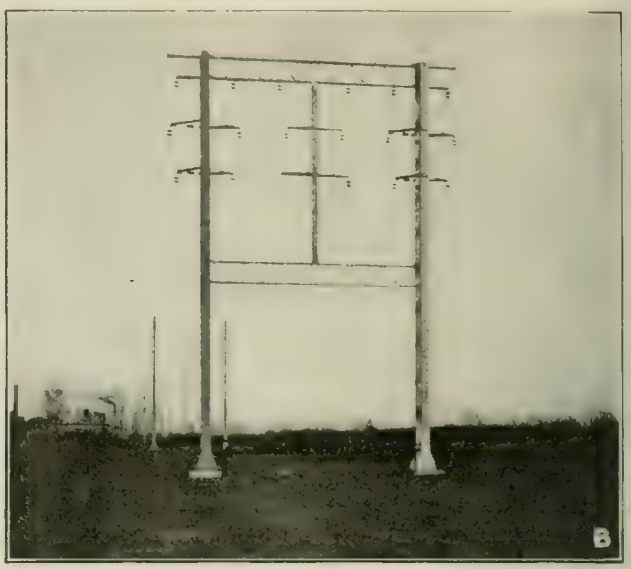
The main horizontal members of this structure are composed of two 30-in. (75-cm.) I beams, each 60 ft. (18 m.) long, placed side by side. Thirty feet (9 m.) of these beams is buried in the massive concrete foundation, the other 30 ft. projecting out over the canal. In these structures the center line of the towers is 25 ft. (7.5 m.) from the face of the canal wall. A heavy brace was added to these special structures to give stability and rigidity, although not needed for strength. In the case of the short cantilevers the brace was omitted.

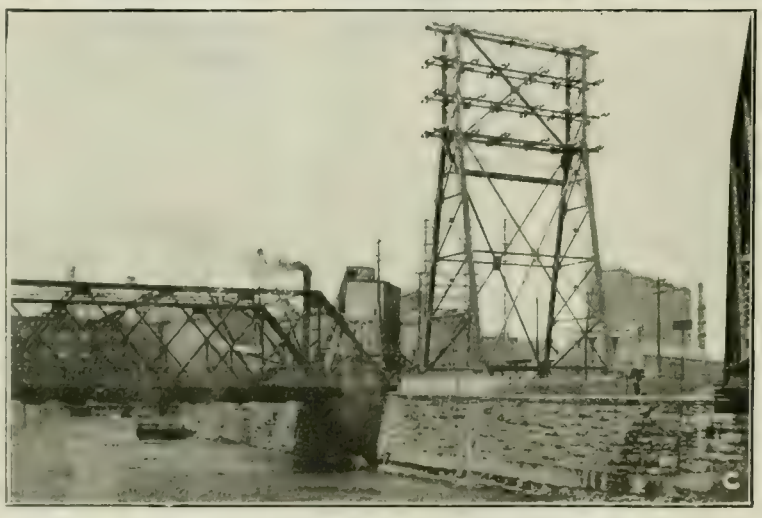
In addition to the special narrow-base towers used on

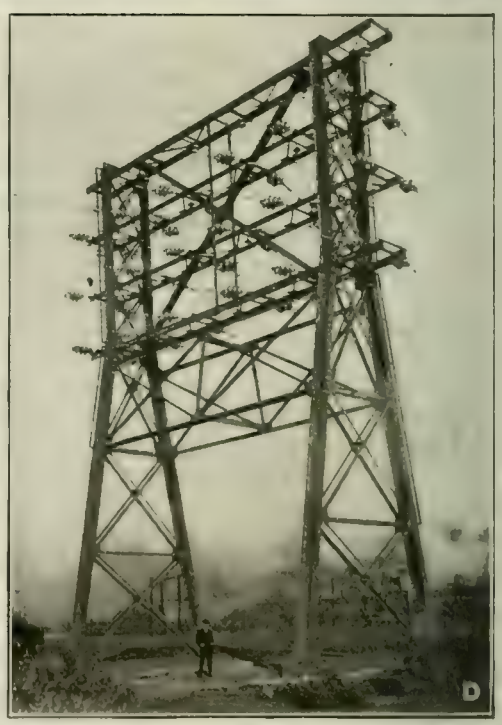
*Fifth installment of a symposium on the 100,000-hp. extension to station No. 3 of the Niagara Falls Power Company. (See Sept. 18, Oct. 2, Oct. 16 and Oct. 23 issues of the ELECTRICAL WORLD.

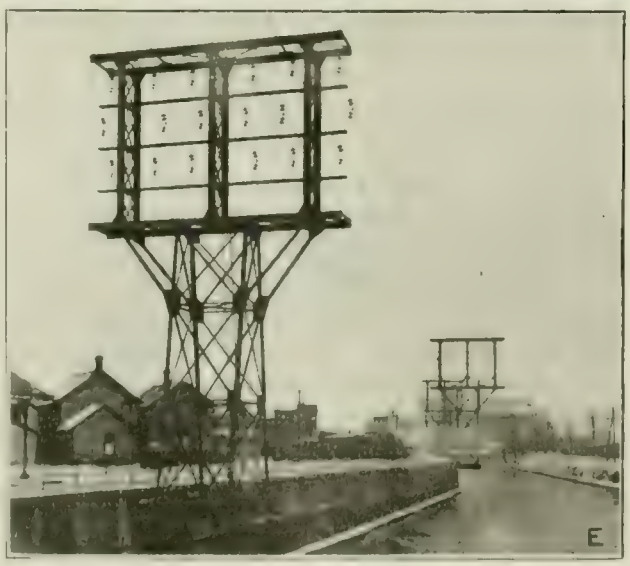
Tower Construction Used to Support Six Circuits from Niagara Falls 100,000-Hp. Extension to Echota Substation











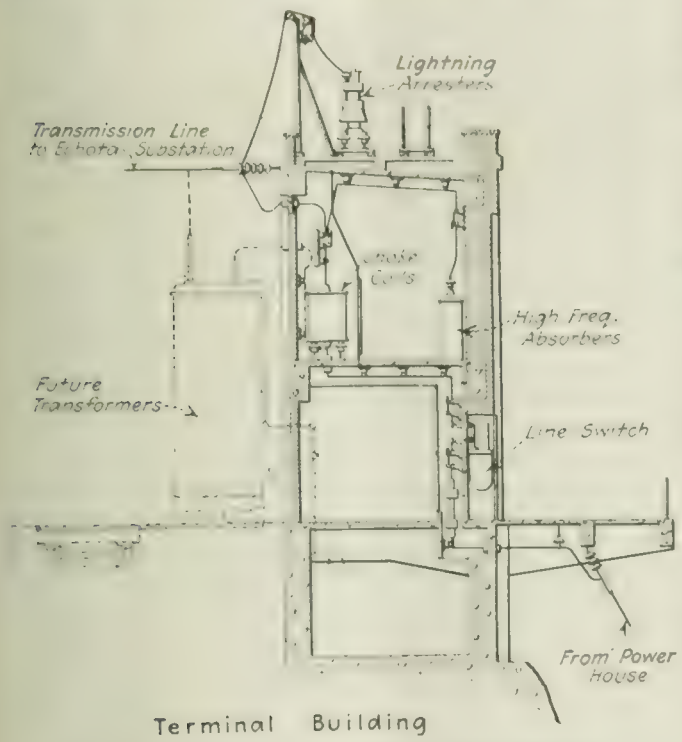


A—Tower on cantilever support for extreme overhang
B—Straightaway towers supporting six circuits.
C—Angle tower at road crossing.
D—Portal tower over main roadway.
E—Cantilever bracing was omitted where overhang was not excessive.
F—Sharp turn accomplished by using three double-circuit towers.

the canal section, the local conditions called for the use of several other types of structure. In full-strain positions three different types were employed, the standard-strain type, portal strain, and two-circuit strain. Between strain points the line is supported on flexible steel bents of portal construction.

The portal type of construction was used for the section along the river bank where the line is built over a future street. For a distance of approximately 1,000 ft. (300 m.) the land which this street is to occupy has not yet been filled in, and the towers were erected on heavy concrete abutments constructed in the bed of the river. One of the towers so placed was a full-strain angle tower.

At the substation end of the line three two-circuit strain towers were used in order to provide for the proper distribution of the circuits at the substation



CROSS-SECTION OF TERMINAL BUILDING FROM WHICH LINES RUN TO ECHOTA

wall. As may be observed the line comprises six three-phase circuits, each consisting of 500,000-circ.mil stranded medium-hard-drawn copper. At present two circuits are used for each 32,500-kva. unit at 12,000 volts, but clearances are provided for 88,000 volts. At 44,000 volts each circuit will have a nominal capacity of one unit of 32,500 kva., and at 88,000 volts each circuit will, if necessary, easily handle the output of three such units, or 97,500 kva. At 88,000 volts, therefore, the capacity of the six circuits will be 585,000 kva., or, roughly, 600,000 hp. It is believed that this is by far the largest capacity for which a transmission line was ever constructed.

Owing to the fact that this line passes through the business portion of a busy city, special precautions were taken to guard against failure. Although the ultimate strength of each conductor is over 20,000 lb. (9,000 kg.), they are strung for a maximum tension under worst conditions of wind and ice of only 6,000 lb. (2,700 kg.). At strain towers double-strain insulators are used having a strength approximately equal to that of the conductor. Short spans, not exceeding 350 ft. (105 m.), were used as a further contribution toward safety and stability.

The line is insulated with Jeffrey-Dewitt suspension-type insulators, two units being used in suspension strings and three in strain. Each of the insulator units was tested electrically to flash over at not less than 90,000 volts and also to a mechanical tension of 8,000 lb. (3,600 kg.). On the canal section, because of the peculiarities of the right-of-way, it was impossible to avoid a number of small angles, at which points suspension strings with hold-downs were used.

Insulator clamps, strain yokes and other miscellaneous insulator hardware were furnished by the Locke Insulator Manufacturing Company.

The line is protected against lightning by five overhead ground wires. On about half the line, where no corrosive fumes from chemical plants were to be expected, $\frac{3}{8}$-in. (9.6-mm.) galvanized Siemens-Martin steel-strand was used. For the second half, where the line passes in close proximity to the chemical plants, $\frac{3}{8}$-in. copper-clad wire was used for this purpose.

At the terminals of the line, at the terminal building and the Echota substation, the lines are first dead-ended on steel towers at some distance from the building and then looped to eye bolts embedded in the building construction, which is especially reinforced to withstand the tension of the conductors.

The proposal to mount the heavy towers on cantilevers along the bank of the canal came from R. L. Allen of the Archbold-Brady Company of Syracuse, to whom also is due the excellent and pleasing design of the towers. The company named furnished the towers for the entire line.

Testing of Government Supplies

FOR many years, as recounted in an address made before the Washington Academy of Sciences by Edward B. Rosa, chief physicist of the United States Bureau of Standards, electric lamps purchased by the Government have been systematically inspected at the factory and samples selected for life test in the laboratory. The information so obtained is utilized in the preparation and periodical revision of standard specifications which are used in the purchase and testing of lamps. Formerly lamps were bought by each department or government establishment separately, without specifications or tests. The prices were relatively high and the quality of the lamps was often uncertain or poor. Since adopting the new method prices have been lowest and the quality the best afforded.

The ordering of lamps by each department is now a simple routine operation, whereas formerly the separate purchasing of lamps involved dealing with agents of various manufacturers and guessing as to who offered the best values. The systematic testing of lamps by the government not only protects the government in its purchases, but it protects the public in large measure, for the test tends to keep up the quality of the entire product and so benefits the public. The value of this work, which puts the purchase of lamps by the government on a business basis and protects the manufacturer of a high-grade product as well as the user, is many times the cost of the work. The influence of the government, instead of being hurtful as it formerly was, is thus stimulating and helpful to the industry, tending to raise the quality of the product and to improve business methods.

Data on Electric Locomotive Performance

The Advantages Upon Which the Case of Electrification Rests Are Mainly Economy of Fuel, Increased Haulage, Low Maintenance and General Flexibility of Electric Locomotives

A COMPARISON of the modern steam and electric locomotive leads immediately to a discussion of the relative fitness of the two types of motive power to meet service conditions, according to A. H. Armstrong, chairman electrification committee of the General Electric Company. In a paper read before the joint meeting of A. S. M. E. and A. I. E. E. sections at New York City on Oct. 22, he gave important data on the performance records of electric locomotives which is abstracted in the following paragraphs.

Accepting the Mikado and Mallet as the highest developments of steam-road and helper engines for freight service, the general comparison of Table I

TABLE I—COMPARISON OF STEAM AND ELECTRIC LOCOMOTIVES

	Mikado	Mallet	Electric
Type	2-8-2	2-8-8-2	6-8-8-6
Weight per driving axle, lb.	60,000	60,000	60,000
Number of driving axes	4	8	12
Total weight on drivers, lb.	240,000	480,000	720,000
Total weight locomotive and tender, lb.	480,000	800,000	780,000
Traction effort at 18 per cent coefficient	43,200	86,400	129,600
Gross tons, 2 per cent grade	940	1,880	2,820
Trailing tons, 2 per cent grade	693	1,495	2,430
Speed on 2 per cent grade, m. p. h.	14	9	16
Horsepower at driver rims	1,620	2,080	5,570
Indicated horsepower at 80 per cent efficiency	2,030	2,600	
Trailing ton-miles per hour on 2 per cent gradient	9,700	13,500	38,800

is drawn with an entirely practicable electric locomotive that can be built without in any respect going beyond the experience embodied in locomotives now operating successfully.

This analysis brings out the fact that to equal the hourly ton-mile performance of one electric locomotive it would require three and four engine crews respectively for the Mallet and Mikado types.

The electric locomotive has demonstrated its very great advantages in relieving congestion on single-track mountain-grade divisions. Due to the increase in number of meeting points through its higher speed, and on account of the independence of climatic conditions of the electric locomotive and other time-saving factors, it is safe to say that the daily tonnage capacity of single-track mountain-grade divisions will be increased fully 50 per cent over possible steam-engine performance by the adoption of the electric locomotive.

The hazard of mountain operation is greatest on down grades, and it is left to electricity to effect the safe

TABLE II—ELECTRIC LOCOMOTIVE MAINTENANCE DATA FOR 1919

	N. Y. C.	C., M. & St. P.	B., A. & P.
Number of locomotives owned	73	45	28
Locomotive weight, tons	118	290	84
Annual mileage	1,946,879	2,321,148	566,977
Cost of repairs per mile, cents	6 39	14.65	6 48

control of descending trains by supplying regenerative electric braking.

The electric locomotive shows great advantage over the steam engine in cost of maintenance. Special importance attaches to this item of expense in these days of high labor and material costs. Electric locomotives are now being operated 3,000 miles (4 800 km.) between inspections on at least two electrified railways and the data that are given in Table II show recent costs. In contrast, it can be stated that the present cost of maintaining a type 2-8-8-2 Mallet may be taken at 60 cents per engine-mile, without including many miscellaneous charges not shared by the electric locomotive. Possibly more direct comparison may be better drawn by expressing maintenance in terms of driver weight, as in Table III.

TABLE III—STEAM AND ELECTRIC REPAIRS ON WEIGHT BASIS

	Steam Mallet	C., M. & St. P. Elec.
Cost of repairs per mile, cents	60	14.65
Weight on drivers, tons	240	225
Cost of repairs per 100 tons locomotive weight on drivers, cents	25	6.52

Including all engine service charges, the facts available give foundation for the claim that electric locomotives of the largest type can be maintained for 25 per cent to 30 per cent of the upkeep cost of steam engines operating in similar service.

As to fuel saving effected by steam railway electrification, estimates of electrical engineers have been called extravagant by steam engine advocates. Fuel economy figured prominently among the reasons leading up to the replacement of the steam engine on the Chicago, Milwaukee & St. Paul Railway, as brought out by a careful analysis of the performance of the steam engines then in service.

The following runs are chosen to bring out most strikingly the inherent disadvantages of operating a steam engine over a single-track mountain-grade division: The run of 111.1 miles from Harlowton, elevation 4,162 ft., to Three Forks, elevation 4,066 ft., over the Belt Mountan divide at Loweth, elevation 5,789 ft.,

TABLE IV—FUEL COMPARISON, SHOWING STANDBY LOSSES

		Steam	Electric
Doing useful work, lb.		23,640	8,100
Making up fire, lb.	1,535		
Delay at Harlowton, lb.	2,270		
Held up at Lennep, lb.	394		
Held up at Loweth, lb.	128		
Held up at Dorsay, lb.	230		
Fire, banked 9 hr., lb.	1,425		
Coasting down grade, lb	3,060		
Total standby losses, lb		9,042	
Regenerative braking, lb			1,430
Total net coal, lb.		32,682	6,670

was made by steam with 871 tons trailing load in twenty-six cars and by electric locomotive hauling sixty-four cars weighing 2,762 tons. The accompanying diagram shows the result reduced to a common basis of 1,000 gross tons moved, including the locomotive and tender weight. The running speed of the electric train was but slightly higher than the steam and the additional correction in the power demand rate of the former is made proportional to the lower speed. Both runs are therefore shown as made in identical time on the basis of 1,000 total gross tons moved in each instance. The measured values of electric locomotive input were raised to the value of there-phase energy purchased to cover a total of 32 per cent of purchased energy lost in transmission and conversion, and the kilowatt-hours so obtained were reduced to coal equivalent in the ratio of 2½ lb. of coal per kilowatt-hour.

While the electric locomotive demands power only when in motion, the steam engine requires coal whether doing useful work, standing idle or coasting down grade. In fact, the standby losses were such a large percentage of the total coal consumed that a careful record was kept of their several amounts, as may be seen by referring to Table IV.

The run of a more modern steam engine would have effected a material reduction in the 23,640 lb. of coal burned in doing useful work, but the amount of coal

TABLE V.—ANALYSIS OF STEAM AND ELECTRIC RUNS, HARLOWTON TO THREE FORKS, IN UNITS PER 1,000 TONS MOVED

	Steam	Electric
Kilowatt-hours at driver rims	2,038	2,038
Horsepower-hours at driver rims	2,625	2,625
Coal per horsepower-hour at driver rims, lb	9 02	3 09
Credited regenerative braking, lb		0 55
Standby losses, 27½ per cent, lb.	2 47	
Total coal per rim horsepower-hour, lb	11 49	2 54

*Measured at power house, includes locomotive losses and 32 per cent transmission and conversion loss

wasted in standby losses (9,042 lb.) might have been duplicated or even possibly increased with larger grate area. As standby losses constitute so large a proportion of the total coal burned (27½ per cent in this instance) it is apparent that enormous economies over the simple engine tested must be realized in the modern superheater and other improvements since introduced to offset in part the high inherent efficiency of the electric locomotive.

The commonly used unit measurement of pounds of coal per 1,000 ton-miles is at best a very rough and unstable comparison of steam engine runs over different profiles, variable quality of fuel and operating conditions. A truer understanding of what takes place under the engine boiler may be shown by continuous records of coal burned, tons moved, profile, delays, etc., all reduced to pounds of coal burned per useful horsepower-hour of work done at the driver rims with segregation of the many standby losses, as in Table V.

It would be a simple matter to carry through a series of runs over the electrified zones of the C., M. & St. P. with a modern Mikado equipped with up-to-the-minute fuel-saving devices and thus provide the necessary data to draw direct comparisons with the electric locomotive. Such tests with modern steam

TABLE VI.—THEORETICAL COMPARISON OF MODERN STEAM AND ELECTRIC LOCOMOTIVES, HARLOWTON TO THREE FORKS

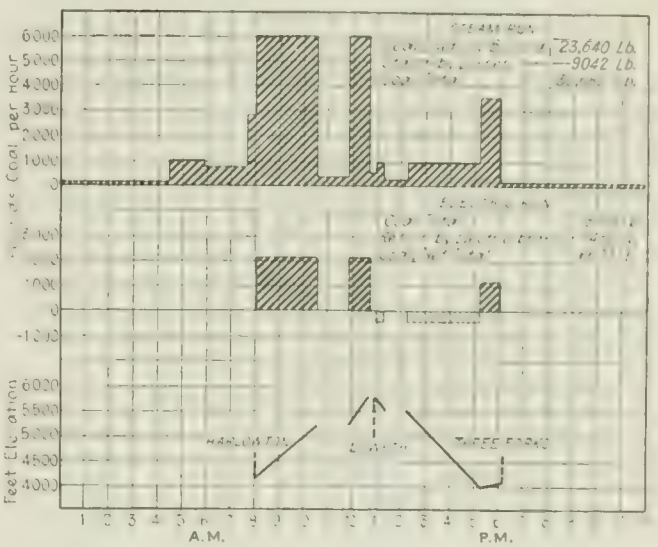
	Mikado	Electric
Type	2-8-2	4-4-4-4-4-4
Weight on drivers, lb	240,000	450,000
Weight engine and tender, lb	480,000	568,000
Tractive effort, 18 per cent coefficient, lb	43,200	81,000
Trailing tons, 1 per cent grade	1,420	2,836
Horsepower-hours at driver rims	4,360	8,200
Coal per indicated horsepower-hour, lb	3	
Coal per driver, horsepower-hour, lb	3 75	
Standby loss, test result, lb	9,042	
Standby loss, per horsepower-hour, lb	2 15	
Total coal per driver, horsepower-hour, lb	5 90	
Coal at power house, per kilowatt-hour, lb		2 5
Coal at power house, per horsepower-hour, lb		1 86
Coal at locomotive driver, per horsepower-hour, lb		3 09
Coal credit due regeneration, lb		0 55
Net coal at driver per horsepower-hour, lb	5 90	2 54
Total net coal, lb	24,800	20,900
1,000 trailing ton-miles	157,500	314,000
Coal per 1,000 ton-miles, lb	158	66.7
Ratio coal burned	2 37	

equipment would undoubtedly discredit the above comparison based upon the economies of six years ago and might lead to something approximating the blend of fact and theory shown in table VI. This table is based upon actual electric locomotive performance, Harlowton to Three Forks, coal taken at 2½ lb. per kilowatt-hour at assumed steam power station. Steam engine values are based upon the known working efficiency of a Mikado equipped with superheaters but penalized with the same standby losses actually determined with a simple engine tested Harlowton to Three Forks and given in Table IV.

In view of all the facts a broad statement may be made that the general adoption of the electric locomotive would probably result in saving fully two-thirds the fuel now burned on present steam engines and possibly one-half the amount of fuel necessary to steam engines of the most modern construction.

The superior operating advantages of the electric locomotive are admitted by many who believe the first cost to be prohibitive, largely due to the necessary trolley construction, copper feeders, substations, transmission lines, etc. Such auxiliaries do add an amount that may equal the electric locomotive expense and the task of proving the electric case is not made easier by the fact that steam engine facilities are already installed and may have little or no salvage value to offset new capital charge for electrification.

Comparing the cost of equivalent steam and electric



COAL CONSUMPTION COMPARISON ON IDENTICAL RUNS BY STEAM AND ELECTRIC LOCOMOTIVES

motive power, it is apparent that on the basis of the same unit prices for labor and material the first cost is approximately the same. While electric locomotives cost possibly 50 per cent more than steam for equal driver weight, the smaller number required to haul equal tonnage may quite offset this handicap, especially with quantity production of electric locomotives of standard design.

No discussion of electric railway economies would be complete without comment upon the increased value of real estate brought about by terminal electrification. Not only is neighboring real estate benefited thereby, but the "air rights" over the electrified tracks may become so valuable as to largely pay the cost of the change from steam. With the work but partly finished the Grand Central Terminal district is already a remarkable example of the indirect benefits derived from electrification.

Some of the principal advantages claimed for the electric as compared to the steam locomotive may be briefly stated as follows:

1. No structural limits restricting tractive effort and

speed of electric locomotive that can be handled by one operator.

2. Practical elimination of ruling grades by reason of the enormously powerful electric locomotives available.

3. Reduction of down grade dangers by using regenerative electric braking.

4. Very large reduction in cost of locomotive maintenance.

5. Very large saving of fuel, estimated as two-thirds the total now burned on steam engines in operation.

6. Conservation of our natural resources by utilizing water power where available.

7. Material reduction in engine and train crew expense by reason of higher speeds and greater hauling capacity.

8. Increased valuation of terminal real estate following electrification.

9. Increased reliability of operation.

10. Material reduction in operating expense due to elimination of steam engine tenders and most of the company coal movement, the two together expressed in ton-miles approximating nearly 20 per cent of present gross revenue ton-mileage.

11. Large reduction in effect of climatic conditions upon train operation.

12. Postponement of immediate necessity for constructing additional tracks on congested divisions.

13. Attractive return on cost of electrification by reason of direct and indirect operating savings effected.

14. Far-reaching improvements in operation that may revolutionize present methods of steam railroading.

Readers' Views and Comments

Graphical Calculation of Illumination

To the Editor of the ELECTRICAL WORLD:

SIR: You may be interested in a short cut in illumination calculations recently worked out by the writer, based upon the use of the illumination rule.*

In order to check up a prospective illumination lay-out for uniformity of light distribution, the "point by point" method is sometimes used. In applying this scheme representative points on the working plane are taken and the vertical intensity of the illumination at each point is found by adding the separate intensities from all lamps which contribute an appreciable amount. In this work the illumination rule is very convenient. The rule is laid off to the same scale as the lay-out being checked, and at various points the vertical intensities due to one lamp or lighting unit, at corresponding horizontal distances, are marked.

The vertical intensity of the illumination at any point may then be determined by placing one end of the rule at the point and reading the intensity due to each lamp that the rule includes as it is turned through a complete circle. The sum of all such readings is the total intensity at the point, due to all lamps. This process repeated for all of the points selected gives an indication of the uniformity of the illumination.

In determining the intensity at various points on the rule, the following formula is used:

$$I = \text{Cp.} \cos^3 \theta / H^2$$

In which

I = intensity of illumination at any given point in foot-candles (see Fig. 1).

Cp. = candlepower of the lamp in the direction of the point.

H = distance of the lamp above the working plane in feet.

θ = the angle included between the normal to the working plane and a line drawn from the lamp to the point.

In order to reduce the calculations involved in the construction of the rule, the accompanying graphical solution has been devised.

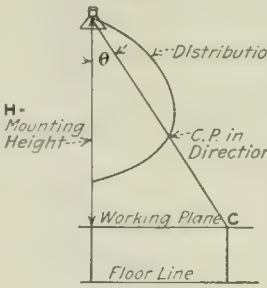


FIG. 1

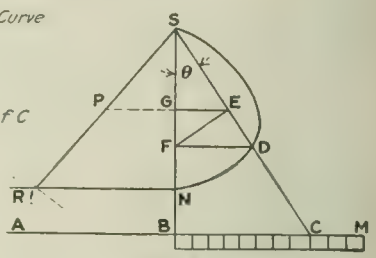


FIG. 2

FIGS. 1 AND 2—BASIS FOR GRAPHICAL SOLUTION

Referring to Fig. 2, draw an arbitrary base line AM. Draw SB perpendicular to AM equal to the mounting height H to same scale as point by point rule BM being made. Draw a distribution curve SDN to any convenient scale. From N draw RN parallel to AM. From S as a center and with a radius equal to the intensity at B to any convenient scale describe an arc cutting RN at R: draw RS. For any point as C draw SC. From the intersection of SC with the distribution curve, draw DF parallel to BM. Then draw FE perpendicular to SC, then GE parallel to BM. Project GE to RS and read intensity for point C at P, etc.

Proof of the method:

SD = candlepower in the direction of C.

SF = candlepower in the direction of $C \times \cos \theta$.

$SE = SF \cos \theta =$ (cp. in direction of C) $\times \cos^2 \theta$.

$SG = SE \cos \theta =$ (cp. in direction of C) $\times \cos^3 \theta$.

Since the intensity varies as (cp.) $\times \cos^3 \theta$,

Intensity at $C = (SG/SN) \times$ intensity at B. But, since by similar triangles $SP/SR = SG/SN$, intensity at $C = SP/SR \times$ intensity at B. But by scale $SR =$ intensity at B, therefore intensity at $C = SP$, to scale.

In order to avoid confusion in the use of this graphical method, the intensity at each point should be scaled and recorded on the rule before another point is taken up.

K. S. WEAVER,
University of Pennsylvania.

Philadelphia.

Dependability of the CO_2 Recorder

To the Editor of the ELECTRICAL WORLD:

SIR: We noted an interesting leader in the issue of Oct. 9 on boiler-room instruments. Toward the close the author says that it is unfortunate that the CO_2 recorder "is, generally speaking, a somewhat delicate piece of apparatus and none too responsive to changes resulting from rapidly changing firing conditions." Is it possible that he was thinking of the old-style CO_2 recorder with a multiplicity of glass bottles, rubber tubes and other fragile parts? A recorder which does not have these disadvantages was designed by a practical power-plant engineer who had suffered the engineer's usual experience and is now built in our own shops. It is very rugged and dependable and can make a complete analysis every two minutes that should surely take care of "rapidly changing firing conditions."

W. ELSWORTH LAWSON,
THE FOXBORO COMPANY, INC.

Foxboro, Mass.

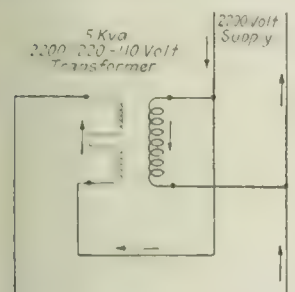
* See "Factory Lighting" by C. E. Clewell, p. 18.

Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Increasing Current of Constant-Current Transformer in Emergency

BY BOOSTING the primary voltage 10 per cent the current of an overloaded constant-current transformer was increased from 5.2 amp. to its normal output of 5.4 amp. in a recent emergency of an Eastern power company. This overloading resulted from some changes made on the lighting circuit which this transformer fed. When the operator tested the circuit he found that the transformer was overloaded so that the primary and secondary coils came together and the amperage was only 5.2 instead of 5.4, owing to the line construction department having cut in too many lights on the circuit.



CURRENT RAISED BY BOOSTING PRIMARY VOLTAGE

In order to avoid a delay in lighting this circuit the following temporary arrangement was made: A 5-kva., 2,200/220-volt transformer which was not in use was connected in the primary leg of the circuit as shown in diagram so as to "boost" the primary voltage 10 per cent. When the circuit was again made alive the coils stood about 2 in. (5 cm.) apart, giving the correct amperage of 5.4. This required only a few minutes so that there was no delay in lighting the circuit. Since that time the same arrangement was used on another circuit while waiting for a larger transformer which had been ordered.

Ampere, N. J. EUSTACE C. SOARES.

Rules for Connecting Service Switches and Meters

INSTRUCTIONS regarding proper installation of customers' services, ground connections and meters recently issued to employees of the Central Maine Power Company, Augusta, are as follows:

1. Meters should be securely fastened to the wall with three screws and not hung on one, as many are at present.

2. The practice of putting two separate circuits into meter terminal chambers instead of setting two cut-outs should not be allowed.

3. It should be remembered that all General Electric and Westinghouse meters run counter-clockwise or from the left to the right when facing meter. Sangamo and Fort Wayne meters run from right to left or clockwise.

4. The grounded side of the service should never be connected to the outside terminal of the meter; that is, the grounded wire should never be the one to go through the meter field.

5. If the inside men when doing new work would always see that the left-hand wire on their entrance switch is the grounded wire, it would never be necessary to cross these leads, as the meter is always placed to the right of the switch. It should be an easy matter to bring the grounded wire out of the conduit so that this will come right.

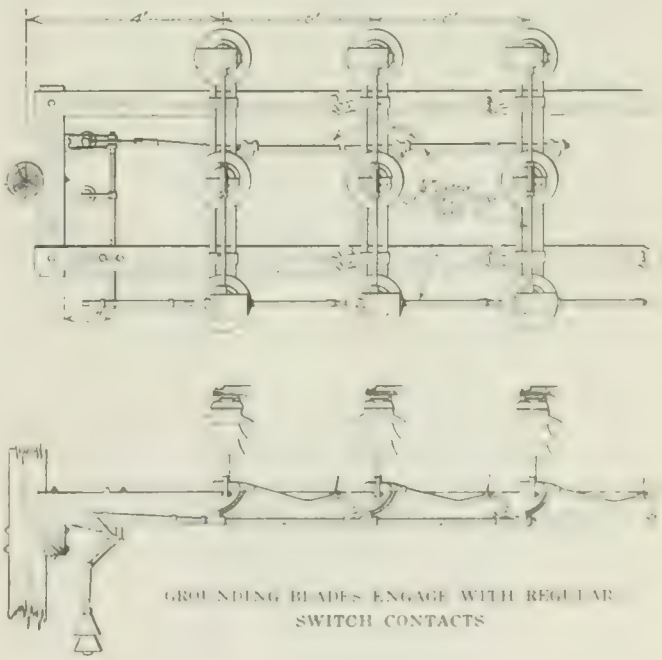
6. The practice of testing for the grounded wire by touching each line wire to a pipe should not be allowed—a test lamp should be used.

7. Care should be taken that it is the middle wire of a 110-220-volt transformer bitch that is grounded.

GEORGE S. WILLIAMS, General Superintendent.

Combined Outdoor Switch and Grounding Device

OWING to the adverse weather conditions near the Great Salt Lake and the accumulation of salt and cement from the chemical works and cement mills of that region, the Utah Power & Light Company has developed the equipment shown for use on its 44-kv. lines. The switch is made for mounting between poles and is assembled as a complete unit. Two operating levers are provided, one for controlling the switch and the other for controlling the grounding device. These are interlocked so that the switch cannot be grounded while it is closed. The rack is made of extra-heavy galvanized pipe, and the contact jaws are shielded for protection against dirt. The grounding switch is an integral part of the device and safely grounds all phases simultaneously, engaging with the regular switch contacts.


GROUNDING BLADES ENGAGE WITH REGULAR SWITCH CONTACTS

P. P. ASHWORTH,
Distribution Engineer.
Utah Power and Light Company.
Salt Lake City.

Company Supplies 2.5-Kva. Rural Transformer Installation for $375



13,200/110-220-VOLT SINGLE-PHASE TRANSFORMER INSTALLATION

FOR $375 the type of customer's transformer installation shown in the accompanying illustration is being supplied by the Miami Valley Electric Company of Sidney, Ohio, one of the Albert Emanuel Company properties. The installation is simple and is easily and cheaply installed. It consists of air-brake switches operated from the ground, horn-gap and resistance lightning arresters, choke coils, expulsion fuses and transformer. The approximate cost of a typical installation on a 13,200-volt line to supply 110-220-volt, single-phase service is shown in the following itemized tabulation of materials and labor:

2½-kva. transformer	$135.00
Switching equipment and lightning protection	160.00
Material for grounding neutral and lightning arrester	2.50
One three-wire secondary rack, bolts, washers and 300 ft. of No. 10 secondary	5.00
Labor, two men, four hours each at 50 cents per hour	4.00
Total	$306.50

For the equipment installed complete with a three-wire secondary not exceeding 100 ft. (31 m.) in length a charge of $375 is made to the farmer. This covers overhead and the slight difference in construction cost in different installations.

D. O. VAUGHN,
Chief Electrical Engineer.

Albert Emanuel Co.,
New York City.

Clinker Grinders Facilitate Operation

TO ELIMINATE the intermittent disposition of clinkers and ashes by dump grates a clinker grinder has been installed by the Detroit Edison Company for use in connection with Taylor stokers. Since the use of clinker grinders gives the highest degree of uniformity in furnace conditions at all times, it has been possible to cut down appreciably the carbon content of the ash. The clinkers and ash are removed from the furnace by the rotation of a toothed grinder, the clinkers being crushed between the grinder and a movable crusher plate. The clearance between the crusher and plate can be adjusted to suit the character of fuel and is a help to the fireman in keeping furnace conditions uniform. At present the grinder is driven by connection to the long-stroke link on the end retorts of the stoker through a ratchet wheel connected to the end of the grinder shaft. The fact that the speed is limited by the stoker speed is a disadvantage when slow-burning coal with a high ash content is used, because the ash cannot be removed fast enough to keep the grates clear of clinkers. This trouble is to be eliminated by an individual motor drive which can be operated at any speed which may be required.

With the present poor coal the grinder teeth wear rapidly. The shell, however, remains in good condition and the removable teeth may be replaced by new ones. The data given were presented in a paper by R. G. Filger of the Detroit Edison Company at the convention of the Michigan Section, N. E. L. A., at Ottawa Beach.

Relation of Lubricating Oil Used to Generator Size

THE amount of lubricating oil used by turbo-generators has been found to be approximately 0.298 gal. (1.12 l.) per hour for each 10,000 kw. of machine rating. The accompanying chart is based on this figure with the realization that straight line consumption curves may not hold true, as larger units may not use oil directly in proportion to their size compared to smaller units. Records were compiled from 108 machines, and although the results were somewhat irregular and in some cases it was not known whether the oil used included that supplied to both generator and turbine, yet the rates were closely enough related to permit using the average.

To illustrate the application of the chart take, for example, a 4,000-kw. unit, operating 120 hours per week. Following along the horizontal line on the chart to the number 4, and then following up vertically to where this vertical line cuts the inclined line marked 120, and following this intersection to the left, we find that such a machine should use fifteen barrels of oil a

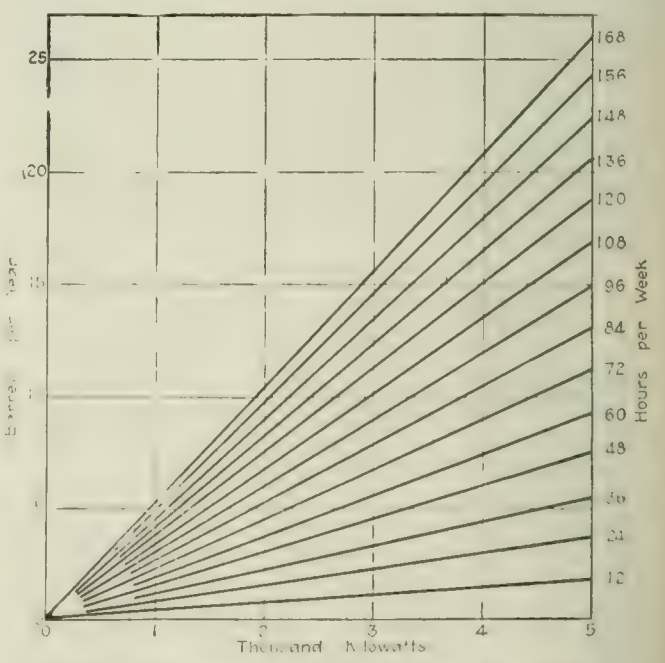


CHART FOR ESTIMATING ANNUAL OIL CONSUMPTION OF TURBO-GENERATOR SETS

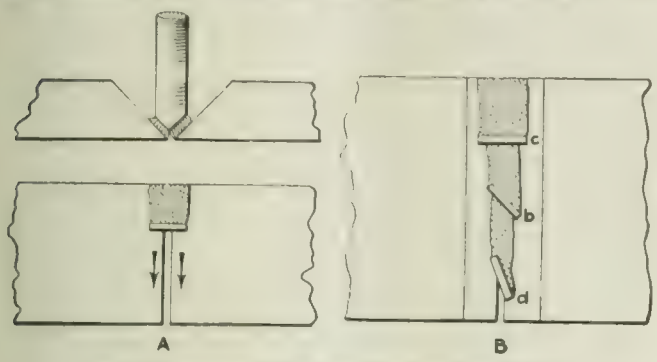
year. Although the chart is not intended to give the results with great accuracy, yet in the absence of other data it will give an idea of the estimated yearly consumption of a new machine.

Industrial Applications

The Economical Utilization of Electrical Energy
in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

Flat Welding Electrode Requires Less Skill

LESS time and skill are required for welding seams with an electrode in the shape of flat wire than with the common round electrode. The flat electrode, *A*, assumes a "V" shape, corresponding to the V in



FLAT ELECTRODE DOES NOT REQUIRE WEAVING

which the weld is being made, owing to the fact that the arc centers at those points closest to the metal and thus melts off the electrode to a uniform distance from the welded metal. This relieves the operator from the necessity of skillfully weaving the electrode from side to side and down into the bottom of the notch. He has only to move the electrode along the cam and feed it into the arc as it melts off. After the weld is completed in the bottom of the notch the electrode is used as shown in *B* to produce a broad, uniformly flat weld.

When using this electrode it is necessary for a welder to carry only one size and use it either flat or edgewise for wider or narrower seams. The wire is also particularly fitted for use with automatic welding machines since it will give broad runs without side motion.

Quasi-Arc Weltrode Company, Brooklyn, N. Y.

W. W. PALMER, Electrical Engineer.

Removal of Shunt from Interpole Winding Improved Operation

IN AN obstinate case of trouble with an old interpole railway machine many attempts to get good operation with an interpole shunt were unsuccessful. Perfect operation was finally obtained by removing two turns from each interpole coil and operating without any shunt around the interpoles.

This was one of the earlier machines, on which interpoles were often wound with the magnetic strength of the interpoles too great, and this was reduced to the correct value by placing shunts around the interpoles. This serves well enough for ordinary loads, but for fluctuating loads, such as street railways or steel-mill duty, the results are not satisfactory. The reason for this is that the shunts are practically non-inductive while the interpole windings are inductive. Hence when a sudden change in load occurs most of the current passes through the shunt and the current in the interpole circuit is insufficient to maintain the interpole strength at the correct value for the increased armature current. Consequently sparking occurs at the brushes.

JAMES DIXON.

Reliance Electric & Engineering Company,
Cleveland, Ohio.

Rewinding a Two-Phase Motor for Three-Phase Operation

CHANGING a two-phase, six-pole motor to operate at the same speed on three-phase energy of the same voltage and frequency was recently accomplished by the writer by rewinding in the method here outlined. The motor was a 100-hp., 220-volt, two-phase, 60-cycle, six-pole, 1,120-r.p.m. squirrel-cage induction motor. The two-phase winding consisted of ninety-six coils, in two layers with eight turns of three No. 10 double-cotton-covered wires per coil, pitch 1 to 12, connected six-parallel, eight coils per group, in twelve groups. The total two-phase winding in series was good for $2 \times 6 \times 220 = 2{,}640$ volts, with a chord factor of 0.88185. The voltage per phase for three-phase would be $2{,}640 \div 3 = 880$ volts per line for a series-delta connection. Although $880 \div 220 = 4$, a four-parallel connection cannot be had on a six-pole motor. A two-parallel connection, however, would give $880 \div 2 = 440$ volts, and to get 220 volts the number of turns per coil could be decreased 50 per cent and the cross-section doubled. The equation $2{,}640 \div 3 = 880$ does not take into consideration the distribution factor, which is 0.905 for a two-phase and 0.995 for a three-phase motor. Taking this into account, the corrected three-phase voltage would be $(0.955 \div 0.905) \times (2{,}640 \div 3) = 1.0552 \times 880 = 928.576$ volts, and with a full-pitch winding the three-phase voltage would be $928.58 \div 0.882 = 1{,}052.81$ volts.

A chord factor was accordingly chosen which would decrease the voltage to 880. This chord factor is $880 \div 1{,}052.81 = 0.8349$, which is the sine of the angle 56° 36′ nearly. Therefore the coil must span $2 \times 56° 36′ = 113°$ in electrical degrees. But one slot spans $180° \div$ (16 slots per pole) $= 11.25°$. Therefore the coil pitch will be $113° \div 11.25° = 10$ slots, or a pitch of 1 to 11. This pitch gives an exact chord factor of 0.83147); thus the three-phase voltage $= (1{,}052.81 \times 0.83147) \div 4 = 218.84$ volts, which is close enough to 220 volts for satisfactory running.

The stator was therefore rewound for three phases with ninety-six coils having four turns of six No. 10 double-cotton-covered wires in parallel per coil, pitch 1 to 11, connected two parallel delta, thirty-two coils per phase, and sixteen coils per circuit. The grouping for ninety-six slots, three phases and six poles was odd. A top-to-top connection was used, the coils being

grouped and arranged as follows: 6-5-5, 5-6-5, 5-5-5, 5-5-6, 5-6-5.

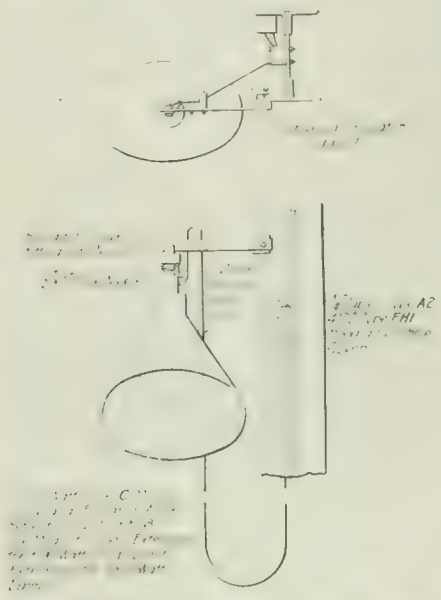
After this change had been made the motor operated satisfactorily.

A. C. Roe.

Detroit, Mich.

Industrial Lighting Fixture Which May Be Raised, Lowered or Detached

A LIGHTING unit which may be raised or lowered on its support, or even detached for use as a portable extension lamp, is employed at the Hog Island shipbuilding yards. This fixture, as may be seen from the accompanying drawing, is held on the flange of a structural-steel column by means of a strap-iron arm bolted to a universal 2½-in. (6.3-cm.) insulator support. By loosening the bolt in the insulator support the lamp may be raised to any desired height, or may be detached altogether and transported to any nearby work where it may be required. The lamp is enclosed in a Benjamin angle reflector No. 5,537 and hung on the end of the arm by means of a Benjamin suspension fitting No. 6,031. Mogul extensions are used for 500-watt lamps, but no extension is required with 1,000-watt lamps. Electrical connection is made through 20 ft. (6 m.) of flexible No. 14 packing-house cord.



LAMP MAY BE ADJUSTED TO ANY HEIGHT OR DETACHED FOR USE AS PORTABLE LIGHT

Inspection System Which Keeps 1,200 Motors Running

TO "KEEP the wheels turning" the maintenance system developed in a Canadian textile mill has been found successful with 1,200 motors ranging from ¼ hp. to 250 hp. in size. Inspections are made as follows:

Motors.—Very little inspection can be made of motors when in position, but in the open type the air gap may be noted. See if oil is creeping along the shaft and being thrown on the stator coils, or if there is any vibration. Oilers must notify the electrical department when a motor is hotter than usual. Motors are thoroughly overhauled once a year, for which purpose they are carried to the shop, taken apart, cleaned, the bearings attended to and the motors revarnished and tested. If a spare machine is not available, the overhauling is done at the week end. In very dirty places it is advisable to drain the oil from bearings every six months. If the oil is clear after it has settled some time, it can be used again. In textile mills look out for cotton fluff forming a siphon. See that the oil rings revolve freely; try turning them with a lead pencil.

Control Equipment.—Isolating panels, circuit breakers, compensators, controllers, resistors, etc., are examined and overhauled every three months, for which purpose all apparatus is made dead. In cases which call for frequent stopping and starting, the apparatus is examined every six weeks. A record of these examinations is kept. Inspection of control apparatus is classified as follows:

Isolating Panels.—Examine for loose connections, signs of arcing or burning. Unscrew plug to see if it sticks and if very tight put vaseline on the thread. Test for slack bolts holding panel on frame.

Automatic Circuit Breakers.—Look for loose connections, for signs of heating of leads or stems of contacts and for bad contacts. If contacts are burned, file and adjust; if too badly burned, renew them. Examine oil for sediment and height. Examine time element for loose nuts, screws, etc. Remove dashpot, examine needle valve, see if oil is clean and at right level, replace dashpot, close breaker and test operation.

Overload Relays.—Same as for circuit breakers. Examine silver contacts of toggle switch which operates the no-voltage coil. Test.

Fuse Boxes.—Look for loose connections, signs of heating by color of contacts; test amount of spring in the fuse clips; look for loose bolts.

Compensators.—Remove case and examine for loose connections, condition of insulation, etc. Examine contacts; file and adjust and renew bad ones. See that the handle works freely and the pawl engages correctly. If any sediment is in oil tank, throw away old oil, clean out tank and fill with new oil. Examine plunger of no-voltage coil.

Ground Wires.—Examine the connections on the water pipe or other ground for signs of rust or corrosion. Examine whole length of ground wire.

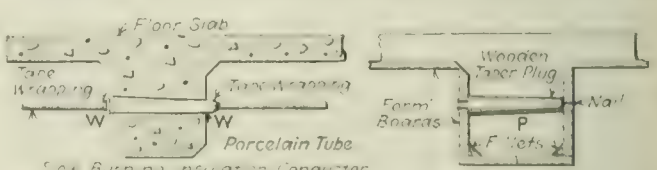
Glasgow, Scotland.

H. E. Wood.

Running Open-Work Conductors Through Concrete Beams

IN FACTORY buildings of reinforced concrete there are sometimes a number of open-work conductors to be run along the ceiling of the lower floor at right angles to the direction of the beams, and it is desired that these conductors shall pass through the beams, rather than be supported on the lower faces. This can be accomplished by nailing a conical taper plug in the beam forms, before the concrete is poured, at each place where a conductor is to pass through (*P* in the illustration). Then, after the concrete has set, the plug is driven out. Each of the holes through the beams is bushed with a porcelain tube. The tube is held from slipping along the conductor by tape wrappings at each end.

An open-work conductor run arranged as shown should be firmly held on strain insulators, which take the tension at each end of the run. A tightening arrangement of some sort should also be provided in conjunction with the strain insulators. The porcelain tubes through each beam simply insulate the conductor from the beam and, obviously, do not prevent it from "slacking back."



CONDUCTOR RUN THROUGH HOLE FORMED IN CONCRETE BEAM

Method of preparing form before pouring concrete is shown at right

James B. Bond.

Omaha, Neb.

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

Present Cost of Materials Compared with 1915 Prices

A COMPARISON of the costs of materials and supplies used and labor employed by a public utility as between July 1, 1915; July 1, 1918, and July 1, 1920, was brought out in a recent hearing before the Railroad Commission of Georgia. The accompanying

COSTS OF COMMODITIES AND MATERIALS F.O.B. ATLANTA AND RELATIVE COST OF LABOR

	1915	1918	1920
Coal, per ton	$2 35	$5 01	$11 80
Gas oil, per gal	0 04½	0 091	0 14
Copper, per lb	0 23	0 27	0 24½
Steel wire, per lb	0 023	0 037	0 039
Standard poles, each, set	10 50	14 00	20 00
Crossarms and brackets	0 98	0 94	1 67
Yellow pine lumber, per 1,000 ft	16 00	34 00	55 00
Insulators	0 95	2 24	2 80
Creosoted ties, each	0 69	1 07	2 02
Cement, per bbl	1 25	2 18	4 50
Linemen, per hour	$0 30 $0 31—$0 36	$0 31—$0 40	$0.57—$0 63½
Common labor, per hour		20— 21½	35
Machinists, per hour	39— 44	.50	83 .85
Carpenters, per hour	27 32	42 45	70 80
Painters, per hour	18 39	25 48	63— 80

table includes the costs of labor and material which were recognized by the commission as greatly increasing operating costs over those of pre-war times.

Increasing Salesmen's Salaries Reduces Cost of New Business

AT THE end of the year 1919 the sales department of the Narragansett Electric Lighting Company, Providence, R. I., was faced with the problem of increasing the remuneration of its lighting salesmen. At the same time it was not wise to increase the cost of getting business. Previous to this year the salesmen had been paid on a salary and commission basis. They wanted an increase for 1920 and felt sure that they would show better results if they received more money for the business secured. After discussing the matter pro and con, the following system was adopted:

A salary equal to the salary and commission earned in 1919 was fixed for each salesman. A quota equal to the amount of business he secured during the year 1919 was then named for each man, the year's business being divided by twelve to arrive at the monthly quota. For each new meter over and above his quota the salesman is paid $3. Renewals, change of names and the like are not classed as new meters. Only entirely new installations, resulting from new wiring jobs, are so considered.

In addition, the salesmen must look after routine business, for which they receive no direct remuneration aside from their salaries. If this business does not receive adequate attention, it is understood that the territory will be divided and part of it given to a new man. This naturally would reduce the salesman's earnings, and it has been found that he will not become so enthusiastic in obtaining new business as to forget about the old.

No man is paid any commissions until he has met his quota. Upon failure to make it one month, the difference between the business actually secured and the amount stipulated is added to his quota for the following month. In other words, each man must earn his salary before he receives a commission. This arrangement protects the company against an increase in the cost of getting business, and it is fair to the salesman because it is based upon actual past performance. This method has eliminated most of the serious disadvantages of the quota system, and in no case is the quota so high as to discourage the salesman.

Although perfection is not claimed for the system, it has brought results. There has been no change in the personnel of the department. The year 1919 showed a good record, but by May, 1920, more new business had been secured than during the whole of 1919. It is expected that the new business for the year 1920 will amount to 250 per cent of that of 1919.

The salesmen have received considerably more money than they would have received by a raise in salary or an increase of commissions without a quota to which they must work in order to earn additional money. The average amount paid to all the men is about 50 per cent more than was paid to them in 1919, but the actual cost of getting the business has been reduced about 25 per cent.

Light Bills Used to Advertise Civic Enterprises



ADVERTISING WHICH GAINED COMMENDATION OF PUBLIC

THE Western Light & Power Company of Colorado is using the back of the bills which it sends to consumers to advertise various civic undertakings held for the public good. As an example the company's district office at Boulder advertised the Larimer County Fair on the back of bills that reach the customers in that territory. In this manner the information is carried to about 20,000 people. This is one of the many ways in which a public utility can gain favor with its consumers and at the same time help to promote civic and county pride.

New Orleans Company Makes Merchandising Department Profitable

CENTRAL-STATION executives and commercial managers who have asked the question "Does my merchandise department pay and what method should be employed to secure the best result?" will be interested in the following letter from W. E. Clement, commercial agent of the New Orleans (La.) Railway & Light Company:

"Our policy has always been to operate our merchandise department at a profit; in fact, the profits very nearly pay for the operation of the entire commercial department. Practically everything in the electric appliance line is carried. At one time we sold some lighting fixtures, such as portable lamps, domes, etc., but have discontinued this practice and for several months past have sold only labor-saving and household convenience appliances.

"An extensive salesroom is maintained in which we display all of the appliances carried. An atmosphere of activity is given to the salesroom by demonstrations of the different appliances. The demonstrations are varied from time to time to avoid monotony. Most of our sales people are young men, although in the salesroom we employ two or three young women. Outside salesmen handle routine business, obtaining applications for light and power, collecting deposits and other matters incident to giving good service, for which they are paid a nominal salary of from $50 to $65 per month. In addition to this salary salesmen receive a commission of 10 per cent on all appliances and tungsten lamps which they sell.

"Our relations with the contractors and dealers are most satisfactory as we confine our sales strictly to electric appliances, most of which are purchased from local electrical jobbers. The company does no house wiring whatsoever, nor does it sell electrical supplies, all of this business being referred to the contractors and dealers. By this arrangement we have been able to obtain and hold the good-will of every one engaged in the electrical business in our city.

"In order to popularize the use of electric appliances we have found it advisable to maintain a repair department in which we repair customers' appliances. No work is done free of charge, with the exception that we make good such guarantees as cover appliances for a certain length of time. All other repair work is charged for on the basis of cost plus a reasonable profit. Nearly all appliances are sold on the installment plan, 5 per cent being added to the cash sale price to cover interest in handling the account when the deferred-payment plan is desired. On washing machines and the higher-priced appliances we have a plan under which we add to the selling price $1 per month for the period over which the customer desires installment payments to run. The limit under this plan is fifteen months.

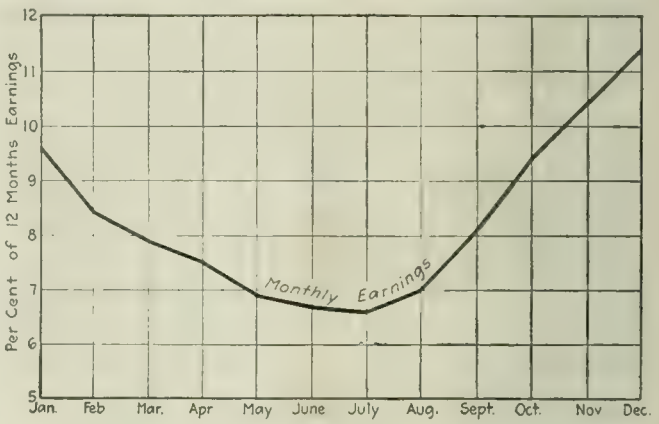
"A cost-accounting system is maintained whereby our profit or loss can be ascertained easily and accurately. All merchandise is carried in stock and charged to operating account as it is sold. The sales are credited daily to this account, so that at the end of the month the auditor can easily render a statement showing results of operation for the month. Once a year an inventory is taken of all stock, discrepancies are rectified and all obsolete appliances are disposed of, the resulting loss being charged off."

Mr. Clement has had charge of the sales department of the New Orleans Railway & Light Company for a number of years, and his comments are made after a wide experience under varying conditions.

Estimating Utility Earnings from Graphic Records

AT THE Kineo (Me.) convention of the New England Geographic Division, N. E. L. A., W. H. Blood, Jr., of Stone & Webster, said that in his work he has frequently been called upon to make estimates of earnings and expenses when the earnings for part of a year or only a month or two were available. To arrive at the proper multiplier the following method was pursued:

Various lighting companies were grouped as to earnings, there being about 200 companies all told. The



DATA ON AVERAGE MONTHLY EARNINGS OF 200 COMPANIES

earnings were ascertained by months and the percentage each month's earnings bore to those of the year were plotted for all the companies on the same sheet, after which a mean was drawn. The diagram shown herewith represents this mean, and the table accompanying it was deduced from the values taken from this curve.

Column 3 of this table, headed "Multiplying Factor," gives the multiplier to be applied to any particular month's earnings to give the yearly earnings. Thus, the January earnings are 9.6 per cent of the year's earnings, and if a certain company earned A dollars in January the yearly income would be $A \times 10.5$. Column 4 gives the multiplier to be applied to the accumulated

RATIO OF MONTHLY EARNINGS TO TWELVE MONTHS' EARNINGS

	Per Cent of 12 Months		Multiplying Factor	
	1 Month	Cumulative	1 Month	Cumulative
January	9 6	9 6	10 5	10.48
February	8.4	18.0	11.9	5.57
March	7 9	25 9	12.7	3.86
April	7 5	33 4	13 3	2.97
May	6 09	40 3	14.3	2.48
June	6.7	47.0	14.9	2.12
July	6.6	53 6	15.1	1.86
August	7.0	60.7	14.2	1.65
September	8.1	68.8	12.3	1.45
October	9.4	78.2	10.7	1.28
November	10 4	88 6	9 65	1.13
December	11 4	100 0	8 82	1.00

earnings to and including any particular month to give the year's revenue. For example, from January to May inclusive 40.3 per cent of the year's revenue is earned. If this value is A, for convenience to get the probable revenue for a year we must multiply A by 2.48. The method of using the mean in obtaining the curve and table permits the elimination of companies where the earnings are erratic, whereas if figures alone were used the erratic companies would naturally be included.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Field Leakage in Synchronous Machines—THEO. SCHOU.—A method of analyzing and determining field leakage between poles of low-speed and high-speed synchronous machines.—*Electrical Review*, Aug. 21, 1920.

Lamps and Lighting

Distance Control of Searchlamps.—A descriptive article dealing with German methods for controlling the direction of the beam of light from searchlamps. In the German navy a system of torsion rods was used to link up the control wheel with the tipping and rotating gears on the searchlamp. However, if ordinary gear drives are used, the searchlamps when the apparatus is rotated will unintentionally carry out a tipping motion, since the tipping gears will be affected when the whole mechanism turns around. Several methods for correcting this error are described. These make it possible to have one given position of the two control handles to correspond to one and only one position of the searchlamp. A special searchlamp design for ship service is described in which two plane mirrors are used to throw out the beam of light, the searchlamp itself being placed inside the hull in a protected position and the beam of light coming up through the hollow steel mast of the ship.—*Elektrotechnische Zeitschrift*, Aug. 26, 1920.

Relative Spectral Transmission of the Atmosphere.—ENOCH KARRER and E. P. TYNDALL.—As part of the searchlamp investigation of the bureau, data have been taken on the relative spectral transmission of the atmosphere. Light from an incandescent lamp was reflected by a mirror 600 m. distant, and the intensity of this reflected light was compared, by means of a spectrophotometer, with the intensity of a beam directly from the lamp. Curves are given for three types of weather conditions—(1) clear and cold, (2) overcast with high humidity, (3) rainy. The first type shows very little selectivity. The second and third types are similar for wave lengths less than 540 μ, there being a decrease in transmission for shorter lengths. In the rest of the visible spectrum the curves of the second type present two maxima and a minimum, which are entirely lacking in the curves for rainy weather. The conclusion drawn from these curves is that the transmission of the atmosphere under the conditions prevailing during the experiments is greatest in the yellow and orange regions of the spectrum.—*Scientific Paper No. 389, United States Bureau of Standards*, July 21, 1920.

Generation, Transmission and Distribution

Efficiency of Aërials and Power Required for Long-Distance Transmission.—G. W. O. HOWE.—That portion of the total energy supplied to the aërial of a transmitting station which is dissipated in the resistance of the wires constituting the aërial, tuning coils and secondary winding of the oscillation transformer, and earth or counterpoise wires, dielectric losses, etc., are calculated by the author.—London *Electrician*, Sept. 10, 1920.

Induction Coefficients of Electric Lines.—CAPDEVILLE.—The author presents a simplified method for determining the coefficients of self-induction and mutual induction between wires which should be useful in complicated cases, particularly in problems concerning polyphase systems. The method depends on the introduction of a fictitious return conductor. Since no current flows in this conductor, it may be reduced to a line, and since no magnetic action can result from zero current, the location of the fictitious neutral appears to be arbitrary. Further consideration of certain invariants, however, discloses that the fictitious conductor may be put in one particular place only, which is defined as the "magnetic center" of the wire system. The various induction coefficients now may be expressed in terms of the distances from the respective wires to this magnetic center. Well-known three-phase formulas are derived as examples of the use of this device, applications to more complicated cases being reserved for a later publication.—*Revue Générale de l'Electricité*, July 31, 1920.

Installations, Systems and Appliances

Method of Testing Magnet Steels.—F. R. HOUSDEN.—Apparatus is described which enables a steel test bar to be brought to the saturated magnetic state in order to produce the maximum remanence and then to have the portion of its hysteresis loop in the second quadrant examined more in detail.—*Beama* (London), September, 1920.

Design of Electrical Installations for Ships.—C. H. WORDINGHAM.—The author says that for use on shipboard electric power has demonstrated its reliability. Its advantages are great, for, in addition to its convenience, adaptability and ease of manipulation, it has the further great merit of being available at any instant, whereas it is unavoidable that steam plant entails either a preliminary warming up or losses while standing. In dealing with distribution systems the author states that alternating current is inferior to direct current on shipboard, particularly on account of the danger of shock. He gives advantages of the radiating system of distribution and deals with the proper selection and protection of cables in this service.—London *Electrician*, Sept. 3, 1920.

New Electrical Precipitation Treater.—MOTOJI SHIBUSAWA and YASUJIRO NIWA.—A description and the theory of a new electrical precipitation treater, with results of experimental work in laboratories. The paper contains: (1) General description of the new precipitation treater, with glass-covered electrodes; (2) experiments of the electrotechnical laboratory, Tokyo, Japan; (3) experiments at the copper refining factory at Nikko; (4) field of practical application of the new pre-

cipitation treater; (5) theory of the new treater. An extensive oscillographic study of the treater is given in this article.—*Journal A. I. E. E.*, October, 1920.

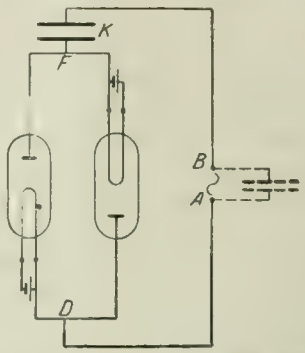
Electrophysics and Magnetism

Resistance and Constancy of Aluminum Contacts.—R. RICHTER.—The author gives a most comprehensive and detailed report of the results of a long series of systematic investigations, made at Karlsruhe, to determine the reliability of contacts between aluminum and other metals. The work covers a period of more than three years, during which time 421 screwed, riveted, twisted, soldered and welded contact specimens were investigated. The samples were arranged on wooden frames, in groups of twenty-four in series, and direct current of 10 amp. was passed through the groups. Each contact was provided with potential terminals, and the resistance was computed from observations of the voltage drop. Each set of contacts was tested by loading it for a long time with 15 amp. alternating current. Load runs were made in dry and moist air and in air containing sulphur dioxide. The contacts also were exposed to mechanical vibrations. During all these tests careful track was kept of the resistance. The screw connectors consisted of cylindrical pieces, 12 mm. (0.5 in.) in diameter and 30 mm. (1.2 in.) long with a co-axial hole for 3-mm. (⅛-in.) aluminum wire, the wire being clamped by one to three screws for each wire end. Screw connectors for aluminum wire were found reliable only when made of brass and when provided with at least three screws per wire. Screw connections of aluminum, zinc, iron and copper were tested, but proved unreliable. Welded contacts between aluminum wires were found entirely reliable. Soldered connections stood the test only when made by means of soldering connectors of solid aluminum, of cylindrical shape, similar to the screw connectors, but provided with an oblong hole in the side for pouring in the solder. It proved advantageous to cover up the aluminum solder with ordinary tin solder. Riveted aluminum-wire connections and twisted connections with and without sleeves were entirely unreliable, but riveted lug connections between aluminum wire and brass lugs seemed to have some stability. The article contains thirty comprehensive tables covering the numerical results of almost every run.—*Elektrotechnische Zeitschrift*, May 6, 13, 20, 27, June 3 and 10, 1920.

Units, Measurements and Instruments

Energetics of Telephone Receivers.—HEIICHI NUKIYAMA.—It is stated that the essential part of the mathematical theory presented in this paper consists of the power analysis in the magnetic circuit which is the main power-transforming system in telephone receivers.—*Technology Reports*, Vol. 1, No. 3. *Tohoku Imperial University*, 1920.

Improvements in Cathode-Ray Oscillographs.—ROGOWSKI.—In the cathode-ray oscillograph an auxiliary electric current gives the cathode ray a motion along the axis of the abscissa at right angles to the direction of motion given to it by the current which is to be studied on the oscillogram. If a sine current is used for the time-axis motion, the scale will not be uniform. Zenneck and Roschansky have suggested devices for giving the ray a constant velocity along the time axis. The present author proposes to use an auxiliary current of triangular wave form, obtained by means of two thermionic valves as indicated in the figure. The condenser K is charged and discharged by a source of alternating current AB, the charging current passing through one and the discharge through the other of the two valves. The impressed voltage must be so high that in either tube the saturation current is obtained almost instantly for every reversal. The condenser K then will be charged and discharged with constant current—that is, under a voltage which varies



VALVE ARRANGEMENT FOR TIME-AXIS MOTION IN CATHODE-RAY OSCILLOGRAPH

directly with time—and if the condenser voltage is impressed upon two auxiliary deflecting plates in the cathode tube, the ray will get the desired linear time-axis motion. In another article Rogowski and Glage describe some experiments with this device, and present oscillograms which show the degree of linearity obtained in the apparatus.—*Archiv für Elektrotechnik*, July 8, 1920.

Telegraphy, Telephony and Signals

Static Elimination by Directional Reception.—GREENLEAF W. PICKARD.—The author considers the possible origins of static and inclines toward a solar origin. He finds that static comes from all directions, with maximum intensity from above and maximum frequency from the horizon. The probable static wave form is a single highly damped pulse. He then describes his early work with loop directional receivers, his invention of the so-called "Dieckmann cage" and his early work in static elimination. He also gives the three-dimensional reception characteristics of linear antennas, loops and various combinations of these. The work carried on under his direction at the Otter Cliffs (Me.) receiving station is described in detail. Highly successful loop-and-antenna combinations were used in static elimination, and these are discussed with numerical results.—*Proceedings Institute of Radio Engineers*, October, 1920.

Energy Measurements in the Radiation Field of Airplane Antenna.—BALDUS AND HASE.—The radiation energy was observed by means of a stationary receiving antenna with loosely coupled aperiodic circuit. The current in the aperiodic circuit was measured by barretter and string galvanometer, and by this arrangement antenna energies down to 10^{-7} watts could be determined. A great number of measurements were made under various conditions, and the results are shown in numerous curve charts. The results seem to indicate that as far as the field energy at a reasonable distance is concerned, a hanging airplane antenna may be replaced by an oscillating dipol, whose axis forms the same angle with the vertical as does the antenna.—*Jarbuch für drahtlose Tel. und Tel.*, May, 1920.

Books of Technical and Industrial Interest

ARMATURE WINDING AND MOTOR REPAIR. By Daniel H. Braymer. New York: McGraw-Hill Book Company, Inc. 515 pages, 301 illustrations.

Actual detailed methods which have been found practicable in repair shops for winding and reconnecting armatures and for locating and correcting motor troubles have been compiled in this book. As no theoretical or design problems are discussed the work is especially fitted to the needs of the electrical men in industrial plants and of repairmen and armature winders in repair shops. The book is written from the "how-to-do-it" standpoint on the winding of direct-current and alternating-current motors, connection and repair of commutators, adjustment of brushes, operation of starters location and remedying of motor and generator troubles, and on the machines and tools needed for repair work. Another feature is that the instructions are arranged so that one step follows another in the same order in which the repairman comes to them on the job. An appendix of tables contains information on sizes of wiring for motors, transformers, fuses and different types of drives. A full chapter is devoted to methods of repairing and rebuilding commutators and another to methods used by repairmen to solve special troubles.

VOCABULAIRE EN CINQ LANGUES DE TÉLÉGRAPHIE ET TÉLÉPHONIE SANS FIL. Par Henri Viard. Paris: Gauthier-Villars et Cie.

Here is a little polyglot dictionary which will be of more than ordinary value to translators and to all who are endeavoring to keep abreast of international progress in wireless telegraphy and telephony by recourse to original documents printed in foreign languages. The five tongues from which terms are here collated, with the definitions officially adopted, are the five which among them divide the speech of the great majority of the inhabitants of the Western World—English, French, Italian, Spanish and German. The vocabulary is printed in parallel columns with the English word first, but to make it easy to find a required equivalent for a word, perhaps entirely different, in one of the other four languages an index is included in which the terms other than English are alphabetically arranged and the exact paragraph in which each will be found is indicated. Thus, if a Frenchman should want the official definition or a foreign translation of "vibrateur" or "ronfleur," the Italian of "risonatore," the Spaniard of "zumbador," or the German of "summer," none of them would be likely to hunt under "b," but a glance at the index would show that "buzzer" was in this instance the key word. The definitions of every term are printed in both English and French and great care to assure correctness has been taken. At the end of the book the international and American Morse radio codes are compared. The publishers, rightly we think, predict that the book will have a hearty welcome from specialists who know by experience that if science has no frontiers languages have

THE BLUE BOOK. The "Electrician" Directory and Handbook of the Electrical Engineering and Allied Trades. London: Benn Brothers, Ltd. 1,445 pages.

The thirty-eighth edition of "The Blue Book," which is the electrical trades directory and handbook published by the London *Electrician*, is thoroughly revised and completely reset. It contains about 100 pages more than the 1919 edition, with the usual arrangement made up in five divisions, as follows: "Handbook," "Alphabetical British Division," "Classified British Division," "Colonial Division" and "Continental Division." In reviewing some of the new features of the handbook the editor comments as follows: "The year 1919 has been a momentous one in the history of the electrical industry, for not only did it witness the successful reconstruction of firms on a peace basis, but it gave birth to the electricity (supply) act, the most important piece of legislation affecting electricity supply since 1882, and to the Ministry of Transport act. The former measure calls into being the electricity commissioners, with extensive powers for the reorganization and development of electricity supply on a national basis, and makes some useful amendments of the electric lighting acts, 1882 to 1909; while the latter act confers wide powers on the Minister of Transport for the organization of the railways and the introduction of electric traction. Already the Electricity Commissioners have started on their important task, and the Minister of Transport has formed a strong committee to report on the most suitable system of electric traction. These measures foreshadow extensive demands for generating plant, rolling stock and equipment from manufacturers and contractors who are already crowded with contracts for extensions of plant postponed owing to the war. The plant on order or decided upon represents over 1,000,000 kw., and many other extensions and new stations are projected. The same happy state of affairs applies to the other branches of the industry—to the manufacturers of electric wires and cables, electric fittings and accessories, wiring contractors, telephone and telegraph engineers, etc."

Books Received

ARTIFICIAL LIGHT. By M. Luckiesh. New York: The Century Company. 366 pages, illustrated.

SERVICE AT COST PLANS. By Harlow C. Clark. New York: American Electric Railway Association. 315 pages.

SPOT AND ARC WELDING. By H. A. Hornor. Philadelphia: J. B. Lippincott Company. 296 pages.

DIRECT-CURRENT MOTOR AND GENERATOR TROUBLES. By Theodore C. Gandy and Elmer C. Schact. New York: McGraw-Hill Book Company, Inc. 274 pages, 109 illustrations.

NINTH ANNUAL REPORT OF THE PUBLIC SERVICE COMMISSION OF WASHINGTON TO THE GOVERNOR. Olympia, Wash.: Frank M. Lamborn, Public Printer.

THE PUBLIC UTILITIES ACT, STATE OF WYOMING Including all amendments to March 1, 1920. Cheyenne Wyo.: Public Service Commission of Wyoming.

EXPORTER'S GAZETTEER OF FOREIGN MARKETS. Compiled and edited by Lloyd R. Morris. New York: Johnston Export Publishing Company. 766 pages.

TWELFTH ANNUAL REPORT OF THE HYDRO-ELECTRIC POWER COMMISSION OF THE PROVINCE OF ONTARIO, FOR THE YEAR ENDED OCT. 31, 1919. Vol. I. Toronto: A. T. Wilgress.

ADVOCATES of steam and electrical operation of railroads, men of high professional standing, held a debate at a joint meeting of the A. I. E. E. and the A. S. M. E. in New York City that attracted great attention among engineers. Electrification was shown to be so successful as an operative means that the question resolved itself into one of whether in each case the change would be financially advantageous.

SPEAKING before the Electric Club of Chicago, Dr. Charles P. Steinmetz advocated railroad electrification as a means of saving fuel.

DIFFICULTIES in applying the emergency coal order of the Interstate Commerce Commission are being encountered, and many utilities are asking for a restoration of assigned cars.

OHIO, Oklahoma and Missouri have been added to the number of states in which bureaus for the dissemination of information regarding public utilities have been established.

"LIGHTNING Protection" will be the topic of the A. I. E. E. meeting at Chicago on Nov. 12.

THE GOOD-WILL advertising campaign undertaken by the Public Relations Section of the N. E. L. A. is developing rapidly through the medium of pamphlets and magazine announcements.

LOWER interest rates for the securities of the public utilities are looked for by E. W. Niver of Halsey, Stuart & Company, New York, whose views have been given to the ELECTRICAL WORLD.

UTILITIES of New York City have pooled their coal supplies, amounting to 440,000 tons, to prevent the likelihood of any of them being compelled to shut down.

HEAVY October snows totaling 46 inches have already fallen in the Sierra Mountains, and Pacific Coast hydro-electric stations look for a plentiful supply of water next year.

EXCESS coal cost is taken into consideration by the Pittsfield (Mass.) Electric Company in a lighting schedule to go into effect on Nov. 1.

A PROPOSED reorganization of the American Bureau of Welding is to be discussed at a meeting in New York City on Friday of next week.

A COMPLETE investigation of all the hydro-electric and water-storage possibilities of California is advocated by the Railroad Commission of that state.

NO MATERIAL change from the conditions reported last week is apparent in the electrical market. Stocks are increasing in some places and sales are occasionally made at less than cost, though prices are on the whole maintained. Building stagnation continues and is bound to react on the electrical market. Christmas buying is being deferred by the retailers. Credits are tighter, and collections are still poor. The presidential election, of course, is playing its part in causing slow business, and an improvement after Nov. 2 is anticipated by many.

News in Brief

Summary of Market Conditions and of Recent and Approaching Happenings of Importance to the Industry

CANADA'S government has refused to prohibit the export of electricity as desired by the Ontario Hydro-Electric Power Commission, and the Toronto Power Company will continue to supply 18,000 hp. to the Buffalo General Electric Company.

SPECIAL attention is to be given to water-power matters at the rivers and harbors congress which will be held in Washington Dec. 8, 9 and 10.

THE PROJECT of the Southern California Edison Company on Big Creek in Fresno County, Cal., is being advertised by the Federal Power Commission, in accordance with the water-power act.

FULL jurisdiction over all public utilities, together with their contracts, has been given to the Alabama Public Service Commission by a recent act of the Legislature.

A PERMANENT industrial lighting exhibit, completely installed and operating, is to be set up in San Francisco immediately, and a suitable location for a similar exhibit is being sought in Los Angeles.

BEFORE the international commission now investigating the St. Lawrence waterway and hydro-electric project Henry I. Harriman, president of the New England Power Company, expressed his approval of the plan.

FOUR large issues, totaling nearly $50,000,000, mark a high record in weekly financing for electrical companies. Of this amount the Westinghouse company offers $30,000,000 in ten-year 7 per cent bonds.

ELECTRICAL credit men are reported to be optimistic despite decreasing demand and slow collections. The depression is thought to be only temporary, and a period of great prosperity is looked for in a few months.

CANCELLATION of orders and other prevailing conditions were discussed at the section meetings of the Associated Manufacturers of Electrical Supplies.

ADOPTION of a uniform method of procedure on rates throughout the state is being advocated by the committee on electric service rates of the Iowa Section, N. E. L. A.

PRACTICAL instruction will be enlarged at the Massachusetts Institute of Technology by opening commercial departments as well as shops of the General Electric Company to students taking co-operative educational courses.

THE RIGHT of the Androscoggin Electric Company to sell electrical energy in the town of Leeds has been affirmed by the Maine Public Utilities Commission against the protest of the Monmouth Electric Company and the Turners Falls Power Company, operating in adjacent territory.

AN ANNUAL loss of $300,000,000 arises from accidents due to defective lighting, according to an insurance expert speaking before safety and lighting engineers.

THE FACT that the average rise in prices of electrical equipment has been much less than in most other lines of industry and the further fact that many manufacturers are working on high-priced materials bought under contract several months ago are proving embarrassing to the electrical trade in connection with the prevailing effort of the public to force down the prices of all commodities.

DECREASE in costs of raw materials, especially copper and cotton, and the cutting out to a large degree of overtime work in factories, while their tendency is to bring lower prices for finished electrical products, will not, owing to various circumstances, have a marked effect in this direction at the present time.

MANUFACTURERS of Christmas tree lighting outfits report that they are unable to fill the demand.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Cancellation of Orders Slows Down Factory Outputs

CANCELLATION of orders which has resulted in a marked slowing down in the output of some factories was the subject of considerable discussion at the section meetings of the Associated Manufacturers of Electrical Supplies held in New York from Oct. 18 to 27. Although many cancellations have been made on account of delayed deliveries, there have been numerous cancellations for various other reasons, and the total has been sufficient to cause some manufacturers to curtail the number of employees. One New England firm has decided to decrease its force by 10 per cent and at the same time lengthen the working day from nine to ten hours without increasing wages. This was necessary in order to keep the plant in operation on a profitable basis.

Those manufacturers who have decreased the number of employees announce that there has been a marked increase in efficiency in their plants, and it was the consensus of opinion that lower manufacturing costs and lower prices are bound to follow. It is expected that prices for electrical supplies will reach an appreciably lower level within the next six months, at which point they will probably remain stabilized.

Difficulties Met With in Applying Emergency Coal Order

DESPITE the softening of coal prices, numerous requests have come to the National Committee on Gas and Electric Service for assistance in one form or another from utilities that are nervous about their coal supply, but in most cases the requests are for a continuance of the assigned-car privilege. It does not seem to be generally understood that under the new public utilities service order assigned cars are to be given only when it has been proved positively that coal cannot otherwise be obtained.

George W. Elliott, the secretary of the National Committee on Gas and Electric Service, points out that his committee, which is working in co-operation with the Interstate Commerce Commission, can look after the distribution of coal only. It has developed in numerous cases that the utility has no contract for coal. If the utility is not protected by a contract, it is difficult for the committee to be of service, although in some cases relief has been given under those conditions through the help extended by the National Coal Association. Wherever it has been established that an emergency exists the coal was obtained through arrangement with the contracting operator.

There has been some difficulty, Mr. Elliott said, in determining just what constitutes an emergency. In some cases four days' supply of coal is regarded as the minimum amount which can be allowed as a margin of safety. In fact, each case, he said, must be considered separately, since so much depends on the probability of securing coal quickly.

Almost $50,000,000 New Electrical Financing This Week

FOUR large issues, totaling $48,375,000 in the last six days, marked a high record in weekly electrical financing. The largest issue was $30,000,000 in ten-year 7 per cent gold bonds of the Westinghouse Electric & Manufacturing Company, offered at 94¾, to net 7¾ per cent. The other three issues were by light and power companies. The Pennsylvania-Ohio Power & Light Company has sold $13,000,000 of twenty-year first and refunding mortgage 7½ per cent bonds at 96½, to yield 7.85 per cent. The other two issues are smaller, as follows: $2,750,000 Conemaugh Power Company first mortgage ten-year 8 per cent bonds at 99, to yield about 8.15 per cent, and $2,625,000 San Joaquin Light & Power Corporation 8 per cent convertible collateral trust bonds, due Nov. 1, 1935, at par.

Electrification Now Merely a Question of Whether It Will Pay

WITH facts on which to base their contentions, proponents of electrical and of steam operation of railroads made it clear last week at one of the most interesting meetings ever devoted to this subject that electrification will come only as a result of individual roads being convinced that the return secured will warrant the expenditure involved. This subject was debated before a joint meeting of the New York sections of the American Institute of Electrical Engineers and the American Society of Mechanical Engineers and the railroad section of the A. S. M. E., with its chairman, E. B. Katte, presiding in conjunction with H. W. Buck and W. S. Finlay, Jr. Each side was represented by manufacturers and operators, who were well qualified to bring out the essential facts. Keen interest was evinced by those in attendance, who filled the hall and all available standing room. On the platform and in the audience were many "old-timers" prominent in the early discussions of electrification problems.

Among the most ardent advocates of railroad electrification who took part in the discussion were Frank J. Sprague, called the "father of electric traction"; A. H. Armstrong,* chairman of the electrification committee of the General Electric Company; F. H. Shepard, director of heavy traction for the Westinghouse Electric & Manufacturing Company; C. H. Quinn, chief electrical engineer of the Norfolk & Western Railway Company; A. L. Ralston, mechanical superintendent of the New

*See [illegible] on page 878

York, New Haven & Hartford Railroad; R. Beeuwkes, electrical engineer of the Chicago, Milwaukee & St. Paul Railway, and E. B. Katté, chief engineer electric traction for the New York Central Railroad. Advantages of the steam locomotive were presented by John E. Muhlfeld, vice-president Railway & Industrial Engineers, Inc.; F. J. Cole, American Locomotive Company; A. W. Gibbs, chief mechanical engineer of the Pennsylvania System; W. L. Bean, assistant general mechanical superintendent of the New York, New Haven & Hartford Railroad; F. H. Hardin, chief engineer of motive power New York Central Railroad, and William F. Kiesel, Jr., mechanical engineer Pennsylvania Railroad.

It was admitted even by the champions of steam locomotives that the electrical system is more economical of fuels, involves lower maintenance expense and handles a greater volume of traffic, but the question of whether it will pay to electrify roads already equipped for steam proved to be a bone of contention. Mr. Muhlfeld contended that a large investment must be scrapped in electrifying a steam system and that past comparisons have not taken into consideration the economy of the most modern steam locomotives. The necessity of more financial data was also expressed by Mr. Cole, who contended that all expenses incidental to electric operation and not merely those connected with locomotion must be charged against electrification. Although the advantages of electrifying the Chicago, Milwaukee & St. Paul Railway, the Norfolk & Western, the New York Central and the Baltimore terminal were recognized by Mr. Gibbs, he said they were due chiefly to the mountains, tunnels, etc., which were encountered and that double-tracking is an alternative which should be considered in most cases. He also brought out the point that if branch lines are not electrified with the trunk lines, steam locomotives and the necessary adjuncts such as intermediate terminals will have to be maintained anyway. The greater cost of electric locomotives as compared with steam locomotives was emphasized by Messrs. Brown and Bean, and the former contended that the coal consumption of modern steam locomotives is 28 to 30 per cent less than the figures given in Mr. Armstrong's paper. (See page 878.)

The cause of the electrification was fairly and ably defended with facts and actual performance data. Mr. Sprague said that his firm belief in the coming supremacy of the electric locomotive is based on the increased traffic capacity of roads which have been electrified. This point was supported by Mr. Shepard, who said that "it is entirely practicable to build an electric locomotive to take any train which will hold together over any profile and at any desired speed."

The opinions of the operating men were particularly convincing. Mr. Quinn said that the Norfolk & Western Railroad had failed to find a steam locomotive to meet its needs, whereas electric locomotives do. The large steam units employed have to move on restricted sections owing to excessive weight and the extra clearance required, but it is not so with the electric locomotive. Comparison of the two systems shows a 25 per cent fuel saving and 100 per cent more tonnage with electric locomotives.

Although electric locomotives were attacked as being constant-speed machines, Mr. Ralston said that he considered them to have sufficiently flexible speed. On the New Haven road they have been hauling 10 to 30 per cent more than rated capacity and saved $755,000 in fuel alone during 1919.

Dr. Steinmetz Advocates Railway Electrification

RAILWAY electrification as a means of solving the coal shortage and the increasing freight congestion was advocated by Dr. Charles P. Steinmetz in an address before the Electric Club at the Morrison Hotel in Chicago on Oct. 21. Dr. Steinmetz pointed out that the railroads use the largest amount of coal that any single industry in the country requires. Any equipment required for railway fuel distribution that can be released for other uses is equivalent to an increase. The electrification of the steam railways will accomplish this in two ways. One is by reducing the total quantity of fuel required for railway use, this saving being estimated by Dr. Steinmetz from statistics gathered from former coal-burning roads at 66 per cent. The other is the release of the large amount of equipment required to deliver fuel to a few in place of the many coaling stations now required.

N. E. L. A. Good-Will Advertising Program Developing Rapidly

THE good-will campaign undertaken by the Public Relations Section of the National Electric Light Association is developing very rapidly. All the pamphlets thus far prepared are selling in enormous quantities.

Brief messages to security holders and prospective security holders of electric light and power companies have been prepared in the shape of four pamphlets with attractive covers. These pamphlets are the result of many conferences between the public service securities committee of the Investment Bankers' Association of America and representatives of the executive committee of the Public Relations Section of the N. E. L. A. The pamphlets bear upon the back cover a copy of a resolution adopted by the Investment Bankers' Association.

P. L. Thomson, chairman of the manufacturers' advertising committee of the Public Relations Section, reports that the campaign for popular-magazine advertising over the names of individual manufacturers but in behalf of the electric light and power industry should be under way within the next few weeks.

Ohio, Oklahoma and Missouri Now Have Utility Information Bureaus

ANNOUNCEMENT is made of the completion of three new state committees on public utility information in Ohio, Oklahoma and Missouri. These committees represent all utility interests of the state and are organized for the purpose of disseminating unbiased information through newspapers, bulletins, speakers and otherwise, so that the public may be fully advised regarding the problems of the utilities and the public's own interest in efficient utility service. A committee is just being completed in Arkansas, with A. G. Whidden of Pine Bluff as director.

The Ohio committee has established headquarters at 901 Illuminating Building, Cleveland, Ohio, with Benjamin E. Ling, an ex-newspaper man, as director. The Oklahoma committee will be conducted under the auspices of the Oklahoma Utilities Association, with H. A. Lane, secretary of that association, as director. The Missouri committee will be conducted under the direction of the Missouri Association of Public Utilities, with headquarters at 3725 North Broadway, St. Louis.

A. I. E. E. to Discuss Lightning Protection at Chicago Meeting

ON FRIDAY, Nov. 12, the American Institute of Electrical Engineers will hold its three hundred and sixty-fifth meeting under the joint auspices of the Chicago Section and the protective devices committee. The electrical section of the Western Society of Engineers will participate. The following program will be carried out:

3 p.m.—Board of directors' meeting, Western Society of Engineers' Rooms, 1735 Monadnock Block.

5:15 p.m.—Informal reception, City Club, 315 Plymouth Court.

5:45 p.m.—Dinner, City Club.

7:30 p.m.—Technical session, City Club: "Lightning-Arrester Spark Gaps—II," by C. T. Allcutt of the Westinghouse Electric & Manufacturing Company; "Life of Performance Tests of Oxide-Film Lightning Arresters," by N. A. Lougee of the General Electric Company; "Studies in Lightning Protection on 4,000-Volt Circuits—II," by D. W. Roper of the Commonwealth Edison Company; "Electrostatic Condensers," by V. E. Goodwin of the General Electric Company.

Canada Refuses to Prohibit Power Exports Because of Situation in Ontario

THE power situation in Ontario, particularly in Toronto, Hamilton, London, Windsor and other cities and towns served by the Hydro-Electric Power Commission, has become very acute owing to the cutting off on Oct. 15 by the Toronto Power Company of a supply of 15,000 hp. which it had been previously furnishing to the commission under a contract with the Ontario Power Company.

A conference was held at the offices of the provincial Hydro-Electric Commission in Toronto on Oct. 22 between Sir Adam Beck, chairman of the commission, and R. J. Fleming, general manager of the Toronto Power Company. The commission had previously appealed to the Dominion government for intervention with a view to having the government place an embargo upon the exportation of power to Buffalo by the Toronto Power Company. Sir George Foster, acting federal Premier, replied that the government could not take any action under the electricity and fluids exportation act of 1907. The reason given was that an embargo would arouse anti-Canadian sentiment in Buffalo.

The contract with the Ontario Power Company under which the Toronto Power Company is now exporting 18,000 hp. to the Buffalo General Electric Company expired on Oct. 20. The Hydro-Electric Power Commission endeavored to purchase this power and offered $20 per horsepower. Mr. Fleming at the conference on Oct. 22 said that the contract with the Buffalo General Electric Company had been renewed. The Hydro officers offered terms on a two-year contract, while the Buffalo company offered to buy on a long-term basis.

Sir Adam Beck stated that Canada, under the terms of the treaty existing between the United States and the Dominion, is entitled to approximately 600,000 hp. from the water available at Niagara but is receiving only 325,000 hp. The United States, he said, is deriving 510,000 hp., while the treaty provides that Canada shall receive power in the ratio of 36 against 20 for the United States. According to Sir Adam, 43,000 hp., consisting of the 18,000 hp. now going to the Buffalo General Electric Company and an additional 25,000 hp. which could be developed by the Toronto Power Company, if made available for the Hydro-Electric Power Commission, would put that body out of difficulty over the winter of 1920-21. Sir Adam asked Mr. Fleming if the Toronto Power Company were disposed to supply this 25,000 hp. to the Toronto Hydro Power Commission under the judgment of the commission at $9 per horsepower, but Mr. Fleming declined to consider the proposition, for engineering and other reasons.

California Commission Links the State's Prosperity with Hydro-Electricity

REFERRING to the estimate of experts that it will require between three-quarters of a billion and a billion dollars to construct the necessary hydro-electric plants to care for future demands for power in California, the Railroad Commission of that state, in a letter to the Governor transmitting its annual report, declared this week that while no estimate has been made of the probable necessary expenditures to carry out a program for the conservation of water for irrigation and domestic uses, the required amount will undoubtedly equal that estimated for electrical development.

Any halt in the state's hydro-electric development will spell disaster, the commission asserts, and it further declares that the state's paramount need is cheap power.

It is the commission's firm belief that financially sound utilities, functioning economically and efficiently, will successfully carry the burden of California's development. It is obvious, it says, that industrial and agricultural California cannot reach the peak of development unless there stride, a step in advance, utilities carrying service possibilities "ready on demand." Such a service can be accomplished only through the fair distribution of the costs and fair treatment of utility consumer, utility owner and utility labor. In this connection the commission declares its belief that utilities are today, as the result of regulation, selling their product at a price nearer that of pre-war days than the price of any other commodity.

Insurance Companies Are Placing More Emphasis on Electrical Inspection

STRICTER adherence to the clause in fire insurance policies which provides that policy holders must have in their possession certificates of inspection covering the electrical equipment installed is being required by the insurance companies. So far this year a number of cases have come up in New York City, involving a loss of as much as $30,000 in a single instance, on which the insurance company has made compromise settlements on the basis of 50 cents on the dollar because the holder of the policy did not have the proper inspection certificate. In all of the cases it was claimed that the fire was of electrical origin. Up to the first of this year insurance companies had for the most part accepted and paid losses even though unapproved equipment was installed or the inspection certificate was lacking.

By withholding payments on losses where the inspection requirements have not been met the insurance companies hope to sound a warning to policy holders who are delinquent in this respect. Enforcement of this clause in the policies will result in the owners either making their electrical equipment conform to the underwriters' requirements or paying an increased rate.

Heavy October Snows Assure Next Year's Power for California

ACCORDING to Weather Bureau statistics more snow has fallen in the Sierra Mountains this month than in any October since 1878, with the exception of the year 1899. As early-season snow is of much more value than snow which falls late in the season, there is every reason for power companies throughout the Pacific Coast States to be optimistic concerning their supply of water for next year. Rainfall in good volume is reported generally among the Coast states in October. While 89 inches of snow fell at Summit, Cal., twenty-one years ago, 46 inches has fallen in the first two-thirds of the month of October, 1920. The mean snowfall for October is given at 13.6 inches.

Alabama Commission Now Possesses Jurisdiction Over All Contracts

A RECENT act of the Alabama State Legislature increases the powers of the Alabama Public Service Commission by giving it full jurisdiction over all public utilities together with their contracts. By this new law the commission now has authority to fix rates regardless of franchises or contracts held by individuals and municipalities or utilities and individuals whether made before or after the act.

A. S. M. E. to Discuss Fuels, Power Supply and Motor-Driven Sawmills

MEETING in New York City on Dec. 7 to 10 in annual convention, the American Society of Mechanical Engineers will, in the course of its program, deal with a number of topics of interest to electrical engineers and central-station management. At a session on fuels the following papers will be presented: "The Fuel Supply of the World," by L. P. Breckenridge; "The Low-Temperature Distillation of Coal," by O. P. Hood; "Fuel Conservation Versus Money Conservation," by D. M. Myers, and "Form Value of Energy in Relation to Its Production, Transportation and Application," by Chester G. Gilbert and Joseph E. Pogue.

There will also be a session devoted to consideration of the future development of power. "Electrically Operated Sawmills" will be discussed by A. E. Hall, and "The Constitution and Properties of Boiler Tubes" will be the subject of a paper by A. E. White.

Uniform Method of Procedure on Rates Advocated for Iowa

ACTIVITY of the committee on electric service rates of the Iowa Section of the National Electric Light Association began with a meeting at Cedar Rapids, Iowa, on Oct. 18, when the subject of rate increases was discussed exhaustively and many differences of opinion were expressed. However, it was agreed that a uniform rate throughout the state was an impossibility because of varying conditions, and that therefore a uniform method of procedure was the sane end toward which to work.

There was prepared for presentation to the executive council a statement recommending the necessity for immediate concerted action on the part of the electric utilities of the state toward obtaining rate readjustments on the basis of investment in property used and useful in supplying electric service, basing the rate of return on the prevailing costs of money, plus a profit, above all the costs of operation, including taxes and insurance, the cost of money, the continuous maintenance of property and the amounts required for amortization and contingencies, and including in rate schedules in addition a fuel differentiation.

The opinion was also unanimously expressed that more publicity on the various rate increases in the state would noticeably ease the situation in other towns, and an effort will be made to inform the general public of all rate readjustments throughout the state.

Coal Cost to Affect Lighting Bills

A RATE will be applied to electric lighting bills after Nov. 1 by the Pittsfield (Mass.) Electric Company which will take excess coal cost into consideration. In a recent statement to customers the company pointed out that the charges for electric lighting service have increased very slightly since 1913. The maximum rate, 12 cents per kilowatt-hour, remains the same. Since 1916 the cost of coal has increased to the company from $4 to $11, or 175 per cent. Labor has increased 75 per cent, and the cost of money borrowed to build lines and to purchase power-plant equipment has increased 60 per cent. By careful operation the company has been able to meet part of the increase in expenses, but the rapid increase in the cost of coal during the past few months makes it now necessary to increase the charges for electric lighting during the months in which the high price of coal prevails.

To the present schedule of lighting rates will be added after Nov. 1 an "excess-coal-cost rate," to be determined monthly by the cost of coal during the preceding month. This rate will be 0.15 cent per kilowatt-hour for each $1 increase in the cost of coal per net ton in the plant of the company above $4. Should the cost of coal drop below $4, a corresponding reduction will be made. Reduction in the cost of labor or in interest rates on borrowed money will also cause a prompt reduction in charges for lighting service.

Defective Lighting Said to Cause Annual Accident Loss of $300,000,000

OUT of an annual economic waste of $2,000,000,000 caused by accidents, R. E. Simpson, safety engineer of the Travelers' Insurance Company, stated at the joint meeting on Oct. 22 of the American Society of Safety Engineers and the New York Section of the Illuminating Engineering Society, it is a conservative conclusion that 15 per cent is due to defective illumination, or a total economic loss of $300,000,000 yearly to the country. This amount exceeds the total annual cost of illumination.

By defective illumination is meant any violation of the principles of good lighting. This is nowhere more evident than in the neglect of such details as the illumination of stairways, passageways and storage space, where as a result there are very many fatal falls.

In view of the direct bearing which lighting equipment has on safety conditions, the importance of keeping the equipment in first-class operating condition and the responsibility in this regard of the man who is maintaining the apparatus were emphasized by A. J. Thompson in his discussion on disconnecting hangers. H. F. J. Porter, consulting engineer of the Society for

Electrical Development, called attention to the relation between sharpness of vision and reduction of accidents, saying that the employer should feel obligated to see that his employees, if their sight is defective, shall have an opportunity to be fitted with the proper glasses.

It is not possible at the present time to define good industrial lighting, S. E. Doane, National Lamp Works, remarked. The view of what constitutes good illumination has changed, and while 15 or 24 foot-candles might now be considered excellent practice for certain industries, it is not entirely improbable that twice these values will be considered the best intensities in the near future. S. G. Hibben, Westinghouse Lamp Company, showed the definite relation of maintenance of lighting equipment to safety arising from the depreciation of illumination through accumulation of dirt on fixtures.

Proposed Reorganization of American Bureau of Welding

A PLAN for the reorganization of the American Bureau of Welding, proposed by Prof. C. A. Adams, director of the bureau, will be discussed at a meeting of the bureau on Nov. 22 at 33 West Thirty-ninth Street, New York City. This plan is briefly that the bureau be organized as the general welding research advisory committee of the American Welding Society and also of the engineering division National Research Council.

The new scheme was explained by Professor Adams before the American Welding Society on Oct. 25 and was heartily indorsed by several of the older members. A tentative program offered at that meeting was partly as follows:

1. Standardize welding procedure, in so far as possible, for each process and for each application.
2. Compile data as to strength, ductility, cost, etc., of welds made by the various methods.
3. Develop a standard training course.
4. Collect impartial data, based on tests, on efficiencies, pounds of metal deposited per hour and per kilowatt-hour, power factor, etc., and data on spot, electro-percussive and automatic arc welding, etc.
5. Compile impartial information on materials, such as fluxes, electrodes and welding rods.
6. Standardize methods for inspecting and testing welds.
7. Make sets of sample fractured welded test specimens of specific materials made by standard procedure, which will be furnished to those interested upon payment of a proper fee.
8. Revise and standardize welding nomenclature.

Harriman Favors St. Lawrence Power Development

HENRY I. HARRIMAN, president of the New England Power Company, Boston, advocated the development of the St. Lawrence waterway and power resources at a hearing Oct. 18 in Boston before the international commission charged with investigating the project. He said that in 113 miles the St. Lawrence falls 91 ft. (28 m.) and that in the 70 miles (112 km.) of rapids above Montreal it falls 230 ft. (70 m.) more. The mean flow is 241,000 ft. (6,750 m.) per second, giving a continuous capacity of 4,000,000 hp. of electrical energy. The Great Lakes act as a reservoir in equalizing this flow within 25 per cent of the mean.

The possible output from this development, it was pointed out, would be 24,000,000,000 kw.-hr. a year, equivalent to the energy of 24,000,000 tons of coal burned in the most modern steam plants. All the public utilities of the state of New York and of New England combined, he stated, produce less than 5,400,000,000 kw.-hr. yearly, or about one-fourth the annual output of these great water powers. If the United States pays half the cost of the St. Lawrence development, the speaker said, it should be entitled to not merely one-quarter of the power which will be developed on the American side of the border but one-half the total power. If the upper estimate of $250,000,000 is accepted as the probable cost, one-tenth of a cent per kilowatt-hour set aside for interest payments and sinking fund requirements will, when the power is sold, pay the entire interest charge and set up a sinking fund that will retire the entire capital expense in thirty-five years.

Ontario Hydro-Electric Commission Favors St. Lawrence Plan

AT A MEETING of the International Joint Commission for the deepening of the St. Lawrence River held at Kingston, Ontario, on Oct. 11, Sir Adam Beck, chairman of the Ontario Hydro-Electric Power Commission, presented a preliminary report of the survey made by the commission of the St. Lawrence River from Kingston to Montreal. The report pointed out that in all consideration of the work navigation and power could not be separated. They were so intimately connected that one could not be sacrificed to the advantage of the other. It was estimated that power equivalent to the extent of 20,000,000 tons of coal per year could be developed, which was more than the entire importation of coal into Canada per year.

Industrial Lighting Exhibit to Open in San Francisco

THE industrial lighting exhibit committee of the California Electrical Co-operative Campaign has completed all the preliminary arrangements and expects to have a permanent industrial lighting exhibit completely installed and operating in San Francisco by Nov. 1. The exhibit in Los Angeles has been delayed owing to difficulty in finding a suitable location. These exhibits follow a similar and successful lighting exhibit at the Pasadena convention of the National Electric Light Association this year.

Electrical Christmas Campaign

THE Society for Electrical Development has just mailed to the industry, both members and non-members, copies of the Christmas campaign issue of its monthly sales service with complete plans and descriptions of all the material and advertising cuts available for the campaign. The advertising program is cleverly built around Santa Claus, with a man and a woman, as shown herewith, whispering in his ear to say "Merry Christmas electrically." The society is trying to broaden this campaign to include the entire industry, non-members of the society as well as members, and is ready to do all in its power to promote buying of electrical gifts.



Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Progress at Binghamton, N. Y.—The month of September was the largest month in kilowatt-hour output and kilowatt demand in the history of the Binghamton Light, Heat & Power Company, the gross output being 2,186,620 kw.-hr., which is an increase of 9½ per cent over August, 1920, and of 50 per cent over September, 1919.

Pole Lines in New Jersey.—The New Jersey State Highway Commission has decided that electric companies may erect pole lines along state roads at places designated by the state highway engineer, but that the companies must paint all poles white to a height of 6 ft. from the ground so that they may act as a danger signal at night to motorists and others.

A Giant Electric Sign.—One of the largest electric signs in the United States is being installed on the roof of the new plant of the Berkshire Knitting Mills at Wyomissing, Pa. The sign will be 365 ft. long and 21 ft. high and will require about 4,500 10-watt lamps. The letters of the display, "Berkshire Knitting Mills—Hosiery as You Like It," will be 10 ft. high.

Nebraska Company Boosts Own Rates.—The Central Power Company of Kearney, Neb., having failed to induce the city commissioners to authorize a 20 per cent increase in rates on electricity, took the initiative by announcing the new rate effective, retroactive from Sept. 1. The Railroad Commission, it is asserted, refused to act; the city commission contended it was powerless to alter rates, and litigation through the Supreme Court would have involved too much delay. The company therefore decided to put the rate into force and await results.

Disposing of Excess Energy from Kerckhoff Project.—Completion by the San Joaquin Light & Power Corporation of the Kerckhoff power plant and of steam plants at Bakersfield and Midway having made available electrical energy beyond its needs, the Pacific Gas & Electric Company has applied to the California Railroad Commission for authority to enter into an agreement with the San Joaquin company under which the excess energy may be delivered to the Pacific system. The commission is asked to approve a plan by which the Pacific company will advance to the San Joaquin company sufficient funds to construct an electric transmission line from the Kerckhoff plant to its electric substation in Merced City. The delivery to the Pacific company is to be made in the city of Newman. The commission is also asked to fix the amount to be paid for the excess energy by the Pacific company.

Standing Committee on Rural Service.—A sign of the times is the reported decision of the executive committee of the Ohio Electric Light Association to appoint a new standing committee on rural service. "There is so much to be learned about this class of business," says the association's monthly bulletin, "and so many angles to its make-up that this committee will have plenty to do for a time at least."

Damming the Chattahoochee.—To replace rock-crib-fill dams near Riverview, Ala., on the Chattahoochee River, which were washed away in last winter's floods, a stone structure 900 ft. long is being built from the Georgia shore to Campbell Island which with a dam now connecting that island with the Alabama side will make a continuous barrier across the river, thus insuring uninterrupted hydro-electric power in that region.

Rutland Company Employees and Consumers Buy Stock.—The Rutland (Vt.) Railway, Light & Power Company has begun selling its 7 per cent cumulative preferred stock to consumers and employees, this being the first time that an opportunity to acquire stock has been given them. To dispose of this stock about 125 employees are organized into teams, each team being headed by a captain, and prizes are offered for the best records. Success seems assured, ninety-six shares having been sold for cash and ninety-eight shares on the installment plan in the first week.

Electrical Development in India.—In a paper recently read before an engineering congress in Lahore, India, the writer estimated the total electrical installations in India as being only 0.742 watt per head of population, which compared with 33 watts in the British Isles, 56.9 in South Africa, 61.8 in Australia and 148 in Canada. India, the author said, has not the same incentive to exploit the water power available because her industry is in the main agricultural, labor is low-priced and the native population have few wants. Two large projects are, however, under consideration—a 60,000-kw. development on the Sutlej and a 10,000-kw. development on the Ravi River. Of these the former is the more economical. Nationalization of the water powers of India was favored in the paper as the best means to insure development.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Montreal Electrical Club.—The Montreal Weekly Electrical Luncheon has changed its name to the Montreal Electrical Club. W. H. Winter has been elected president and T. H. Chennel secretary-treasurer.

Jovian Order.—The date of the annual convention of the Jovian Order, to be held at the American Hotel Annex, St. Louis, has been changed to Nov. 25 and 26, so as not to conflict with the dates selected by any other organization.

American Welding Society.—"The United States Navy's Arc-Weld Battle Towing Target No. 60" was described by James W. Ovens of the Norfolk (Va.) Navy Yard at a meeting of this society in New York on Oct. 25.

Radio Club of America.—This club met at Columbia University, New York, on Oct. 22 to listen to a paper by Julius G. Aceves, assistant research engineer to Prof. M. I. Pupin, on "Determination of Resistance, Inductance and Capacity by the Wheatstone Bridge Method."

Philadelphia Section, A. I. E. E.—Officers of this section for 1920-21 are as follows: Chairman, C. E. Bonine; secretary and treasurer, R. B. Mateer; assistant secretary, Raymond Bailey; managers, P. H. Chase, E. B. Tuttle, C. W. Fisher, B. Reynolds and L. J. Costa.

Association of Iron and Steel Electrical Engineers.—The Philadelphia Section of this association is to meet on Saturday, Nov. 6, when "Electric Heat Treatment—Present Practices and Future Possibilities," will be discussed by George P. Mills, Electric Furnace Construction Company, Philadelphia; J. R. Bower, American Car & Foundry Company, Berwick, Pa., and James E. Wilson, Treadwell Engineering Company, Easton, Pa. On Monday, Nov. 8, the Cleveland District Section will discuss a paper by Gordon Gage, chief electrician American Rolling Mill Company, Middletown, Ohio, on "Slip Regenerators Versus Notchbacks."

Coming Meetings of Electrical and Other Technical Societies

Institute of Radio Engineers—New York, Nov. 3.

Association of Iron and Steel Electrical Engineers—Philadelphia Section, Nov. 6; Cleveland Section, Nov. 8.

National Association of Railway and Public Utilities Commissioners—Washington, Nov. 9.

Society of Naval Architects and Marine Engineers—New York, Nov. 11-12.

American Institute of Electrical Engineers—Chicago Section, Nov. 12.

Electric Power Club—Hot Springs, Va., Nov. 15-18.

Florida Ice and Public Utilities Association—Miami, Fla., Nov. 15 and 16.

National Electric Light Association—Southeastern Geographic Division, Miami, Fla., Nov. 17-19. (For program see issue of Oct. 23, page 815.)

Electrical Supply Jobbers' Association—Cleveland, Nov. 17-19.

American Engineering Council—Washington, Nov. 18-20. (For program see issue of Sept. 25, page 654.)

Jovian Order—St. Louis, Nov. 25 and 26.

American Physical Society—Cleveland, Nov. 27; annual meeting, Chicago, Dec. 28-Jan. 1.

American Society of Mechanical Engineers—New York, Dec. 7-10.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Character of Service—Inefficiency.—The customers of an electric company should not be compelled to pay for the operation of an inefficient, obsolete and worn-out plant, the New York Public Service Commission for the Second District has asserted. Figures which show an increase in the unit cost of production of electricity of 68.9 per cent for the year 1918 over 1917, and of more than 61 per cent for 1918 over 1916, show a steady deterioration in the efficiency of the plant or in the business management.

Means of Arriving at Just Returns Where Several Municipalities Are Served.—Just and reasonable rates for electric utility service within a municipality wherein the plant is situated and from which nearby municipalities are supplied by transmission line are ascertained, according to the Missouri Public Service Commission, by considering the system as a unit, after eliminating the expense and return due to the transmission line, and then assigning the greater portion of the burden of the transmission line to the communities served thereby.

Coal Clause Authorized in Indiana.—Authority to vary electric power charges fifteen-hundredths of a cent a kilowatt-hour for each 5 cents up or down from an average monthly coal cost of $3.70 a ton is contained in an order the Indiana Public Service Commission has issued applicable to the Muncie district, served by the Indiana General Service Company. The commission authorized the company to increase the last two steps in its secondary power rates so as to produce about $2,000 more revenue a month. Only one or two large companies are affected by the specific increase, it is said in the order.

Pacific Power & Light Rate Increases Granted.—The Public Service Commission of Washington on Sept. 29 handed down a decision in the case of the Pacific Power & Light Company, Portland, Ore., concerning applications for rate increases made in March on all cities and towns served by the company in Washington, involving gross annual increases of $240,000. All the company's requests were granted, with substantial modifications, however, in the cities of Yakima, Walla Walla, Pomeroy and Toppenish, where the increase asked was held to be excessive. The increases cover domestic and commercial metered lighting, flat commercial lighting and commercial and flour-milling power. No change was asked for in cooking or irrigation power.

Special Rates Given to City by Franchise Invalid.—The Public Utilities Commission of Idaho, in passing upon the application of the Utah Power & Light Company for authority to apply a regular schedule for emergency service to the city of Idaho Falls in connection with the operation of its municipal plant—the city on its part claiming the privilege of a special rate by the terms of a franchise granted by it to the power company in 1907 and running twenty years—has declared that no municipality can delegate by franchise authority not vested in it by the state nor claim privileges as a customer not in accordance with the rates and rules and regulations fixed by statute covering commission regulation. "Our attention has not been called," says the commission's order, "to any provision of the public utilities law which authorizes or justifies the public utilities corporation applicant herein to make any charges to the city of Idaho Falls for service rendered other or different than those specified in its schedules on file and in effect at that time. It is therefore ordered that the petition be granted and that applicant be required to apply such rates for service as are named in schedules on file at the time the service is given."

Vermont Commission on Principles of Valuation.—In finding unfounded a complaint that the power rates of the Montpelier & Barre Light & Power Company were unreasonable, the Vermont Public Service Commission made the following among other observations upon the principles underlying valuation: (1) The fair present-day value is the proper basis for rate making. (2) Original cost taken alone is not a proper basis for determining present-day values, but is entitled to consideration. (3) It is not just to fix values upon present-day prices if these are abnormally high or low. (4) A valuation based upon average prices for ten years including the war period ought to produce as fair results as it is possible to obtain. (5) A flat estimate of $20 per horsepower as applied to different water powers of a hydroelectric company could not be approved where in fixing such value no consideration was given to the probable cost of development and this cost would vary. (6) In determining the cost of reproduction new there should be added to the sum obtained by estimating the actual cost of the several units of which the property is composed a sum to represent the overhead expenses incidental to the construction of the plant as a whole and not assignable to any particular unit. (7) The accrued deficit of a utility from the time it came into the hands of the present owners could not be allowed as going value since such a method would guarantee the utility against all losses. (8) Reproduction cost new should be reduced by a sum which would leave that figure fairly representative of the value of the properties as they in fact exist at the time of valuation.

Recent Court Decisions

[illegible] courts in legal cases involving electric light, power and other public utility companies.

Jury Entitled to Know that Witnesses in Damage Suit Represent Insurance Company.—In an action for the death of a servant, while it would have been an error to disclose to the jury the fact that an insurance company was bound by contract to indemnify the defendant, the Supreme Court of Missouri observed in Snyder vs. Wagner Electric Manufacturing Company, yet if the insurance company chose to produce its own witnesses, the jury was entitled to know whom they represented and to have their interest in the case disclosed. (223 S. W. 911.)*

Missouri Commission Law.—The Supreme Court of Missouri has held, in State ex rel. Case, that the statute providing that writs to review orders of the Public Service Commission may be sued out of the circuit court of the county where the hearing was held or in which the commission has its principal office is not void under the constitution, the condition th. jurisdiction shall depend on a hearing having been held being a reasonable one and the presumption being that the commission in fixing a place for hearing will exercise sound discretion and consider the convenience of the parties and witnesses. Where the commission held a hearing on a rate case first in one county and afterward in another county, the Circuit Court of the latter county had jurisdiction to review the commission's order. (223 S. W. 664.)

Assumption of Risk by Lineman Question for Jury.—In Clark vs. Kansas City Light & Power Company, a verdict against the company for the death of a lineman through contact with improperly insulated 2,300-volt wires was reversed by the Kansas City Court of Appeals and the cause remanded to the inferior court because of inadmissible and prejudicial testimony to the effect that it was customary to send another man up a pole with a lineman to help him, which in this case had not been done. The court found, however, that as a matter of law the man could not be held negligent if he failed to observe that the insulation was in bad condition and that as a matter of law he did not assume the risk when on his foreman's order he ascended the pole, these being questions for the jury. An instruction that it was defendant's duty to exercise the utmost care to keep its high-tension wires adequately protected was not erroneous. (223 S. W. 984.)

*The left-hand numbers refer to the [illegible]

Men of the Industry

Changes in Personnel and Position— Biographical Notes

L. M. Klauber, who has recently been promoted to be general superintendent of the San Diego (Cal.) Consolidated Gas & Electric Company, of which he was previously assistant general superintendent, has been with that company since 1911. He was born in San Diego in 1883 and was graduated from Stanford University in the department of electrical engineering. From 1908 to 1910 he spent in the Westinghouse Electric & Manufacturing Company's graduate apprentice school at East Pittsburgh, Pa. His first position with the San Diego company was that of new-business solicitor, after which he served as engineer in charge of record department, superintendent of electric department and assistant general superintendent. Mr. Klauber has been a frequent contributor to the technical press, writing mainly on problems of transmission and distribution. He has also a number of inventions of electric distribution specialties to his credit. He is vice-chairman of the overhead systems committee of the N. E. L. A., a member of the electrical apparatus committee and chairman of the Pacific Coast engineering committee, and he is a member of the A. I. E. E. and several other national technical societies.



L. M. KLAUBER

Lester B. Mann, who has been appointed Assistant Commissioner of Patents, entered the Patent Office in 1908 as a fourth assistant examiner. From that position he rose through the various grades to first assistant examiner. At the outbreak of the war Mr. Mann entered the military service, from which he recently obtained his release.

R. F. Schuchardt, electrical engineer of the Commonwealth Edison Company, Chicago, has recently returned from a European trip. Mr. Schuchardt visited France and England to study electrical apparatus and distribution and transmission-line development.

Harry B. Joyce, formerly power engineer of the United Electric Light & Power Company, New York, has joined the engineering staff of Johnson & Benham, Inc., engineers, New York.

Frank E. Scovill, heretofore manager of the Arkansas Light & Power Company at Camden, has been transferred to the Paragould (Ark.) office of the company in the same capacity.

E. M. Ashworth, assistant general manager of the Toronto Hydro-Electric Commission of Toronto, has been appointed acting general manager of the commission following the appointment of General Manager H. H. Couzens to the position of general manager of the Toronto Transportation Commission.

L. P. Hockett, auditor and accountant with the Public Utilities Commission of Utah for the last two years, has resigned to accept a position with the Public Service Commission of the State of Washington. The attention of the Washington authorities was attracted to Mr. Hockett's work by his efforts to obtain betterments in the accounting of public utilities before the state commissions. He was instrumental in bringing about a conference recently at Boise, attended by representatives of the accounting departments of the Washington, Oregon, Montana, Idaho and Utah commissions, at which a uniform system of accounting to be put into effect in the various states represented was taken up.

George S. Williams, who was recently appointed general manager of the Androscoggin Electric Company, Lewiston, Me., has been connected with the Central Maine Power Company for a number of years. While devoting most of his attention to his new duties at Lewiston, Mr. Williams will continue his connection with the Central Maine organization as general superintendent. Mr. Williams was born in Augusta, Me., on Sept. 9, 1882. In 1903, after studying for three years at the University of Maine, he became connected with the old Kennebec Light & Heat Company, which later became a part of the Central Maine Power Company. From June, 1903, to May, 1904, Mr. Williams worked in Augusta. He was then sent to Gardiner, where he worked for two years as lineman and inside wireman. He was later advanced to superintendent of the electrical division, and the following year the gas plant was added to his responsibilities. In 1915 he was made power solicitor of the company and two years later, when war conditions in Bath made necessary the prompt and efficient reconstruction of the entire distributing system, he was called upon to perform this important work. Three years ago he became general superintendent of the company.

H. H. Couzens, manager of the Toronto Hydro-Electric Commission, has been appointed general manager of the combined Toronto Railway Company and Toronto Civic Railways. This appointment is to take affect when the Toronto system is taken over as a civic enterprise next year.

J. L. Longino has been appointed general manager of the Pine Bluff (Ark.) Company, succeeding J. A. Whitlow, who has been made traffic manager of the Arkansas Light & Power Company. Mr. Longino has heretofore been chief engineer of the latter company's properties.

Y. Furukawa, managing director and chief engineer of the Kyushu Light, Power & Traction Company of Fukuoka, Japan, recently visited the various power plants in the Northwest on a tour of inspection of the steam-electric generating stations of the country. He is also familiarizing himself with American central-station policy.

Edward R. Davenport, for the last fifteen years sales manager Narragansett Electric Lighting Company, Providence, R. I., has resigned to become associated with the Providence banking house of Bodell & Company. In his new connection he will be vice-president of the Vale Kines Manufacturing Company, Dayton, Ohio, maker of electric motor-driven water pumps. He entered upon his new work about Oct. 15 and for the present will probably make his headquarters at Dayton. Mr. Davenport is a native of Brooklyn and is well known for his progressive merchandising and new-business policies in central-station work. He entered the employ of the Brooklyn Edison Company about twenty-five years ago as an office boy and was rapidly promoted to the assistant secretaryship. After ten years in Brooklyn he went to Providence. Mr. Davenport has for a number of years been active in the Commercial Section of the National Electric Light Association, and has contributed many addresses and papers upon merchandising methods.



E. R. DAVENPORT

Chester B. Lawson has been appointed superintendent of the electrical department of the Eastern Pennsylvania Railways, Pottsville, Pa. He succeeds H. L. Treeman, resigned. Mr. Lawson was graduated from the Pottsville High School in 1905. After completing a course in electrical engineering at Lehigh University he was employed for a time in Boston. He has been connected with the Eastern Pennsylvania Railways for the past six years.

H. L. Treeman has tendered his resignation as superintendent of the electrical department of the Eastern Pennsylvania Railways, Pottsville, Pa. Mr. Treeman was graduated from the Oklahoma Agriculture and Mechanical College in 1909 with the degree of bachelor of science, having specialized in mechanical and electrical engineering. For several years thereafter he was employed by the Edison Electric Illuminating Company, Brooklyn, N. Y., as power engineer. In 1915 he left the service of that company to accept the position of electrical engineer of the Eastern Pennsylvania Railways. He was promoted to be electrical superintendent two years ago.

H. W. Hough, for the last ten years chief electrical and research engineer for the Cleveland (Ohio) Electric Illuminating Company, on Oct. 1 joined the



H. W. HOUGH

staff of the Daniel M. Luehrs Company, industrial consulting and construction engineers at Cleveland. Mr. Hough has had experience in the design of modern power houses, substations, transmission systems and distribution systems. He has also been actively engaged for a number of years in the solution of the many industrial problems incident to the supply of light and power, particularly as applied to large electric furnaces, rotating electrical machinery of many types and electric welding and heating devices.

R. W. Davenport, a hydraulic engineer on the staff of the United States Geological Survey, has been transferred temporarily to the staff of the Federal Power Commission.

W. C. Davisson, for eighteen years connected with the West Virginia Water & Electric Company at Charleston, W. Va., has severed his connection with that company as vice-president and treasurer to engage in private business.

Charles W. Hobbs has resigned as president of the San Angelo Water, Light & Power Company, a subsidiary of the Interstate Electric Corporation of New York. Mr. Hobbs had been associated with the corporation for thirty-two years.

Robert M. de Vignier, for more than ten years a member of the engineer staff of the Western Electric Company and more recently with E. I. du Pont de Nemours & Company, has been appointed chief engineer of the American Vulcanized Fiber Company, with headquarters at Wilmington, Del.

Max Thelan, chief of the liquidation and claims division of the Railroad Administration, has resigned to resume his legal practice in California. Mr. Thelan was formerly chairman of the California Railroad Commission. He will be succeeded on the Railroad Administration by L. M. Alvoid, assistant to the director-general.

G. J. Wheat, until lately assistant superintendent of the Alameda County (Cal.) district of the Pacific Gas & Electric Company, resigned that post to become general manager of the Wheat Electric Company, electrical contractors and dealers of Santa Maria, Cal.

Dr. E. F. Northrup has resigned his professorship at Princeton University in order to devote his entire time to



DR. E. F. NORTHRUP

his work with the Ajax Electrothermic Corporation of Trenton, N. J. Dr. Northrup was recently elected vice-president of that company and is now engaged in perfecting a brass-melting furnace of this Ajax-Northrup type.

George A. Porter, who has been associated with the Cumberland County Power & Light Company at Portland, Me., for many years, has just been made manager of the company's division at Bonny Eagle, Me.

Obituary

Alexander Macauley, for the last fifteen years superintendent of the electrical department of the Beverly (Mass.) Gas & Electric Company, died at his residence in Beverly Oct. 11. Mr. Macauley was a native of Souris, Prince Edward Island, and was about fifty-six years of age. He entered the employ of the Beverly company thirty-two years ago.

A. W. Sanborn, who until recent years was associated with his son, Gerry M. Sanborn, in the Sanborn Electric Company of Indianapolis, died recently in Dover, Me., where he had been visiting. Mr. Sanborn had been in failing health for some time. He was seventy-three years of age.

C. E. Acker, who developed the first electrolytic process for the manufacture of caustic soda by the electrolysis of molten salt, known as the Acker process, died at his home at Ossining, N. Y., on Oct. 18. Mr. Acker also built the works of the Acker Process Company at Niagara Falls for the manufacture of tetrachloride of tin and carbon tetrachloride and was the first to manufacture carbon tetrachloride in America. He was born at Bourbon, Ind., March 19, 1868, and was educated at Wabash College and Cornell University. He began his business career by engaging in electrical engineering work in Chicago, continuing in this occupation from 1888 to 1893. Since that time he had been engaged in pursuits connected with chemistry and electrochemistry. He was a director of the American Electrochemical Society and a member of the Society of Arts of London, the Faraday Society of London, the American Institute of Electrical Engineers, the American Chemical Society, the Society of Chemical Industry and the Chemists' Club.

Richard Lamb, a civil engineer who died at the Methodist Hospital, New York City, on Oct. 19, at the age of sixty-one, had an interesting association with electrical development. He was the designer of an electric haulage plant on the Erie Canal, opened up the Virginia Copper Company's mine and erected its plant, and designed a plant for extracting copper from ore by electrical deposition instead of by the old smelting process. As a member of the American Road Builders' Association he did much for the advancement of highway engineering, on which he was an eminent authority. He was a member of the American Society of Civil Engineers, the American Institute of Electrical Engineers and the New York Electrical Society.

Trade and Market Conditions

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

Price Problem an Embarrassing One to Electrical Trade

TWO more or less embarrassing factors confront the electrical manufacturing industry in connection with the readjustment and general tightening up of business conditions now going on. The first is that the average rise in prices since 1914 has been much less than in most other lines of trade. A prominent manufacturer of electrical equipment recently stated that a check of the price lists of two large competitors showed an average increase of 78 per cent over 1914 prices. Charles L. Eidlitz, president of the R. B. Corey Company, has calculated that the price of electrical goods has increased since 1914, on an average, 87 per cent. A general survey of the field indicates that these figures represent the average fairly well. The public is set on forcing price reductions in general trade lines where increases in price have been 100 per cent and more, and this determination is having an effect in slowing up buying in some lines of electrical goods. A reduction in prices that will meet public ideas of what is right would mean the wiping out of profits and in many cases an absolute loss.

The second factor alluded to is that many manufacturers are working on high-priced materials bought under contracts several months ago either because such contracts had to be made to secure materials or because the readjustment of conditions was not foreseen. In many cases these contracts run at least to the first of the year; therefore any reduction in raw-material prices now can have no effect. Even with materials purchased after the first of the year at lower prices, the lower costs cannot be largely reflected in finished products for several months because of the time taken in putting equipment through factory processes. The combination of circumstances, taken with the public attitude on price changes, produces a difficult situation which must be met by a frank statement of conditions that will procure a hearing, or else the industry must face losses that are undeserved.

Record Export of Transformers and Rheostats in August

EXPORTS of electrical materials amounted to $61,022,347 for the first eight months of the current year, according to the Bureau of Foreign and Domestic Commerce. This figure compares well with totals of $62,294,672 and $38,591,243 for the same period in 1919 and 1918, respectively. Exports through August are running about $500,000 ahead of 1919 on interior wiring supplies, dynamos and motors, but are behind last year's totals by about $2,000,000 on insulated wire and $1,000,000 on tungsten lamps.

The export total of $7,810,175 for last August is slightly above the present year's average. The figure represents a gain of more than $1,000,000 over the previous month and a gain of about $100,000 compared with August, 1919. Thus far the present year's volume of electrical exports is closely holding to the approximate annual total of $90,000,000 that has been previously indicated.

A feature of the exports for August, 1920, is the tremendous jump in the exports of rheostats. The total value of $730,818 sets a new high record in that line and is more than the total of all the other months this year put together. Another record was also made in August, when the previous high total of $554,576 for monthly exports of transformers that was hung up in August, 1918, was exceeded by almost $170,000. Besides the export totals of $659,200 in generators and $174,910 in carbons surpassed the best previous figures of 1920. On the other hand, the total of $2,787 recorded in August was the lowest figure yet reached in exports of carbon-filament lamps.

	— Eight Months Ended —			
	Aug., 1919	Aug., 1920	Aug., 1919	Aug., 1920
Batteries	$587,951	$444,859	$4,164,107	$4,277,326
Carbons	106,823	174,910	1,034,411	966,598
Dynamos and generators	586,211	659,200	3,621,893	4,193,364
Fans	53,099	54,911	1,191,040	860,501
Heating and cooking apparatus	124,668	118,817	1,095,415	1,164,877
Insulated wire and cables	741,443	420,208	6,991,392	4,662,652
Interior-wiring supplies	166,499	241,425	1,583,780	2,093,126
Arc lamps	3,373	711	11,786	16,324
Carbon-filament lamps	10,135	2,787	127,382	66,553
Metal-filament lamps	350,284	213,615	3,415,815	2,512,437
Magnetos, spark plugs, etc.	230,403	169,543	2,114,594	2,393,687
Meters and measuring instruments	268,448	152,696	1,461,124	1,677,969
Motors	729,608	845,729	7,111,752	7,668,715
Rheostats and controllers	45,833	730,818	336,790	1,128,295
Switches and accessories	356,676	283,900	2,432,471	2,766,189
Telegraph apparatus, including wireless	115,645	31,903	676,145	443,341
Telephones	324,755	218,073	2,491,201	2,348,098
Transformers	441,733	721,507	3,960,304	2,771,963
All other	2,472,641	2,324,563	18,898,987	19,010,332
Total	$7,716,228	$7,810,175	$62,294,672	$61,022,347

Market for Christmas-Tree Lighting Outfits Undersupplied

MANUFACTURERS of Christmas-tree lighting outfits without exception report that they are unable to fill the demand. One of the largest makers of complete outfits has been sold ahead since March 1 and has accepted no new orders since that date. Another has accepted no new orders since June, and a third, while accepting a few, has, it is said, been making no efforts to obtain additional business for a long time.

One producer is meeting with considerable success on a new lighting outfit which is now on the market for the first time and which consists of a transformer and multiple lamps instead of the usual method of series lighting. The output of this set has also been sold out for the rest of this year. Considerable complaint is heard in many cases of inability to obtain enough lamps for Christmas-tree lighting sets. According to one of the large producers of these lamps this scarcity is due to the extraordinary demand that has existed for automobile and flashlight lamps and which has largely monopolized manufacturing facilities.

Stocks with manufacturers are non-existent. The latter are concentrating their efforts upon filling all back orders by Dec. 1, but it seems that this will not be accomplished in all cases. Prices are steady, with no prospect of any change this year, it is said. One of the representative makers reports no price fluctuation since an increase of about 7½ per cent more than six months ago. A feature of the present season is the small amount of competition in this line on the part of Japanese goods. Few if any complete lighting outfits from Japan are on the market, and the number of lamps from that source is generally said to be inconsiderable.

It is a fact, however, that more than 8,000,000 incandescent lamps were imported into the United States last year at an average value of less than 2½ cents per lamp. It is evident, therefore, that the bulk of these lamps were

miniatures. Furthermore, it is known that of the miniature lamps that came into the United States in 1919 at least 75 per cent came from Japan and were designed for the Christmas-tree trade. During the first quarter of 1920 a million and a quarter of lamps were imported at an average value of 2.1 cents. Taking these figures together with the fact that certain jobbers are known to have had vast quantities of these Japanese lamps in stock after the 1919 Christmas season, it is evident that at least a few millions of Japanese lamps will be offered to buyers this year. These lamps could be obtained at retail last year for 5 and 10 cents.

American manufacturers are inclined to underestimate the number of Japanese lamps which will be available this year. Furthermore, they claim that because of the inferior quality of these foreign lamps competition will not be felt.

Fancy lamps in the shape of birds, animals, etc., seem to be scarce this year. Very few are coming in from abroad, it is said, and manufacturers here are concentrating on the regular line.

Credit Men Optimistic in Face of Lengthening Collections

AS A RESULT of decreasing demand and rapidly increasing inventories in most lines at present collections are lengthening materially, according to the credit managers of several of the leading electrical interests. One of these companies reports that from May 1 to date the average length of time in which customers meet their bills has increased 26 per cent. Another authority estimates that in the East accounts on the average are running over the normal time within which bills are met by at least fifteen days.

The root of the situation is held to be that at a time when decreasing demand dictates that stocks should be reduced manufacturers are unloading supplies upon distributers. A considerable number of cancellations and requests for extensions of time in accepting goods have resulted. With a smaller and slower turnover, many electrical firms have had to ask for paper to be accepted instead of cash, with a consequent tightening of credit and the lengthening of collections that has been noted. Furthermore, in order to liquidate stocks, price cuts have been resorted to in some cases. This price cutting has by no means been general however. The pinch is especially felt in the central district of the West, according to one of the large national organizations. This is said to be a result of the extra load entailed on banks by the carrying over of crops there. The East, on the other hand, appears to be better off than any other section as regards credit.

In general the view is taken by the leading electrical interests that the above conditions will continue and perhaps become even worse for possibly the next three months or so. Then the pendulum is bound to swing the other way, this view holds, and a period of great prosperity for the electrical trade will set in. This widespread optimism seems to be based on several factors. Among these are the opening up of European markets, expectations of a boom in the building industry next year, the fact that price cuts and cancellations have not been so general as in other lines, and also the belief that overstocking will not proceed to extreme lengths because the electrical market has all along been so greatly undersupplied on many articles.

This view is concurred in by the New York Electrical Credit Association, according to E. D. Tolles, the secretary, who sees no great change in business conditions recently that has influenced credits in the electrical industry. The number of forms used by members of the association to report delinquent customers has increased, it is true, but it is held that this fact must be discounted. One significant feature, however, is the increase in the average number of forms used per member from 1.3 in 1919 to about 1.7, the estimated average of this year. The number of delinquent customers reported to the N. Y. E. C. A. in August this year was 196, or 1.2 per member, which is the lowest average recorded since 1912. The vacation season is held largely responsible, however. The number of delinquent customers increased to 282 in September, 1920, and for the first twenty-five days of October the figure is 265, which indicates a further increase this month. These totals compare with 121 delinquent customers reported in August, 1919, 136 in September, and 226 in October. It must be remembered, however, that at present there are 50 per cent more members reporting than last year. The largest total of delinquent accounts reported to the association this year was 370 in April.

Winding Tape Slightly Lower in Price

A REDUCTION averaging about 15 per cent in the price of the high-grade cotton tapes used in generator and motor windings went into effect in several recent readjustments of quotations by leading producers, and delivery conditions are considerably improved as well. Shipments can now be made in from six to ten weeks, compared with about twelve to fourteen weeks in the early summer, on substantial orders. The supply of raw material in the hands of the tape manufacturers is on the whole excellent, but the cost of yarn continues high, notwithstanding the slump of cheap grades of cotton in the open market. Leading grades of yarn cost the tape manufacturer around $1.50 to $1.75 per pound today; wages are not being reduced as yet, and the amount of business on the books of some concerns bids fair to keep the plants going on substantially full time for many weeks. A fair average cost for sizes commonly used would be from $2 to $3 per gross yard, and it is said on good authority that prices will probably not change much until the end of the year at least. One of the leading manufacturers points out that should prices fall materially before 1921 buyers would be fairly treated as to readjustment.

Cotton sleeving is in heavy demand now, and in order to fill orders night work is being done. One concern is running three daily shifts on this class of production. Eight to ten weeks' delivery is offered. Prices average about $2 per pound, net, with 50 cents per pound extra for colors.

Metal Market Situation

COPPER producers during the past week have accepted a fairly large volume of business at a price of from 15 to 15.25 cents. In spite of this concession from the previous nominal level of 17 cents that had been maintained, there is no evidence of any sustained buying movement. Consumers seem to feel that they can obtain plenty of copper when needed at still lower prices. On the other hand, a price of 15.25 cents is below the level of production costs for more than one interest, it is stated, and some mines are expected to be forced to shut down. Production is being curtailed at present, and further reductions in output may be expected in an effort to reduce the large surplus stocks which have accumulated. The outside market is now quoting electrolytic at close to producers' prices. Some quantities are available at 15 cents f.o.b. refinery, and this price might even be shaded for October delivery.

NEW YORK METAL MARKET PRICES

Copper		
[illegible]	9[illegible] 5 0	91 10 0
[illegible]	[illegible] per [illegible]	[illegible] per [illegible]
Prime Lake	[illegible]	[illegible]
Electrolytic	[illegible]	[illegible]
Casting	[illegible]	[illegible]
Wire bars	[illegible]	[illegible]
Lead (trust price)	5	7 25
Antimony	[illegible]	[illegible]
[illegible]	4[illegible]	43 00
Sheet zinc, f.o.b. smelter	[illegible]	12 50
Zinc dust	[illegible]	[illegible]
Tin	[illegible]	3[illegible]
Aluminum, 98 to 99 per cent	33 10	33 [illegible]

OLD METALS

[illegible]	[illegible] per [illegible]	[illegible] per [illegible]
[illegible] copper wire	[illegible] 00	[illegible] 50
[illegible]	7 [illegible] 8 [illegible]	7 [illegible] 7 [illegible]
[illegible]	[illegible]	[illegible] 06
[illegible]	[illegible] 00	0– 5 75
Zinc [illegible]	4 50– 5 00	4 0[illegible] 4 [illegible]

THE WEEK
IN TRADE

EXCEPT perhaps that demand is less active, if anything, conditions in the electrical market are about the same as reported last week. Stocks are piling up locally, and as a result in some places sales are being made at less than cost. Generally speaking, however, jobbers are maintaining prices, not caring to take any loss on their stock just yet.

The trade generally seems to feel that the market will continue as it is until after election. Just what the after results will be does not seem clear. A slight buying movement might take place for a few days, but there seem to be no indications of any continued demand.

Building operations are slower than ever, and the dearth of new construction is bound to have a greater unfavorable reaction on the electrical market next spring.

Christmas buying by retailers has not yet started. In fact, there is every indication that last-minute buying in hand-to-mouth quantities will characterize the season.

Credits are tightening, but there does not appear to be any "strong-arm" work done in trying to shorten collections. It would not be surprising to see better collections immediately after the elections.

NEW YORK

Local market conditions remain unchanged. In all lines there is the same dullness that has marked the past two weeks. The demand is not particularly strong, as there is no new building construction under way and the consumption of wiring material is limited, as before, to extensions and some rebuilding. Stocks are reported as being from fair to good—in some cases too good. No apparent effort is being made to round out the stocks with the elections undecided and the continued instability of prices.

Prices have steadied a bit in many lines, yet there is no doubt that the market has definitely become a buyers' market. This is particularly shown in the matter of wire, which has not responded to the price recessions of last week. It has been stated that it is the last salesman to call who receives the order as he is in a position to meet any previous price. This does not mean that all sellers are after orders at any price, but that, in particular lines, many sellers are willing to get into the market in order to balance stocks. A few specialty manufacturers are guaranteeing prices to Jan. 1, 1921. Two items of electric ware have been advanced by the Westinghouse Electric & Manufacturing Company.

Collections have steadied at fifty to sixty days. Creditors are being very closely watched but are not being crowded.

Wire.—Stocks are not moving at the prices conceded last week. Buyers may be expecting some further recessions.

Hollow Ware.—Some manufacturers have good stocks on hand, but most jobbers report a great scarcity. The Christmas demand is fair. Prices have remained stable.

Heaters.—The market has been good in heaters. Shipments are coming through well and stocks are not depleted. Prices remain steady.

Friction Tape.—No change in prices has yet resulted from the drop in the price of cotton. Shipments and stocks are good and the demand is fair. Half-inch black is quoted at 50 cents per pound.

Washing Machines and Vacuum Cleaners.—Sales have been very good during the past few weeks, probably as a result of the electrical show, and shipments are coming in well. A few manufacturers have found it desirable to reduce their prices somewhat.

Schedule Material.—The market is inclined to be erratic. Pull sockets are off, with large stocks on hand. Material containing porcelain is yet very difficult to obtain.

Rigid Conduit.—Delivery is uncertain. Prices are somewhat unreliable owing to the spotty condition of stocks both as to sizes and as between jobbers.

CHICAGO

The lethargy which has gripped all other lines of trade has crept speedily through the electrical trade during the past fortnight, sharp complaint being heard about decreased business on all sides. The only exception is that business originating in maintenance departments of public service corporations and municipalities continues good. Retail trade of all sorts is only a fraction of the spring volume, even rural districts reporting a distinct slump. Jobbers' accumulation of stock is now a problem in many lines.

There is a widespread demand for lower prices. Students of the trade, who believe cuts at present to be impossible, feel that a guaranty of prices for six months would do much to restore confidence and induce buying, as it is known that much needed buying is being indefinitely delayed. The influx of job seekers has reached sizable proportions and seems to include men from all over the East. Shoe workers from Lynn, machinists from Waterbury and mechanics from Detroit are competing with Chicago men for jobs, in a decreasing market, numerous lay-offs and reductions being recently noted.

Motors.—Small motors, from 1 hp. to 15 hp., are more easily obtained, as many small dealers who have been hoarding these scarce sizes are putting them on the market, several assortments of from 25 to 250 hp. being recently reported. Jobbers and makers are still behind, but demand has materially lessened. The fact that local power companies are at their load limit and can assume no additional contracts for service is hurting motor sales.

Protective Apparatus.—Lighting arresters, circuit breakers and oil switches are still behind in production. No talk of price cuts is heard, plenty of business at current prices being reported on the books of manufacturers.

Copper Wire.—Recent sharp breaks in the copper market was immediately reflected in the establishment of lower prices on wire. Bare copper is now on a 22-cent base, which means $22.25 per 100 lb. on No. 8 in 200-lb. lots, and weatherproof is on a 25-cent base, or $28 per 100 lb. for No. 12 triple-braid in 500-lb. lots. Demand is normal and deliveries are good, bare in car lots being available in three weeks or less.

Insulators.—Porcelain remains the hard problem of the line-material list, deliveries still ranging around four months. On some special heavy disk-strain insulators delivery cannot be obtained under a year. The recent destruction of one of the Hemingray factories by fire has delayed some deliveries of glass, but production will be back to normal in about two weeks. No price changes are noted in either porcelain or glass.

Poles.—Stocks are getting badly broken, the more popular sizes being hard to find, which is a normal condition for this time of year. Preparations are being made for the approaching producing season in the North woods.

Lamps.—Miniature-lamp makers have been hard hit by the slump in the automobile industry, and enormous stocks are accumulating, actually millions of automobile lights being in warehouses. Lamps for industrial and domestic use are in reduced demand, but railroad buying has reached such a volume as to make good business. No price changes are foreseen.

Washing Machines.—No material change in the washing-machine market is noted. Some dealers are asking for guaranteed prices.

BOSTON

Business receded somewhat during the past week in both jobbing and manufacturing circles. A representative Boston distributer reports that the number of orders coming in is running about 20 per cent below the rate of last month, but that the size of individual orders is well maintained. A waiting attitude among buyers is the result of recent price reductions in various lines of textile and leather manufacture. Weatherproof wire is weaker in price, but most electrical commodities are changing hands at firm prices except

where overstocks or close competition pull down quotations. Collections are only fair. Large engineering establishments are completing important jobs placed under contract some time since, but new work is marking time before the presidential election, which unquestionably is a factor in the current hesitation to expand business on a large scale. Throughout New England manufacturers report easier labor conditions. Brass manufacturers in the Naugatuck Valley of Connecticut have gone upon a five-day week to avoid extensive lay-offs. Press statements to the effect that the Massachusetts plants of the General Electric Company will be indefinitely curtailed after Nov. 24 are incorrect, only the usual suspension to take the yearly inventory being planned.

Wire.—Weatherproof wire dropped from a 26-cent to a 23-cent base during the week. Deliveries are a little tight on this material. Rubber-covered wire is selling at $10.50 to $11 per 1,000 ft. in the No. 14 size, in 5,000-ft. lots. One jobber had about 3,000,000 ft. on hand Saturday.

Rigid Conduit.—Shipments continue uneven and stocks are spotty. Moderate-sized demands are being cared for, however. The tube mills are extremely busy producing oil piping, which cuts into conduit deliveries. Prices of typical sizes are: Black, 1-in., $189.50 per 1,000 ft., and ½-in., $96; for galvanized, 1-in., $200, and galvanized, ½-in., $102.

Motors.—Deliveries range from three or four weeks to six and eight months. Some manufacturers are sold out until the end of next spring, while others, through enlarged plants and increasingly popularity of products, can fill orders quite promptly in comparison with the former. Prices still hold firm.

Controlling Apparatus.—A very active demand is noted. Prices have remained steady since the last advance of about 15 per cent in August. Improved motor deliveries are pressing the controller manufacturers in some cases, a fair average delivery on smaller equipment being two months.

Non-Metallic Flexible Conduit.—Stocks are of liberal size, but prices do not show any tendency toward sagging off. The consumption of this material holds up well. Quotations are $33.50 per 1,000 ft. for the ⅜-in. size and $36.50 per 1,000 ft. for ½-in. size, both in 5,000-ft. lots.

Fixtures.—Business is brisk and prices are about 10 per cent below quotations of a few months ago. Stocks are in fine shape, and a splendid trade is anticipated during the next two months. Portable lamps are in healthy demand, and a leading dealer states that prices are now down to about 25 per cent above pre-war figures, representing a total reduction of 50 per cent from his peak quotations.

Flexible Armored Conductor.—No. 14, single-strip, sells for $85 per 1,000 ft. in 1,000-ft. to 10,000-ft. lots. One jobber had 200,000 ft. in stock at the end of last week. Demand is not very heavy.

Radiators.—Trade is excellent, with steady prices. Deliveries are good and stocks are fairly complete.

ATLANTA

The past week has brought no stabilizing influences in the Southeastern field. Business in the agricultural districts has been discouraged by the many interpretations placed on the government's attitude toward assistance to the section in the financing of the cotton crop. It would seem, however, that the suggestion put forth at the meeting of the American bankers' convention for an export corporation and the summary of facts as outlined by the secretary of the New Orleans Cotton Exchange should go far to restore confidence in continued business prosperity. Last year's consumption of cotton was in excess of the supply, and all indications point to the same condition existing this year. Nevertheless, the uneasiness has had its effect on both the jobbing and retail trades and business has slackened up all along the line. Jobbers report the continued movement of the electrical material required in the building trades, and contractors continue busy on existing work, but inquiries and orders have slumped badly. Some jobbers express the opinion that a reduction in price in certain lines is inevitable, but all jobbers are of the opinion that the present slump is temporary and will probably last only until after the presidential election. Hardware jobbing firms report heavy cancellations of orders and are in turn canceling orders on manufacturers. This will be reflected somewhat in the electrical jobbing lines on building specialties. Practically all lines of electrical material are on hand in reasonable quantities, except certain classes of wiring devices in which porcelain enters.

Wire.—An average reduction of 2 cents per pound is quoted on both rubber-covered and weatherproof wire, effective at once. While weatherproof continues somewhat short in popular sizes, the rubber-covered stocks are in very good shape, with factory shipments running from three to eight weeks. The demand, due in a measure to back orders on weatherproof, continues to hold fairly well.

Flexible Armored Conductor.—Improvements in shipments are bringing about a slow betterment in stocks, though deliveries continue somewhat slow. New prices are offered in this line with two-wire No. 14, lots of 1,000 ft. to 2,500 ft., at $110 per 1,000 ft. Back orders continue to hold up the demand in this line.

Tape.—No break in the price of tape has yet been announced, though jobbers expect that the conditions in the rubber and cotton markets will be reflected at almost any moment in a sympathetic price reduction in this line. Prices: 8-ounce roll, ¾-in. wide, lots of 25 lb. to 100 lb., 71 cents per pound.

Poles.—The rebuilding of distributing lines in anticipation of the winter season is sustaining the market for poles. The car shortage continues to be the principal obstacle in the way of a plentiful supply as stocks at point of shipment are reported good. Chestnut poles are becoming more difficult to obtain and are not up to former quality. Price: 30-ft., $6.

Rigid Conduit.—Satisfactory stocks of black pipe are reported by all jobbers, but galvanized, especially in ½-in. and ¾-in. sizes, continues very scarce. Prices: Lots less than 2,500 lb., black, ½-in., $8.89; ¾-in., $11.80; 1-in., $17.44; 2-in., $37.90. Galvanized, ½-in., $9.40; ¾-in., $12.49; 1-in., $18.46; 2-in., $40.18.

Cut-Out and Outlet Boxes.—Stocks of this material have improved in the past two weeks and, with the exception of special sizes, are reported in fair shape. No reduction in prices is yet reported, though the demand is off quite noticeably.

ST. LOUIS

The past week has seen a slightly more active market than last, but there still remains the tendency both among large buyers and the retail trade to defer making any but necessary purchases. In this way the St. Louis electrical market is being affected by decreasing prices in other lines, but so far the electrical industry here has made little effort to follow the general trend. St. Louis jobbers have large stocks in a number of lines and demand has dropped off, but prices continue to remain firm with a very few exceptions.

Contractor-dealers are still doing a fair volume of business, but much of it is due to the fact that there are numbers of buildings on which work started last spring and which are just now getting to the stage where the electrical contractor can do his work. Since Aug. 1 no building operations of any consequence have been started, and a slump for the contractor-dealer can be expected whenever the present construction is completed. There is still a good volume of house-rewiring business, but this does not ordinarily form a great part of the contractor's business.

Retail dealers report only a small volume of business and a decided slump in the sale of appliances. The public is taking precisely the same attitude toward the electrical dealers that it has taken toward retailers in other lines, that of expectation of a price drop.

Collections are generally very slow, and some jobbers and manufacturers report tu ning down new accounts or limiting old ones mainly because of credit conditions.

Weatherproof Wire.—This is one item on which the market is showing signs of weakness. There are large stocks here and demand has fallen off considerably. These conditions have induced some jobbers to show a willingness to unload their stocks at whatever they can get, while others

are holding as firmly as possible in the belief that the tactics of the former will relieve the market and bolster prices again. The current quotation is 26 cents, but some sales are being made several cents below this price.

Lamps.—Stocks of lamps have bettered materially, and the situation is easier, though demand continues steady. The stocks are not yet complete because of the difficulty in getting the type C lamp in the 75-watt and 100-watt sizes, and it will probably be several months before jobbers have their reserve stocks complete. Series lamps for street-lighting purposes are coming in better than they were six and eight weeks ago, and jobbers have fair stocks to cope with a steady demand.

House-Type Meters.—Central stations are still demanding good quantities, but stocks have become larger owing to better deliveries from manufacturers. The central stations are using them mostly for replacements and remodeling.

Lamp Cord.—This is available in moderate quantities in most sizes, but the small stranded wire remains scarce. Stocks of the silk-covered cord are decidedly spotty, and many users are turning to the mercerized cotton cord of which there is a fair supply. No. 18 twisted pair is being quoted at $28.50 per 1,000 ft., net, in average lots.

Sockets.—There are more sockets in stock here than the demand can take care of, but jobbers are not wavering on their prices as the belief prevails that as soon as building starts again the manufacturers will not be able to keep up with orders. The prices quoted are 51 cents net for pulls, 28 cents for keys and 26 cents for keyless in case lots.

Fuse Plugs.—There is a good supply and a fair demand. Immediate delivery can be made on average quantities. Up to 30 amp. the price ranges from $4.75 to $5 per 100 according to quantity.

Panelboard Switches.—Manufacturers here report that they are running about 15 per cent behind on their orders, that production is normal and that no slump has been felt.

SALT LAKE CITY—DENVER

Many electrical jobbers are struggling to keep from becoming overstocked. When merchandise was scarce they ordered from various markets to insure being in a position to meet the demand. Now factories are speeding up production and pyramided orders are beginning to pour in. The result in many cases is a resort to cancellation. Many manufacturers are showing a disposition to hold jobbers to their contracts. Crops are moving satisfactorily and money is beginning to circulate more freely. The coal mines are running full blast. The metal-mining business is in bad shape, and mining activity generally is at a low ebb. Most jobbers are stocking extensively in anticipation of better times although they are not looking for immediate relief. They are confident that by spring business will be in a far better way. Only a few of the more timid and pessimistic are holding back. Conditions are better for electrical contractors. A few sizable building jobs are getting under way and prospects for more contracts are brighter.

Electric Ranges.—Though the market is best in the summer months, business is still holding up. Already this year one jobber has disposed of eleven carloads.

Washers.—The thing of chief interest in this line is the overabundance of stock. Warehouses are being taxed to the limit. The market is slow.

Heating Appliances.—Dealers are having no trouble to stock up with best sellers in the hollow-ware line. They buy from jobbers only as they are able to sell, exhibiting a marked tendency to play safe.

Motors.—This phase of the market seems to be one of the bright spots. Dealers sell all they are able to secure from jobbers. The demand is especially good for sizes ranging from 2 hp. to 20 hp.

Transformers and Meters.—There seems to be some scarcity of stocks. The demand is good.

SEATTLE—PORTLAND

The change in business conditions in the Northwest from week to week during the past month is negligible. Jobbers report a quiet market with practically no movement of heavy power apparatus, transmission equipment and house-wiring devices. Domestic appliances, including expensive merchandise, are moving well and farm-lighting plant sales are going as well as was anticipated, or even better. Retailers state that counter business is holding up well with percolators and toaster stoves leading the movement of socket devices. Heaters are in big demand, and retailers are having a hard time keeping stocks filled. Lamps and flatirons also enjoy good sales. Shortages have not been overcome in heating devices, small motors, washing machines and porcelain ware. Shipments are coming through in satisfactory manner, and, everything considered, stocks are in fine shape. Prices remain practically the same. Residence construction is dropping off, and the building of large structures heretofore mentioned will probably be postponed until spring or maybe later.

Portland jobbers report that business continues good but that part of the volume is in filling back orders, although there is considerable new business. Transportation is catching up with orders, which means that stocks will show further improvement. Pipe and porcelain recently advanced to cover increased freight charges, but wire registered another drop. Certain lines of heavier equipment have advanced about 3 per cent. The jobbers will probably absorb the increased freight charges on lighter equipment. Collections are slow. To date the movement of crops has apparently made no change in electrical industry.

Flatwork Ironers.—This device, while comparatively new in this section, is attracting considerable attention. Dealers are demonstrating it at every opportunity and report that sales are quite satisfactory.

Heating Appliances.—Some dealers hold that this season will establish sales records, while others are not so optimistic. Stocks are in good shape and replenishments are easy to obtain. Prices show no particular change.

Vacuum Cleaners.—This device, which is always moving in this territory, is going better than ever this fall. Stocks are in good shape and shipments of the 32-volt type are moving exceptionally well, especially in eastern Washington.

Storage Batteries.—Stocks in most cases are low owing to fall business, which was slightly heavier than was anticipated. Sales are still going along well and are expected to continue.

SAN FRANCISCO

All reports show a tremendous amount of new building in southern California, especially in Los Angeles, where building permits for 1920 will total well over $50,000,000 in value, the major portion of which is for big jobs. In other parts of the state a steady decrease is noted. Buying consists of small unit packages, except where substantial price or delivery advantages are offered.

Roughing-in Material.—Los Angeles jobbers and dealers say that it is impossible to maintain any stocks of rubber-covered wire, conduit boxes, condulets and schedule material because of the demands of new buildings.

Insulators.—The bay district is experiencing a complete dearth of split porcelain knobs in standard sizes, and because of this fact it is temporarily possible to use solid porcelain knobs.

Lamp Cord.—Although regulations require the use of asbestos-protected lamp cord for certain type C lamp installations, comparatively little of this class of cord has been sold recently. However, several good sales to fixture houses are reported, and the ratio of use seems to be increasing.

Washing Machines.—More conservative buying is the rule. Several well-established dealers have found themselves in financial difficulties because of overbuying. A ten-lot or a twenty-lot price seems to be most favorably regarded.

Farm Plants.—After a sale that decreased during the crop-moving months a better rate of sale is now the rule, for the ample 1920 crops are now disposed of and farmers not only have more leisure to talk to agents but ample means to pay for the plants. An especially good sale of 32-volt household appliances is reported.

Radiators.—A splendid sale of radiators is predicted for the 1920-1921 season, judging from advance orders. The field has never been campaigned before so thoroughly.

NEW APPARATUS & APPLIANCES

A Record of Latest Developments
and Improvements in Manufacturers' Products
Used in the Electrical Field

Lighting Panels for Residences

A complete equipment of service-switch main and branch connections is mounted upon a molded composition



DEAD-FRONT PANEL FOR RESIDENCES

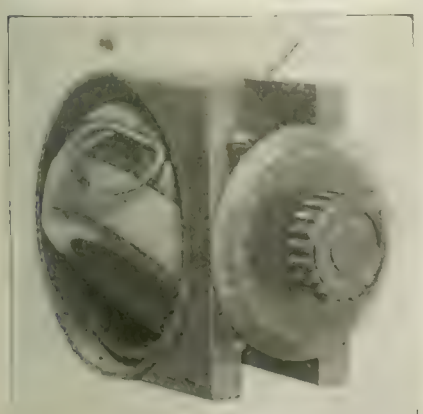
base in the panels recently brought out by the Benjamin Electric Manufacturing Company, Chicago. This panel is made in both open-front and dead-front for any number of circuits up to ten.

Combination Switch and Receptacle Plate

A new type of combination switch and receptacle plate with removable door is being offered by the Peerless Light Company, Chicago. This plate is suitable for the old-type No. 1908 receptacle or the new-type standard flush receptacle.

Variometer

A variometer known as type ZRV, with the outer winding made in the form of a section of a sphere, form-



BALL MAY BE CONTINUOUSLY REVOLVED WITHOUT BREAKING CONNECTIONS

wound and supported inside a 4½ in. bakelite tube, while the inner winding is directly on a hardwood ball treated to exclude moisture, has been placed in production by the Clapp-Eastham Company, Cambridge, Mass. The maximum inductance is 1.25 millihenries and the minimum inductance 0.1 millihenry.

Skeleton Bell

Simplified construction which eliminates several of the features that often caused trouble in electric bells is the principal point of interest in the new line of skeleton bells designed by the Signal Electric Manufacturing Company, Menominee, Mich. The armatures and strikers of these bells are in one piece, the binding posts are insulated and non-turning, the contacts are of heavy coin silver, and the adjustments are simple and positive.

Continuous-Current Radio Transformers

To produce practically unfluctuating direct current at 375 volts and 550 volts a transformer in 50-watt and 200-watt sizes respectively has been developed by the Acme Apparatus Company, 27 Windsor Street, Cambridge, Mass., for use with rectifying tubes, a small condenser and an "Acme" 1.5-henry choke coil. These transformers are also provided with windings for use in heating the filaments of the rectifying tubes and the oscillating tubes used in the generation and modulation of the continuous wave current.

Insulating Varnishes

A complete line of insulating varnishes and japans suitable for many applications in the manufacture and maintenance of electrical equipment, including the impregnation of coils wound with untreated fibrous materials, has been placed on the market by the General Electric Company, Schenectady, N. Y. The varnishes are divided into two general classes, known as black varnishes and yellow, or clear varnishes. Both general classes are subdivided into everal classes for special uses.

Notes on Recent Appliances

Automatic Household Refrigerator

A refrigerator has been developed for household use by the Refrigo Corporation, Milwaukee, Wis.

Tabletop Dishwasher

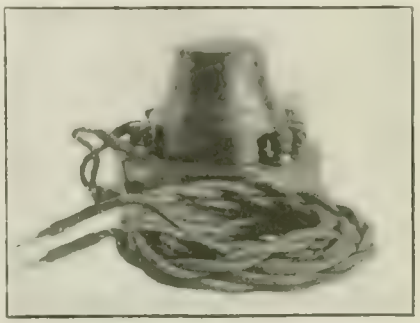
A new model dishwasher is being manufactured by Mermaid Dish Washer Company, Middletown, Conn

Heater for Running Water

An electric heater to be attached to the faucet directly or by means of a rubber hose has been developed by the National Electric Water Heater Corporation, New York City. This device heats the water as it flows through from the faucet.

Buzzer for Testing Electric Wires

The Emka buzzer tester brought out by the Electric Signal Manufacturing Company, Inc., 31 Tremont Avenue, Orange, N. J., may be used for testing



FOR TESTING CIRCUITS OR CONTACTS

open or short circuits in houses, or factory wiring, motor windings and other electrical circuits. This instrument is a combination of buzzer, telephone connections and batteries in one set.

Operating Levers for Oil Circuit Breakers

Improvements have recently been made by the General Electric Company in the levers of oil circuit breakers which are operated manually and do not require extra heavy leverage to close the breakers. The new levers are of the same size for breakers of all capacities within the range of application, all parts except the links



STANDARDIZED IN ALL SIZES

being mutually interchangeable. This standardization results in few parts per handle, facilitating repairs and adding to the uniformity and appearance

MANUFACTURERS' ACTIVITIES

Record of Changes Affecting Sales and Distribution Together with Trade Personals and Notes on Foreign Trade, Jobbers' News and New Trade Literature

VICTOR B. SEIDEL, president of the Seidel Engineering Company of Tulsa, Okla., has established an electric welding industry catering to oil-field equipment in the Southwest. Mr. Seidel is sending a portable electric welding outfit out into the oil fields.

THE WESTERN APPLIANCE MANUFACTURING COMPANY, Railway Exchange Building, Seattle, has let contract for the erection of a one-story factory, to be used for the manufacture of an electrical appliance known as the Mercer ironing machine. The structure will be 110 ft. x 90 ft. inside and will cost $25,000 exclusive of equipment. The plant, it is reported, will have a capacity of 500 machines within ninety days. Officials of the company are C. N. Biggs, president; T. H. Vanasse, vice-president, and C. M. Mercer, secretary.

DATA ON FIXTURE MANUFACTURERS' PURCHASES OF SOCKETS BEING COLLECTED.—The National Council of Lighting Fixture Manufacturers has sent a questionnaire to its members asking them for information on the monthly purchases of different types of sockets during the past year. Members are asked whether they purchase from manufacturers direct or from jobbers.

INVOLUNTARY PETITION IN BANKRUPTCY FILED AGAINST BLUE BIRD.—An involuntary petition in bankruptcy has been filed in the United States District Court at St. Louis against the Blue Bird Appliance Company, organized several years ago as the selling agency for the Blue Bird Manufacturing Company, washing-machine manufacturer. The latter company was recently taken over by the Davis Sewing Machine Company of Dayton, Ohio, and will be removed to that city within the next year. At the time the company was purchased it was understood that creditors of the appliance company had been given a satisfactory settlement of their claims, and the present involuntary petition in bankruptcy comes as a surprise. The claims filed by creditors amounted to approximately $30,000, and the petitioners claim that in the last four months the company has preferred certain creditors with money and property.

THE ILG ELECTRIC VENTILATING COMPANY is moving into its new plant at 2850 North Crawford Avenue, Chicago. The new building has 100,000 sq.ft. of floor space and provides for doubling the output.

CLARENCE C. BRINLEY has been retained as Eastern manager of the trolley carrier department of the Conveyors Corporation of America and will be attached to the New York office, 110 West Fortieth Street. He was first connected with the C. W. Hunt Company and went to the Conveyor's Corporation from the Gifford-Wood Company. During the war he was conveyor engineer for the Air Nitrates Corporation.

THE AMERICAN STEAM CONVEYOR CORPORATION, 326 West Madison Street, Chicago, announces a change in name to Conveyors' Corporation of America.

J. M. BARR is now associated with the Mechanical Appliance Company, Milwaukee, Wis., as general manager. He was formerly connected with the Westinghouse Electric & Manufacturing Company, Fairbanks, Morse & Company and the Howell Motors Company.

FIXTURE MEN PREPARING FOR BUFFALO FIXTURE MARKET NEXT FEBRUARY. Plans are going ahead for the second lighting market of the National Council of Lighting Fixture Manufacturers at Buffalo during the week of Feb. 11. This will be staged in conjunction with the annual convention of the council and also of the Lighting Fixture Dealers' Society of America. Representatives of the Glassware Guild and the manufacturers of fixture accessories will also be present. The market, which was held last year for the first time, will be established in the Elmwood Music Hall where space has been provided for seventy-four principal booths with room for a number of smaller booths that will bring the total up to approximately 100. Each of the principal booths, it is stated, will be wired for 2,000 watts. Charles H. Hofrichter, 8410 Lake Avenue, Cleveland, Ohio, is secretary of the National Council of Lighting Fixture Manufacturers.

HOOVER SWEEPER CELEBRATES TWELFTH BIRTHDAY.—The Hoover Suction Sweeper Company, Canton, Ohio, recently celebrated its twelfth anniversary. The machine was originally manufactured in 1908 in a small room in Canton, from which status it has grown rapidly, except for a few lean years when the machine as well as the market had to be developed, until now its sales organization comprises, according to W. H. Hoover, president of the company, eighty divisional and district managers, 650 salesmen and altogether in the organization 1,800 people.

SANFORD RILEY COMPANY BUILDS LARGE SINGLE-STOKER.—The Sanford Riley Stoker Company, Worcester, Mass., has received an order from the Public Service Electric Company of New Jersey for one of the largest single-set stoker installations ever built, the equipment to be installed in the Burlington generating station. Two B. & W. boilers are being equipped, each boiler having 14,180 sq.ft. of heating surface. The projected grate area is about 310 sq.ft., and the boilers are set with the bottom of the front header 12 ft. above the floor line. The tubes are 20 ft. long and the furnace dimensions are: Width, 28 ft. 8½ in.; length from inside front wall over rear end of stoker, 10 ft. 10¾ in. Each boiler will be furnished with an eighteen-retort, extra-long Riley underfeed stoker. The maximum capacity of each stoker is about 11 tons of coal per hour, corresponding to an overload of about 350 per cent on the boiler. Each stoker will be equipped with six two-speed Riley gear boxes, and an individual four-speed induction motor of the General Electric K-T type will be provided for each gear box, giving a range of eight stoker speeds. The largest stokers previously made by this company were of the sixteen-retort size.

Supply Jobbers' Notes

THE PIEDMONT ELECTRIC COMPANY, Asheville, N. C., has had its territory enlarged to cover both North Carolina and South Carolina for the distribution of A B C electric washers and is starting on an active campaign for their sale.

THE MANHATTAN ELECTRICAL SUPPLY COMPANY, New York, has reported for the nine months ended Sept. 30 gross sales of $5,752,136, as compared with $4,976,213 for the corresponding period of 1919, an increase of $775,923.

EMIL ZINSMEYER, until Oct. 1 sales manager for the Frank Adam Electric Company, St. Louis, Mo., has announced his resignation to become connected with the Electrical Warehouse Company of Detroit, Mich., electrical jobber. Mr. Zinsmeyer was with the Frank Adam Company for nearly twenty years. The vacancy created by his resignation is being filled by Phil Rabon, who has been on the sales force of the Frank Adam Company for several years.

Foreign Trade Notes

THE INDUSTRIAL ENGINEERING COMPANY has appointed R. G. Lee as general manager of the company in Canada and the United States. Mr. Lee has been power manager of the Toronto Hydro-Electric System for the past seven years. The business of the Industrial Engineering Company will be divided into two departments, the first, that of consulting engineering and the second that of handling electrical apparatus and machinery. The company will have offices in Toronto and Windsor in Canada and in Detroit, Cleveland and Buffalo in the United States. H. C. Betiam, formerly with the Toronto Hydro-Electric System, has been appointed manager for the district of Toronto.

THE CANADA WIRE & CABLE COMPANY has appointed W. R. Greenshields as assistant sales manager. He has been in the service of the company for nine years.

THE ENGLISH ELECTRICAL COMPANY, LTD., London, Eng., has recently established offices in the Transportation Building, Montreal, Quebec. The company is a consolidation of the Dick, Kent Company, Ltd., Preston, England; Coventry Ordnance Works, Coventry, England; Williams & Robinson, Rugby, England; Phoenix Dynamo Manufacturing Company Ltd., Bradford, England, and Siemens Brothers Dynamo Works, Ltd., Stafford, England. Owing to the recent purchase of the Siemens works at Stafford, the English Electric Company will take charge of the business in Canada formerly conducted by the Siemens Company of Canada, Ltd. C. W. Stokes is the Canadian manager.

FOREIGN GOVERNMENT BUYS EXPANDED STEEL POLES.—The Italian State Railways are reported to have placed an order for 21,800 one-piece steel poles with the Italian plant of the Bates Expanded Steel Truss Company. These poles are to be used for the electrification of steam railroads, as are other similar poles which have been ordered by the Royal Swedish Railways and by some of the South American governments.

TAIT'S ELECTRICAL DIRECTORY.—The 1920 edition of this reference book, covering Australia and New Zealand, is now available and can be obtained from Scottish House, 90 William Street, Melbourne, Australia. The volume contains detailed data on central stations in Australia and New Zealand and also on electric plants at coal mines in New South Wales.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A Norwegian firm (No. 33,903) is in need of electrical equipment and supplies such as insulators, insulated and non-insulated copper wire, transformers, instruments and apparatus for generating stations, and all supplies for power transmission and house installations.

Trade Publications

STORAGE BATTERY LOCOMOTIVES.—The Jeffrey Manufacturing Company, Columbus, Ohio, has issued catalog No. 231, covering storage battery locomotives for industrial plants.

MINING MACHINES.—The Jeffrey Manufacturing Company, Columbus, Ohio, has issued bulletin No. 241, covering its 35-B Shortwall mining machine.

LOCOMOTIVE CONTROLLERS.—The Jeffrey Manufacturing Company, Columbus, Ohio, has issued bulletin No. 204, covering its locomotive controller.

ROTARY COAL DRILLS.—The Jeffrey Manufacturing Company, Columbus, Ohio, has issued bulletin No. 243, covering electric rotary coal drills.

BULLETIN INDEXES.—The General Electric Company, Schenectady, N. Y., has issued indexes to its descriptive bulletins and sheets and to its supply-part bulletins.

WIRE AND CABLE.—The Habirshaw Electric Cable Company, Yonkers, N. Y., has issued a manual covering its wires and cables.

FUSES.—A. F. Daum, Pittsburgh, Pa., has issued bulletin No. 20-I, covering refillable cartridge fuse shells.

CONVENIENCE OUTLETS.—The Cutler Hammer Manufacturing Company, Milwaukee, Wis., has issued publication No. 857, covering the application of receptacles in the "convenience outlet" campaign.

ENGINEERING ORGANIZATION.—Ford, Bacon & Davis, engineers, 115 Broadway, N. Y., have issued a pamphlet covering their service.

ELECTRIC COAL CUTTERS.—The Jeffrey Manufacturing Company, Columbus, Ohio, has issued bulletin No. 209 covering electric coal cutters.

STORAGE BATTERY LOCOMOTIVES FOR MINES.—The Jeffrey Manufacturing Company, Columbus, Ohio, has issued catalog No. 312, covering storage battery locomotives for mines.

ELECTRIC ENTRY DRIVERS.—The Jeffrey Manufacturing Company, Columbus, Ohio, has issued catalog No. 769 covering electric entry drivers for coal mining operations.

MINE LOCOMOTIVES.—The Jeffrey Manufacturing Company, Columbus, Ohio, has issued catalog No. 263, covering mine locomotives.

SHAFTING EQUIPMENT.—The A. & F. Brown Company, New York, have recently issued catalog No. 66, covering shafting, pulleys, clutches, gears, sheaves, etc.

COPPERCLAD WIRE.—The Copper-Clad Steel Co., Rankin, Pa., has issued for distribution a booklet on its "copperweld" wire products.

MARINE PUMP.—The Worthington Pump & Machinery Corporation, 115 Broadway, New York, has just issued a new illustrated 125-page catalog, No. BK-3000, covering its line of marine pumps and auxiliaries.

New Incorporations

THE ROYAL ELECTRIC COMPANY, with offices at 12 East Sixth Street, Chattanooga, Tenn., has just been incorporated. The company has been doing business for some time and has the Tennessee and Georgia territory for the P. A. Geir Company's line.

THE FIRST NATIONAL LIGHTING CORPORATION has been incorporated under the laws of the State of Ohio with a capital stock of $100,000 to manufacture and distribute commercial and industrial electric lighting fixtures in all the territory east of the Mississippi River. The officers of the company are Joseph L. Jaffe, president; William S. Kiesel, vice-president, and C. H. Heide, secretary-treasurer. Offices and showrooms have been opened at 2030 East Twenty-second Street, Cleveland, and it is stated that the new factory will be in full operation this fall. The company proposes to manufacture a standardized line of commercial and industrial fixtures.

THE MARTIN WRIGHT ELECTRIC COMPANY, Dallas, Tex., has been incorporated with a capital stock of $20,000 by Martin Wright, E. B. Zoller and L. B. French.

THE MOUNT CARMEL LIGHT & POWER COMPANY, Marion, Va., has been incorporated with a capital stock of $5,000. W. A. Scott is president and C. W. Respass is secretary.

THE ROYAL ELECTRIC COMPANY, Chattanooga, Tenn., has been chartered with a capital stock of $30,000 by F. E. Bryant, F. B. Dickinson and J. B. Milligan.

THE ALDERSON (W. VA.) ELECTRIC APPLIANCE COMPANY has been incorporated with a capital stock of $10,000 by L. E. Collins and R. B. Beadles.

THE OWASSO (OKLA.) POWER & LIGHT COMPANY has been chartered with a capital stock of $10,000 by E. L. Mayfield, B. Swift and J. E. Moore.

THE WEST HARRISONBURG LIGHT COMPANY, Harrisonburg, Va., has been incorporated with a capital stock of $5,000. H. A. Logan is president and J. S. Flory is secretary of the company.

THE TUCKER-PARTHREE ELECTRIC COMPANY, 122 Hollingsworth Street, Baltimore, Md., has been incorporated with a capital stock of $50,000 by Francis Tucker, Clarence E. Parthree and Isaac T. Parks, Jr.

THE HIGH TENSION SUPPLIES COMPANY has been incorporated in Delaware with a capital of $100,000, to manufacture electrical appliances, by F. Hoey, Frederica, Del.; R. H. Kenney, Dover, Del., and D. T. Swing, Ridgely, Md.

THE RUBIN ENGINEERING CORPORATION has been incorporated in Delaware with a capital of $100,000 to make mechanical and electrical appliances, by F. R. Hansell, J. V. Pfurm and E. M. Macfarland, Philadelphia, Pa.

THE BUFFALO REFRACTORY CORPORATION has been incorporated in Delaware with a capital of $100,000, to manufacture heat and electric resistance products, by L. H. Melwood, J. M. Mills and W. H. Kelly, Buffalo, N. Y.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

EAST LEE, MASS.—The erection of an electric power plant on the Housatonic River is being planned for. Carl Wurtzbach, High Street, Lee, is interested.

TERRYVILLE, CONN.—The Eagle Lock Company contemplates enlargements to its power plant, including the installation of new equipment.

Middle Atlantic States

FILLMORE, N. Y.—Application has been made to the State Public Service Commission by the Fillmore Electric Company for authority to erect an addition to an electric plant in Genesee Falls. W. L. Young, Fillmore, is president.

FREEPORT, N. Y.—The Common Council has had plans prepared for extensions and improvements to the municipal power plant to cost about $100,000. Work will be started at an early date.

HAMMOND, N. Y.—The Hammond Light & Power Company has applied to the Public Service Commission for permission to erect electric plants in the towns of Morristown and Hammond.

KINGSTON, N. Y.—The Kingston Gas & Electric Company has applied to the State Public Service Commission for authority to operate in the towns of Hurley, Ulster and Esopus.

LEWISTON, N. Y.—Application has been made to the Public Service Commission, Second District, by the Lewiston & Lake Shore Power Company for authority to issue $15,000 in bonds, the proceeds to be used to improve its property, including the purchase of new meters and transformers, improvements to its distribution and municipal system in Lewiston and the distribution system on the Fort Niagara Beach and Lake Road, new equipment in the Youngstown and Lewiston substations, etc.

NEW YORK, N. Y.—Bids will be received by the Superintendent of School Buildings of the Board of Education, room 2800 Municipal Building, Manhattan, until Nov. 3 for the installation of electric equipment in the new Public School No. 62, on Leggett Avenue, Borough of the Bronx.

OSSINING, N. Y.—Bids will be received until Dec. 2 for the erection of a prison building at the State Prison to cost about $325,000. Considerable electrical equipment will be required. L. F. Pilcher, Hall of Records, New York City, is architect and engineer.

MAURER, N. J.—The Barber Asphalt Paving Company, 233 Broadway, New York City, contemplates rebuilding its power plant, reported to have been damaged by fire to the extent of $3,000,000, including machinery. Electric traveling cranes, etc., will be installed.

MILLBURN, N. J.—Bids will be received by Dean Emery, president of the Board of Education, until Nov. 8 for electrical work, the installation of electric equipment, etc., in connection with the proposed new addition to the Wyoming School on Myrtle Avenue.

NEWARK, N. J.—The Lyraphone Company, Woodward Avenue, has plans under way for the construction of a power house, 25 ft. x 36 ft., at its local plant.

TUCKERTON, N. J.—Application has been made by the Atlantic City Electric Company, Atlantic City, for the erection of a transmission line to the radio station here, to be operated in the future by the United States Radio Supply Company. The municipal officials are also negotiating with the Atlantic City company for the installation of a local commercial system, including street-lighting and general service.

LEBANON, PA.—The Cornwall Railroad has plans under way for the construction of a machine and repair shop and power house to cost about $130,000.

PHILADELPHIA, PA.—Bids will be received by Major H. J. Lumsden, Frankford Arsenal, until Nov. 9 for the installation of an electric lighting system in the new power plant building.

PITTSBURGH, PA.—The Pittsburgh Street Railway Company, Chamber of Commerce Building, has had plans prepared for an addition to its electric power plant on Brunots Island.

WILLIAMSPORT, PA.—The Lycoming Foundry & Machine Company, Oliver Street, has plans under way for the construction of a power house to cost about $30,000.

BALTIMORE, MD.—The Baltimore & Ohio Railroad, B. & O. Terminal, has plans under way for the electrification of certain sections of its line. Plans also include the construction of two hydro-electric plants, one on the Savage River and the other on the Cheat River. J. E. Davis is electrical engineer for the company.

AVONDALE, W. VA.—The Mountain State Coal Company of Huntington is having plans prepared for the erection of an electric power plant at Ritter. C. T. Benson is president.

CHARLESTON, W. VA.—Bids will be received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Nov. 17 for the construction of an electrical distribution system at the armor plant. (Specification 1294.)

WASHINGTON, D. C.—The Potomac Electric Power Company contemplates power plant improvements and extensions to cost about $600,000.

WASHINGTON, D. C.—The city officials contemplate the installation of a new street-lighting system. Warren B. Hadley is electrical engineer of the district.

North Central States

LAKE CITY, MICH.—Arrangements have been made by a committee of Lake City citizens, headed by Attorney Henry Miltner, to secure electric light and power for the village from the Winterfield Light & Power Company, now erecting a plant on the Clam River.

CLEVELAND, OHIO.—A proposition to issue $90,000 in bonds will be submitted to the voters at the general election for the purpose of erecting an electric light plant in East Cleveland. A. Carran, City Hall, East Cleveland, is in charge.

LOUISVILLE, KY.—The Board of Park Commissioners contemplate the installation of electricity in Central Park at a cost of about $12,500.

INDIANA HARBOR, IND.—The Board of Commissioners of Lake County have filed petition with the State Tax Board for permission to issue $30,000 in bonds for the installation of a police alarm system.

INDIANAPOLIS, IND.—The Merchants' Heat & Light Company, Washington and Meridian Streets, contemplates the erection of a 40-ft. x 55-ft. addition to its power plant. Charles Bressman, 1503 Merchants' Bank Building, engineer.

DELAVAN, ILL.—A special election will be held on Nov. 3 for the purpose of submitting to the voters a proposition to issue $8,000 in bonds for the installation of electrical equipment for the water-works systems, etc.

SPRINGFIELD, ILL.—Ordinances have been passed by the City Council for the installation of a new ornamental lighting system in the area bounded by Williams Boulevard, West Grand Avenue, Park and Lawrence Avenues. The cost is estimated at $7,600.

OSHKOSH, WIS.—Plans are being prepared for the installation of an ornamental street-lighting system at this place. Ira Parker is [illegible]

PRINCETON, WIS. — The Princeton Power & Light Company has plans under way for the construction of a hydro-electric plant. The Jacobson Engineering Company, 522 Metropolitan Bank Building, Minneapolis, Minn., is engineer.

SEYMOUR, WIS.—The Badger Utility Company of Pulaski has contracted with the Wisconsin Traction Light, Heat & Power Company for electric power of 100 hp. Plans include the installation of a substation at Seymour.

TWO RIVERS, WIS.—It is reported that the Wisconsin Basket & Pail Company contemplates rebuilding its factory and power plant recently destroyed by fire, causing a loss of about $13[illegible]. New power-plant equipment will be purchased. John F. Conat is president.

UNION GROVE, WIS.—The State Board of Control, M. J. Tappins, secretary, Madison, is having plans prepared for a power plant at the Southern Wisconsin Home for the Feeble Minded. John C. White of Madison is engineer.

BEAVER CREEK, MINN. — A special election will be held for the purpose of submitting to the voters a proposition to issue $13,000 in bonds for an electric lighting system. B. R. Page is city clerk.

MARSHALLTOWN, IOWA. — The City Council has authorized John I. Bell, councilman, to receive bids on poles, wires and other necessary equipment for the construction of a lighting system in the city.

PERU, NEB.—At a recent village meeting an ordinance was passed, calling for a special election to be held soon to vote on $10,000 in bonds for the purchase and improvement of the electric light plant. Extension and improvement to the system are also contemplated.

OTTAWA, KAN.—At a recent election bonds to the amount of $165,000 were voted for improvements to the present municipal light and water plant.

PLEASANTON, KAN.—Preliminary plans have been prepared for the erection of an electric light plant at this place. E. T. Archer & Company, 609 New England Building, Kansas City, Mo., are engineers.

Southern States

MANCHESTER, GA.—Improvements and extensions to the municipal electric light system to cost about $10,000 are contemplated.

SMYRNA, TENN. — A corporation has been formed by the citizens of Smyrna for the purpose of erecting an electric light plant. The stock has been sold and charter secured.

Pacific and Mountain States

WILSONVILLE, ORE. — N. W. Young has had plans prepared for the extension of his electric light system from Wilsonville to the Frog Pond district.

BAKERSFIELD, CAL.—The Pacific Gas & Electric Company has applied to the Railroad Commission for authority to purchase the excess energy of the San Joaquin Light & Power Corporation. Plans will include the erection of a transmission line from the Kerckhoff plant to the San Joaquin's substation at Merced.

GLENDALE, CAL.—The Verdugo Woodlands Improvement Association, recently organized, contemplates improvements to the street-lighting system, telephone service, etc.

GRASS VALLEY, CAL. — The Delhi Mining Company has plans under way for the construction of a hydro-electric plant on Bloody Run. Plans include the installation of two large electric generators and auxiliary operating machinery. Harry Skewes is superintendent.

SAN DIEGO, CAL.—The San Diego Consolidated Gas & Electric Company has applied for permission to appropriate 10 second-ft. from the Pauma Creek, San Diego County, for the development of 560 hp. Diversion works consist of a [illegible] and dam. The cost is estimated at about $225,000.

SAN FRANCISCO, CAL. — Application [illegible] to the Railroad Commission by the Coast Valley Gas & Electric Company to issue $[illegible] in bonds, part of the proceeds to be used to follow [illegible] capacity of [illegible] feeders in Salinas Valley, [illegible] extensions to electric distribution [illegible] during the next twelve months. $1,000 [illegible] new outdoor high-tension substation at Salinas, $15,000; new distribution substations at east and west sides of the Salinas Valley, $30,000; duplicate transmission line from Metz to King City, $25,000; convert Soldad-King City line from 30 kv. to 60 kv., $30,600; etc.

SAN FRANCISCO, CAL.—According to M. M. O'Shaughnessy, city engineer, plans for the electric power plant at Hetch-Hetchy to cost about $6,000,000 are under way, and the construction of this plant may be followed by the establishment of auxiliary plants at other points. The main plant is to be erected at Priest's Hill where it is expected to develop 36,000 hp.

Record of Electrical Patents

Notes on United States Patents

(Issued Oct. 19, 1920)

14,959 (reissue). WIRELESS TELEPHONE SYSTEM; Lee de Forest, New York, N. Y. App. filed May 16, 1916. Sounds made clear.

1,355,838. INSTANTANEOUS HEATER; Charles D. McLean, Berlin, N. H. App. filed Sept. 22, 1919. For water.

1,355,849. PORTABLE LAMP; Francis M. Rosenfeld, New York, N. Y. App. filed Feb. 5, 1919. Flashlight.

1,355,863. TELEGRAPH INSTALLATION; Oskar Srnka, Brunn, Austria. App. filed June 14, 1915. Any number of messages transmitted simultaneously.

1,355,867. LIQUID HEATER; William I. Thompson, Stoneham, Mass. App. filed Sept. 29, 1919. Radiator.

1,355,869. SYSTEM OF ELECTRICAL REGULATION; William A. Turbayne, Niagara Falls, N. Y. App. filed Feb. 11, 1915. Battery charging from variable-speed generator.

1,355,884. ALTERNATING-CURRENT FREQUENCY METER; John G. Blessing, Chicago, Ill. App. filed Feb. 19, 1917. Meter and timing device.

1,355,886. CUT-OUT BOX; Hector H. Brown, Baltimore, Md. App. filed May 31, 1919. Conduit openings changeable in size.

1,355,887. PANEL BOX; Hector H. Brown, Baltimore, Md. App. filed May 31, 1919. Improved front.

1,355,897. TESTING CIRCUIT FOR REPEATERS EQUIPPED WITH AUTOMATIC NETWORK-SELECTORS; Charles S. Demarest, Brooklyn, N. Y. App. filed Dec. 5, 1918. For amplifying signals.

1,355,898. TESTING AND MONITORING EQUIPMENT FOR REPEATER CIRCUITS; Charles S. Demarest, Brooklyn, N. Y. App. filed Dec. 5, 1918. Artificial loads.

1,355,899. DRY BATTERY; Carleton Ellis and Alfred A. Wells, Montclair, N. J. App. filed Oct. 31, 1917. Made of old materials.

1,355,905. MEANS FOR SECURING ELECTRICAL FITTINGS TO CONDUIT OUTLET BOXES AND THE LIKE; Leonard Milne, Westminster, London, England. App. filed Sept. 30, 1918.

1,355,917. AUTOMATIC TELEPHONE SYSTEM; George E. Schomaker, Chicago, Ill. App. filed May 23, 1917. Two-wire.

1,355,926. TELEPHONE-EXCHANGE SYSTEM; Dawson M. Taggart, East Orange, N. J. App. filed Oct. 23, 1918. Trunk circuits.

1,355,927. TELEPHONE-EXCHANGE SYSTEM. Dawson M. Taggart, East Orange, N. J. App. filed Dec. 28, 1918. Connection of manual with automatic.

1,355,932. COMBINED SOUND AND HEATING ELEMENT; Allen J. Walter, Mansfield, Ohio. App. filed July 5, 1919. Medical.

1,355,943. AUTOMATIC SWITCH FOR CIGAR LIGHTERS, ETC.; Charles F. Cuno, Meriden, Conn. App. filed April 22, 1920. Spring reel.

1,355,957. TELEPHONE TRANSMISSION SYSTEM. Percy M. Gardenier, Bayside, N. Y. App. filed July 23, 1918. Four-wire telephone repeater.

1,355,971. SUBSTATION SUNDER. George H. Heydt, New York, N. Y. App. filed Dec. 1, 1916. Mounted in base of desk stand.

1,355,983. AUTOMATIC TELEPHONE-EXCHANGE SYSTEM; Jacob W. Lattig, Glenside, Pa. App. filed Sept. 11, 1909. "Up-and-around" switch.

1,356,010. AUTOMATIC TELEPHONE SYSTEM; Winfred T. Powell, Chicago, Ill. App. filed April 14, 1917. For large organization.

1,356,012. ELECTRICAL CONTROLLING SYSTEM; Frank B. Rae, Cleveland, Ohio. App. filed March 19, 1917. For charging battery.

1,356,042. TOASTER; Lloyd G. Copeman, Flint, Mich. App. filed Oct. 31, 1919. Removable grid.

1,356,071. ELECTRICALLY HEATED INSTRUMENT; Frank Kuhn and Lawrence H. Thomas, Detroit, Mich. App. filed June 11, 1920. Terminal block housing.

1,356,099. REGULATOR FOR ELECTRIC GENERATORS; William A. Turbayne, Niagara Falls, N. Y. App. filed April 17, 1914. For variable-speed battery-charging generators.

1,356,156. TELEPHONIC RECEIVER; Nathan A. Kurman, New York, N. Y. App. filed Oct. 10, 1917. Diaphragm mounted between cushions.

1,356,164. TELEPHONE-EXCHANGE SYSTEM; Alben E. Lundell, New York, N. Y. App. filed July 14, 1917. Semi-automatic.

1,356,176. LISTENING KEY; Franklin A. Stearn, Paterson, N. J. App. filed Oct. 25, 1916. Telephone.

1,356,181. TELEPHONE-EXCHANGE SYSTEM; Ray S. Wilbur, Lyndhurst, N. J. App. filed May 21, 1919. Automatic ringing.

1,356,190. TELEPHONIC TRANSMITTER; Bertram S. Cohen, Twickenham, England. App. filed Dec. 31, 1919. Placed against throat.

1,356,197. PROCESS OF PRODUCING A DOUBLE-COPPER-OXIDE PLATE; George S. Engle, Oranston, R. I. App. filed Oct. 8, 1912. For primary batteries.

1,356,222. MULTIPLE TELEPHONY; Ernst Ruhmer, Berlin, Germany. App. filed April 4, 1911. Several messages by one wire.

1,356,226. SYNCHRONIZER; Melvin L. Severy, Los Angeles, Cal. App. filed May 7, 1917. For synchronizing two independently driven and distant shafts.

1,356,244. ALTERNATING-CURRENT GENERATOR; Thomas F. Wall, Southsea, England. App. filed Sept. 30, 1918. For reciprocating drills, hammers, etc.

1,356,256. TELEPHONE SYSTEM; William G. Britten, Westfield, N. J. App. filed Aug. 19, 1918. Announcing system.

1,356,260. APPARATUS FOR DISPLAYING UNITS AND QUOTATIONS, NEWS AND ADVERTSING; William H. Butler, New York, N. Y. App. filed 28, 1919. For increasing utility of stock ticker.

1,356,290. MOTOR; Orlando E. Kellum, Los Angeles, Cal. App. filed March 10, 1920. Synchronous, for phonographs, etc.

1,356,293. DIMMER FOR ELECTRIC LIGHTS; Eugene J. Klinger, South Elgin, Ill. App. filed Dec. 13, 1919. Automobile.

1,356,335. ELECTRIC HEATER; Pierre J. H. Bernard, Montreal, Quebec, Canada. App. filed May 29, 1919. High-resistance ribbon wound on mica cylinder.

1,356,342. MANUFACTURE OF NICKEL-STEEL; Percy F. Cowing, New York, N. Y. App. filed June 16, 1920. As a cathode deposit.

1,356,369. TROLLEY POLE; Axel A. Johnson, Hoquian, Wash. App. filed May 24, 1920. Replaces wire on wheel.

1,356,403. TELEPHONE SYSTEM; Edwin S. Pridham, Oakland, Cal. App. filed May 7, 1918. For noisy places.

1,356,431. PROCESS OF MAKING ALKALINE GELATINOUS ELECTROLYTES; George S. Engle, Cranston, R. I. Oct. 8, 1912. Prevents dissemination of soluble electrodes.

1,356,435. DOUBLE-COPPER-OXIDE Battery Element; George S. Engle, Washington, D. C. App. filed Oct. 8, 1912. For primary batteries.

1,356,436. ELECTROLYTE FOR PRIMARY BATTERIES; George S. Engle, Washington, D. C. App. filed Oct. 8, 1912. Alkaline, gelatinous and has minimum causticity.

1,356,468. ELECTRODE; George W. Peters and Oscar F. Alkire, Charleston, Wash. App. filed Feb. 27, 1920. Made from rolled strip.

1,356,484. ELECTRIC APPARATUS; Anthony T. Boltas, Plainfield, N. J. App. filed Aug. 19, 1919. For stimulating rain.

1,356,488. RADIO-TELEGRAPH SYSTEM; Marconi Company, Leghorn, Italy. App. filed July 6, 1920. Control from a distance.

1,356,505. SYSTEM OF GUNFIRE CONTROL; Elmer A. Sperry, Brooklyn, N. Y. App. filed Oct. 10, 1914. To indicate to control station the position of guns.

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Power Contracts and the Small Consumer

THE Public Utility Commission of Utah in its decision on the special contracts of the Utah Power & Light Company has established a precedent of great moment to electric light and power companies. In brief, the case dealt with contracts, mostly for long terms, which were not in conformity with published schedules of the power company, but were preferential and discriminatory. Without setting aside the contracts—in fact, holding that they are still binding on the consumer—the Utah commission held that in the interests of the general public it can modify and change them in so far as they relate to rates, facilities and privileges. This is of special significance to the small consumers, for if large power consumers because of legal change of rate can break contracts and supply their electrical wants from isolated plants, for instance, the large central-station investment made to serve them would be lost, and hence the interest on that investment would have to be borne by all other users. This is the chief point in the Utah Power & Light case.

Training Men for Some One Else

CENTRAL-STATION maintenance work has of necessity been very largely neglected during the last few years. While in most departments this has been often due to lack of materials, in the meter department the lack of suitably trained men has been and still is the principal difficulty. Meters have been rightfully termed the cash registers of the industry, and upon their proper maintenance may depend whether a company will show a loss or a profit on its operations. Meter maintenance requires the services of technically trained men, and the work has proved attractive to the younger men entering the industry. However, the remuneration has too often been insufficient to induce those having the proper qualifications to stay at it long enough to be able to do the advanced work. The money which might have been used to increase salaries is now being used continually by some utilities to train new men who soon leave to get more money and often better working conditions from companies which have spent nothing on training. Universities in the Middle West have performed a real service by conducting metermen's courses to increase efficiency. However, better qualified employees want more pay, and therefore this education may increase rather than decrease the difficulty of retaining good metermen. The revenue of a central station depends so much on efficient meter maintenance and testing that this work should be made amply remunerative and probable avenues of advancement should be opened up. New men should be trained, but the educational system should not be allowed to become so burdensome that the companies cannot make meter maintenance attractive enough to hold the men for advanced work after they have become proficient.

Exporting Electrical Goods to China

THE organization of a hundred-million-dollar export financial corporation by the American Bankers' Association to further national welfare by maintaining and effectively developing American foreign trade ought to set at rest any fear that American industry will be swamped by European goods dumped on the market. It ought also to give heart to American manufacturers contemplating export trade. Only a short while ago a consortium of American, English, French and Japanese bankers was arranged for financing and furthering Mongolian trade. Commenting on this arrangement, Mr. Lamont of the banking house of J. P. Morgan indicated that China, in addition to requiring a great system of railways, would need a large quantity of electrical equipment. He indicated that 400,000,000 of kindly, honest and highly intelligent people would require on a prodigious scale the many domestic appurtenances that American ingenuity has evolved and that to keep these millions supplied with motion pictures alone would be quite a task even for Americans. Discounting his statement by 75 per cent, the fact remains that the opportunities are still immense. If China is to receive financial assistance from the United States, she will of necessity use American goods, and among the numerous branches of industry in which America excels the electrical is not the least. American manufacturers of electrical goods should therefore look to the Far East for new business of some importance.

Plant Efficiency Rewards Hard Work

POOR coal, irregular fuel supply, changing loads, labor difficulties and inexperience in co-ordinating plants for maximum combined operating efficiency put a heavy burden upon the central-station manager in many localities. It is not so easy under these conditions to produce energy at figures which may be cited with pride. None the less, the present high cost of production justifies a more vigorous attack upon station fuel losses than has been conducted in some places since the close of the war. That such an attack may be successful is clear from a recent comparison of two successive years' operations in about half a dozen plants ranging in size from 11,000 kva. to 63,000 kva. Two years ago the yearly records showed that five out of seven of these plants consumed above 2.3 lb. (1 kg.) of

coal per kilowatt-hour, the best showing being about 1.93 lb. (0.87 kg.). In the fiscal year just closed half the plants ran below 2.3 lb., and the best showing was 1.74 lb. (0.78 kg.). All the plants were within a radius of 150 miles (240 km.). Industrial power plants in the same region often consume 4 lb. or 5 lb. (1.8 kg. or 2.2 kg.), and it is gratifying to see these medium-sized central stations responding to hard and sustained work on the part of their operating managements. The central station points the course of efficiency for all power producers, and every manager should devote his best efforts to the arduous task of getting the most possible out of his equipment.

The Power Situation on the Pacific Coast

ONE of the singular features of electric power development is that in the three Pacific Coast states, which have been a most progressive part of the country in transmission work and which have more than 40 per cent of the available water power of the United States, there should still be serious shortage of water power—one which called for the consumption of nearly 5,000,000 barrels of fuel oil last year. The situation really points directly to the weak spot in all hydro-electric development, that is, the great variability from season to season and year to year in water supply. A paper by F. H. Fowler in last week's issue brings the salient points of the situation into view in the most striking manner. The fundamental fact is that the rainfall along the Coast decreases steadily from north to south, some parts of Washington showing the highest annual rainfall in the United States, while portions of southern California drop to near the minimum. The northern portion of the range is well forested, the southern portion is bare, which again has its effect on the annual distribution of run-off.

The use of power varies seasonally, like its source, and to make the most of the total resources one must have the maximum practicable storage. Here again the possibilities vary widely along the Pacific coast. In the extreme north the available heads are comparatively moderate, and for this as well as other topographical reasons storage on a large scale is somewhat difficult. As one goes southward opportunities for storage with high heads present themselves, but the water supply is extremely variable from month to month. In the northern region, as Mr. Fowler shows, there are great possibilities in the way of developing cheap power on a large scale, power cheap enough to be utilized for electrochemical or similar industries were the conditions favorable.

Some of these industries are of a character that to a certain extent makes it possible to develop them with regard to seasons, and therefore if cheap power were available from surplus water power for four or five months in the year good use could be made of it. Then, too, in many regions the amount of usable power varies with the irrigation situation, itself demanding storage. The maximum utilization therefore depends on combining these contributing factors into a connected whole so that surplus water shall be stored as far as possible, preferably in places where the need for irrigation or the available head is very great. Granted storage, it is still necessary so to distribute and operate the sources of power on the great network of distribution as to enable this storage to be carried out at the best efficiency, that is, when and where the loss of potential energy, measured in cost, is a minimum. This is the crux of the whole hydro-electric problem. The situation affords certainly the best opportunity for utilizing a great trunk-line distribution that has yet developed, and, further, it is not complicated by the presence of either cheap coal or cheap transportation.

Illumination for the Average Eye

FROM a practical standpoint perhaps the most noteworthy paper presented at the recent Illuminating Engineering Society convention was that by Dr. C. E. Ferree and G. Rand on the functioning of the working eye under variations of illumination. The knowledge heretofore available pertained to vision of test objects under uniform conditions of illumination in a fixed place, while the great value of Ferree and Rand's most recent work is that they have studied conditions of vision somewhat as they would be found in actual industrial operations. The result of their research is to place before the illuminating engineer a most important mass of new data of direct practical bearing in his work.

The investigators started out by a carefully conducted series of acuity tests showing the power of discrimination of the eye for detail at various illuminations. The variation of acuity thus found does not differ widely, when the nature of the test object is taken into account, from variations obtained by other investigators, but it shows a somewhat more rapid rise of acuity with illumination above two or three foot-candles in intensity. Following the same process with acuity measurements made by means of lenses giving slight astigmatism, it was found that the gain in acuity with increasing illumination was considerably more marked than in the normal eye. In other words, for the common, somewhat imperfect eye, high illumination is even more necessary than with perfect vision.

In the investigation of the readiness with which detail could be quickly grasped under varying illumination, where the speed of seeing is taken into account, a still greater improvement appeared as illumination increased. The same kind of improvement was shown when the test made had to do with the prompt shifting of the eye from plane to plane, often necessary in industrial work, and finally when the power of the eye to sustain high acuity for considerable periods was tested the importance of good lighting came out with astonishing force.

These investigations throw a new light on the value of high degrees of illumination under conditions of practical working. As a striking and yet not extreme example of results found, passing from two to six foot-candles slightly more than doubled the acuity, changed the speed of discrimination and the speed of adjustment in nearly the same ratio, and increased the power to sustain acute vision more than fivefold. For a slightly astigmatic eye the general results were similar, except that the speed with which detail was picked up under the higher illumination was increased thirteen times. The evidence is most conclusive as to the need of considerably higher illumination than has heretofore been considered necessary, when one takes into account the average rather than the perfect eye and the conditions of quick and easy seeing over the working day which form the basis of industrial efficiency.

Co-ordinated Inspection Forestalls Operating Trouble

IN THE earlier days of electrical distribution inspection consisted chiefly in waiting for something to happen and hoping nothing would. Today every operator of a power system realizes that the best way to prevent things from happening is to keep on the constant look-out for sources of danger and to do away with them promptly before they cause trouble. A good case in point is that which we describe this week as a fair type of the inspection systems found practically useful in operating power transmission systems.

It will be observed from the tables which accompany the article that the whole scheme is based on doing regularly what is too frequently left to some convenient time. First comes very frequent examination of everything which from constant use and the nature of its service is likely to make trouble on short notice; second, a rather frequent study of material less likely to deteriorate through use or less used is made, and finally, at regular times, a very careful overhauling of fundamental apparatus takes place to detect incipient faults which may have been overlooked in general operation or in more casual inspection.

The records of the company referred to show that this systematic way of following up all the equipment from day to day or week to week is really worth while, because it means continuity of service, fewer minor repairs, and sometimes avoidance of serious major repairs. Nothing except co-ordinated inspection of this kind can really accomplish the result sought, since it is extremely easy for casual inspection at odd times to miss parts of the equipment or to overlook the numerous small things which may cause material damage or even shut down the station.

Axe and Good Insulators Best Safeguards of Lines

ETERNAL vigilance is the price of continuity of service. This fundamental is peculiarly true of the sort of system which F. I. Bowler considers in this issue; that is, a comparatively small system formed by the interconnection of previously independent stations with lines built for various voltages and at various times. Transmission systems of this general character are particularly likely to show the results of heterogeneous methods of building in a somewhat unpleasant manner. The value of Mr. Bowler's article lies in the fact that it deals with successful efforts to improve the service with regard to interruptions during a program that has extended over about ten years. The system started off with something like five interruptions per mile of line per year, and it has wound up the period with less than one. Analyzing the situation, improvement in the last three or four years has been very marked and appears to be due purely to care of the lines themselves, watchfulness in maintenance and the abandonment of dubious construction as soon as it is detected.

The final result speaks well for the performance of wood-pole lines for moderate voltages when the construction is carefully watched. A modest amount of tower line insulated for double the present working voltage has very naturally shown exceedingly little trouble of any kind. On the wood-pole lines constructions which were obviously bad, like pole-top insulators grounded on the lightning protection and pin-type insulators with the axis horizontal, were cut out with good results. The burden of the whole story is that when a group of plants of varying age and character are interconnected the strength of the outfit is simply that of the weakest point, as usual, and concurrently with any such interconnection must come a general and thorough overhauling of the system. The sooner this is done the better. The weak point of most of the older constructions was an insufficient factor of safety in the insulation, with resulting serious dangers from overvoltage, whether from surges or induced lightning discharges. This situation is rendered worse by not infrequent carelessness with regard to proximity of trees found along moderate-voltage lines of small companies.

In the particular instance before us the extent to which trees were looked out for is shown by the practical cessation of troubles from this cause after the first two or three years of consolidated operation. Nothing but constant watchfulness can avoid interruptions on moderate-voltage circuits of old design running through a wooded country. The axe and good insulators are the best preventive methods whatever the material of the pole line.

Voltage Ratings in the United States

WITH the growth of extensive transmission systems in this country, involving a multiplicity of voltages for generation, transmission, distribution and utilization, it has become necessary to eliminate as many as possible of those voltages that are little used or are not rational. It is also highly important to state specifically what is meant by the normal voltage of a transmission line, for instance, which may vary through a wide range over long lines. These matters will come up for discussion before the International Electrotechnical Congress, and it is particularly important that the American viewpoint should receive the fullest consideration from engineers abroad as well as in this country.

As we have pointed out before in these columns, engineers in other countries are ready to co-operate with American engineers in establishing international rules which shall represent the best practice in any country, and they naturally look for enlightenment to any nation which has had particularly valuable experience in any phase of electrical development. In the matter of high-tension transmission practice much of the pioneer work has been done in the United States, and the practical experience gained in the operating of large high-tension networks should go far toward the crystallization of international practice.

One point in particular which is brought out in the paper by Messrs. Newbury and Moore is of great importance when stating the system voltage for which apparatus is to be supplied. It is said that "in a system employing transformers the normal voltage of the system or circuit is defined as the highest rated voltage of the secondaries of transformers supplying the system or circuit." Such a definition should prevent connecting to the circuit any apparatus insufficiently insulated to withstand the maximum voltage stress to which it may be subjected.

That a large number of systems in the United States do not employ the standard utilization voltage, 110, was indicated in a table published in the ELECTRICAL WORLD for May 15, 1920, page 1136.



Samuel Macaw Kennedy

Who by advocating the Golden Rule as a fundamental principle has become a recognized leader in that rapidly growing school of public utility executives who believe in dealing with the public as a group of reasonable individuals

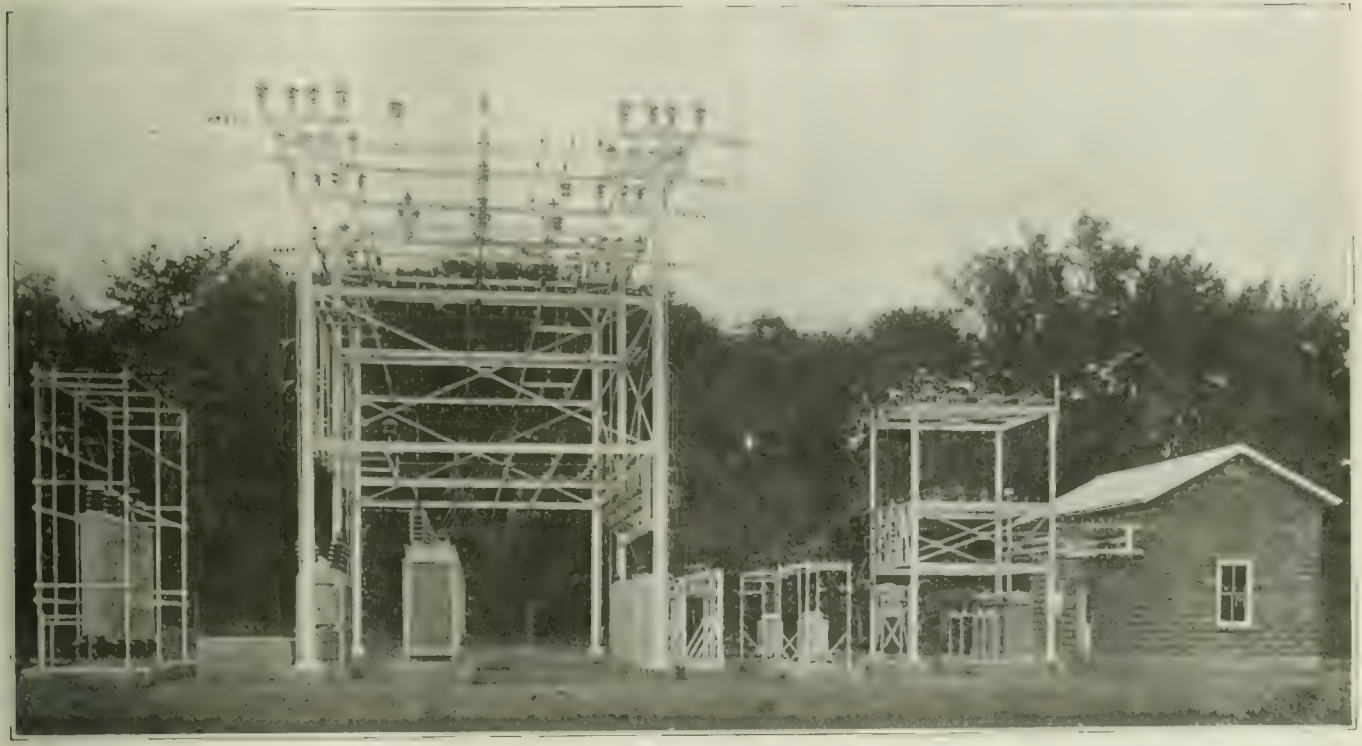
BY COMBINING a real business intelligence with a clear understanding that the psychology of public relations concerns the individual rather than the mass, S. M. Kennedy has shed new light on the great problem so fundamental to a full realization of the future of central-station service, namely, the establishment of public relations on a satisfactory basis. To Mr. Kennedy the public is not a unit but a great number of human beings, each one representing an individual service requirement that can be classified and adequately satisfied. Once one has caught this conception it is not difficult to understand why he places such emphasis on that old-fashioned courtesy in which a wholesome use of "I thank you" is the rule. Being a firm believer in the Golden Rule in business as well as social life he has never ceased to instill into the hearts of the men and women under his direction this homely doctrine. To Mr. Kennedy it is not idealism, it is a fundamental of good business. There has never been a doubt in his mind that a utility grows financially strong mainly as a result of making friends. Years ago he expounded the theory that the making of one enemy can undo the work of making a large number of friends. Another truth that he has discovered is that the utility as a rule does not really make friends or enemies for itself. Rather is this the result of the relationship of one individual to another. The individual employee dealing with the individual customer is the one who makes or breaks the confidence of the public. As Mr. Kennedy has repeatedly pointed out, the average human being sees the company through each of its representatives, whether it be the telephone operator or meter reader, salesman or "trouble shooter," cashier or lineman. It has taken a long while for these simple truths to receive more than passing attention. On the Pacific Coast, where Mr. Kennedy has long been looked up to as a leader, this philosophy of his has made a strong impression. Last May at the Pasadena N. E. L. A. convention it so fired those to whom it was expounded that it has spread like wildfire nation-wide.

Mr. Kennedy came into the industry by force of circumstance just a little less than twenty years ago. In that time the Southern California Edison Company, of which he is now vice-president in charge of business development and public relations, has grown until in point of output it stands fourth among the electric light and power companies of the United States. He has been prominently identified with all the forward movements on the Pacific Coast, including the California Co-operative Campaign, the beginning of a nation-wide co-operative movement. Mr. Kennedy was born and educated in Canada. For ten years he was engaged in his father's business of importing. At the age of thirty-one his health broke down and for five years he traveled in search of a congenial climate. In 1901 he became assistant to the president of the United Electric, Gas & Power Company, which in 1903 was absorbed by the Southern California Edison Company. Since that time he has guided the commercial end of the company's business. Mr. Kennedy's writings have received a very wide circulation. His essay "The Man on the Street" is probably the best known of them and is one of the brightest chapters in the literature of the industry. His latest volume, "Winning the Public," groups together all of his good-will precepts and is already becoming very popular.

Reducing Transmission-Line Interruptions

How One Company Made Use of Records of Transmission-Line Troubles to Locate Faults in Construction — Interruptions per Mile Reduced 90 per Cent in Ten Years

By F. I. BOWLER
Electrical Engineer Central Hudson Gas & Electric Company, Poughkeepsie, N. Y.



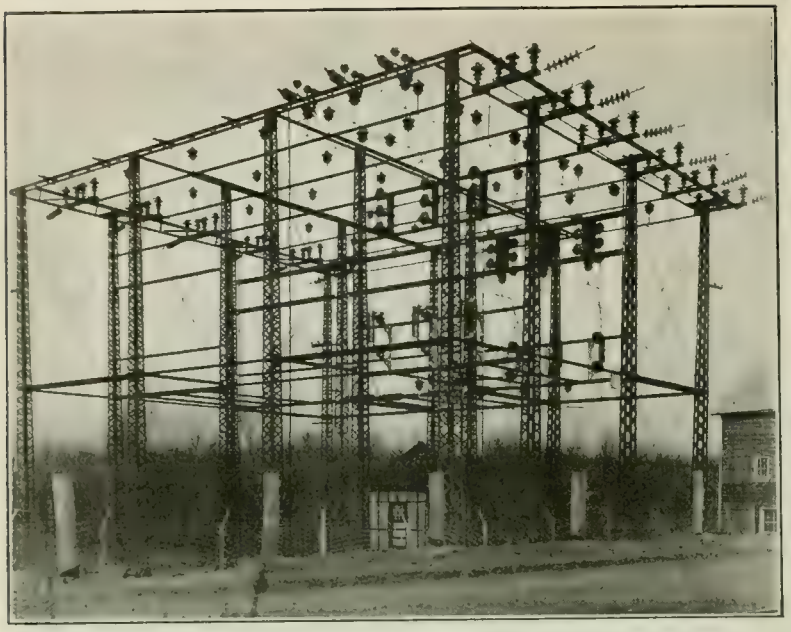
EXEMPLARY CONSTRUCTION WORK, SAUGERTIES (N. Y.) SUBSTATION AND LINE-SECTIONALIZING TOWER

BY KEEPING a record of transmission-line trouble and by systematic analysis of the record it has been possible to effect a marked reduction of interruptions per mile of circuit on the lines of the Central Hudson Gas & Electric and associated companies. As a result of this study it has been decided not to use pin insulators in a horizontal position in the future, owing to weathering effects. Suspension units without cement have also been adopted for railroad crossings, and many minor changes have been made in transmission-line construction by careful analysis of experience shown by the records. A summary of the records for ten years shows 593 interruptions attributed to twenty-four different classes of trouble.

These companies furnish electric service in the Central Hudson River Valley, including the industrial cities of Newburgh, Poughkeepsie and Kingston and part of the Catskill Mountain summer resorts. The main generating station is a steam station at Poughkeepsie. This is supplemented by hydro-electric stations at Hunter and Cairo, in the Catskill Mountains, and in times of emergency by standby steam plants at Newburgh, Kingston, Saugerties and Catskill. A 5,000-kw. hydro-electric station is now under construction at Rifton, on the Wallkill River. The steam plant at Rhinebeck is operated independently of the main system. As is generally the case, the various companies and plants were first operated independently and afterward connected by transmission lines in order to lower

TABLE I—FEATURES OF TRANSMISSION LINE CONSTRUCTION ON CENTRAL HUDSON SYSTEM

Name of Line	Year Built	Type of Construction	Type of Insulator	Rating	Wire	Ground Wire	Length Miles
River...	1911	Single-circuit	Pin	[illegible]	No. 2	Steel	14
(Highland-Balmville)		Ground wire and bayonet					
Ohioville—New Paltz	1909	Single-circuit, ground wire and bayonet		33,000	No. 2 solid Cu.	Steel	8
New Paltz—High Falls	1909	Single-circuit, ground wire and bayonet		33,000	No. 3 Cu, equal	Steel	8
New Paltz—Walden	1912-13	Single-circuit, ground wire and bayonet		33,000	No. 2 Cu	Steel	14
(Walden-Balmville)	1914	Single-circuit, ground wire and bayonet		33,000	No. 2	Steel	7
Kingston—High Falls...	1908	Single-circuit		33,000	No. 5	None	13
Walden—Blooming Grove	1916	Single circuit, ground wire and bayonet..	Pin	33,000	No. 4	Steel	15
Main steel tower line	1917-18	Double-circuit	Suspension	66,000	No. 1		48
Poughkeepsie—Athens		Steel towers, one ground wire each circuit in nearly vertical plane	Five for				
		13 200-volt lines					
Kingston-Saugerties	1917	[illegible]	[illegible]	13,200	No. 4	Steel	1
Kingston—Port Ewen	1914	[illegible]	[illegible]	[illegible]	No. 4	Steel	7
Milbrook—Poughkeepsie	1920	Single-phase	[illegible]	[illegible]	No. 4	None	14
Catskill—Ravena	1912	Pole-top pin	Pin	15,000	No. 1	None	17
Catskill—Mountain	1905	Pole-top pin	Pin	15,000	No. 0	None	22
Saugerties—Diamond Mills	1920	Single-circuit, ground wire and bayonet	Pin	17,000	No. 1 0	Steel	2



AMPLE CLEARANCES TO GROUND FORESTALL SERVICE INTERRUPTIONS

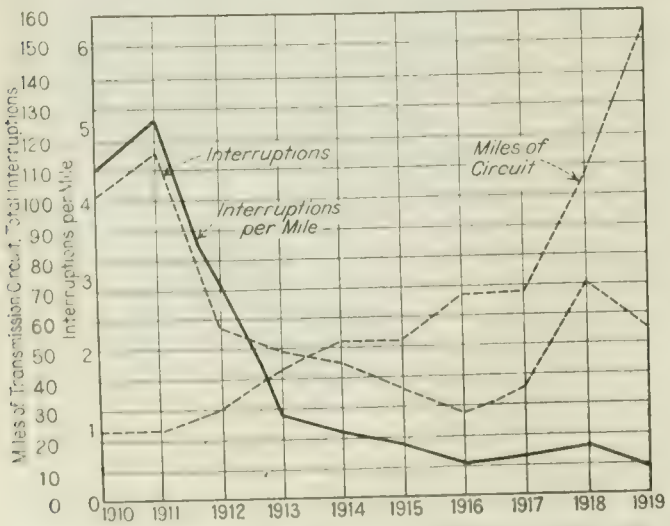
production costs and secure larger capacity in reserve equipment.

The transmission-line table shows the main lines of the company and their general characteristics. Practically all of the lines are constructed with a two-wire telephone circuit which connects the various generating stations and substations to the office of the system operator at Ohioville.

The first 33,000-volt line was constructed by the Central Hudson company in 1909 in accordance with the general practice prevailing at that time. A triangular pole-top construction was adopted with the pole-top pin bolted through the pole to a galvanized angle-arm bayonet which supported a stranded steel ground wire, grounded at every fifth pole.

Improvements in Transmission-Line Construction

In 1913, after an investigation of the operating results of the system, it was deemed advisable to remove the pole-top insulator from metallic contact with the ground wire. Accordingly the insulators were mounted on a short top arm with a great improvement in operation. The present standard 33,000-volt wood-pole construction is the result of ten years' operating experience. Up to the present time only chestnut poles have been used. They are all treated with a preservative compound with excellent results.



WHAT MAY BE ACCOMPLISHED BY GRAPHICAL STUDY OF INTERRUPTION RECORDS

In 1918 several miles of wood-pole line were removed and replaced with steel towers. The poles were in such good condition that it was practicable to use them again for distribution service without cutting off that portion below the ground line.

The 13,200-volt wood-pole construction has so far given excellent service. A ground wire is used attached to steel angle-iron bayonets. Practically all of the lines have been erected for single circuits, but they can be easily changed to two or more circuits by adding additional arms. In connection with the use of overhead ground wire it has been our experience that it does not prevent spill-overs at insulators with resulting momentary interruptions, but it has apparently eliminated the failure of poles and cross-arms by direct stroke and long interruptions to service due to necessary renewal of poles and insulators. The resultant time saving is a very important factor in restoring service.

How the Operating Records Are Used

Since the year 1910 the system operator has kept a record of all interruptions. This has been of great assistance in analyzing the operation of the lines. At regular periods the engineering department reviews this record, conducts any necessary tests of old and new equipment and consults with other engineers as to the best present-day practice. Definite recommendations are then made to the operating department as to methods by which it can replace faulty equipment and obtain better results.

TABLE II—REPORT OF INTERRUPTIONS ON HIGH-VOLTAGE LINES

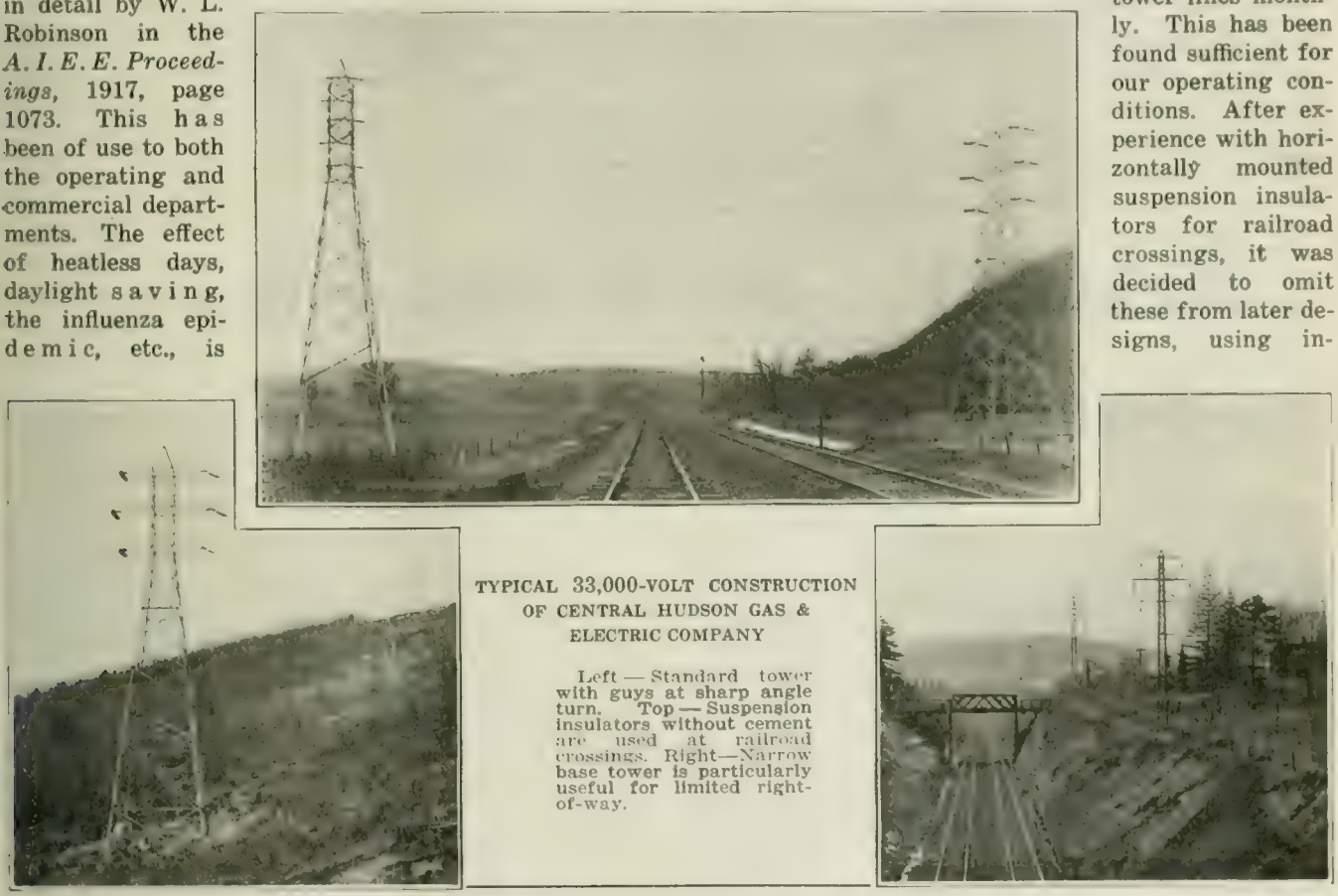
Cause	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	Total
Short circuit	12	6	14	2	4	..	..	..	..	2	40
Overload	15	10	5	..	..	..	..	..	..	3	33
Unknown	29	14	..	4	3	1	4	6	12	8	81
Line down	..	..	6	..	..	..	..	..	..	..	6
Substation	..	5	5	4	5	3	4	2	2	7	37
Generating station	6	13	3	2	4	2	2	5	2	1	41
Trees	9	12	..	16	18	6	3	1	1	6	72
Phasing in	..	1	..	1	1	..	..	..	..	1	4
Connecting lines	..	..	..	1	..	2	2	..	3	..	8
Lightning	18	27	10	10	5	11	9	12	24	12	138
Insulators	6	15	6	8	..	2	..	4	4	7	52
Storm	..	..	..	..	2	1	..	..	1	1	6
Error	..	..	1	1	..	3	..	1	3	3	12
Blasting	5	1	..	..	..	..	1	1	..	..	8
Ground	..	10	6	..	1	..	..	..	..	..	17
Line trouble	..	..	..	..	2	..	1	1	1	..	5
Wire	..	1	..	..	..	..	1	1	5	..	8
Birds and animals	..	..	..	..	..	..	1	1	5	1	8
Underground cable	..	..	..	..	..	..	..	..	3	2	5
Submarine cable	..	..	..	..	..	..	..	..	2	..	2
Malicious	..	..	..	..	..	..	..	..	1	..	1
Accidents	1	..	..	..	..	..	..	..	1	..	2
Water supply shut off	..	..	1	..	..	..	..	..	..	..	1
Cross-arm and pins	..	1	..	..	4	..	..	1	..	..	6
Total	101	116	57	49	45	36	28	36	70	55	593

The record shows every interruption of any part of the main high-voltage system. A large percentage of the interruptions are only of short duration, being caused by overloads, short circuits, lightning and unknown causes. Several of the substations are equipped with reverse-energy relays which have acted to maintain voltage on the substation bus so that

an interruption does not always mean the loss of voltage on all parts of the system. An interruption is classified as the loss of voltage on any of the transmission lines or substations.

The interruptions per mile of transmission line per year probably summarize the results obtained to best advantage. A graphic chart is also maintained for general record purposes over a period of years. The different interruptions are classified and graphically shown by suitable colors and cross-hatching, and the large number of lightning interruptions are especially noticeable during the lightning season.

Since January, 1918, a graphic daily cut-out card record has been maintained. This method is described in detail by W. L. Robinson in the *A. I. E. E. Proceedings*, 1917, page 1073. This has been of use to both the operating and commercial departments. The effect of heatless days, daylight saving, the influenza epidemic, etc., is brought out on a card record of this character in an excellent way.



TYPICAL 33,000-VOLT CONSTRUCTION OF CENTRAL HUDSON GAS & ELECTRIC COMPANY

Left — Standard tower with guys at sharp angle turn. Top — Suspension insulators without cement are used at railroad crossings. Right—Narrow base tower is particularly useful for limited right-of-way.

We believe our experience with transmission insulators is very similar to that of other companies of the same size. However, a résumé may be of interest. The 33,000-volt insulator in use on practically all lines was designed about 1907 and possesses the general characteristics of that design period. Tests made when first installed, after four years' and nine years' service, show virtually the same wet and dry flash-over values, but the last tests show a drop from an average of about 212,000 volts to 180,000 volts in puncture under oil.

Horizontally Mounted Pin Insulators Fail

After several failures in service tests of equipment removed from service and an analysis of the experience of others, it was decided not to install pin-type insulators with the main axis horizontal. It is our experience that the action of the weather on insulators mounted in this position materially increases the depreciation and leads to ultimate failure by puncture of the insulator. A large percentage of the total number of horizontally mounted 70,000-volt insulators failed in service under 33,000 volts after being erected from six months to a year.

A very similar experience has been had with suspension insulators used as strains for crossings of important highways, railroads, telephone lines and outdoor substations. It has been necessary to replace the old-type suspension insulators with modern types having no cement in their make-up. The suspension and strain insulators used on the steel tower line have not given any trouble. This may be due to the fact that the line is insulated for 66,000 volts and operates at 33,000 volts. Wood-pole lines are patrolled weekly and steel-tower lines monthly. This has been found sufficient for our operating conditions. After experience with horizontally mounted suspension insulators for railroad crossings, it was decided to omit these from later designs, using instead two pin-type insulators with a special arcing shield. This design has received very favorable comment from railroad and telephone engineers and has given excellent service for the short period of a year in which the design has been in use.

Considerable trouble was experienced with weather-proof triple-braid, twisted-pair leads used from telephone lines to substation sets and for several long runs. During the past three years this wire has been gradually replaced with two wires run on independent insulators with greatly improved service. Combined lightning arresters and fuses of heavy construction with one-to-one transformers are used for protection with good results. The lines are generally very quiet when consideration is given to the fact that only on the lines built since 1914 are the high-voltage circuits transposed. Previously it had been considered good practice to run lines without transpositions.

Very little trouble has been experienced with apparatus. In one case reverse-current relays were cross-phased, giving about 60 per cent correct operation.

The connections were changed and no further trouble has been experienced. Lightning protection has generally kept pace with the latest improvements, changing from multi-gap to electrolytic arresters, adding first a charging resistance, later sphere and impulse gaps, and finally a new type of arrester which does not require daily attention.

The company operates 5 miles (8 km.) of underground and 2 miles (3.2 km.) of submarine cable at 13,200 volts. In addition there is a short run of about ½ mile (0.8 km.) of 5,720-volt submarine cable. All cable has varnished-cambric insulation with lead-sheathed, steel-armored wires, a portion of it having rubber insulation next the conductors.

The most serious interruptions from cable failures have been from trouble in the joints. In one case one of the underground cables feeding Newburgh failed and the trouble was located by means of a vibrator and exploring coil. It proved to be in a splice, the manhole being filled with water. Considerable damage from water penetrating the cable insulation resulted, but upon replacing a certain amount of cable and making a very careful splice operation of this cable it became satisfactory, and has remained so ever since.

One of the No. 2/0 submarine cables gave evidence of trouble and soon afterward failed completely. The fault was located very closely by the Varley loop test, and upon raising the cable from the river the cast-iron box surrounding the lead sleeve was found fractured. This box appears to have failed owing to the cast iron being put in tension. Investigation of the cable showed water had penetrated a distance of about 1,200 ft. (360 km.), and accordingly the greater part of the cable was replaced.

In making splices in this new cable the electrical connections were staggered in what is known as the "duct splice" method. This gives factory-applied insulation between phases and results in a much smaller sleeve. The armor wires were carefully interlaced from both ends over this sleeve and no cable box was used. The method has proved entirely satisfactory over two years of service.

Rational Practice in Voltage Rating

Reasons Leading Up to Development and Application—Where Standardization Does Not Exist Logical and Economical Practices Have Been Established—Field for More Standardization—Classification of Systems Into Four Groups

By F. D. NEWBURY and R. W. E. MOORE
Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.

IN THE very early development of the electrical industry experimental work commonly employed 100 volts, and this value was used on account of limitations in lamp construction. Lamps and other simple devices were constructed for this voltage. Generators also were commonly designed for 100 volts. There was, however, a tendency for distributing circuits to increase in voltage. This was due partly to the desire to reduce the effect of voltage drop by increasing the base voltage, but largely to the influence of the carbon incandescent lamp, which, for practical reasons, was supplied to the industry in a wide range of voltages from 100 upward. These lamp voltages ranged from 100 volts to 130 volts and brought into existence a corresponding range of utilization circuit voltages. The present practice shows a variation in circuit voltages of from 110 volts to 120 volts. This condition retarded standardization for a long period of time and has made it difficult to accomplish.

The tendency for voltages to increase seems to be universal. Direct-current traction voltages may serve as a typical example. Since 1900 traction voltages have increased from 500 volts to 550 volts, and during the past ten years to 600 volts. This general tendency for voltages to increase as soon as put into use is mentioned only to indicate the reason for the basis of 110 commonly used, and also to suggest the difficulty of maintaining for any length of time a standard based on any lower voltage.

In this connection some statistics may be interesting showing the magnitude of the field covered by the present discussion and consequently the extent to which these standard practices have become well established.

In a single year (1919) there were 182,000,000 incandescent lamps sold within the United States. There are nearly 6,000 main generating stations in the United States having an aggregate generator rating of nearly 13,000,000 kva. and representing a capital investment of between two and one-half and three billion dollars. This does not include isolated plants, power stations serving only one manufacturing plant, nor the plants operated by electric railway companies for their own power. There are 126 power plants of over 20,000 kw. capacity. The rapid increase in the number of new alternating-current generating stations makes this subject of standard alternating-current voltages particularly important at the present time. In the United States alone, for example, 226 *new* central stations were built in 1919. Of the central stations (stations generating power to sell) in the United States nearly 80 per cent use entirely alternating current only and an additional 10 per cent use a combination of alternating and direct current. In addition to the figure given above, there are a very large number of isolated and industrial generating plants as indicated by the census of 1917, which showed 45,000 such plants.

How Systems May Be Classified

Systems and apparatus, from the standpoint of voltage standardization, may be conveniently divided into four groups. This division into classes is employed only for the purpose of presenting this subject in the clearest form, and the limiting values employed in each class are not to be considered as representing definite limits in practice. The four groups are:

1. Relatively small systems (up to 1,000 or 2,000

kva.), with voltages up to 2,400, in which generators may be directly connected to the utilization circuits, or step-down transformers may be used (Fig. 1).

2. Systems of medium size (up to possibly 20,000 kva.), supplying urban communities of medium size, using generator voltages up to and including 13,200, and which may or may not use step-up and step-down transformers between the generators and distribution circuits (Fig. 2).

3. Systems of large size (larger than class 2 and up to approximately 100,000 kva. or 200,000 kva.), serving

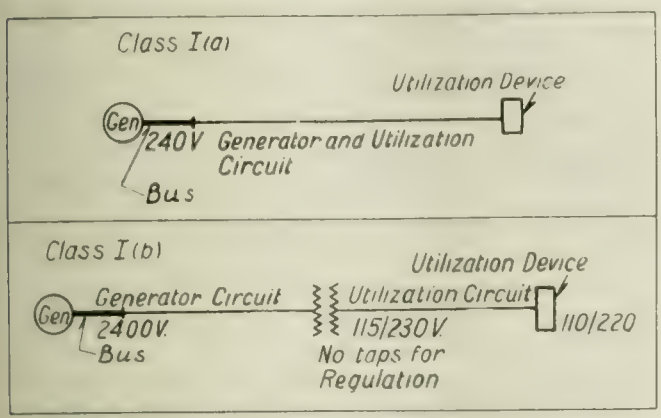


FIG. 1—REPRESENTATIVE DIAGRAMS FOR SMALL SYSTEMS

the largest urban communities or supplying areas of considerable extent by transmission lines, employing voltages up to roughly 88,000 and having step-up and step-down transformers (Fig. 3).

4. Large, long-distance transmission systems employing voltages up to 220,000. From the standpoint of standard voltages this class is simply an extension of the preceding class (Fig. 4).

The accompanying table gives a somewhat complete list of the values used in practice as the normal voltages for circuits in the several classes of systems.

The utilization device voltages given are those which are standard for a very large amount of apparatus using current, especially motors, but there are some devices supplied at other ratings. This is particularly true of lamps.

A word of explanation concerning the terms used in the illustrations of typical systems and in the above tables may be necessary. Circuits may be conveniently divided into four main classes:

1. The *generator circuit* is the part of the system from the generator to the station bus. The same voltage value is considered to exist throughout the generator circuit, which obviously is the generator voltage, and it is convenient to omit the word "circuit" in referring to the voltage of this part of the system.

2. The *transmission circuit* is the part of the system in which bulk power is transmitted from one locality to another locality; it is that part of the system between the secondary of the station step-up transformers and the primary of the step-down transformers serving the distribution circuit. The transmission circuit may be divided into primary and secondary transmission circuits when several transmission lines at reduced voltage are tapped off the main or primary transmission circuit.

3. The *distributing circuit* is that part of the system consisting of the distributing network.

4. The *utilization circuit* is that part of the system to which lamps, motors, heating apparatus and other utilization devices are connected. A distinction is made between the voltage of the utilization circuit and the voltage of the utilization device which represents the conventional voltage drop in the utilization circuit.

It will be noted at once that generator voltages in class 1 are multiples of twelve, while voltages in the other classes are multiples of eleven. The reason for this difference is the absence of transformation in the majority of installations employing low-voltage generators. Originally it was common practice to adhere to the same ratio in generator voltages as in voltages of other apparatus and the standard generator voltages were 220, 440, 1,100 and 2,200. However, as 110 and 220 became better established as the standard voltages and the requirements concerning uniformity of voltage in utilization circuits became more exacting, it was found that generators, supplying utilization without transformers, must be designed for higher voltages to provide for the necessary drop between generator and the consuming device. The lower voltages, 220 and 440, were the first to be changed to those higher values of 240 and 480, and there was a period when standard generator voltages were 240, 480 and 2,300, but this proved uneconomical from the generator standpoint, since it is convenient that the voltages within a given class be whole-number multiples of the basic voltages (in this case 120). Therefore the standard voltages of 240, 480, 600 and 2,400 were finally reached.

It has been pointed out that the development of lamps, motors and other utilization devices led to a basic voltage of 110. This in turn determined the common factor of eleven used throughout American practice for transmission, distribution and utilization circuits.

There is an apparent discrepancy between the voltage recommended for generators (240, 480 and 2,400) and the corresponding voltages recommended for distribution circuits for transformers (230, 460 and 2,300). Utilization devices of the same voltage may be supplied directly from both of those voltage sources. These differences arise from the different conditions existing in two cases.

1. There is more freedom in the choice of transformer locations with reference to the center of the load than in the case of generators, so that the permissible voltage drop between the generator and its load should be greater than between the distribution transformer and its load.

2. Transformers may be designed, as in the case in United States practice, to operate successfully within a moderate range beyond their rated voltage, while generators cannot be provided with this voltage margin without providing equal percentage increase in capacity. This also makes it possible to provide satisfactory voltage at the utilization device with the lower transformer secondary voltage.

Generators inherently have a fixed maximum voltage at the maximum rated load and rated power factor, because of the fixed exciting voltage, and a higher voltage cannot be maintained unless the excitation voltage is increased above its normal value. It is logical, therefore, to consider the station-bus voltage as establishing the system voltage where there is no step-up transformation. In systems having step-up transformers connected to the station bus the ratio of transformation establishes the normal voltage of that part of the transmission system. Several secondary transmission or distributing circuits of varying length and density of loading may be tapped off from this primary transmission circuit, each having its own load drop and

other service requirements. It has, therefore, become standard practice to provide transformer taps in the step-down transformers. The ratio of transformation in the step-down transformers, therefore, establishes the normal voltage of the distributing circuits.

It will also be noted that while the common divisor of voltages for transmission circuits is 11 (22,000, 33,000, etc.), the corresponding factor for distributing circuit voltages is 11.5 (2,300, 6,900, etc.).

It is American practice, for reasons of manufacturing economy, to design distributing transformers (up to 6,900 volts) feeding the utilization circuits without voltage taps. This makes it desirable to provide for a large part of the total voltage drop of the system at the point in the system where taps are available ahead of the distributing transformer. This is the reason for the higher basic voltage (115 instead of 110) in the distributing circuit as compared with the basic voltage in transmission circuits.

It will be noted that the total difference between the generator or secondary voltage of the step-up station transformers and the utilization voltage is based on approximately 10 per cent line drop. This value is subject to variations in practice, but 10 per cent represents, according to American experience, a fair compromise between reasonable cost and good service. It also represents a compromise based on practice that embraces the widest possible variety of conditions in cost of power, from one extreme of high-priced coal or oil to the other extreme of water power, and a wide variety in service requirements, ranging from large congested city conditions to transmission systems hundreds of miles in extent. It is to be understood that closer regulation is obtained, when desired, as in city lighting circuits, by the liberal use of feeder regulators, or on transmission circuits by synchronous condensers.

There is another question that inevitably arises in any discussion of standard voltages. What is the normal voltage of the circuit? Voltages of widely different values exist in the same circuit in many practical cases owing to line drop, or in the case of long transmission lines with high capacitance the voltage at the receiving end of the circuit may be higher under light-load conditions, necessitating a reduction in the voltage at the generating station, or the equivalent to maintaining normal voltage at load centers. Engineering considerations of insulation margin of safety make it necessary to consider the highest rated voltage of any apparatus connected to the circuit as the normal rated voltage of the circuit. Then all apparatus that is to be connected to the circuit should be designed to have the recognized standard margin of safety based on this normal rated voltage of the circuit, even if, under usual operating conditions, a particular piece of apparatus is connected to a part of the circuit that operates at a lower voltage than the normal voltage of the circuit under same load conditions.

The practice has developed, in view of these conditions, of defining the normal voltage of the system in the following terms. This definition and practice has been suggested for general adoption:

"In system employing transformers the normal voltage of the system or circuit is defined as the highest rated voltage of the secondaries of transformers supplying the system or circuit. This voltage rating applies to all parts of that particular system or circuit.

"It is to be understood that the standard rules for dielectric strength tests be based on the *normal* voltage of the system or circuit as defined above, and all dielectric strength tests shall be based on the normal voltage of the system, even if apparatus is applied on a part of the system which ordinarily operated somewhat below the normal voltage."

This definition of normal voltage is intended for application to all systems. Any definition of normal voltage of the circuit that is not based on the highest voltage existing normally in the circuit is, in effect, a reduction in the recognized margin of safety of the insulation; and, rather than accomplish such a reduction in margin of safety indirectly in this way, it would seem preferable to do it directly by changing the standard dielectric test rules. But the tendency in connection with the rules for dielectric strength seems to be in the direction of increasing the margin of safety rather than decreasing it.

NORMAL VOLTAGES IN THE FOUR GROUPS OF SYSTEMS

Class	Generator Voltage *	Transmission Circuit Voltage	Distribution Circuit Voltage	Utilization Circuit Voltage	Utilization Device Voltage
No. 1a (Without distributing transformers; see Fig. 1 a)	240				220
	480				440
	600				550
	2,400				2,200
No. 1 b (With distributing transformers; see Fig. 1 b)	240			115	110
	480			230	220
	600			460	440
	2,400			575	550
No. 2 (See Fig. 2)	6,600		2,300	115	110
	11,000		2,300/4,000 Y	230	220
	13,200			460	440
				575	550
				2,300	2,200
No. 3 (See Fig. 3)	6,600	22,000	2,300	115	110
	11,000	33,000	2,300/4,000 Y	230	220
	13,200	44,000	6,900	460	440
		66,000	11,500	575	550
		88,000	13,800	2,300	2,200
No. 4 (See Fig. 4)	6,600	†22,000	2,300	115	110
	11,000	†33,000	2,300/4,000 Y	230	220
	13,200	110,000	6,900	460	440
		132,000	11,500	575	550
		154,000	13,800	2,300	2,200
		220,000			

* The generator voltages as given are commonly accepted in the United States as system voltages where there is no step-up transformation.

† Secondary transmission circuits.

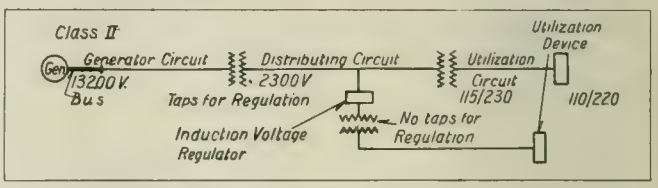


FIG. 2—SYSTEMS UP TO 20,000 KVA. AND 13,200 VOLTS

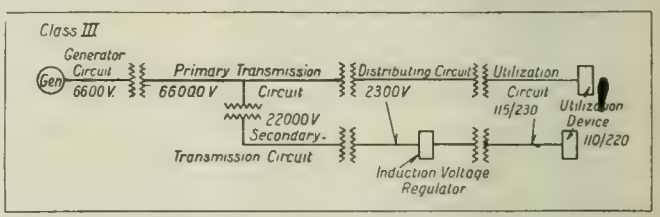


FIG. 3—LARGE SYSTEMS WITH VOLTAGES UP TO 88,000

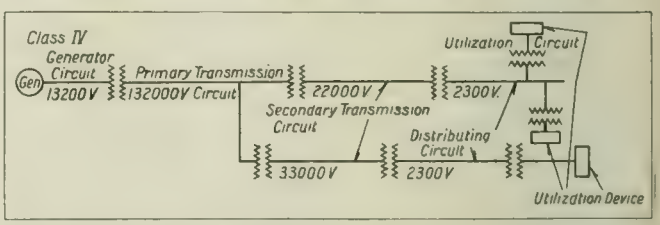


FIG. 4—LARGE SYSTEMS EMPLOYING EXTRA-HIGH VOLTAGE

Motor Features Requiring Standardization

In Order to Promote the Standardization of Mechanical Features of Motors Good Practice in Choice of Proportions and Materials for Parts Is Discussed—Special Purpose Motors Should Conform to Standards So Far as Possible

By C. W. STARKER
Roth Brothers & Company, Chicago, Ill.

THE necessity of standardizing mechanical characteristics of electric motors in order to hold down production costs and to facilitate their repair and maintenance in the industries was pointed out by the writer in an article, "Mechanical Design of Electric Motors," printed in the ELECTRICAL WORLD for April 24, 1920. In the present paper mechanical proportions and materials are discussed, showing the progress made toward standardization thus far and indicating problems requiring solution. The effect of various proportions and materials on the characteristics of the motor is fully considered.

PLANNING A LINE OF APPARATUS

A uniform and economical line of apparatus with a minimum number of different parts can be developed only if the entire line is mapped out from the start, not by designing each size as occasion offers, perhaps months apart. The first step in the case of a line of motors is a decision on horsepower ratings, speeds, voltages and so on. For a general-purpose motor this matter is fairly well standardized and uniformly accepted. For special purpose motors the different sizes of driven machine such as special machine tools, or other machines and their power requirements, are the determining feature.

Diameter and Length of Core.—The next step is to establish diameter and length of armature core or, for alternating-current motors, bore and width of stator core. Diameter and length together as D^2L presents a means for comparing volume of active material between machines of different design. Out of a given amount of material it should be possible to obtain a given motor output, assuming grade of materials, performance characteristics, such as efficiency or temperature, and finally the skill of the designer, to be the same. The D^2L may be plotted in a curve against the motor torque or horsepower per hundred revolutions (Fig. 1).

For purposes of comparison the D^2L for existing lines and competitive lines is plotted on the same curve. Having in this manner made a decision as to the diameter and length, we can still build a machine of large diameter and narrow core or choose a smaller diameter and correspondingly greater width. The principal considerations in this respect are, first, that the weight and cost of inactive material, including brackets, etc., increases with the diameter. The flywheel effect increases even with the square of the diameter, and this is an item of importance, particularly in reversing service or where frequent starting of the motors is required. On the other hand, a machine of small diameter and excessive length may be difficult to ventilate and to keep within the prescribed limits of temperature rise. The selection of proper ratios is therefore a matter of judgment and experience. Uniform steps of diameter and width should eventually be adopted as standard for the line. Frequently, particularly in the case of alternating-current motors, it may be desirable to design or even to build a rating two ways, that is, of small diameter and considerable width of core, or of the next larger diameter and next smaller step in core width.

Number of Poles.—With direct-current motors a similar border territory exists near the dividing line between two and four poles and between four-pole and six-pole designs. A 10-hp.-general-purpose motor for instance is uniformly built as a four-pole machine. In

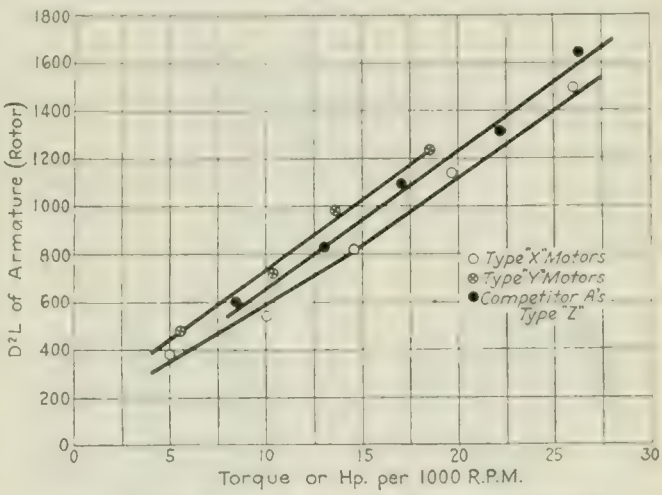


FIG. 1—RELATION BETWEEN ARMATURE PROPORTIONS AND TORQUE

the case of a 2-hp. motor there may be a choice between two and four poles and on a 50-hp. motor between four and six poles. In general, the lower number of poles means a larger amount of material both in magnetic section of frame and in commutator face, etc. On the other hand, the greater number of poles, field coils, brush holders, studs, etc., involves increased labor cost. The whole question is, therefore, a matter of cost comparison.

In regard to commutating poles the usual practice is to build the small two-pole machines without commutating poles, four-pole machines with two commutating poles (certain more or less special cases excepted), six-pole motors with six commutating poles. With the small motors commutating poles are omitted, as service conditions and possible gain by commutating poles, compared with the increased costs, are such as not to warrant their use. There is again a certain border territory where opinion differs and some manufacturers use commutating poles while others do not.

Having settled these general points, it is well, in mapping out a line of motors, to tabulate the principal data and results of preliminary calculation in tables.

Air Gaps.—In connection with alternating-current motors a decision must also be made in regard to air gaps and the use of open or partly closed slots. Minimum air gaps permit a minimum amount of material for a given output. On the other hand, inaccuracies and manufacturing variations in the punchings, in building of cores, in machining and assembling of parts,

and finally the item of bearing wear, require that for satisfactory service the air gap should not be decreased beyond a certain amount. Practice in this respect is fairly well established, namely, approximately 0.017 in. (0.43 mm.) for a 2-hp. or 3-hp. motor, increasing to a $\frac{1}{32}$-in. (0.79 mm.) single gap on a 15-hp. or 20-hp. motor.

Closed or Open Slots.—Closed slots are particularly advantageous from a purely electrical standpoint and effect a saving in active material. From a manufacturing and repair standpoint, however, the open slot with fiber wedge has the advantage of permitting the use of form-wound coils, easily inserted and removed from the slots, while the closed or partly closed slot makes it necessary to thread wire for wire through the small opening in the slot. Here is, therefore, a manufacturing consideration, a question of customer's attitude and a cost question to be weighed against one another. The cost question may be determined accurately by designing and estimating of a machine in both ways, with more material and open slot or a smaller machine with partly closed slots. The magnetic bridge or wedge was introduced with the object of combining the advantages of the open slot with the better magnetic conditions of the closed slot. For the present the slot question is mentioned as one of the general points to be decided in mapping out a line of motors. General practice is to build the small motors with partly closed slots, the larger sizes with either open slot or metallic wedge. The dividing line has varied considerably according to the tendency one way or the other of the manufacturer and motor users.

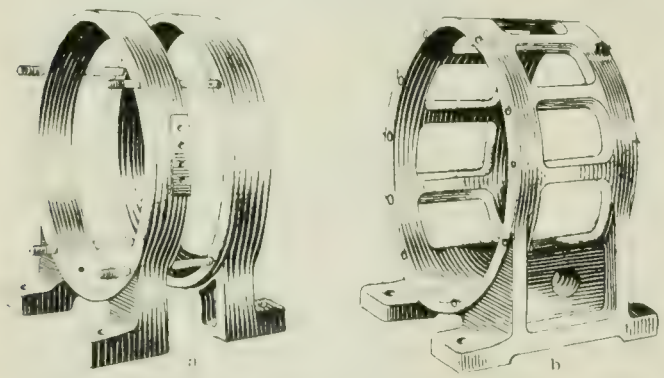


FIG. 2—CAST-IRON FRAMES USING MINIMUM MATERIAL
(a) Two rings riveted together. Feet are cast integral with end rings. (b) Skeleton construction.

Choice of Materials for Motor Frames.—Considering direct-current motors first, the frame has the double function of a magnetic yoke and of a mechanical supporting member for poles, field winding, brackets, etc. Several different materials may come into question for possible use—cast iron, malleable iron, cast steel, forged steel and sheet steel. According to their magnetic permeability, these materials compare about as follows, at a magnetic density of 100,000 lines per square inch (15,500 lines per sq.cm.): Cast iron, 30; semi-steel, 41; malleable iron, 69; cast steel, 82; cast steel annealed, 87; hot rolled steel, 93; sheet steel, 98 to 100. For a given flux per pole at a given magnetic density the weight of a frame for these different materials would have to bear a ratio according to these figures. A cost comparison is still more instructive, but on account of the varying prices of castings and the item of labor, patterns and tools entering into the problem no generally applicable figures can be given. The above, however, sufficiently indicates the reason why cast iron today is practically abandoned as a material for direct-current motor frames except in the very smallest sizes of fractional horsepower motors.

Malleable iron is little used, as cast steel offers greater advantages at a very little greater cost, considering the possibility of reduced section. Hot rolled steel plate for direct-current motor frames came into commercial use some ten years ago and is today used on a very large scale by several manufacturers. Aside from lighter weight, there are the advantages of uniform cross-section, of freedom from blowholes, which means uniform motor performance, and of easy machining, drilling and tapping. Great flexibility of design is assured as rings are readily rolled of different width or thickness with the same equipment. Before these frames, formed into rings from universal mill plate or, within commercial widths, from bar stock, came into use it was proposed to roll up cylinders from steel bands, hoop steel, on edge and rivet the turns together. It has been suggested and actually tried to make motor frames, including pole projections, from sheet steel, punched in complete circles or in sections, built up and riveted. However, this idea, involving as it does considerable waste of material, great tool expense and labor in building, has not been able to hold the field, except perhaps for small fractional horsepower motors or very special cases. Today the rolled-steel motor frame appears to be the most efficient.

With alternating-current motors the frame has no magnetic function. It serves merely as a supporting member for the primary laminations, bearing brackets, etc. There are therefore several possibilities. Rolled steel in this case loses the advantage of superior permeability, but may be used on account of its strength and with a view to using existing equipment and parts in common with the direct-current line. As indicated in Fig. 3a, a special shape of punching or similar means is required with the straight cylindrical frame to obtain the necessary depth for the primary winding. Cast iron may be used and can be shaped to give sufficient strength and rigidity as well as provide proper ventilation and direction of air currents (Fig. 5). These two illustrations show different means for taking care of the varying core widths used within the same frame—a pin or pins in the center and bolts or rivets through the punchings in the former case; in the latter end plates of varying width or keyways milled at different distances from the center. The scheme of ventilation is indicated by arrows showing the direction of air currents in both designs. Coils as well as iron are effectively cooled by air currents passing over them.

If the cast-iron frame is reduced to the minimum required for mechanical strength, so that merely connecting ribs remain between the two sides of the motor frame, there results the so-called skeleton frame construction (Fig. 2b). It is, at least in the writer's opinion, a question whether there is sufficient gain in material saved, and there is undoubtedly a loss in rigidity, particularly in the larger sizes for this construction.

In designs used for alternating-current motors up to 15 hp. or 20 hp. the frame is often entirely omitted and the primary laminations are riveted together between strong end rings. These may be made of cast materials, or, more economically, if quantities warrant the tool expense, of pressed steel (Fig. 4). Large, tight-fitting rivets, driven under hydraulic pressure of about 25

tons and more, must be used with this construction, in order to insure reliability in rough handling and severe service. A large number of rivets is preferable, some manufacturers using twelve, others four. In either case they may be uninsulated, but they must be well out of the magnetic path. This construction may be further reinforced by a unit base (Fig. 2b) joining end rings.

The motor frame usually has foot projections, on which the machine rests. In severe service there is considerable strain transmitted through these parts and a strong construction is required. Ribs of large cross-sections are provided in the case of cast frames. With rolled-steel frames the design of a suitable foot presents some difficulty. Small motors may use a cast base, bolted on. On larger sizes and up to 150 hp. a riveted construction with the base made from malleable iron, cast steel or, best, from pressed steel has been in

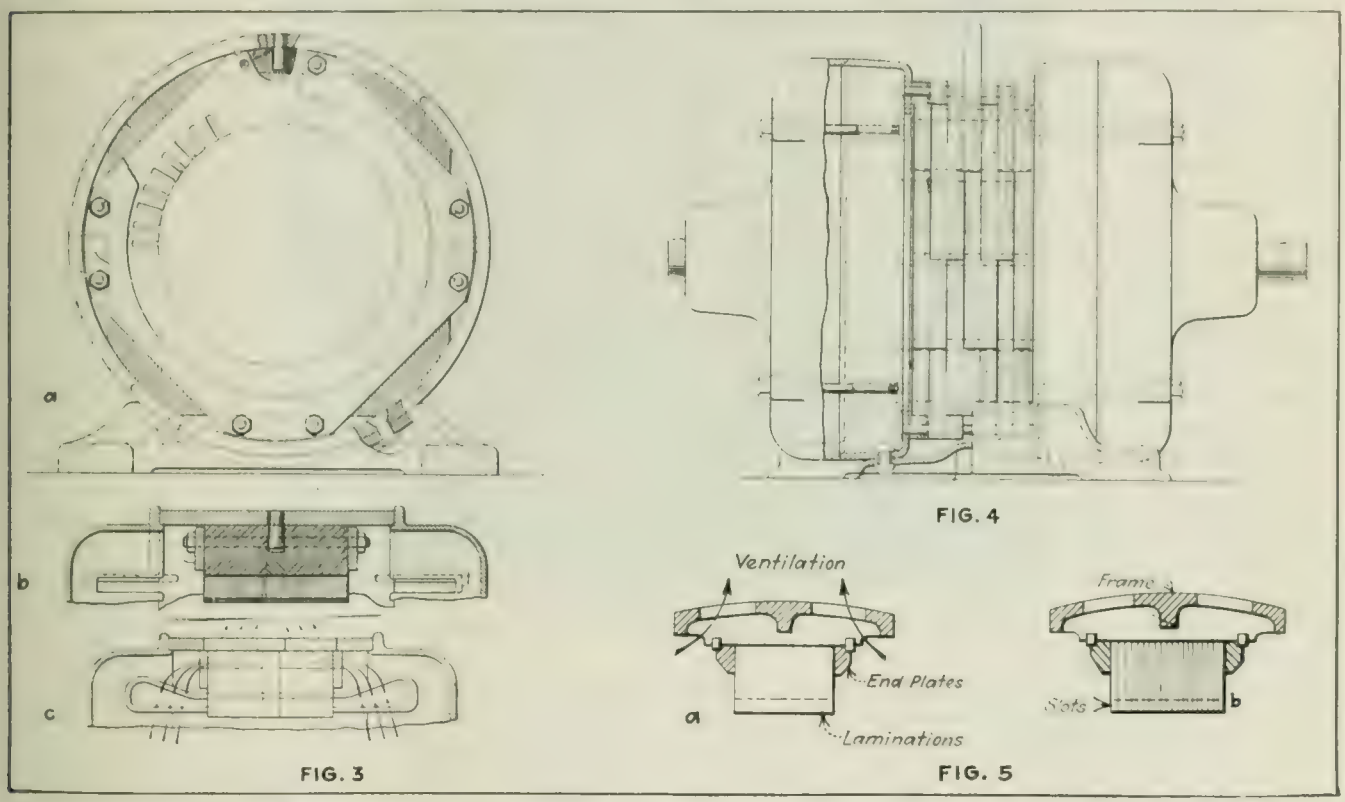


FIG. 3 FIG. 4 FIG. 5

FIGS. 3, 4 AND 5—SOME COMMON DESIGNS OF ALTERNATING-CURRENT MOTOR FRAMES

Fig. 3—Rolled steel frame, (a) arrangement of stator core, (b) support of stampings, and (c) ventilation scheme. Fig. 4—Pressed-steel rings riveted through core. Fig. 5—Sections of cast-iron frames with provision for different core sizes.

successful use for many years. The rivets in this case must be large in size and number and driven under heavy hydraulic pressure. With the rapid development in recent years of the electric arc-welding process and the increasing skill of the operators of welders, a solid forged foot, welded to the frame, has come to the fore and is used in actual service in considerable quantities.

Frame Diameter and Width.—In the process of mapping out a line of motors we have determined the armature diameter and core width and decided on the general construction of a frame. The next step then is to determine frame diameter and width. For alternating-current motors the frame bore follows from the inside diameter of the stator punching, plus slot depth, plus magnetic section required below the slot for the lowest number of poles to be designed on this rotor diameter. The outside of the frame is determined by requirements of ventilating space, coil clearance and mechanical stiffness. The frame width is a matter of accommodating the maximum core width necessary and of easy accessibility for coil winding.

With direct-current motors the points to be observed in this connection are that the radial depth of the field coils must be sufficient to provide a sufficient number of square inches radiating surface of the coil in order to keep the temperature rise within the prescribed limits. Crowding of the field coils must be avoided to facilitate manufacture and to prevent grounds or shorts in the coils. With the cross-section of the frame determined by flux and magnetic density permitted, the decision is still open as to proportion between width and thickness of frame. The width should be sufficiently small to permit free ventilation. On the other hand, the thickness of the frame should be such that the flux coming out of the pole body can freely enter the frame. This relation may be stated in the following form: Frame width times circumference of pole body should be equal to, or greater than, the cross-sections of the pole body. In small sizes the minimum frame thickness is also limited by the size of bolts required for supporting the bearing bracket.

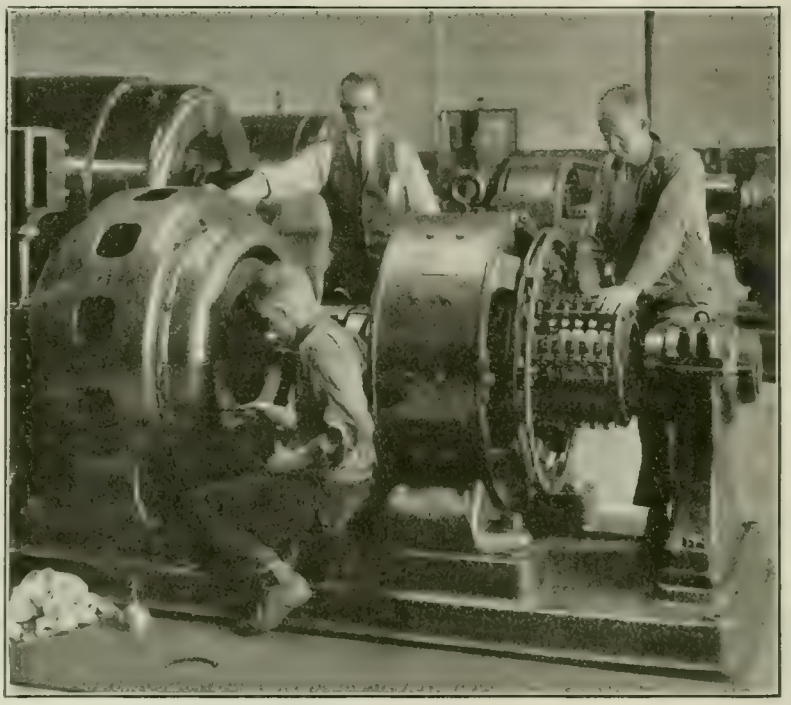
In working out the details of the design of a motor frame the usual attention must be paid to facility in making patterns and castings, avoidance of cores and loose pieces, simplicity of machining and interchangeability of drill jigs and of machining fixtures.

Uniform practice in regard to clearance for foundation bolts on general-purpose motors has been adopted as a recommended standard practice by the motor manufacturers (see Electric Power Club rules) so as to make these bolt holes practicable either for accurate setting on a machined base or for mounting on a rough concrete foundation.

Scheduled Inspection for Power Plants

Well-Ordered Routine Inspection of Electrical Equipment in Steam and Hydro-Electric Plants Catches Incipient Troubles—Analyses Made from Reports that Aid in Plant Administration

A DEFINITELY scheduled inspection system embracing simple instructions and records has been developed for the plants of the United Electric Light Company, Springfield, Mass. Special inspectors are employed who make daily, weekly, monthly, semi-annual and annual inspections in the steam plant and the hydro-electric plants. Besides inspecting all electrical equipment, these men make minor repairs, test and filter oil in transformers and switches, blow out motors, charge storage batteries used on control circuits and make sure that a sufficient number of repair parts are always kept in stock. From the compiled results of these inspections yearly analyses are made by the electrical engineer which are valuable for suggesting possible improvements regarding operation, type of equipment and station layout. Seven men are primarily responsible for the electrical inspection. At the head of the organization (Fig. 1) is the company's electrical engineer. Reporting to him, and in immediate charge of the work, is a chief electrician. Five inspectors handle the service under the latter, the duties being subdivided so that all inspectors spend a large part of their time at the main station, with excellent co-operation, a daily meeting being held at 8 a.m. One inspector handles the work at the two hydro-electric plants and spends the balance of his time at the main plant on more delicate inspection and maintenance of instruments and relays.



AIR GAPS OF MOTORS ARE MEASURED WEEKLY AT SPRINGFIELD, MASS.

The inspection program is most extensive for State Street, or No. 1 station, which is a 34,500-kva. steam plant. In the plant one 20,000-kva. unit, three 1,000-kva. units, and one each of 2,500, 4,000 and 5,000-kva. rating are in service. The plant is interconnected with the 66,000-volt transmission system of the Turners Falls Power & Electric Company through a transformer substation of about 22,500-kva. rating at State Street. At Indian Orchard is a 2,940-kva. hydro-electric plant and at Birchem Bend is a 640-kva. hydro-electric station, the main steam plant being about 6 miles (10 km.) from the two smaller stations. The auxiliary motors in all the stations total about 2,300 hp., of which about 2,000 hp. is located at State Street. Local distribution is at 5,500 volts, two-phase. These motors operate oil circuit-breakers (seventy-seven motors), drive arc generators, regulators, fans, pumps, coal-handling machinery (fourteen motors totaling about 200 hp.), etc.

The schedule of work for the steam plant is shown on page 923. In addition the daily routine includes oiling and wiping motors and testing potential transformer secondaries for open circuits. All motors are under the daily supervision of the operating force, and daily inspections are made of the blowers and motors belonging to the ventilating system, and also of the electric elevator motor and control mechanism. The daily work of the State Street station takes about two hours with an inspector and assistant and two hours of the time of an assistant who inspects and replaces lamps. One inspector and assistant perform the weekly inspection at this plant in one day. The monthly inspection of oil switches occupies two days, an inspector and assistant being required. At the hydro-electric plants the inspection is practically the same as at the State Street plant. For convenience in checking the work the apparatus is listed on 3 x 5-in. cards. Each card applies to one type of equipment, such as generators, exciters, etc., and contains the instructions for all inspections to be made on this type of equipment.

TABLE I—TROUBLES LOCATED BY INSPECTORS DURING A YEAR

Trouble Detected	Number of Times Reported
Fire extinguishers missing	8
Transformer valves leaking	2
Brushes gone on collector rings, generators or exciters, or brushes set improperly or sticking	9
Lightning arresters open-circuited	1
Field rheostat with burning contacts	2
Cranes developing flat wheels, grounds in crane wiring, resistors loose or broken	6
Control batteries defective	2
Switches running warm	1
Loose contacts	-
Oil breakdown tests below normal	12–15
Rubber gloves:	
Punctured	1 Pair
Broken down at 7,500 volts on test	1 Pair
Relays, contacts bent or loose	Several
Primary insulator on bus broken	1
Oil switches faulty in operation due to worn or slipping clutches in mechanism	5
Reverse-current relays open circuit	1
Ground wires cut off outside station	2
Oil-switch contacts requiring replacement	Many
Generator air-gap wedges coming out	1
Motor armatures rubbing	Several

Frequency of Inspections and Where to Look for Trouble

Weekly—Monday

Station Lights:

General Inspection for cleaning, etc.:

66,000-volt, 5,500-volt, 2,400-volt, oil switches and compartments.

Lightning arresters and compartments at Turners Falls Switch House and Tower and roof, complete with equipment; record charging current.

5,500-2,400-volt transformers.

All lighting services, boxes and receptacles.

Fire extinguishers.

Blowers and motors on ventilating system.

Elevator motors and control.

All motors under the care of operating force. (Blow out at the time of this inspection all open motors and examine for bearing wear, lubrication, etc.)

Generators and exciters, brushes, brush-holders, commutators and rings, etc.

Rotaries, brushes, rings, commutators, bearings, etc.

Rectifier Heating Lights:

I R S Regulator Relays and Contact-Making Voltmeters:

See that contacts are clean and leads well secured.

Arc Board Flexible Jumpers:

See that the insulation is intact.

Signaling Devices:

Try all devices for operation and make sure there are no loose contacts, loose dirt or foreign material to prevent satisfactory operation.

By means of lamps on P. F. potential bus, test for blown fuses on all power circuit potential transformers. With test lamp make same test on all other potential transformer leads.

Operators' Reports:

Investigate any such reports which have not been cleaned up from the previous week.

Brush Arc Machines:

Examine brush arc machines for evidences of trouble.

Storage Battery for Control:

See special instructions.

Monthly Inspections

Motors:

Inspect all motors and their controls and make any repairs required. Note any changes which might be made with benefit in the care and operation of the machines. Note any addition to list of station motors installed during the previous month.

Inspect all fuses and replace any that are incorrect, and report use of incorrect fuses.

Oil Switches:

Inspect all oil switches, try them for operation, and where solenoid-operated, operate them both by the solenoid and by hand. Lubricate at this time when necessary. Examine carefully for sticking or faulty operation.

The above applies only to such switches as may be operated without cutting off customers' service. (See yearly inspections for switches, the cutting out of which will interrupt customers' service.)

See that auxiliary contacts are cleaned and in correct alignment.

Oil very sparingly all moving parts equipped with oil wells or holes. See that the brush contacts and the stationary contacts on H-3 switches are cleaned and in good condition.

Relays:

Relay inspector should try relays on each switch and each phase when switches are out of service for the above.

Disconnecting and Expulsion Fuses:

Examine disconnecting switches for evidence of trouble, also expulsion fuses. Examine operating rods for both and see that they are in good condition.

Examine fuse pullers, test leads and hooks.

Storage Batteries:

Charge control batteries for No. 2 and No. 3 Stations and replace those in service by the one just charged.

Circulating Water Supplies:

Test all circulating water supplies to transformers, regulators and rectifiers for free circulation. Allow a full stream to flow through all cooling coils for two or three minutes to loosen up and remove accumulating sediment. Where the apparatus is equipped with open flow indicators, precautions will be necessary to prevent splashing.

Air Breakers (Relay Inspector):

Examine for heating and operation, airbreak circuit breakers with reverse current relays, remote-controlled field switches, etc.

Rubber Gloves:

Carefully examine and test electrically all rubber gloves left in the station for the operators' use. If these gloves show evidences of puncture or wear they are to be replaced and turned over to the chief electrician for test. When tested write date on wrist of glove, with water-proof ink, and initial.

Switchboards:

Examine in detail all instrument and control equipment on panels for loose, dirty or broken contacts or connections, improper or burned out fuses, etc.

Quarterly Inspections

Jan. 1, April 1, July 1, Oct. 1.

Test Transformer Oils:

Test oil in 66,000-volt transformers, 13,200-volt transformers and their regulators, and 5,500-volt transformers. Filter oil at the first opportunity if it tests below an average of 16,500 volts with 1-in. disks 0.1 in. apart.

Ground-Wire Connections:

Inspect all ground-wire connections on lightning arresters and high-voltage station apparatus. This wire is to be examined up to the point where it is attached to pipes, flumes, etc.

Rectifier Transformers:

See that the accumulated dust is removed from rectifier transformers by means of compressed air. In so doing, make sure that the air is dry and does not deposit moisture on the coils. Try rectifier dash pots, and if necessary adjust in accordance with the manufacturer's instructions. Give each rectifier tube in service heat treatment, in accordance with manufacturer's instructions.

Semi-Annual Reports

Nov. 1 and May 1.

Generators:

This is a complete inspection of generators including the removal of the end shields, inspection of generator windings, air gaps, air ducts, inlets and outlets, armature and field leads, thermometers, etc.

Relays:

Test and adjust all relays. On bellows-type relays the leather should be rubbed gently with neatsfoot oil the day before the relays are calibrated.

Repair Material List:

Check up the stock-room repair material on hand. See that new apparatus installed in the past six months is properly protected by repair material.

Make any suggestions with reference to repair material lists which appear necessary.

Yearly Inspections

June 1

Oil Switches:

Examine all 2,300, 5,500, 13,200 and 66,000-volt oil switches and contacts. Filter oil and replace where necessary.

General

Get shipping memos from stockkeeper and open and check all material received for new construction work, etc., where material is too bulky or where, for any other reason, it is not taken into stock and opened and checked by the stockkeeper in detail. Report all shortages at once.

The above does not, in any way, prevent the necessity for reporting at once any case of trouble requiring outside help or material not regularly kept in stock, or at that time out of stock, even though regularly kept in stock.

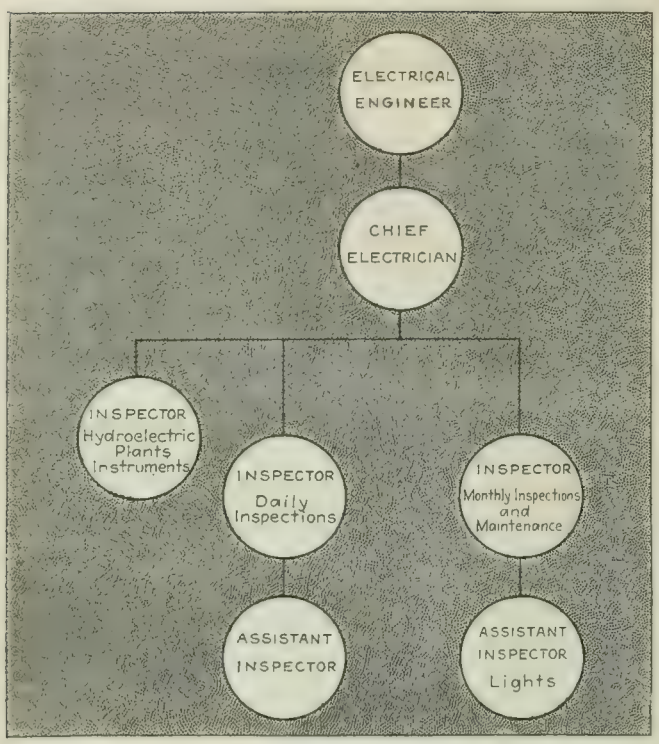


FIG. 1—SEVEN-MAN INSPECTION ORGANIZATION FOR THREE PLANTS TOTALING 38,000 KVA.

While it is impossible to tell in how many cases the inspectors have caught troubles which might have caused serious breakdowns later, the character of defects revealed by inspection affords excellent evidence of the value of the system. A recent analysis by J. P. McKearin, electrical engineer of the company, covering a year's inspection reports, showed, among other data, the conditions to be remedied listed in Table I. As an example of the value of the system it might be pointed out that in the case of the generator air-gap wedge becoming loose the consequences might have been very serious had the trouble not been detected. The unit was one of 20,000-kva. rating, and inasmuch as the wedges are of laminated sheets the coils might easily have been damaged had the trouble continued without being observed.

In conclusion, a few operating defects taken from an inspector's notebook are added as an indication of the importance of forestalling trouble.

NOTES FROM INSPECTOR'S NOTEBOOK

A 5,000-volt switch blocked by a stick dropped by painters.

The air-gap on a type H-3 switch magnetic clutch widened by the use of emery cloth.

Bell cranks improperly set, resulting in unequal movement of oil switch mechanism.

Loose brushes and rough slip rings.

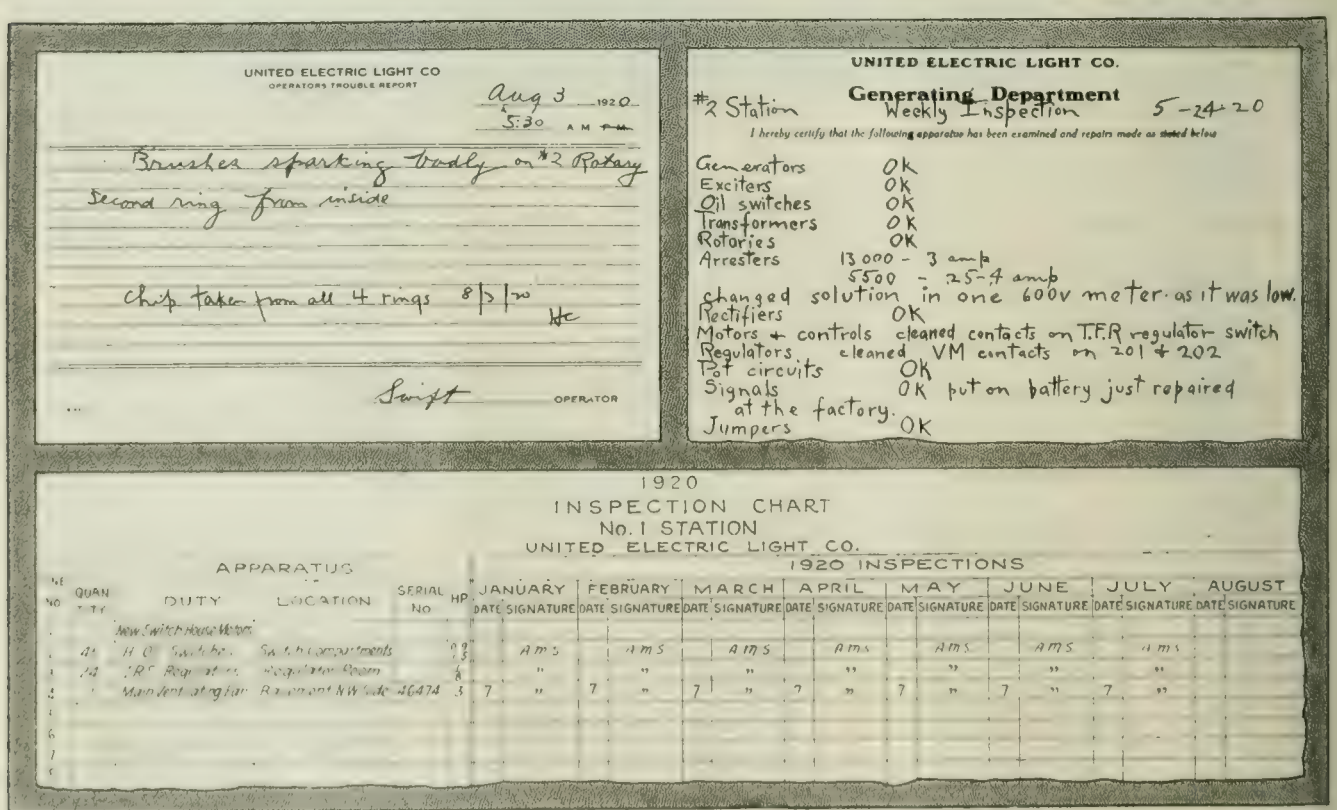
Too many brushes down in starting rotary converter, due to broken clips.

Hot blades on knife switches, due to spread clips.

Lamp and fuses missing or blown on emergency lighting circuits.

Water carried from air-washer into generator stator, one burnout resulting.

Distortion of field coils at bends due to loose winding and heating.



UNITED ELECTRIC LIGHT CO
OPERATORS TROUBLE REPORT

Aug 3 1920
5:30 A M

Brushes sparking badly on #2 Rotary
Second ring from inside

Chip taken from all 4 rings 8/3/20 Hc

Swift OPERATOR

UNITED ELECTRIC LIGHT CO.

#2 Station **Generating Department** 5-24-20
Weekly Inspection

I hereby certify that the following apparatus has been examined and repairs made as stated below

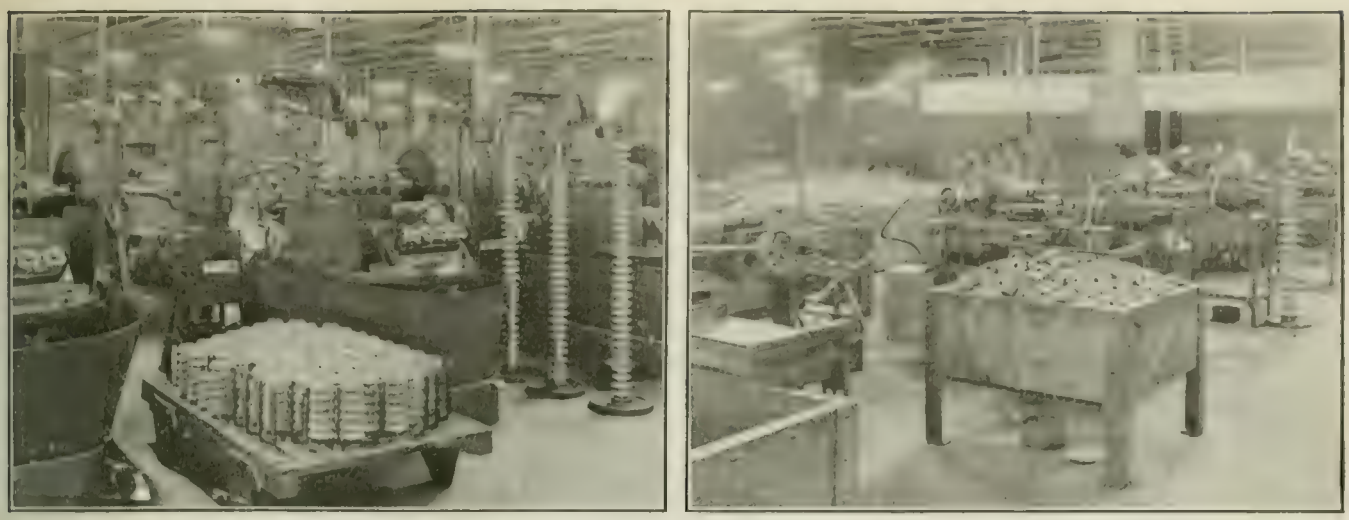
Generators	OK
Exciters	OK
Oil switches	OK
Transformers	OK
Rotaries	OK
Arresters	13,000 - 3 amp 5500 - 25-4 amp
	changed solution in one 600v meter as it was low.
Rectifiers	OK
Motors + controls	cleaned contacts on T.F.R regulator switch
Regulators	cleaned VM contacts on 201 + 202
Pot circuits	OK
Signals	OK put on battery just repaired at the factory.
Jumpers	OK

1920
INSPECTION CHART
No. 1 STATION
UNITED ELECTRIC LIGHT CO.

NO	QUAN TITY	APPARATUS DUTY	LOCATION	SERIAL NO	HP	1920 INSPECTIONS JANUARY DATE	JANUARY SIGNATURE	FEBRUARY DATE	FEBRUARY SIGNATURE	MARCH DATE	MARCH SIGNATURE	APRIL DATE	APRIL SIGNATURE	MAY DATE	MAY SIGNATURE	JUNE DATE	JUNE SIGNATURE	JULY DATE	JULY SIGNATURE	AUGUST DATE	AUGUST SIGNATURE
		New Switch House Water																			
1	#1	H O Switches	Switch compartments		0.9		Ams		Ams		Ams		Ams		Ams		Ams		Ams		
2	#1	I R C Regulators	Regulator Room		8		"		"		"		"		"		"		"		
3	1	Main Vent Engine	Room on NW side	46474	3	7	"	7	"	7	"	7	"	7	"	7	"	7	"		
4																					
5																					
6																					
7																					
8																					

FIG. 2—FORMS USED FOR RECORDING RESULTS OF INSPECTIONS

Left upper—Operator reports to inspector on this form any trouble which he has noticed while on shift. Right upper—On this blank are recorded each piece of equipment inspected and a notation of trouble found and what was done to remedy it. Lower—On this sheet all equipment inspected is listed and checked after every inspection. The sheet embraces one year's inspection.



ABSENCE OF HEAVY SHADOWS IS NOTICEABLE IN THIS SHOP LIGHTING

Illumination of Machine Tools

Average Intensity Over Machines Is 15.35 Ft.-Candles in Plant of Central Gear Company—Conditions at Night as Pleasant as in Daylight

BY G. WAGSCHAL
Electrical Engineer, Esseltyn, Murphy & Hanford

GOOD illumination is essential to the night operation of a plant if quality and quantity production are to be obtained. A soft, well-diffused light which will enable the operators to make accurate micrometer readings without undue eye strain should be provided. Dark spots, gloomy ceilings and shadows should be avoided because these things affect the morale of the workmen and morale is now recognized as an important factor in production. It follows, therefore, that initial cost, while important, should not be the primary factor.

The Central Gear Company of Detroit, which manufactures gears and transmissions for use in automobiles, has a lighting installation, as shown in the accompanying illustrations, which gives the results most desired by the factory management. The lighting equipment consists of 220-volt type F Cooper Hewitt lamps hung 10 ft. 6 in. (3.2 m.) from the floor and spaced 15 ft. x 16 ft. (4.5 m. x 4.8 m.) apart. There are two lamps on each circuit, and each circuit is controlled from a safety-type panel box, one of which is mounted on nearly every alternate column in the building. A 110-volt plug receptacle is also provided on every column to supply energy to small electric tools.

The average intensity of illumination over the machines was found to be 15.35 ft.-candles (165 lumens per sq.m.) and the average intensity of illumination in the aisles was found to be 10.85 ft.-candles (116.8 lumens per sq.m.). The energy consumption corresponding to these values was 1.6 watts per square foot.

Readings were taken for positions of maximum and minimum intensity over the machines and in the aisles at a working plane of 3 ft. 6 in. (1.07 m.) above the floor. The illuminometer readings were taken without a color screen because its accuracy is not above question. Furthermore, the results given can be used for comparison by others whether or not they have a color screen available.

The old empirical rule of 1 watt per square foot (10.8 watts per sq.m.) is being superseded by a careful study on the part of the illuminating engineer of all factors entering into the problem, giving due consideration to intensity, diffusion and proper distribution of light. The tendency today is toward a higher standard of factory illumination with increased visual acuity obtained by the utilization of higher intensities and by the elimination of glare.



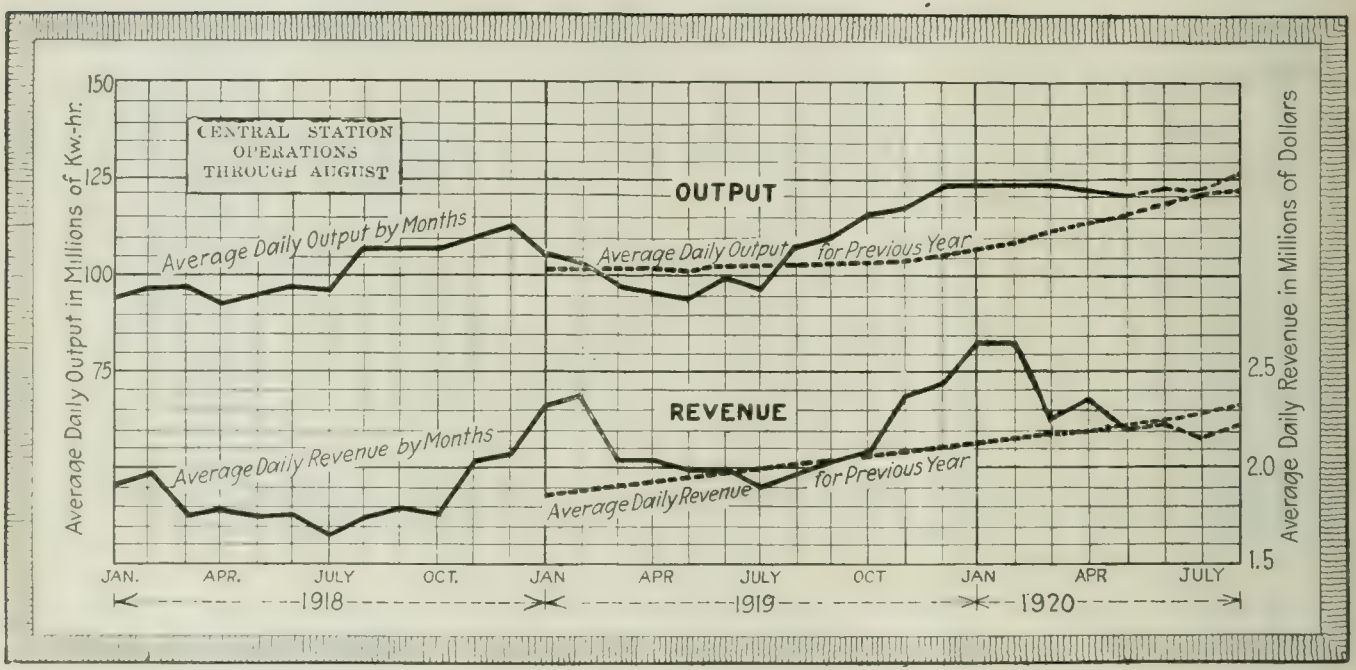
NATURAL LIGHT (LEFT) IS CONTRASTED WITH ARTIFICIAL LIGHT (RIGHT)

It should be remembered that the measuring instruments record only the intensities of illumination and not the ability to see, which is the prime object of all illumination. However, the ability to distinguish detail can be brought out by the camera, as the accompanying pictures show very clearly. It is interesting to note in comparing the photographs that better results were obtained with the artificial lighting than were obtained with daylight.

All the wiring in this plant is in conduit. Four No. 12 B. & S. (3.31-sq.mm.) two-conductor lighting circuits are taken from the lighting panels in 1-in. (2.54-cm.) conduit. The 1-in. conduit is carried to a central point in the roof trusses, and from there one circuit is taken in ½-in. (1.27-cm.) conduit to each pair of lamps.

All the efforts made to simplify the layout and to increase the value of the lighting installation to the factory manager are made for the sole purpose of continually increasing the quality and quantity of the factory output.

Record Output During Industrial Depression



THAT a new output record was hung up by the central stations of the country during the month of August is indicated by returns for that month received by the ELECTRICAL WORLD. For the first time in the history of the industry the average daily output was in excess of 125,000,000 kw.-hr. Owing largely to curtailment of operations in several lines of industry, this record advance was not shared by the strictly industrial sections of the country. The increasing seasonal energy demand for lighting purposes throughout the nation was sufficient, however, to overcome the small output increases in the industrial sections and establish a record for central-station operations.

Curtailment of production was more or less general in all sections of the country. The New England States, however, were especially affected. Boot and shoe, silk, woolen, cotton and textile mills were seriously curtailed in operations. It was reported that the number of woolen mills idle during August was as great as during the semi-panic year of 1907, and many mills were working on a five-day-week schedule. In spite of these curtailments in industrial operations and consequent decrease in power demand, the central-station output in New England for August was about 2 per cent greater than that of July.

Steel-ingot production during August was the largest since December, 1918, with the exception of February and March of this year. It was reported that steel mills were still operating at only about 80 per cent capacity, notwithstanding this increase in production. Curtailment in production was reported in several industries. The returns for the Atlantic States indicate, however, that the output was about 30,000,000 kw.-hr. in excess of July's output.

Automobile production seems to have reached a working level, and very little additional curtailment was reported during August. Several other industries in the North Central States, however, reported curtailment of production in varying degrees, which probably accounts for the fact that, notwithstanding the seasonal increase in lighting demand, the central-station output of this section was approximately the same as that reported in July.

The pre-eminence in the lighting load of the South Central States and the increasing seasonal demand for such energy probably account for the fact that the output of that section increased about 5 per cent over July.

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE MONTHS

	Percentage of Installed Ratings Represented	Revenue from the Sale of Energy			Percentage of Installed Rating Represented	Kw.-Hr. Output		
		1919 Thousands	1918 Thousands	Per Cent Increase		1919 Thousands	1918 Thousands	Per Cent Increase
Sept.	53	$32,344	$28,336	14 0	53	1,761,582	1,695,862	4 3
Oct.	55	35,492	30,077	18 0	60	2,175,636	1,987,004	9 0
Nov.	53	37,439	31,927	17 2	58	2,055,428	1,895,693	8 2
Dec.	59	44,125	37,978	16.0	65	2,509,571	2,270,833	10 0
		1920	1919			1920	1919	
Jan	57	46,614	39,002	19.8	67	2,581,096	2,186,732	18 0
Feb	63	45,881	37,502	22.1	69	2,494,764	1,986,493	25 3
Mar	65	46,155	36,840	25 0	70	2,698,890	2,103,587	28 0
April	65	45,547	36,541	24 5	70	2,603,692	2,098,559	24 1
May	65	43,888	35,512	23 4	70	2,631,580	2,179,916	21 2
June*	66	44,434	35,528	24 5	71	2,630,831	2,175,645	20 2
July†	66	46,634	36,272	28 4	71	2,682,723	2,238,252	20 0
Aug.‡	66	47,103	36,560	28.9	71	2,770,741	2,287,394	21.5

*Includes estimates for twenty-three companies, representing 2 9 per cent of the total installed rating of all central stations.
†Includes estimates for thirty-eight companies, representing 5 5 per cent of the total installed rating of all central stations.
‡Includes estimates for eighty-two companies, representing 14 6 per cent of the total installed rating of all central stations.

Labor and industrial conditions throughout the Mountain and Pacific States were reported as good in August with the exception of the lumber industry, which was operating at less than 75 per cent capacity and many lumber mills were completely shut down. Lack of sufficient rain in the mountain regions of California was causing considerable worry and restricting the extension of operations in that state. In spite of these facts, however, the central stations of the Mountain and Pacific Section reported a record output of 808,000,000 kw.-hr. for the month of August. This section still holds the record for a continuous monthly gain in output since January of this year.

The average daily income for 1920 reached the low point in July, the ordinates of the new curve for this year being between 20 and 29 per cent greater than those of 1919.

Electric Heating Declared Impracticable by Canadian Authority

NO PRESENT possibility of using hydro-electricity for heating purposes is seen by C. A. Magrath, formerly Fuel Controller of the Dominion of Canada. For this conclusion Mr. Magrath gives three reasons. First, although the potential capacity of Canada's water powers is enormous, they are insufficient to heat electrically its present homes, to say nothing of future growth, and at the same time to meet the light and power requirements; second, the tremendous cost of the power plant and of the power transforming and transmitting equipment—all of which would of necessity be in use at the same time in cold weather and none of which would be needed for heating in warm weather—puts electric heating beyond practical consideration; third, the proposal to use electrical energy for heating is based upon unsound scientific principles. Electricity should not be wasted; but in the ordinary electric heater the heating element is in the form of resistance, and all the energy is thus a low type.

To heat electrically 20,000 houses each needing 25 hp. at the same time would entail a power plant and transmission installation of 500,000 hp., Mr. Magrath estimates. This is 25 per cent more power than the total capacity of the three large power companies at Niagara Falls, Ontario. If there were so much water power developed and undeveloped that there was no economical use for it, now or prospectively, there might be some excuse for advocating electric heat, the former Fuel Controller concludes; but when ten times as much coal can be saved at every point where electric motors replace steam-driven machines as could be saved by the same amount of energy used for electric heating conservation efforts should be centered on the electric power question—not on the visionary project of electric heating.

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

	Month	New England States				Atlantic States				North Central States				South Central States				Pacific and Mountain States			
		Percentage of Installed Ratings Represented	1919 Thousands	1918 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	1919 Thousands	1918 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	1919 Thousands	1918 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	1919 Thousands	1918 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	1919 Thousands	1918 Thousands	Per Cent Increase
REVENUE	Sept	73	$4,019	$3,536	13 6	53	$11,429	$10,069	13 5	46	$9,671	$8,278	16 6	38	$1,724	$1,488	16 0	63	$5,501	$4,965	10 9
	Oct	72	4,127	3,453	19 1	53	12,684	10,822	16 9	52	11,401	9,484	20 2	38	1,840	1,519	21 1	62	5,440	4,799	13 9
	Nov	71	4,432	3,800	16 2	56	14,738	12,761	15 7	44	10,541	8,689	21 2	39	2,063	1,694	21 8	63	5,665	4,983	13.9
	Dec	73	4,908	4,254	15 1	57	15,926	13,806	15 8	49	11,660	9,833	18 5	44	2,496	2,070	20 0	77	9,135	8,015	14 2
			1920	1919			1920	1919			1920	1919			1920	1919			1920	1919	
	Jan	78	5,635	4,718	19 8	59	17,659	14,625	20	51	12,885	10,799	19 6	53	3,047	2,538	19 9	75	7,388	6,322	16 1
	Feb	82	5,354	4,368	22 1	61	17,245	14,343	20 4	55	13,191	10,403	26 0	53	2,949	2,360	24 7	79	7,142	6,028	18.3
	Mar	82	5,136	4,044	27 0	63	17,696	14,279	23	57	13,270	10,469	26	54	2,910	2,287	27 8	79	7,145	5,741	24
	April	82	5,087	3,943	29 0	64	17,700	14,383	23 5	57	12,690	10,042	26	54	2,952	2,181	35	79	7,118	5,992	19
	May	82	4,897	3,741	30 1	64	16,624	13,631	21 9	57	12,471	9,853	26 8	54	2,829	2,140	32 0	79	7,067	6,147	15
	June	82	4,948	3,778	30 5	65	16,525	13,449	22 1	57	12,412	9,77	26	54	2,849	2,127	33 9	79	7,700	6,398	
	July	82	5,007	3,891	28 8	65	16,904	13,438	25 7	57	12,816	9,791	30 7	54	2,764	2,193	26 0	79	9,143	6,999	
	Aug	82	5,073	4,091	24 0	65	17,013	13,614	24.9	57	13,422	10,12	32	54		2,260	37 8	79	8,479	6,46	
KW.-HR. OUTPUT			1919	1918			1919	1918			1919	1918			1919	1918			1919	1918	
	Sept.	73	153,837	146,209	4 5	53	610,254	610,179	0 1	46	515,519	463,929	11 5	38	58,316	54,838	6 3	63	423,656	420,707	0
	Oct	72	162,859	142,326	14 4	53	694,584	659,859	5 3	67	815,284	709,663	15 3	38	67,155	56,742	18 5	62	435,754	418,412	4 1
	Nov	71	153,171	140,240	9 2	56	724,6C7	707,347	2 4	60	686,486	597,855	14 9	39	68,352	59,507	14 7	63	422,812	390,744	8
	Dec	73	180,493	152,304	18 0	58	803,165	733,222	8 9	67	825,313	713,959	15 8	44	88,658	73,728	20 1	77	611,942	597,620	2
			1920	1919			1920	1919			1920	1919			1920	1919			1920		
	Jan	78	207,158	159,773	29 8	60	853,057	717,303	19 2	63	841,841	731,755	15 2	56	140,736	117,677	19 9	75	538,304	460,221	16 2
	Feb	82	187,264	148,103	26 2	62	809,865	672,836	20 1	73	858,939	663,523	29 4	56	130,473	98,098	33 0	79	508,223	403,933	26 1
	Mar	82	198,603	148,512	33 7	64	897,327	711,828	26 0	74	913,659	711,7	28	56	137,306	102,545	33 9	79	551,995	428,941	28 6
	April	82	187,174	144,922	29 1	65	883,264	701,778	25 9	74	857,467	687,751	24 7	56	135,140	99,877	35 2	79	540,647	464,231	16 7
	May	82	188,566	148,186	27 3	65	854,631	711,276	20 0	74	862,127	700,095	23 3	56	137,779	98,815	39 2	79	588,457	521,544	12 6
	June	82	189,934	149,602	26 5	66	865,714	721,688	19 9	74	855,013	681,789	25 3	56	132,733	99,660	33 2	79	587,437	522,901	12.2
	July	82	190,895	159,009	20 0	66	881,156	714,494	23 3	74	844,486	703,447	20.0	56	139,254	106,345	31 8	79	2	554,957	12.9
	Aug	82	195,718	170,549	13 5	66	900,510	726,945	24.1	74	891,611	736,753	21.5	56	145,687	110,059	31 9	79		543,088	17.5

Determining Size of Wire and the Length of Span

No. 6 Wire and a 250-ft. Span Are Found to Be Economical for Most Cases Where Voltage Lies Between 33,000 and 66,000

By D. F. Parrott

FOR 33,000-volt to 66,000-volt lines economy in construction and operation can be obtained if No. 6 hard-drawn copper wire is adopted as a minimum size. Any size smaller than this is weak mechanically when used on long spans, and this causes high operating and maintenance costs. To shorten the length of span sufficiently to overcome this mechanical weakness makes construction costs higher in proportion than the difference in cost between the smaller wire and No. 6 wire. No. 6 hard-drawn copper may be safely used where the products obtained by multiplying load and distance values do not exceed the following:

192 kilowatt-miles for	2,300 volts
581 kilowatt-miles for	4,000 volts
1,570 kilowatt-miles for	6,600 volts
6,270 kilowatt-miles for	13,200 volts
17,340 kilowatt-miles for	22,000 volts
38,690 kilowatt-miles for	33,000 volts

These values are used for three-phase, 60-cycle lines operated at 80 per cent power factor and allowable line drop of 10 per cent. For single-phase lines one-half the values given are used. The safe carrying capacity of 60 amp. per wire should not be exceeded when using the kilowatt-mile values. For No. BB iron wire it is advisable to use 20 per cent of the kilowatt-mile values given.

Copper-clad steel wire can be used where the cost of a copper-wire line is in excess of the amount to be expended and is much more economical than the use of iron wire on account of its longer life resulting in lower maintenance costs. It also has a conductivity in terms of copper standard 10 per cent or 20 per cent greater than the conductivity of iron, according to the grade of copper-clad wire used. Copper-clad wire is manufactured in two grades, 30 per cent and 40 per cent of the volume conductivity of solid copper at 20 deg. C. To use the kilowatt-mile values the engineer should take 30 per cent or 40 per cent, according to grade selected, for copper-clad wire. Copper-clad wire is approximately 8 per cent lighter, per unit of volume, than copper wire and has about 15 per cent greater mechanical strength than copper wire for equal cross-section. Comparison of costs of suspension construction for various spans from 250 ft. (76 m.) to 350 ft. (106 m.) showed the following values:

Labor for stringing wire (three No. 1 bare stranded conductors and 0.25-in. (0.6-cm.) Siemens-Martin steel ground wire):

250-ft. span	94 man-hours per mile
275-ft. span	92 man-hours per mile
300-ft. span	90 man-hours per mile
325-ft. span	88 man-hours per mile
350-ft. span	86 man-hours per mile

Labor per pole for 250-ft. span:

Setting only	2.00 man-hours
Tamping	0.75 man-hours
Framing (one the ground)	1.40 man-hours
Hanging insulators	0.67 man-hours
Truck drivers, foremen, inspection, etc.	2.00 man-hours
Commissary and depreciation on camp equipment	1.70 man-hours
Total	8.25 man-hours

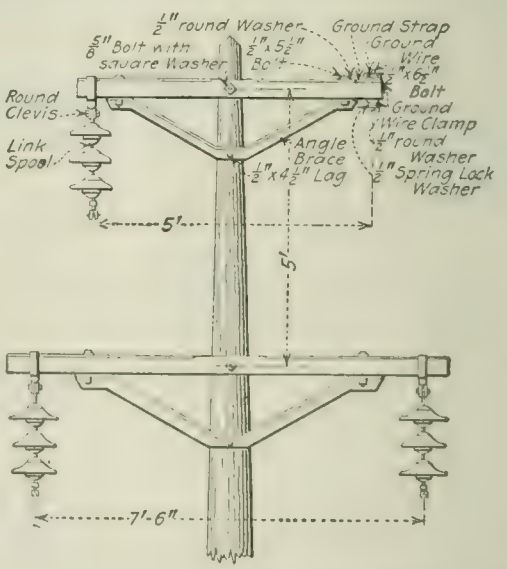
For longer spans this value was increased until 13.9 man-hours was reached corresponding to a 350-ft. (106-m.) span.

In determining the height of the pole required a clearance of 16 ft. (4.9 m.) minimum in the middle of the span is allowed for telephone wires, 6 ft. (1.8 m.) between these telephone wires and the lower high-tension wires, 3½ ft. (1 m.) for the length of suspension insulator string, 5 ft. (2 m.) between cross-arms and 1 ft. (0.3 m.) from the top cross-arm to the top of the pole. The sag allowed was based on a standard table, and the depth of pole setting was 6½ ft. (2 m.) for 45 ft. (14-m.) poles and 50-ft. (15-m.) poles, and 7 ft. (2.1 m.) for 55-ft. (17-m.) poles, in a straight line. Six inches (1.5 cm.) deeper was specified on curves, corners and dead-ends. The material used on the pole head was the same as that shown in the accompanying drawing.

The result of this comparison of cost, assuming the 250 ft. (76 m.) span to be 100 per cent per mile, was:

Span Length	Per Cent Cost of Labor and Material per Mile
250 ft.	100.0
275 ft.	99.8
300 ft.	96.2
325 ft.	97.1
350 ft.	94.6

These figures would appear to favor the long span, but they are based on uniform spans on level ground. No crossings or corners are included. If these were included, the result would probably favor the shorter



POLE-TOP USED FOR 33,000-VOLT TO 66,000-VOLT LINES

spans. Over rough country it is quite probable that the increased cost for long spans would be greater than for short spans. But even under the conditions assumed for this comparison, with level country—that there are no angles or crossings—the cost per mile is nearly constant.

In view of this fact it would seem that the 250-ft. (76-m.) span would be the most desirable, not only because of the better mechanical support but because of better wire separation during storms and in heavy winds, which will very materially cut down maintenance costs and add practically nothing to the construction costs. This information was presented at the Milwaukee State Electrical Association.

Readers' Views and Comments

Non-Recognition of N. E. L. A. Standards Results in Confusion

To the Editor of the ELECTRICAL WORLD:

SIR: Specifications for a standard cross-arm were adopted several years ago by the National Electric Light Association, and since that time a large number of central-station companies have come to recognize the excellence of the design suggested. In view of this fact it seems rather unfortunate that so many jobbers and manufacturers have practically ignored the recommendations of the association and have clung to designs of little or no merit, which do not represent the best thought and practice of the industry. One design of cross-arm quite generally used in many parts of the country a few years ago, and which was perhaps as near a standard as any up to the time of the appearance of the N. E. L. A. specifications, was of 3¼-in. x 4¼-in. section with one foot of length for each pin. That is, four-pin, six-pin and eight-pin arms were respectively 4 ft., 6 ft. and 8 ft. long. The spacing of the pole pins was 16 in. and of the end pins 12 in. The standard N. E. L. A. arm, as is well known, is 3½ in. x 4½ in. in section, with wider pin spacings and the very desirable width of climbing space of 30 in. between pole pins.

Standardization by one company on the basis of the N. E. L. A. specifications led to inquiries of several jobbers for six-pin arms. One firm replied that this arm was "special," was not carried in stock, and that the order could only be filled from the mill, but that it had a very good supply of the "standard" 3¼-in. x 4¼-in. six-pin 6-ft. arms available for immediate shipment. Another firm stated that it could fill the order for fir arms only from the Pacific Coast but had a large stock of the "standard" 3¼-in. x 4¼-in. arms for immediate shipment. A third jobber had a small stock of the desired arms, but the number was so very small that it was of practically no value to the intending purchaser.

Such replies indicate even to the casual observer that those three jobbers were out of touch with the efforts of the association at standardization. It is not improbable that other intending purchasers had been previously discouraged by the difficulty of obtaining the desired material and as a result had accepted the older type of arm. If there really existed no demand for the N. E. L. A. arm, it would appear that the jobbers were overlooking desirable business by not calling to the attention of the central stations in their territory the recommendations of the association.

When the same central station mentioned above ordered a certain type of fused cutouts, which were to be installed on the N. E. L. A. arms (these having been finally secured) they came with hangers for 3¼-in. arms, the manufacturer insisting that this was the width of "standard" arms. Then the hardware manufacturer was approached for transformer cutout clamps and clamp pins, and the information came back that if arms were used larger than the "standard" 3¼-in. x 4¼-in. it would be necessary to supply these items suitable for 4-in. x 5-in. arms, since only two sizes were made. These larger clamps were of necessity accepted, but when used on 3¼-in. x 4¼-in. arms the bolts were too long and had to be cut off, and at the same time one of the advantages of the clamp pins was lost: *i.e.*, the fibers of the wood could not be bound tightly together to prevent splitting and the rapid disintegration of the arm.

Columbus, Ohio. L. C. PETERMAN.

Resuscitation Through Pain Inflicted by a Blow

To the Editor of the ELECTRICAL WORLD:

SIR: An article written by me and printed in the ELECTRICAL WORLD for Feb. 26, 1916, on page 498, recounted experience and progress since 1912 in regard to resuscitating victims of electric shock through inflicting pain upon them by means of a blow. In a second article from me, printed May 5, 1917, page 840, pictures of the method advocated were given. So great is my faith in it that should all other methods fail I should still practice it. I now wish to state that nine lives have been saved through this means. An account of two of these accidents follows:

On Aug. 25, 1920, George Frickel of Jamaica, city of New York, a lineman in a gang under the foremanship of John Langdon, was shocked while on a pole making a half tap to a 2,200-volt primary wire. He was wearing leather gloves and sustained charred, third-degree burns of both hands which later necessitated the amputation of a finger. The shock rendered him unconscious, and he was held fast to the wire, the deadly current pulsating through his body, until the foreman, who had been around the corner several spans away, ran to his assistance, climbed the pole and knocked him free from the wire. The unconscious man was held at the top of the pole by his safety belt. The foreman then proceeded with resuscitation methods by repeatedly striking the point of the man's jaw, pulling forward his tongue and shouting in his ear. He soon regained consciousness.

Similarly, on Oct. 11, 1920, James McDermott of Richmond Hill, city of New York, a lineman in the same gang, received a shock of the same voltage. He and another lineman, A. C. Maass, had just arrived at the top of a junction pole. McDermott was trying to get in position at the end of the top cross-arm and was standing on the second arm, preparing to pull up the line protectors, when he lost his balance and fell forward, his hands coming in contact with the insulators where the primary wires were dead-ended. Maass gave first aid by repeatedly striking McDermott's jaw and shouting his name in his ear. McDermott recovered while on the pole and was able to descend to the ground with little assistance. He will lose a finger.

As shown by the above cases, it is possible to resuscitate the victim while he is still on the pole by striking the point of the jaw and shouting in the ear. Thus no time is lost. Should that fail, then the method outlined by me previously should be followed. That is, in lowering the man allow him to drop when about three feet from the ground, assigning some one to protect his head from injury, and then repeatedly strike his feet with a heavy stick, a pair of connectors or some blunt instrument. Do not remove the shoes. Strike the soles of the shoes and continue to administer sharp, heavy blows and to shout in the man's ear during the progress of the prone-pressure method.

W. P. STRICKLAND,
General Inspector.

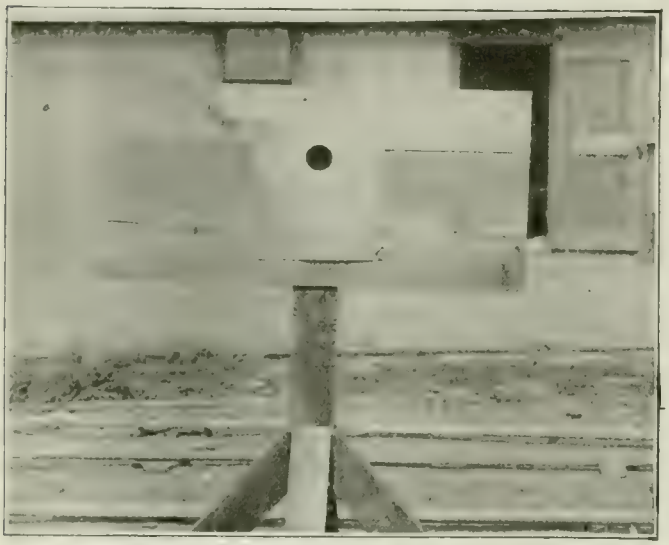
New York & Queens Electric Light & Power Company,
Long Island City, N. Y.

Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

A Universal Danger Sign

AN EMBLEM indicating danger wherever it appears is used by the Hydro-Electric Power Commission of Ontario on all its construction and operating work, according to a statement made by W. H. Mulligan before the National Safety Council. One application of the



UNIVERSAL DANGER EMBLEM DESIGNED TO CATCH THE EYE USED ON ALL DANGER SIGNS

emblem is in connection with work on live lines in power plants. The square and diagonal lines are white on a blue field and the center spot is bright red, the combination being especially designed to catch the eye.

Advantages of Colloidal Fuel

ADVANTAGES of "colloidal fuel," which is a blend of oil and coal dust, were enumerated by Dr. C. A. Sheppard before a "fuel symposium" of the American Chemical Society on Sept. 9. Among these advantages are the following:

1. Colloid fuels are liquid and are handled and atomized for combustion like fuel oils.
2. They contain more heat units per gallon than fuel oils.
3. They contain very little moisture and ash.
4. The temperature at which they take fire (flash point) is above 200 deg. Fahr. They are immune from spontaneous combustion.
5. Not only are they vaporless up to high temperature, thus avoiding explosive mixtures with air, but they may be fireproofed by a "water seal" of an inch or more of water, owing to the fact that they are heavier than water.
6. Hence also they will sink if spilled blazing on the surface of water, *i.e.*, they are self-quenching. Their fire risk is as low as anthracite coal and far less than bituminous coal or ordinary fuel oil.
7. They are the most compact fuels known, requiring least storage space.

Colloidal fuels belong to a distinct class of blended fuels ranging from liquid to semi-liquid. They were developed in this country during and subsequent to the last two years of the war. They are composites in which finely divided carbonaceous solids or semi-solids —various kinds of coal—are so suspended in and blended with liquid fuel oils as to form stable and readily atomized fuels. They have been developed for burning with the regular types of atomizing burners using ordinary fuel oils, but have also possibilities for use in internal-combustion engines of the Diesel and semi-Diesel type.

The machinery for compounding these fuels is simple. It consists of a suitable mill for pulverizing coal, coke, etc., storage and blending tanks for the oil bases and mixing kettles for compounding the composite fuel. Little modification in existing types of machinery is necessary, and the process is readily made continuous. The cost of manufacture may be reckoned at approximately $1.50 per ton, inclusive of the "fixateur"—a substance used in small quantity to stabilize the mixture.

Simple Equipment for Making Voltage Tests on Rubber Gloves

EQUIPMENT for making tests on rubber gloves and methods of making these tests, as described by the accident prevention committee at the National Electric Light Association 1920 convention, are outlined in this article.

For obtaining the test voltage the use of a single 10,000-volt transformer rated at from 2 kva. to 5 kva. is preferable, but standard 2,200-volt lighting transformers may be used by connecting them in series on the high-tension side and in parallel on the low-tension side. Since, however, one end of the high-tension circuit is likely to be more or less grounded (through the vessel containing the water in which the glove is suspended), the insulation between primary and secondary of the transformers at the opposite end of the series is likely to be subjected to an excessive stress.

The means employed for raising the voltage gradually should be such that the wave form will not be distorted. The resistance method of controlling the voltage is cheap, and the preferable method is to connect a rheostat in potentiometer style; that is, with the two ends of the rheostat directly across the supply circuit and with one end of the rheostat and the contact arm of the rheostat connected to the low-tension side of the transformer. The rheostat should be able to carry a current about ten times the exciting current of the transformer at maximum voltage.

For measuring high-tension voltage an ordinary voltmeter on the low-tension side of the transformer is entirely satisfactory for practical purposes. The practical method of measuring leakage current through the gloves is to connect an ordinary ammeter in the low-tension circuit of the transformer and note the amount

of the decrease in the current when one glove is disconnected at a time. This decrease divided by the ratio of the transformer gives roughly the current through the glove. This method does not recognize the effect of the phase difference between the exciting current and the current through the gloves, which is not necessary if several gloves are tested at a time.

Gloves are usually tested in groups of any convenient number of from five to fifteen. A convenient method is to suspend each glove in water to within about 1½ in. (3.75 cm.) of the glove top, by means of two spring-clip clothespins attached to the ends of a suitable wire hook hung from a wooden framework. The glove is then filled with water to the same height and potential is applied to the water inside the glove by means of a chain suspended within it. Each glove can be suspended in a separate vessel of water, or all may be suspended in a common vessel. Naturally the vessel will be connected to the grounded end of the high-tension circuit. A single-pole knife switch should be provided in each high-tension circuit so that the leakage current can be measured as indicated above. Moreover, if a glove fails during the test, it can be eliminated.

All of the usual safety precautions pertaining to high-voltage circuits should be observed. The glove rack and the wiring should be properly guarded so that neither the tester nor stragglers can accidentally come in contact with them. The main swicht should be provided with a spring which makes it necessary for the tester to hold it closed. A long insulated pole hook should be used for opening the switches in series with the gloves when measuring leakage currents.

Whatever transformer equipment is used, care should be taken that both the low-tension circuit and the high-tension circuit are thoroughly grounded.

The cost of a special transformer outfit of 5-kva. capacity and for 15,000 volts or 30,000 volts is about $750. An ammeter for leakage current measurements, containers for gloves, switches for leakage current measurements, wire and insulators could be furnished and installed for approximately an additional $150, making the total cost of a complete equipment for testing rubber gloves, transformer oil, etc., about $700 or $750. Where four standard 2,200-volt lighting transformers of about 1-kva. capacity are used the additional cost of a voltage-regulating rheostat, ammeter, voltmeter, etc., including installing, would probably be about $200 to $250.

Drying racks with wooden pins and metal drip pans underneath are convenient. The size of the drying equipment may be somewhat reduced if an electric fan is used to circulate the air heated over a lamp bank. Wooden pins are used on the drying racks, metal pins having been found injurious to the rubber as the pins become hot.

For holding the gloves two cases with locks are provided by one company. One case is for gloves which have successfully passed through the test, have been dried and are ready again for use. The other case contains the gloves which are returned for test. It has a slot in the top to permit gloves to be dropped into it singly. The slot is omitted in the first case so as to prevent the possibility of any returned or defective gloves being dropped in with the good gloves. Electric branding irons are used by some of the companies for placing the necessary company property identification marks on the outside of the gauntlet of the gloves and usually at a point opposite the wrist as well.

Machine Reduces Cost of Hole Digging and Pole Setting 25 per Cent

AT A total cost of $4.72 per pole, 928 poles were set by the boring and setting machine shown in the photograph for lines of the Detroit Edison Company. The poles set were mostly 40-ft. (12-m.) poles, with some "forty-fives" (14 m.) and a few "fifties" (17 m.). The costs include digging the hole, setting the pole, straightening and tamping and moving the machine between pole locations, 176 ft. (54 m.), as well as 20 per cent depreciation. The costs cover only working days, no charges being made on days when repairs were necessary or for moving from one place to another. This cost of $4.72 per pole compares favorably with the average cost of $6.25 for digging and setting by hand.

The gang doing the work consisted of one foreman, one digger driver, one digger operator, three or four ground men, one truck and truck driver. The machine set the 928 poles on five different jobs from March to June under very bad road conditions, mostly on unimproved clay roads, as well as on several miles of private right-of-way on farm lands, necessitating the crossing of ditches. Several of the holes were dug in more than 2 ft. (61 cm.) of water, and quicksand was encountered in several places. It is interesting to note that the machine operates very satisfactorily in quicksand as it gets the pole in place before the sand has a chance to drift into the hole.

This machine is made by the International Earth Boring Machine Company and is equipped with a



MACHINE HAS DUG HOLE AND IS NOW SETTING POLE IN POSITION

Monarch tractor. Two sizes of drills were used, one 24-in. (61-cm.) and one 30-in. (76-cm.), according to the size of pole to be set. The crossarms, braces and insulators, including large pin-type insulators, can be placed on the pole before it is picked up by the machine.

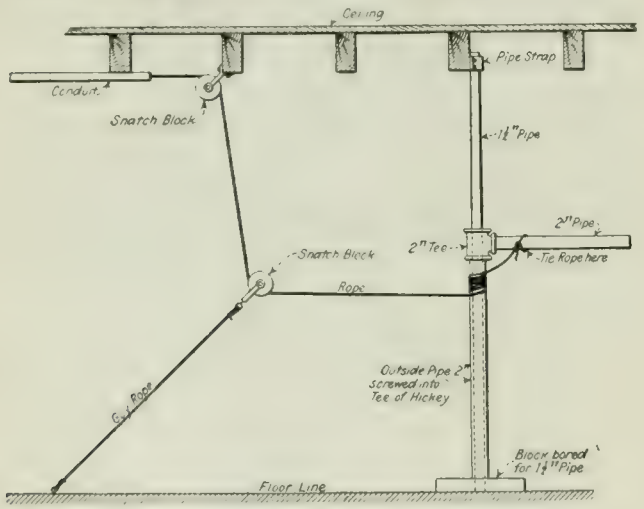
Detroit Edison Company, Detroit, Mich. P. O. REYNEAU, Assistant Electrical Engineer.

Industrial Applications

The Economical Utilization of Electrical Energy in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

Pulling Cable Without Tackle or Windlass

FOR pulling cable through conduit where a regular tackle or windlass is not available a device such as that shown in the illustration made of a pipe and a hickey has proved very useful to the writer. A long 1½-in. (3.75-cm.) pipe is passed through the tee of a 2-in. (5-cm.) hickey, into which is also screwed a short piece of 3-in. (7.5-cm.) pipe to act as a drum for the rope. The two ends of the smaller pipe are then fastened, the upper end to a beam on the ceiling by means of a pipe strap and the lower end into blocks fastened to the floor. A rope is connected to the cable



DEVICE MADE FOR PULLING CABLE THROUGH CONDUIT

to be pulled and is passed as shown around the 3-in. pipe and attached to the handle of the hickey. In using the device the handle is turned to the left in order not to loosen the 3-in pipe from the screws in the hickey. It will be discovered that a tremendous leverage can be obtained from this device. A. PERTLE.

Chicago, Ill.

Electric Shovel Economical in Excavating Canal

ABOUT 0.8 kw.-hr. per cubic yard (10.4 kw.-hr. per cu.m.) of earth excavated from a 90-ft. (27-m.) canal was consumed by the electric shovels used in digging the Queenstown-Chippawa power canal of the Hydro-Electric Power Commission of Ontario. More than 20,000 cu.yd. (15,280 cu.m.) of earth and rock were removed daily in digging this canal, the major portion of this being accomplished by means of three 8-cu.yd (6.1-cu.m.) electric shovels.

The performance of one shovel by day and by night during seven days is shown by the accompanying record. This Bucyrus shovel is of 300 tons weight, has a 90-ft. boom, uses buckets with a capacity of 5, 6 or 8 cu.yd. (3.8, 4.5 and 6.1 cu.m.), and works on a forty-second to fifty-second cycle of operation. This shovel was working 90 ft. below the surface and loading material on cars approximately 50 ft. (15 m.) above its own base. The test covered a period of seven days, night work being done on only the last two days.

TEST ON ELECTRIC SHOVEL DIGGING 90-FT. CANAL

Total yards, whole test	24,706.5
Total yards, day work only	15,380.0
Total yards, day and night	9,326.5
Kilowatt-hours, whole test	20,436.0
Kilowatt-hours, day work only	12,216.0
Kilowatt-hours, day and night	8,220.0
Kw.-hr. per yard, whole test	0.826
Kw.-hr. per yard, day work only	0.794
Kw.-hr. per yard, day and night	0.882

Storage-Battery Maintenance Systems for Good Operation

TO KEEP a storage battery in good condition some routine system of charging and maintenance must be consistently followed. In such a system the method of charging is probably the most important item. Charging of lead batteries must be at such a rate as not to produce gassing of the electrolyte or a cell temperature in excess of 100 deg. Fahr. (44 deg. C.). Stamped on the name plate of the battery are two charging rates, the lower of which is the finishing rate. The higher figure is given only as a satisfactory rate at which the greater part of the charge may be given under usual conditions. The lower rate or finishing rate is the highest rate at which the battery should be charged after gassing starts, but it is not necessary to decrease the rate below this rate except on equalizing charges.

As a rule the maximum starting rate is equal to the number of ampere-hours out of the battery at the time. For example, a 300-amp.-hr. battery fully discharged could be placed on charge at 300 amp., but the rate would have to taper automatically to keep within the number of ampere-hours out of the battery at any time. This result can be obtained by applying an approximately constant voltage of 2.3 for each cell in the battery.

There are several disadvantages which affect the practicability of this "constant-potential" system. First, the charging rate required at the start of the charge is very high, which calls for high capacity in charging equipment and increases the maximum demand on which the cost of power usually depends. Second, the charging rate, after about 85 per cent of the charge has been put in, falls so low that a long time is required to charge the cell completely unless the voltage is raised to about 2.5 or 2.55 volts per cell. This adjustment beyond the end of the charge has to be made manually, so that the system cannot be considered as automatic. The minimum time of charging a battery in this way is about three and three-quarter hours.

A better scheme in many ways is known as the "modified constant-potential system." This calls for a fairly constant voltage of about 2.6 volts to 2.65 volts per cell. A fixed resistance is inserted in series with the battery and should be of such value as to keep the initial rate within the capacity of the apparatus and also as low as the time requirements will allow. The final rate after the cells start to gas should drop to the finishing rate. The minimum time of charging in this way is about four and one-half hours. This system is very flexible and is the most suitable where the proper voltage can be obtained.

The most satisfactory automatic scheme for cutting off the charge is the ampere-hour meter. The meter is mounted on the truck or tractor in series with the battery at all times, so that charging and discharging current passes through it. After the correct amount of charge has been put in, the meter closes a contact which energizes a circuit breaker to open the charging circuit. The ampere-hour meter also provides a direct indication at all times of the state of charge of the battery.

Once every week the daily charge should be continued at approximately one-half of the finishing rate until all the cells are gassing evenly and freely and until three consecutive readings taken at half-hour intervals of the specific gravity of the pilot cell and battery voltages show no increase.

The battery may be discharged without injury at any rate of current it will deliver. The discharge should be stopped and the battery promptly recharged when the voltage drops to 1.7 volts per cell when delivering the normal service rate stamped on the battery name plate or when the gravity drops over 100 to 125 points for a complete discharge. Thus, if the gravity of a fully charged cell is 1.275, it will at the end of discharge be between 1.175 and 1.150. The battery should not be discharged below this point.

Once every week, or as often as found necessary by experience, pure distilled water should be added. It is necessary at all times to keep the plates and separators covered with electrolyte. Extreme care must be taken in keeping the distilled water free from contamination. The solution in the cells, called electrolyte, is a mixture of especially pure sulphuric acid (oil of vitrol), of 1.835 specific gravity, and pure water. When first installed, the specific gravity of the electrolyte with the battery fully charged should be between 1.270 and 1.280 (temperature corrections are given below). Decreasing specific gravity throughout the battery (when not due to insufficient charging) indicates that sediment is accumulating in the bottom of the jars. An inspection should be made when the specific gravity of the fully charged battery is below 1.250. Never, under any circumstances, should electrolyte of higher than 1.300 specific gravity (corrected for temperature) be poured directly into the cells.

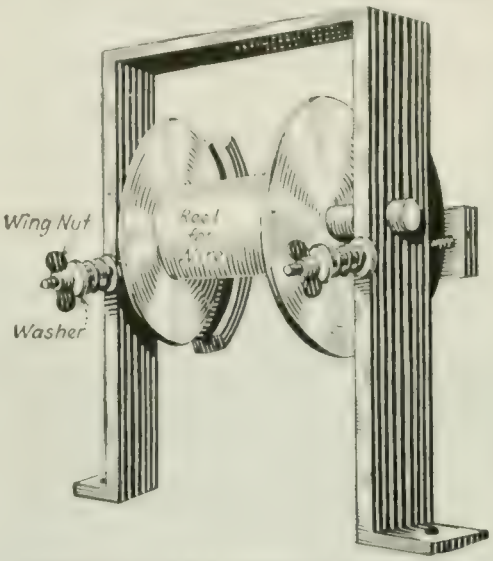
Change in temperature of electrolyte affects the specific gravity, and where the change is considerable it should be allowed for when taking readings as follows: For each three degrees in temperature above 70 deg. Fahr. add one point to the hydrometer reading, and for each three degrees of temperature below 70 deg. Fahr. subtract one point. Example: If the hydrometer reads 1.285 at 100 deg. Fahr., the corrected specific gravity will be 1.275.

ANDERSON PACE.*

*Formerly with Mercury Manufacturing Company, Chicago, Ill.

Rack for Small Wire Reels Which Maintains Proper Tension

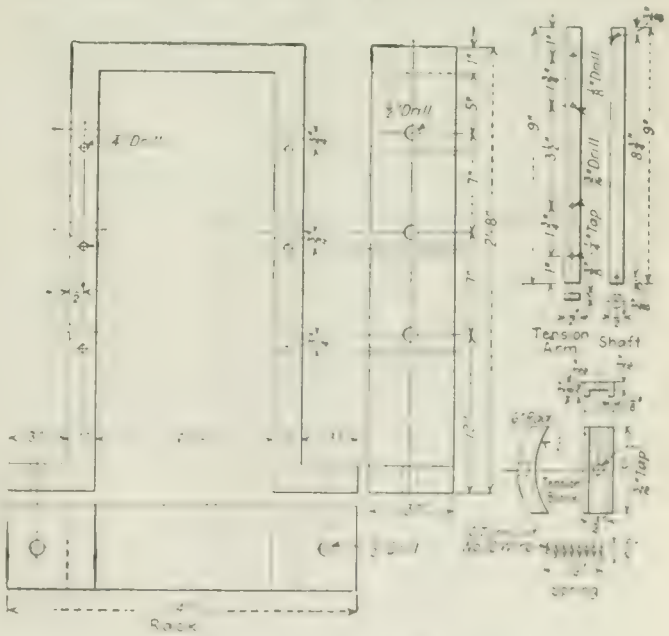
AS THE tension under which wire is drawn from the reels in winding operations affects the ease and speed of working, the rack shown in the illustration was built for holding and controlling reels of wire in sizes from No. 20 to No. 40. The tension is adjusted by



TENSION ON WIRE VARIED BY WING NUTS

springs which control the pressure of blocks against the ends of the reels.

The blocks are attached to a cross arm with machine screws, the ends of the screws being filed flush with the concave surface of the blocks. The tension bolts are threaded and firmly screwed into the two outside holes tapped in the arm, so the bolts will not turn when adjusting the wing nuts. To load the rack the reel is



DETAILS OF RACK FOR WIRE REELS

held so that the ends fit into the grooves of both tension blocks. The shaft is slipped through the reel and the cotter pins replaced so the shaft will be held in place. The reel may be rotated in either direction.

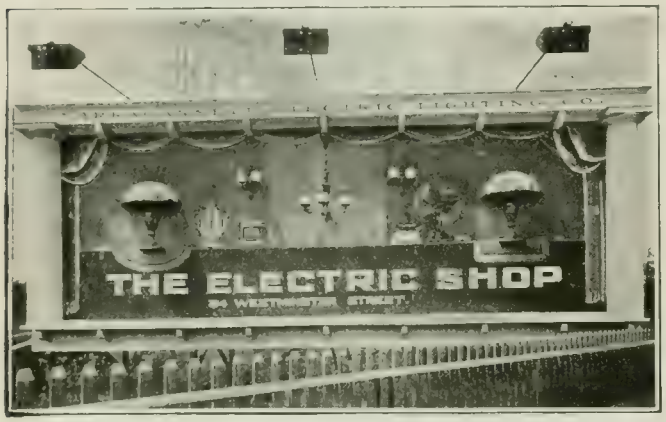
Detroit, Mich. A. C. ROE.

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

Making Billboard Advertising Realistic

RAISED models of campaign portable lamps two and one-half times the size of the original lamp are shown by the Narragansett Electric Lighting Company, Providence, R. I., in billboard displays as illustrated. The lamps are so accurately made that the two



BAS-RELIEF FIXTURE ADVERTISING AT PROVIDENCE, R. I.

halves shown on the board can be joined together as one complete lamp. In the center of the display are models of other campaign fixtures such as chandeliers and wall brackets. The display is connected to a flasher which lights in turn the portable lamps, center fixtures and then the reflectors at the top. E. R. Davenport, sales manager of the company, considers these signboards to be the best advertising that the company has ever done.

Should Central-Station Rates Be Materially Increased and at Once?

BY KASSANDRA

AN INCREASE in rates so as to give sufficient chance to earn, but not pay in dividends, more than a fair return on the investment will in the end be for the advantage of the public. Of course, the owners of a property cannot expect to receive in dividends more than a fair return for the use of their property and for their skill. The excess on a fair return should be put back into the property.

The logic of the situation can be shown by a numerical example. Suppose the pre-war rates were 8 cents retail to 1 cent wholesale and the return just a fair one. Now, the rise in prices of labor, coal, copper, etc., means that for the same output—that is, neglecting for a moment any decrease in costs due to increase in size and efficiency—it would take today a rate of 16 cents retail and 2 cents wholesale to earn a fair return on what the investment would be when the plant was worn out and replaced by new plant at the present prices.

Increased size and efficiency would very likely in time have brought the 8 cents and 1 cent down to say 6 cents and ¾ cents, if it had not been for the war inflation, and on this basis the 16-cent and 2-cent rate which we would otherwise secure will be only 12 cents and 1½ cents. This indicates that in say twenty years from now, when the central stations have from 90 to 100 per cent of their plant bought at high prices, the rates will be higher than now.

In looking forward to future rates of 12 cents and 1½ cents, as compared with the 8 cents and 1 cent of today, we have three choices:

First, raise the rates at once to the full extent and pay corresponding dividends. This is what the farmer and factory and landlord do, and it means big profits for them such as have been reflected in the prices of industrial common stocks, real estate, etc.

Second, the central station can postpone the raise in rates as long as possible. This will mean that the rates will rise gradually until the total raise has been reached. As a matter of fact, the raise so far has been fairly quick, owing to the rise in coal and labor affecting the cost and rate quicker than the rise in plant investment affects the rates, but the principle is the same; that is, the rates so far have been raised only enough to maintain the earning at a fair return. Again, the essence is that the central station should as a second choice raise its rates each year only just enough to keep the return on the investment a fair one. This is what is going on.

The third choice would be for the central station to raise its rates by enough to earn more than a fair return, but to put the excess over a fair return back into the property as an investment on the part of the public, not as property of the stockholders, who would be entitled only to their fair return in dividends.

It might be said that this would be beneficial to the public generally (or the future customers) at the expense of the present customers. But is not this proper? The fair or economic rate, considering today's costs of material and labor, is 16 cents and 2 cents. The pre-war rates (all of them in principle and the wholesale rates in particular) were just below what the man who makes his own power or gets his service in some other way would have to pay. Hence the present customers who are wired and have service are really profiteering, as compared with their neighbors who do not use central-station power but instead pay the high prices for the competitive service.

If it cost a private plant 1.05 cents in pre-war times and the central station price was 1 cent, this was fair competition. But if it costs the private plant 1½ or 2 cents today while the central-station customers of today are getting the service for 1 cent or 1.1 cents is not this profiteering on the part of the customer? It is, unless the customer who uses central-station power is selling *his* product or services to the public at a less price than the man who operates a plant. Are there

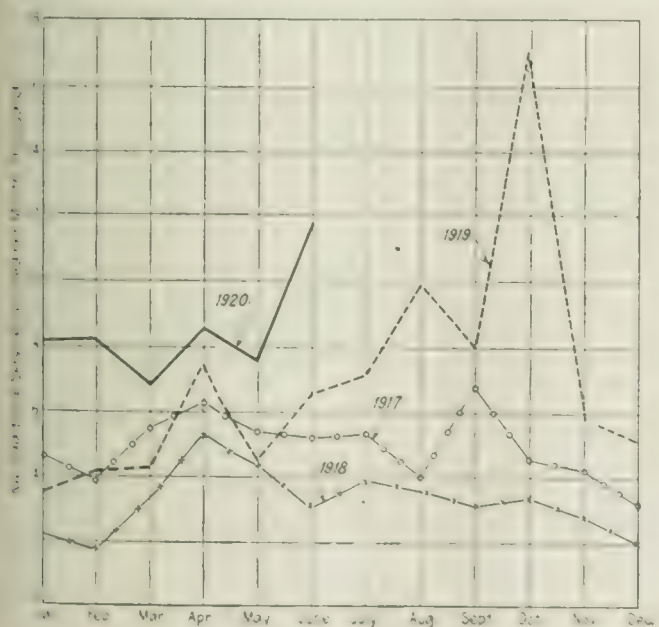
any shoe factories or other users of central-station power who are doing anything other than keeping for themselves the profits they get from the present low rates for electric service, as compared with the profit (or loss) they would have without central-station service?

If central stations generally should until the demand for their service falls off raise rates to a point where they could get turbines and boilers and cables to supply all who want service at the high price the situation would be better all around. In such case the companies that make turbines, cables, etc., could supply the equipment needed, and since the excess earnings over the fair return to the stockholders would go back into the plant, the public as a whole and the future customers would benefit.

Keeping rates down makes present customers none others than profiteers. Raising rates so that the demand for increased facilities and increased service falls again to normal will, unless more than a fair return is actually paid over to the stockholders, benefit the public. This proposition may seem odd to the man who believes that low prices for today are the only thing to be considered, but if we are considering the future the way to get low prices for the future is to have high prices today.

Civic Advantages of Adequate Power Supply

BECAUSE of its ability to supply energy of new electric light, power and industrial heating customers during the past four years the Union Electric Light & Power Company of St. Louis is credited with being largely responsible for the marked increase in the industrial activities of the city. Bankers and business men say that had St. Louis grown during the past



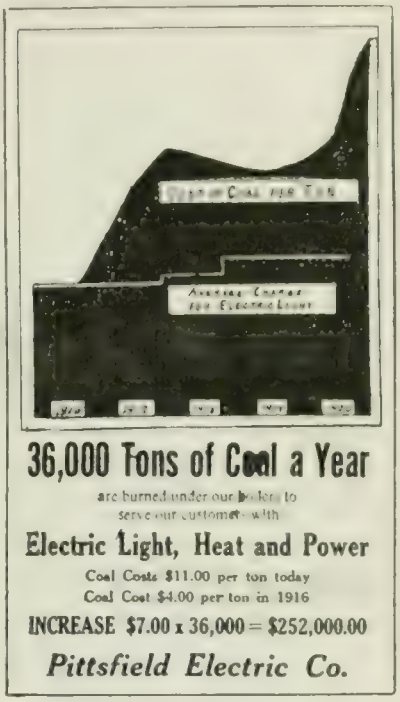
MONTHLY NET POWER LOAD ADDED TO LINES OF ST. LOUIS COMPANY SINCE 1916, TOTALING 120,000 KW.

decade at the same rate as during the last four years the Missouri metropolis would now rank higher in the census returns.

When war was declared the St. Louis company had considerable reserve plant capacity and it has since made additions to its generating station. As a result it has been possible for the company to increase the net connected load on its lines by almost 120,000 kw. in three and one-half years. The new power business secured each month is shown by the curve, which represents the net additional load minus all disconnections.

Graphic Illustration of Increased Operating Costs

TO SHOW a comparison of the largely increased cost of coal with the very slightly increased rates for electric service the Pittsfield (Mass.) Electric Company has used some interesting publicity matter, of which the accompanying reproduction is a representative type. As announced in the ELECTRICAL WORLD last week, page 894, the company after Nov. 1 will add an "excess - coal - cost rate" to its present lighting schedules. The excess rate is to be a charge of 0.15 cent per kilowatt-hour for each $1 increase in the cost of coal per net ton above $4.



TYPE OF GRAPHIC PUBLICITY

This type of publicity, which shows graphically how the company's operating costs have mounted while its rates for service remained almost stationary, proved very effective in explaining the situation to the public.

California Co-operative Campaign Continues Electrical Homes

REQUESTS from builders, real estate owners and contractors are rapidly coming in to the California Electrical Co-operative Campaign to continue and extend its "electrical home" activities. Builders find that home seekers have an increased desire to build homes having the facilities afforded by many convenient electrical outlets; owners of tracts of land report greatly stimulated sales in the vicinity of the "electrical homes" which have been exhibited to the public, and the contractors and dealers have been called on to provide more outlets and have sold many appliances as a direct result of the exhibits.

Two electrical homes in Los Angeles will be ready for exhibition during November and December, and one in Long Beach during December. Thirty thousand copies of the wiring plans of the homes have been distributed to those visiting the homes and to others. Hundreds of framed copies of these plans are being displayed in the offices of architects, lumber companies, power companies and contractor-dealers. In addition to this a vigorous advertising campaign is being carried on.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Induction Motor Core Losses.—P. L. ALGER and R. EKSERGIAN.—An analysis of core losses in induction motors is the object of the research described in this paper. The authors subdivide the core losses into six elements and point out that only one of the six is ordinarily calculated by designing engineers, with resulting large discrepancies between expectation and fact. The belief is expressed that to calculate other elements approximately is entirely feasible and that such calculations would explain most of the variations in core loss now attributed to imperfections in manufacture. Rational formulas are developed for the losses in the core back of the teeth, which are found to give larger values than the more approximate formulas now in use, and the conclusions are presented in the form of charts giving the correction factors to apply to the usual formulas for all ordinary conditions. A Webb floating dynamometer, which was constructed for the measurement of the extremely small torques due to these core losses, is described, and results on the losses in a smooth-core rotor obtained with it are presented. These results and those obtained by an independent electrical method of testing are compared with the expected values based on the theoretical conclusions previously derived, reasonable agreement being found.—*Journal A. I. E. E.*, October, 1920.

Lamps and Lighting

Effect of Variations in Intensity of Illumination on Functions of Importance to the Working Eye.—C. E. FERREE and GERTRUDE RAND.—Intensity is only one of the lighting factors which influence the functional powers of the eye, the authors say. Their study was conducted only under conditions in which the increase of intensity did not result in the introduction of harmful glare into the field of view. Moreover, much wider ranges of intensity were employed, and the effect on other functions of importance to the working eye has been tested—acuity, power to sustain acuity, speed of discrimination, and speed of adjusting the eye for clear seeing at different distances. The effect of increase of intensity has been measured both on normal eyes and on eyes with small errors in refraction of a type and amount which are of very frequent occurrence even in the corrected eye.—Paper presented before Illuminating Engineering Society, Oct. 18, 1920.

Measurement of Reflection Factors.—C. H. CHARP and W. F. LITTLE.—By the use of a small integrating sphere similar to one described in a recent issue of the ELECTRICAL WORLD by A. H. Taylor a procedure has been worked out whereby the reflection factor of any surface, whether matte or glossy, may be measured by an absolute method. Data obtained by the authors check very closely with those obtained by Taylor, although the two methods were developed independently.—Paper presented before Illuminating Engineering Society, Oct. 18, 1920.

Cooper Hewitt Mercury-Vapor Lamp—I.—L. J. BUTTOLPH.—The first of three articles on the mercury-vapor lamp. This part covers the theory and operation of the lamp.—*General Electric Review*, September, 1920.

Generation, Transmission and Distribution

Theory of the High-Tension Insulator.—SCHWAIGER.—The distributed capacity to ground and the capacity between the insulator and the high-tension conductor, together with the internal capacity between the different parts of the insulator, cause irregularities in voltage distribution, so that certain parts of the insulator during service and test are exposed to greater electrical strain than others. This phenomenon is well known for the case of the suspension insulator chain. The author now establishes artificial schemes to picture the electrical conditions not only in suspension insulators but also in insulators of pin type and in bushings, and presents experimental and theoretical curves showing the voltage distribution under certain simplifying assumptions. The analytical results check fairly well with measurements made on simplified insulator models, without petticoats.—*Elektrotechnik und Maschinenbau*, Sept. 16, 1920.

Steel-Pole Design.—FEUER.—A ready-reference formula is derived, useful for quick determination or control of steel dimensions for transmission-line poles, when the loading force is given, and also the wind pressure on poles and cross-arms. The author also presents a formula for computing cross-arm sections, taking into account line-conductor weight, side pull due to wind pressure and the bending effect and torsional strains caused by a one-side conductor break.—*Elektrotechnische Zeitschrift*, Sept. 16, 1920.

Current-Carrying Capacity of Lead-Covered Cables.—RALPH W. ATKINSON.—Data are given whereby the carrying capacity of lead-covered cables can be calculated on the basis of thermal limitations. Carrying capacity as limited by voltage drop or economical considerations is not discussed. The appendix contains a chart by which it is possible to determine graphically for given conditions the carrying capacity of three-conductor paper and varnished-cloth cables installed in conduits. There is also included a chart illustrating the relation between the various temperatures and temperature rises of a group of lead-covered cables.—*Journal A. I. E. E.*, September, 1920.

Traction

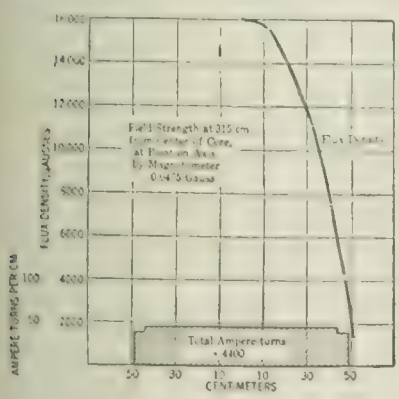
Direct or Alternating Current for Railroad Electrification.—SEEFEHLNER.—There is a decided tendency among certain groups of European engineers to put all direct-current electrification under a common classification as the "American system" and accordingly to

assume that direct current is the only form of supply accepted in America for railroad electrification. This tendency is vigorously opposed by the author in an article referring to the present discussion regarding the choice of a system for Austrian railroad electrification. The author maintains that little stress should be laid on the fact that direct-current supply was chosen for the Chicago, Milwaukee & St. Paul electrification, in view of the peculiar circumstances which affected the choice. First of all, he says, the already existing three-phase transmission lines lifted the burden of transmission-line construction from the backs of the electrification engineers, enabling them to get access to power at any point on the road, so that numerous converting stations could be easily erected all along its length. The author further declares that Swiss and German progress in single-phase traction is very little appreciated in America and that one important reason for choosing direct current for the road mentioned was the lack of time for investigation and trial in a period when any kind of electrification was sure to promote economy.—*Elektrotechnik und Maschinenbau*, Aug. 29, 1920.

Installations, Systems and Appliances

Ward Leonard Control Applied to Heavy Cranes.—H. H. BROUGHTON.—A discussion of the floating cranes which have been provided for the Panama Canal. The subject is considered under three separate groups, namely, (1) power house on the pontoon, (2) motor house on the rotating portion, (3) operator's cabin, also on the rotating portion.—London *Electrician*, Sept. 10, 1920.

External Field Produced by Cylindrical Electromagnet.—CARY T. HUTCHINSON and HAROLD PENDER.—The fundamental problems of cylindrical electromagnets are the determination of the number of ampere turns required to produce a given magnetic field intensity at



FLUX DISTRIBUTION ALONG AXIS OF MAGNET

a considerable distance along the axis of the core for both alternating-current and direct-current excitation and also the disposition of the winding on the core which will give a required magnetizing force with the least number of volt-amperes. This problem is attacked from both an analytical and an experimental point of view. Typical flux distribution curves are given for various arrangements of the exciting coils. Flux values were measured by means of an exploring coil and ballistic galvanometer, while magnetizing force was determined by a magnetometer.—*Journal A. I. E. E.*, September, 1920.

Some Phenomena Observed in Electric Furnace Arcs.—J. KELLEHER.—A study of the causes tending to create variations in the current drawn by the electric furnace, with particular reference to the effect of slags of different compositions upon the current change caused by a given movement of the electrode.—Paper presented before American Electrochemical Society, Sept. 30, 1920.

Units, Measurements and Instruments

Measurement of Casting Temperatures in the Brass Foundry.—JOHN ARNOTT.—After reviewing the various methods available for temperature measurement in castings the author sums up the characteristics a pyrometer should have for this service as follows: (1) It should be accurate within 1 per cent. This means a maximum error of 10 deg. at 1,000 deg. C. (2) It should be capable of use up to 1,300 deg. C., if need be. (3) It should be direct-reading and involve no calculation or correction. (4) It should indicate the temperature of molten metal within at most one minute of immersion. (5) It should be strong and not easily put out of order; at any rate it should permit of easy and cheap repair. (6) It should not be too expensive.—London *Engineering*, Aug. 27, 1920.

Telegraphy, Telephony and Signals

Secret Telephony.—POIRSON.—If the telephonic current passing from a transmitter to a receiver is reversed by a commutator operated at sufficient speed, the arriving current is so distorted that no intelligible sounds are heard in the receiver. If the reversals are made at the rate of a few hundred per second, the voice is very much distorted but the words are still intelligible. Above 1,050 reversals per second, however, it is quite impossible to understand what is said. If at the receiving station there is another commutator, operated in synchronism with the transmitting commutator, the voice current may be restored to more or less normal form. The talk then will be clearly heard in the receiver, while it will be impossible for any eavesdropper to "listen in" on the conversation. The author gives a detailed description of this system of secret telephony, which is said to have come to important use in France during the war and after. The commutators used are of a rotating type and driven by two small shunt motors fed from local storage batteries. The motors are kept in synchronism in the following way: In each motor two taps are brought out from diametrically opposite points on the armature winding and connected to two slip rings, so that each machine is made into a synchronous converter. On the slip-ring side the machines are directly interconnected over a circuit made up of the two telephone wires in parallel and a ground return. Synchronizing currents then will flow over the telephone wires, but when the system is correctly adjusted these currents are very small and do not in the least disturb the conversation.—*Bulletin de la Société Française d'Electriciens*, April, 1920.

Theory of the Triode Oscillator with Intermediate Circuit.—KURT HEEGNER.—If a simple oscillating audion system with tuned plate circuit is inductively coupled to an output circuit containing inductance and capacity, another type of oscillator is obtained which the author characterizes as having an intermediate circuit for transferring the oscillating energy to the output circuit (antenna). The existence of two tuned circuits in the system leads to considerable complication in a discussion of the oscillating characteristics. The problem is treated very comprehensively by the author, and different modes of oscillations are algebraically defined.—*Archiv für Elektrotechnik*, Aug. 8, 1920.

News in Brief

Summary of Market Conditions and of Recent and Approaching Happenings of Importance to the Industry

OCTOBER proved to be the record month for this year in the total of stocks and bonds issued by electric light and power companies, these aggregating $38,295,300. This does not include $30,000,000 in bonds issued by the Westinghouse Company at 94¾, to yield 7¾ per cent. Of the public utility issues the largest are $13,000,000 in bonds of the Pennsylvania-Ohio Power & Light Company, $5,420,300 in Commonwealth Edison stock and $5,000,000 in bonds of the Wisconsin Electric Power Company.

A HYDRO-ELECTRIC plant rated at 60,000 kva. is to be constructed near Charlotte, N. C., by the Southern Power Company. This will be the ninth water-power plant to be tied into that company's high-tension network. The plans call for its completion by the summer of 1922.

TO MEET construction expenses resulting from the carrying out of its extensive hydro-electric development, the Pacific Gas & Electric Company plans the sale of $5,000,000 of its first preferred stock. It is the plan of the company to sell the stock over its own counters.

THE FORTIETH anniversary of the founding of the American Society of Mechanical Engineers was celebrated by meetings in New York and about forty other cities, the dominant note struck by the speakers being the opportunities for civic usefulness that lie before the engineer.

ALLEGING that the city of Tacoma, Wash., through an official, indulges in many unfair practices in selling electrical goods and also that a power shortage is threatened by reason of its sale of electrical energy outside the municipality, three electrical dealers of that city have begun injunction proceedings.

CHARGES that Pacific Coast subsidiaries of large electrical manufacturing concerns are operating in restraint of trade are being investigated by the Department of Justice.

FALLING prices and greater ease in the coal market are now reported, while it has thus far been possible to take care of the public utilities under emergency orders, restoration of the assigned privilege is urged.

THE PROPOSED super-power zone in the Southern States is to be studied by the Atlanta Section of the A. I. E. E.

ABOLITION of the Public Utilities Commission of Illinois was indorsed in the election of Len Small as Governor of the state.

NO IMPROVEMENT in the electrical market has been noted except in the Middle West. Price cutting is in process in the Eastern States, but elsewhere prices are being maintained. Stocks are accumulating and better deliveries are helping conditions. The credit situation remains the same, and there is no change reported in the matter of collections. Labor is more plentiful and more efficient. Some electrical manufacturers are making lay-offs. Building remains almost at a standstill. A dull winter followed by a good spring is a favorite prediction.

AN EFFORT is being made by the Indiana Committee on Public Utility Information to have the local chambers of commerce throughout the state pass resolutions calling attention to the vital services rendered by the utilities and asking public co-operation in the form of willingness to pay adequate rates.

INDUCTIVE interference is to be studied from the standpoint of minimizing the susceptibility of communication systems to the inductive fields of power circuits by the N. E. L. A. committee on inductive interference, which will meet in Salt Lake City on Nov. 15.

RESOLUTIONS addressed to the people of Illinois which urge them to safeguard the Public Utilities Commission of that state against attacks made upon it have been adopted by the Central States Group of the Investment Bankers' Association of America.

CAMPAIGN plans to popularize the use of electricity in homes and industries are being pushed by the Electrical League of Cleveland.

WATER-POWER development in its commercial aspects formed the subject of discussion at the Del Monte convention of the Pacific Division of the Electrical Supply Jobbers' Association.

LESS than four months remains in which to establish an accounting system for the Federal Power Commission, and it is thought that only the principles of accounting can be set forth in the time allowed by law and that the details will have to wait.

A FRONTAL attack is to be made upon fundamental problems in insulation research by the insulation committee of the National Research Council. To this end a paid secretary is to be employed.

PLANS for the development of 800,000 hp. by the erection of ten hydro-electric power houses along the Rhine have been approved by the French government. From four to five years is estimated as the time necessary to carry out the project.

EDUCATIONAL courses for industrial electrical men in company time were favored by members of the Chicago Section, A. I. and S. E. E., in discussing the education of steel-mill electricians.

SAMUEL INSULL, speaking before the employees of the Public Service Company of Northern Illinois, dwelt on the importance of making the people realize the serious public results that the crippling of the utility companies would bring about.

TO FURTHER its good-will campaign the publicity department of the National Electric Light Association has prepared four booklets addressed to holders of public utility securities.

PROGRESS in the standardization of washing-machine motors is reported by the manufacturers' committee that has the subject in charge.

CONDUIT production, contrary to the general rule of increasing stocks and slackening demand, is still six to seven months behind orders.

PRICES of wiring material show no sign of an immediate drop.

MANUFACTURERS of schedule material are still actively engaged in production, and many back orders are being filled.

LITTLE or no recession in the demand for power and distribution transformers is reported.

OCTOBER'S close found copper once more below 15 cents, or under the 1906-1913 average of 15¼ cents; but the rapid decline does not appear to have brought about any large market. In the electrical industry manufacturers are stocked with expensive metal and disinclined to buy more.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

To Attack Inductive-Interference Problem from New Angle

THE complete program for the extension of the activities of the National Electric Light Association on the inductive-interference problem will be discussed at the meeting in Salt Lake City on Nov. 15 of the inductive-interference committee of the association.

Heretofore study has been mainly devoted to the disturbing features of inductive field produced by power circuits and the means for their reduction rather than being directed toward minimizing the susceptibility of communication apparatus. It is now planned to develop studies of the susceptibility of communication systems to the inductive fields of power circuits, and also of means for minimizing this susceptibility.

Hydro-Electric Power Survey to Be Made by Southeastern A. I. E. E. Members

THE Atlanta Section of the American Institute of Electrical Engineers at a recent meeting decided to take up during the winter the study of a super-electrical power zone, collaborating with the power committee of the national association and supplementing the work already done by the War Industries Board in its hydro-electric power survey of Georgia, Alabama, Tennessee and the Carolinas. The object is the conservation of coal and future water-power development and interconnection of transmission lines over large areas in the states mentioned. The investigation will require the assistance of the affiliated engineering societies.

Acts that Hurt Utilities Are of Greater Danger to Public, Says Insull

THE serious results sure to spring from action crippling public utilities must be made plain to the public, President Samuel Insull declared in his address to the employees of the Public Service Company of Northern Illinois at the annual meeting of the company N. E. L. A. section on Oct. 25 and 26. "What we need to do," Mr. Insull said, "is to bring home to the people the extremely serious situation in which the citizens of this state will be placed if the various great public utilities do not receive the necessary protection to enable them to build up the necessary credit to obtain the necessary capital with which to develop their business. The communities we serve, as a matter of fact, are infinitely more interested in our success than are the twelve thousand owners of our property, for unless we are able to function and to carry on our business and supply the various industrial, residential and mercantile establishments in these communities with gas and electric service it will be impossible for them to prosper."

In speaking of company affairs Mr. Insull also emphasized the duty of company employees to take an active part in local affairs, saying: "Above all, there is the duty that we owe to the state which affords us protection and gives us an opportunity to gain a livelihood, and that is to do our duty as citizens."

Effort in Indiana to Secure Passage of Resolutions Favorable to Utilities

EVERY public utility in Indiana has received from the state Committee on Public Utility Information a copy of a set of resolutions with the suggestion that the executives of public utilities in every community which has a chamber of commerce take up with that organization the question of securing the adoption of the resolutions. The tentative draft of resolutions sent out called attention to the facts that development of community life and prosperity of public utilities go hand in hand; that good service can be had only by the payment of adequate rates; that increased costs have complicated the problems of utilities, and that the public should co-operate to the extent of being willing to pay fair rates for the service rendered.

These resolutions were based on a resolution recently adopted by the Chamber of Commerce of the Borough of Queens, New York City.

I. C. C. Keeps Utility Emergency Coal Order in Force

WHEN the matter of assigned cars for public utilities was considered by the Interstate Commerce Commission on Nov. 1 that body did not think the public utility coal situation throughout the country sufficiently serious to change service order No. 21 to permit a freer use of priority transportation. Thus far, under the co-operative plan, it has been possible to take care of each of the emergencies which have arisen. George W. Elliott, the secretary of the National Committee on Gas and Electric Service, laid before the commission the pleas of a large number of public utilities for the extension of the assigned-car privilege and pointed out the difficulties which many of them are having in securing deliveries on their contracts. He pointed out that between 80 and 90 per cent of the requirements of the gas and electric companies are covered by contracts. During the week ended Oct. 23, the latest time for which figures are available, deliveries of coal were running from 40 to 50 per cent below daily requirements.

While the addition of 2,000 cars daily to the number available in the Middle West is certain to make for gradual improvement of the situation, it is the belief of Mr. Elliott that it will be several weeks yet before public utilities will be able to build up sufficient reserves to give them the margin of safety that they should have. The minute that the assigned-car privilege was denied the public utilities the temptation again was thrust before the operators of selling coal in the spot market rather than make deliveries at contract prices.

Department of Justice Investigating Trade Practices on Pacific Coast

ON THE complaint of an individual electrical contractor in San Francisco the Department of Justice has made a preliminary investigation of the charge that Western subsidiaries of large electrical manufacturing concerns are operating in restraint of trade. The preliminary investigation failed to disclose any evidence which would justify the department in taking action against the companies concerned, but before dropping the matter the department has decided to make a somewhat more thorough investigation.

Coal Situation Has Become Easier, with Falling Prices

IN AN effort to bring the coal industry back to a more normal condition members of the National Coal Association adopted a program on Oct. 26 at Cleveland to eliminate exorbitant prices and other bad practices in the distribution of bituminous coal. An effort will be made particularly to help the government in its war on those who are profiteering.

Coal prices are rapidly coming down from the unreasonable heights to which they went. Spot bituminous is said to have averaged during October as much as $4 a ton, while mine quotations are around $2 a ton lower than a month ago. It is further held by those conversant with conditions in the coal market that the supply is rapidly becoming easier owing to removal of the Great Lake priority, the decreased industrial demand and greater transportation facilities. More coal, it is stated, is being delivered on contract, and these deliveries will continue to increase.

Investment Bankers Urge Public to Safeguard the Commissions

FOLLOWING a precedent established last spring by the governing body of the entire association, the executive committee of the Central States Group of the Investment Bankers' Association of America, comprising the states of Illinois, Wisconsin, Indiana and Iowa, has adopted resolutions which are commended to the serious consideration of the business men of Illinois urging public support for the Public Utilities Commission of that state. The committee dwells on the fact that the direct investments of many thousands of people and the indirect investments of many more thousands, placed through savings banks and insurance companies, are represented by public utility securities.

The utilities, if properly administered, free from political control and adequately financed, so that they may function to the best possible advantage, are essential to the well-being of every community, the committee declares.

The resolutions were inspired by recent attacks made upon commission regulation of utilities. They reiterate the stand taken by the governing body of the Investment Bankers' Association of America that commission regulation is the modern, progressive, economically scientific method of administering the affairs of public utilities. They urge the people of Illinois to safeguard their present public utilities law in every possible manner in order to promote stability in the investment field and to assure at once proper administration of the affairs of the utilities and proper service by them to the various communities of the state.

Committee of Iowa Section, N. E. L. A., Urges Increased Electric Rates

THROUGH a new committee the Iowa Section of the National Electric Light Association is undertaking the task of convincing the public that increases in electric service rates are needed. Austin Burt of Waterloo is chairman, N. T. Wilcox of Keokuk is vice-chairman. In a letter asking immediate united action Mr. Burt indicates that a 50 per cent increase in rates is necessary to meet increased costs of coal, labor and other items. The committee also contemplates educational work in connection with the question of valuations. It is understood that the State League of Municipalities contemplates presenting drastic measures at the next session of the Legislature. The committee is planning to put before the members of the Legislature the exact condition and needs of the Iowa utilities.

October Record Month in Electric Light and Power Financing

DURING October $38,295,300 in stocks and bonds of electric light and power public utilities was offered to the public. This is the highest total that has been reached in any month so far this year in this class of securities. Another issue of interest to the industry but not included in the above total is the thirty-million-dollar, ten-and-a-half-year bond issue of the Westinghouse Electric & Manufacturing Company, sold at 94¾, to yield 7¾ per cent. Of the public utility financing, $5,420,300 is in stock of the Commonwealth Edison Company, offered to stockholders at par, and the balance of $32,875,000 is in bonds and notes. These are for the most part long-term obligations, with the exception of a six-month issue of the Hagerstown & Frederick Railway Company amounting to $1,050,000, sold at 96½ and yielding 7.85, and $650,000 in five-year notes of the Danville, Champaign & Decatur Railway & Light Company, bearing 8 per cent interest and sold at par. The yield column shows very little change. In four cases it falls below 8 per cent—two thirty-year issues, one twenty-five-year issue and one twenty-year.

Company	Amount of Issue	Period	Class of Security	Rate of Interest	Per Cent Yield	Offered at
Public Service Co. of Northern Illinois	$4,000,000	10-year	Collateral gold notes	8	8	100
Danville, Champaign & Decatur Railway & Light Co	650,000	5-year	Bond secured convertible gold notes	8	8	100
Commonwealth Edison Co	5,420,300	....	Stock	..	..	par
Nebraska Power Co.	1,600,000	30-year, due June 1, 1949	First mortgage gold bonds	6	7 30	84 50
Middle West Utilities	2,500,000	15-year	Secured gold notes	8	8 50	96
Conemaugh Power Co	2,750,000	10-year	First mortgage gold bonds	8	8.15	99
Kentucky & West Virginia Power Co., Inc.	1,500,000	30-year	First mortgage gold bonds	7	7 75	91 50
Wisconsin Electric Power Co	5,000,000	25-year	First mortgage sinking fund gold bonds	7.50	7 60	99
Hagerstown & Frederick Ry. Co	1,050,000	6-month	Collateral trust notes	8	8	100
Pennsylvania Ohio Power & Light Co	13,000,000	20-year	First and refunding mortgage gold bonds	7 50	7 85	96 50
San Joaquin Light & Power Corp	2,625,000	15-year	Convertible collateral trust bonds	8	8	100
Ottawa (Can.) Light, Heat & Power Co	1,200,000	10-year	First mortgage and collateral trust gold bonds	8	8	100

Prominent Utility Banker Sees Lower Interest Rates for Utility Securities

PUBLIC utility securities, especially those of the electric light and power companies, now occupy a much better position than at any time in the past two years, E. W. Niver of Halsey, Stuart & Company, New York City, investment bankers, declared to a representative of the ELECTRICAL WORLD last week. There is an increasing demand for long-term securities, and the general attitude toward the utilities has become more favorable.

"At this time," said Mr. Niver, "banking houses are purchasing long-term securities of high-grade companies to sell on a 7.5 to 8 per cent basis that they could not have considered five months ago owing to market conditions which existed at that time. One of the best indications of the present trend is the increasing demand on the part of investors and dealers for utility securities. While the present market cannot be termed a 'utility market,' there is, nevertheless, a very noticeable inclination on the part of investors to favor this class of security rather than other issues which have been popular during the past two or three years.

"An electric utility which might have had difficulty six months ago in putting out securities at a net cost of 10 to 12 per cent can now obtain money at approximately 9 per cent, and in case of a long-term issue of two or three million dollars the net cost would be somewhat lower. In other words, money is costing 2 to 3 per cent less than last spring, when the utilities could do only short-term financing, for which they paid as high as 13 per cent in some instances.

"There is no one particular reason to which can be assigned the improved demand for the issues of electric utilities. The fact that public service commissions are granting rate increases and inserting coal clauses in contracts has strengthened the position of the companies. Another important factor is the work which the utilities themselves have done in improving public relations by putting their case squarely before the public. The policy of customer ownership has been the best thing that they could have adopted. It has resulted in the sale of millions of dollars' worth of preferred stock widely distributed, and many of these small preferred stockholders are now buying utility bonds.

"With the increasing demand for utility securities," concluded Mr. Niver, "investment bankers are able to give more favorable consideration to new issues, and the natural result, as has already been shown, will be cheaper money for the public utility companies."

Home-Rule Candidate for Governor Wins in Illinois

ABOLITION of the Public Utilities Commission, home rule and 5-cent street-car fares were prominent features in the campaign of Len Small of Kankakee for Governor of Illinois, which resulted in his election Tuesday by a plurality over Senator James Hamilton Lewis estimated at close to 500,000. Small's plurality, while a record for the state, is estimated at about 60 per cent of Senator Harding's for the Presidency. Small's victory gives the so-called City Hall machine of Chicago the control of the state and all municipal taxing bodies except a few small park districts. The effect on the utility situation in the state cannot now be foretold as action must be taken by the State Legislature before the commission can be abolished. It seems, however, that the election result will bring the whole utility controversy in Illinois before the Legislature in an effort either to abolish the commission or greatly to curtail its powers. The Chicago street railway system has so far been the principal bone of contention in the political controversy and for that reason will probably be the first point of attack.

Local Dealers Charge City of Tacoma with Unfair Practices

INJUNCTION proceedings based on a charge that the city of Tacoma, Wash., is exercising a monopoly of the electrical supply business have been filed against the city and I. S. Davisson, Commissioner of the Light Department, by A. Z. Smith, R. A. Wheelock and Roy F. Owen, three local dealers in electrical apparatus. Seven alleged unfair practices are cited by Messrs. Smith, Wheelock and Owen in their complaint. The first complaint alleges that the city sells electrical apparatus and appliances at 5 per cent above cost, whereas any other dealer cannot possibly transact such business at less than 15 per cent above cost. The plaintiffs ask that Commissioner Davisson be enjoined from handling electrical apparatus at rates not compensatory to the city or to the capital employed in the business.

The second complaint is that motors are leased to individuals by the city with an agreement that those leasing them can buy the motors and get credit for all rent paid within twelve months less the interest on the investment. Through this practice, it is alleged, the city reduces the price below actual cost. It is also charged that the city has contracts from one or more large manufacturers for the exclusive handling and sale of their motors, thereby preventing dealers from doing business directly with such manufacturers. Violation of the city charter is charged against Commissioner Davisson because of his alleged practice of purchasing electrical goods without calling for bids. If bids were called for, the complainants declare, the supplies could be purchased more cheaply and the local dealers would have the same opportunity as "favored dealers" to supply the city with goods.

The further charge is made that without regard to statute limitations upon municipal handling of electrical supplies the city has carried on a general business with all comers, whether in or out of the city. As a sixth charge it is declared that the city makes bids unlawfully in competition with all dealers, and still further unfairness is alleged because of the city's practice of keeping leased motors in repair.

In a second and separate cause for action brought by the three dealers they declare that an early shortage of power threatens the residents of the city through Commissioner Davisson's practice of selling power. At the cost of $2,000,000 Tacoma built a hydro-electric generating plant, they declare, with ample capacity to supply the city with light and heat for many years to come. Of late, they say, Commissioner Davisson has exceeded his powers and sold electrical energy to many persons and corporations outside of the city, so that the amount of power available is greatly reduced. Such sales of power, it is alleged, have been made at rates below those charged to the citizens of Tacoma.

Southern Power Company Will Build New 60,000-Kva. Hydro-Electric Plant

PLANS are being prepared by the Southern Power Company for the construction of a new 60,000-kva. water-power plant near Charlotte, N. C. This will be the ninth hydro-electric plant to be tied into that company's system of 2,050 miles of high-voltage transmission lines and will bring the total rating of its hydro-electric and steam stations up to 340,900 kva. This new station will be laid out for four units operating under a head of 85 ft. It will be of the usual type of construction adopted by the Southern Power Company and similar to the Wateree station described in the May 8 issue of the ELECTRICAL WORLD except that the switching structure will be mounted on the roof of the station instead of on a special structure. Outdoor transformers will be used mounted on the side wall of the power-house structure as in the case of the Wateree design. The dam and power house will require about 250,000 yd. of masonry. Preliminary specifications for the four waterwheels have been sent out to the manufacturers. W. S. Lee, vice-president and chief engineer of the Southern Power Company, states that the plans for the new station call for its completion in the summer of 1922.

Attention Called to Tax-Free Feature of Preferred Stock Dividends

THERE is a marked tendency on the part of investors to favor the purchase of public utility issues, and many of the old investors who in normal times were partial to this class of securities are again buying them, said G. A. Hoyt, utility specialist of William A. Read & Company, investment bankers, to a representative of the ELECTRICAL WORLD. This attitude is due to the belief among investors that the utilities have passed their peak of high operating costs and that the general decline of prices will very shortly be reflected in increased net earnings. Another very noticeable feature is the general sentiment that the days of 8 per cent money are about over and investors are already purchasing securities on which the return is considerably under the above figure. Mr. Hoyt pointed out that a recent issue of railroad securities bearing 7 per cent is now selling above par.

Commenting on the type of financing which would be most advantageous to an electric utility, Mr. Hoyt referred to the recent issues of 8 per cent preferred stock by the Cleveland Electric Illuminating Company and Philadelphia Electric Company.

"Aside from the fact that stock is not a mortgage against the property and tends to build up the equity back of the senior securities, many investors would rather purchase preferred stock than bonds and notes," said Mr. Hoyt. "The reason for this is that dividends on stock are free from the federal normal income tax, while this is not the case with bond interest. Even when the 2 per cent normal tax is paid by the issuing company preferred stock dividends show a greater net return. The comparative savings in tax by the purchase of an 8 per cent preferred stock at 100 are indicated in the accompanying table, which shows the net percentage return after payment of all federal tax from an 8 per cent preferred stock contrasted with (1) an 8 per cent bond and (2) an 8 per cent bond free from 2 per cent normal income tax.

"There is no doubt that public utilities will enjoy material benefits from declining prices, and as a consequence they will be able to obtain money at lower rates.

Annual Income	Eight per Cent Preferred Stock	Eight per Cent Bond	Eight per Cent Bond Free from 2 per Cent Normal Tax
$5,000	7 92	7.60	7.76
10,000	7 68	7 04	7 20
20,000	7 28	6.64	6.60
30,000	6 88	6 24	6 40
40,000	6 48	5 84	6.00
50,000	6 08	5 44	5 60
60,000	5 68	5.04	5 20

From the standpoint of the utility the securities issued at this time should carry a callable feature which would enable it to refund an issue when the cost of money makes this advisable. This condition may not be very far in the future."

National Research Council Takes Up Insulation Problems

A FRONTAL attack to be made upon the fundamental problems in insulation research by the insulation committee of the National Research Council, according to a report from Dr. F. B. Jewett, chief engineer of the Western Electric Company, who is chairman of the new committee. At a recent meeting of this committee it was decided to employ a paid secretary whose duties shall include the gathering of all of the known information concerning insulation investigations and the maintenance of records of the committee's activities as the work progresses. The secretary has not yet been appointed.

The committee also decided that it would attack the technical problems by providing some research men in the universities with funds and materials supplied by the industries, under the guidance of the National Research Council.

The scarcity of skilled and trained research men who are capable of attacking these recondite insulation problems is a matter of much concern to the insulation committee. An effort will be made to discover among the post-graduate students and the faculties of the universities men who are able to do this work. The benefits that will ensue to the electrical industry if these problems receive satisfactory solution will in all probability be so great that to measure them in financial terms at this time would be extremely difficult.

Illinois State Electric Association to Meet in Chicago on Dec. 9

THE 1920 convention of the Illinois State Electric Association has been called for Thursday, Dec. 9, at the Hotel La Salle, Chicago. In the morning there will be an address by M. H. Aylesworth, executive manager of the National Electric Light Association, and reports from the committee on modification of electric service rules, R. S. Wallace chairman, and the committee on rules governing rural service, D. W. Snyder chairman. R. D. Hart, president Illinois Electric Metermen's Association, will report on the meter school. In the afternoon two papers will be read, followed by discussions—"The Best Method of Measuring Energy Supplied at Low Power Factor," by E. T. Anderson of the People's Power Company, and "Sale of Securities to Customers," by F. H. Scheel of the Public Service Company of Northern Illinois.

Cleveland Boosts Electrical Service

POPULARIZATION of electricity for home and industrial use is the object of a campaign being undertaken by the Electrical League and affiliated electrical organizations of Cleveland. Plans for a campaign to extend through the coming spring and summer were brought forth at a meeting on Oct. 27 in the headquarters of the league at the Hotel Statler.

Pacific Coast Jobbers Discuss Their Relation to Water Power

AT THE meeting of the Pacific Division of the Electrical Supply Jobbers' Association held at Del Monte, Cal., on Oct. 21 to 23, attention was given to the part that the jobber is to play in the hydro-electric development of the West. A very interesting chart had been prepared by J. M. Morris, sales engineer of the Westinghouse Electric & Manufacturing Company, on which was shown the approximate amount of materials for electrical generation, transmission, distribution and utilization which would be purchased for every kilowatt of hydro-electric energy generated.

A particularly optimistic view was sounded by John A. Britton, vice-president and general manager of the Pacific Gas & Electric Company, in a general survey of the hydro-electric situation in the West. A. Emory Wishon, assistant general manager of the San Joaquin Light & Power Corporation, brought out the features of the electrical industry which make it the basic industry of virtually all of the other industries, particularly in the West, and the one which would be the last to feel depressions, and even if they came would feel them to a less degree. The financing of all the immense developments contemplated was discussed by A. N. Kemp, controller of the Southern California Edison Company. The organization of a voluntary speaking bureau to provide speakers for all kinds of organizations was dealt with by Robert Sibley, editor of the *Journal of Electricity*.

A. S. M. E. Celebrates Fortieth Anniversary

THERE was celebrated throughout the country on Friday evening of this week the fortieth anniversary of the founding of the American Society of Mechanical Engineers. At this time the opportunity was taken to emphasize the opportunity of the engineer in public life and his responsibility to society.

The official meeting was held at the Engineering Societies Building in New York, but the meetings held in other cities, about forty in number, had the same broad theme. J. Herbert Case, acting governor Federal Reserve Bank of New York; Samuel Gompers, president American Federation of Labor, and William B. Dickson, vice-president Midvale Steel & Ordnance Company, were the speakers at New York. Telegrams from prominent engineers and industrial leaders were read.

A. W. Berresford, president of the American Institute of Electrical Engineers, in a written contribution to the celebration of the anniversary, pointed out the opportunity afforded to the engineer for a fuller expression of his civic duty. Mr. Berresford said:

"The engineer exists in sufficient numbers to constitute an important, and by reason of his qualifications an influential, part of our people. If he will so associate as to convince the remainder that his expression or action is the actual consensus of his opinion after unprejudiced deliberation, then this expression must and will be given due weight, if for no other reasons than his peculiar qualification and the absence of any possibility of its having been dictated by personal interest."

The A. S. M. E. was organized on April 7, 1880, with eighty present. The society now has 13,000 regular members and 1,000 student members. There are local sections or branches in forty-two industrial centers.

Good-Will Appeal to Holders of Electric Light and Power Securities

ANOTHER part of the printed matter issued in connection with the general good-will campaign which the publicity department of the National Electric Light Association is conducting is now ready for circulation. This is a series of four booklets which are written for the purpose of appealing primarily to holders of electric light and power company securities. They are designed



THREE OF THE INVESTOR'S GOOD-WILL SERIES

to be sent out by electric utilities to all holders of their securities and any others especially interested and by the investment bankers to their customers.

A number of conferences were held with the public securities committee of the Investment Bankers' Association before the series was printed. Already, it is stated, the N. E. L. A. is assured of a circulation of at least 100,000 for each pamphlet. The booklets have attractive covers, and each one bears an appropriate appeal, the respective inscriptions being: "The Power of Co-operation," "The Greater Earning Power of Present-Day Investments," "Where the Dollar Brings Returns," and "The Demand Which Increases Dividends."

Less than Four Months in Which to Establish Water-Power Accounting System

IT IS believed to be physically impossible to comply with the requirements of the water power act in the matter of completing the various accounting tasks which are specified in the law. After an extended search a chief accountant has only recently been found. Less than four months remain in which the Federal Power Commission may do the work. It is believed, however, that the major principles of accounting can be set forth and the details allowed to wait until later. The National Electric Light Association and the National Association of Railway and Public Utilities Commissioners have been appealed to for assistance.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

New Installation of Vermont Hydro-Electric Corporation.—The new power house of the Vermont Hydro-Electric Corporation near Rutland, known as the Glenn station, has been placed in operation and will generate 13,200 volts, part of which will be stepped up to 44,000 volts and fed into the main transmission line.

China Turns to Electricity.—A recent report from China says that many orders have been given for power and lighting plants for cotton mills and that the demand for lighting plants for cities in the interior is steadily growing. Steam turbines are to the fore where large plants are concerned and are being introduced to some extent in the smaller plants since the rise in the price of crude oil. The Chinese, it is asserted, demand equipment of sterling quality capable of long service.

Rate-Raising Procedure in Oregon.—Public utilities in Oregon cannot advance their rates or charges without a public hearing before the Public Service Commission and an order from that body authorizing the increase, according to an opinion prepared by Attorney-General Brown. "It is apparent that if the rates prescribed by the commission may be abrogated by the utility filing a new schedule the force and effect of the commission's order amounts to little," he asserts. It is Mr. Brown's opinion that as far as rates which have been fixed are concerned the only way to accomplish a change is by a suit in court or by a complaint to the commission on the ground that the rates are unreasonable or by original complaint filed with the commission.

Pittsburgh Stewards Favor Electric Cooking to Reduce Food Prices.—To effect a reduction in food prices in restaurants connected with industrial plants, department stores, clubs and public eating places the Pittsburgh Stewards' Club at a recent meeting favored adoption of electricity for cooking and baking, according to a report in the local press. It was held by the stewards that the installation of electrical appliances in the cooking ranges of restaurants would solve the problem of gas shortage as well as cut down the production cost of meals. It was estimated by officials of the club that more than a thousand restaurants could advantageously make the change. A committee was appointed to arrange for a special meeting to be known as "electrical night." At this session electrical cooking appliances and equipment were to be exhibited.

Massachusetts' Public Utility Legislation.—Under the heading "New Legislation of Especial Interest to Public Utilities, Including Municipalities Owning Lighting Plants," the Massachusetts Department of Public Utilities has just issued a publication containing laws and portions of laws passed by the Legislature of 1920 that fall under the classification of the above title.

Carrying Electricity to French Canada.—A leaflet printed in French by the newly organized Electrical Co-operative Association of the Province of Quebec dwells on the great field for electric expansion in that province, where, the leaflet says, only 850,000 hp. out of a potential hydro-electric supply of 6,000,000 hp. to 8,000,000 hp. has been developed and where only 31 per cent of the population make use of electricity as compared with 79 per cent in California, 91.4 per cent of the people in that state being reached by the distribution systems as against 55 per cent in Quebec. "It is generally admitted," the leaflet says, "that in the isolated districts the sale of appliances and wiring of dwellings encounters a serious obstacle in the fact that good contractor-dealers are rare. The association will be able to render great service to the companies by encouraging contractor-dealers to settle in these places and establish a business."

Rates Still Go Up.—Advanced schedules in lieu of an emergency surcharge have been authorized by the Wisconsin Railroad Commission in Milwaukee, Racine, Kenosha, Cudahy and other places served by the Milwaukee Electric Railway & Light Company. The same commission has authorized the Wisconsin-Minnesota Light & Power Company to increase its rates in all the Wisconsin cities where it operates, these including Eau Claire, Chippewa Falls, La Crosse, Menomonie and about thirty other cities and villages. The Los Angeles Gas & Electric Corporation has been authorized by the Railroad Commission of California to increase its electric rates by 12½ per cent. Other places where charges have been raised are Antigo, Wis.; Haverhill, Mass.; Perry, Juniata, Berks, Lancaster and Chester Counties, Pa.; Tampa, Fla.; Memphis, Tenn.; Urbana, Ill.; Woodstock, Ill., and places in Arkansas served by the transmission lines of the Commonwealth Public Service Company of Fort Smith.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Engineering Society of Akron, Ohio.—On Oct. 27 the electrical section of this society was addressed by R. W. Shenton of the Nela Park laboratories on "The New Era in Lighting."

Rensselaer Student Branch, A. I. E. E.—At the first monthly meeting of the student branch of the A. I. E. E., at Rensselaer Polytechnic Institute, Troy, N. Y., Wynant J. Williams, professor of physics, was elected chairman for the coming year.

New York Section of Welding Society Formed.—The Metropolitan Section of the American Welding Society was organized in New York City, on Oct. 25. Officers are: Chairman, H. A. Currie; first vice-chairman, F. E. La Schaum; second vice-chairman, E. M. T. Rider; treasurer, W. E. Gray, Jr.; secretary, Howard Odiorne.

Iowa Section, N. E. L. A.—New committees for this section have been appointed with the following chairman: Public relations, O. H. Simonds, Dubuque; valuation and rate of return, C. N. Chuff, Davenport; legislation, F. J. Hanlon, Mason City; customer ownership of public utility securities, S. Dows, Cedar Rapids; electric service for farmers, John M. Drabelle, Cedar Rapids; 1921 convention, C. N. Chubb; accounting systems for municipal plants, H. Bellamy, Knoxville; electric service rates, Austin Burt, Waterloo.

Ohio Electric Light Association.—The first meter conference under the auspices of the meter committee of the Ohio Electric Light Association will be held on Nov. 11 at Columbus. The principal subject in the morning session will be a discussion of types, connections and testings of switchboard instruments. In the afternoon session safety measures in customers' installations will be discussed from the standpoint of the underwriters, followed by a general round-table discussion. This is to be an open meeting. S. T. Henton of Akron is chairman.

Coming Meetings of Electrical and Other Technical Societies

Association of Iron and Steel Electrical Engineers—Philadelphia Section, Nov. 6; Cleveland Section, Nov. 8.

National Association of Railway and Public Utilities Commissioners—Washington, Nov. 9.

Society of Naval Architects and Marine Engineers—New York, Nov. 11-12.

American Institute of Electrical Engineers, Chicago Section, Nov. 12. (For program see issue of Oct. 30, page 893.)

Electric Power Club, Hot Springs, Va., Nov. 15-18.

Florida Ice and Public Utilities Association—Miami, Fla., Nov. 15 and 16.

National Electric Light Association—Southeastern Geographic Division, Miami, Fla., Nov. 17-19. (For program see issue of Oct. 23, page 845.)

Electrical Supply Jobbers' Association—Cleveland, Nov. 17-19.

American Engineering Council—Washington, Nov. 18-20. (For program see issue of Sept. 25, page 651.)

Jovian Order—St. Louis, Nov. 25 and 26.

American Physical Society—Cleveland, Nov. 27; annual meeting Chicago, Dec. 28-Jan. 1.

A. I. E. E. (New York Section) and A. S. M. E. (Metropolitan Section)—Joint meeting, New York, Dec. 3.

Rivers and Harbors Congress—Washington, Dec. 8-10.

Illinois State Electric Association—Chicago, Dec. 8.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Company's Judgment on Effect of Rate Increase Carries Assumption of Correctness.—Except in a clear case, the Department of Public Utilities of Massachusetts has held, the commission ought not to substitute its own judgment for that of the management of a corporation as to whether an increase in rates will increase the revenue in a case where the company is not meeting its operating expenses under the present rates.

Kansas Industrial Court Assumes Jurisdiction of Wage Dispute Between Electric Company and Its Employees.—Declaring that it had jurisdiction over a wage controversy between the Topeka Edison Company and its employees, since the industry concerned is an essential one upon the continual and efficient operation of which the people depend for necessaries and comforts of life, and that it is a matter of public interest that skilled and faithful workers should be always available, the Kansas Court of Industrial Relations proceeded to establish a minimum wage scale of 67½ cents an hour.

Valuation of Street Lamps.—The value of the lamps used in a street lighting system, the Wisconsin Railroad Commission has asserted, must be carried either in the plant account or as material or supplies, although the lamps are subject to constant renewal. A part of the value of a steam-power plant of an electric company must be apportioned to street-lighting service, although a large part of the energy is purchased, in a case where the steam plant is operated over the peak of the load and for a part of the time at least the street lights are burning. An energy consumption of 356 watts for 600-cp. lamps burning 4,000 hours a year and 257 watts for 400-cp. lamps was held not to be excessive.

Air and Water Heating Discouraged.—The Public Utilities Commission of Idaho, in granting authority to the Idaho Power Company to enforce rates for air and water heating which are equivalent to a 30 per cent increase throughout the entire territory of the company, also gave the company permission to refuse to new customers more than 4 kw. connected load for this purpose. The commission declared its conviction that the use of electricity for heating air and water for domestic purposes is not feasible and that the equipment which would be necessary for heating service is needed for power uses. Consideration was also given to the fact that the air and water heating service was installed at a time when there were several companies operating in the field, since consolidated by the Idaho Power Company, and that attempts were made to compete with coal as a heating agent. Though this has been found impracticable, allowance is made for the later increases in coal prices.

Apportionment of Indirect Expense.—The indirect expense of an electric utility supplying service to a street railway should be apportioned, according to a decision of the Missouri Public Service Commission, by ascertaining the ratio of the supplying utility's total indirect expense to direct expense and adding the percentage so obtained to the direct expense chargeable to street-railway service. Compensation allowable a street railway for constructive delivery of energy to the distributing utility may most equitably be based upon the compensation received by the distributing utility for constructive delivery of its energy to the supplying utility.

Additional Revenue to Which Utility Is Entitled Dependent on Several Factors.—In granting increased rates for water and electricity to the Buckhannon Light & Water Company, the West Virginia Public Service Commission said that the amount to which a utility is entitled depends upon the present fair value of its plant for rate making, upon its operating revenue under the existing rate, upon its operating expenses, and to a certain extent upon the kind of service it has been rendering to its patrons. Despite the fact that the service had been subject to justifiable complaint, an increase sufficient to provide a reasonable return should be allowed, the commission held, with the requirement that necessary repairs be made within a reasonable time, inasmuch as the bonded and floating indebtedness of the company virtually equaled the fair value of the property and it would be obliged to go into the money market to procure funds for the necessary betterments.

Suspension Versus Abandonment of Service.—Commenting on the distinction between suspension of service and abandonment of service, the Montana Public Service Commission recently observed: "Suspension of service may be voluntary or involuntary and implies a breach or interruption, more or less temporary, of continuity of service, without any intent to surrender the right to render the service. Abandonment, on the other hand, involves an act of relinquishment of its rights, privileges and franchises by the company without regard to any future possession by itself or any other person but with an intention to divest itself permanently and totally of the right to render the service. The use of these two terms we think most important for clarity of thought in this branch of public utility law." A utility cannot, the commission declared, rely upon confiscation as justifying suspension of service where it has made no application to the commission for an increase in rates.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Utility Cannot Increase Franchise Rates Without Action by Commission.—In Village of Mount Morris vs. Pavilion Natural Gas Company the Supreme Court of New York found that the company, which accepted a fifty-year franchise from the village imposing certain rates, could not exact increased rates from its customers without action by the Public Service Commission pursuant to statute and that it could be enjoined by the village from so doing. (183 N. Y. S. 792.)*

Contracts and Powers of the State.—In affirming the power of the Public Service Commission to increase street-railway rates found inadequate to yield a fair return (People ex rel. City of New York vs. Nixon), the Court of Appeals of New York laid down two general propositions—first, that one whose rights are subject to state restriction cannot remove them from the power of the state by making a contract about them; second, that the obligation of a contract is determined by the law in force when it is made, since existing statutes enter into the terms of a contract by implication. (128 N. E. 245.)

Electric Company Not Negligent in Failing to Provide Barrier Between Substation Bus Wires and Transformer.—By a vote of four to two the Supreme Court of California, in Coughlin vs. Great Western Power Company, reversed the verdict of the lower court and found that the company was not grossly negligent in failing to erect a barrier between its 22,000-volt wires and the substation transformer. Suit was brought because of injury to an operator from electric shock while dusting a dead wire in close proximity to the high-tension conductors. The plaintiff's contention that the current jumped 21 inches to his hand was pronounced scientifically impossible, there being a lightning-arrester gap an inch away and ironwork connected to the ground a foot away from the bus wires which would have intercepted escaping current. Evidence was given to the effect that from motives of economy the company had not erected a barrier, although the dangerous condition had been brought to its attention. On the other hand, the employee admitted "flipping" his duster about in spite of the hazardous nature of the task in which he was employed when he received the shock. (191 Pac. 920.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System

Men of the Industry

Changes in Personnel and Position—Biographical Notes

Edwin S. Carman has been elected president of the American Society of Mechanical Engineers, succeeding Major Fred J. Miller. Mr. Carman was born in Prairie Depot, Ohio, in 1878, and was graduated from the Central Manual Training School of Cleveland, Ohio. After graduation he entered the shop of the Sun Oil Company of Toledo and four years later became associated with the American Machine & Manufacturing Company of Cleveland. He was appointed chief engineer of the company after two years' training in the engineering department, and while with that company he designed a complete line of electric traveling and special forge-shop cranes and hoists, billet rotators, wire-fence machinery and rolling-mill equipment. In 1908 this company was consolidated with the Johnston-Jennings Company of Cleveland, and Mr. Carman was appointed chief engineer and manager of the engineering and machine department. In the same year Mr. Carman was engaged by the Osborn Manufacturing Company of Cleveland, manufacturer and dealer in wire bristle and fiber brushes and wheels, hardware specialties, foundry supplies and equipment, to design, manufacture and build up a complete line of foundry molding machines. In 1913 he became directly associated with the Osborn Manufacturing Company as chief engineer in charge of engineering and manufacturing of the machine division, and in 1916 he was elected a director. He was appointed works manager of both the machine and brush divisions of the company in 1917. He is the author of a treatise on foundry molding machines and pattern equipment and a contributor of papers on the art of machine molding. Mr. Carman has been prominent in the activities of the engineering societies, serving as president of the Cleveland Engineering Society and chairman of the Cleveland Section of the American Society of Mechanical Engineers. He has for a considerable period taken a very active part in the affairs of the last-named society.



E. S. CARMAN

F. E. Carpenter, heretofore master mechanic of the West plant of the Merchants' Heat & Light Company, Indianapolis, Ind., has been advanced to the position of mechanical engineer.

W. J. Canada, engineering director of the National Electric Light Association, is visiting the Pacific Coast investigating inductive interference problems and getting the viewpoints of utility engineers and managers on the various phases of this problem.

Benjamin F. Thomas has resigned as mechanical engineer for the United Railways of St. Louis to take the position of assistant superintendent of power for the Scullin Steel Company of St. Louis. Mr. Thomas has been with the United Railways for three years. He is a graduate of the Massachusetts Institute of Technology and is a member of the St. Louis Section, A. I. E. E., and the St. Louis Electrical Board of Trade.

E. O. Shreve, manager of the San Francisco office of the General Electric Company, who has been in the East on a business trip, visiting the main offices and plants of the General Electric Company, left New York on his return trip to San Francisco, Friday, Oct. 29.



E. O. SHREVE

Mr. Shreve is one of the most active figures in the electrical industry in San Francisco, particularly in electrical association affairs, having been for two years president of the Electrical Development League in San Francisco, which is the rallying place of those who are ambitious to promote the welfare of the industry.

Prof. Charles F. Scott, chairman of the department of engineering, Yale University, returned on the Finland recently from a three months' sojourn in Italy. Professor Scott had been representing the Western Electric Company in dealing with communication cable location, his associate being L. P. Ferris, formerly assistant engineer in the California inductive interference studies. The particular problem this year was whether it was practicable to run a cable as projected from Milan, Genoa and Turin without interference from railroad and transmission lines, and if not, what precautions should be taken by the telegraph administration and railroad administration or the former alone. Part of the railway, which is in the shape of a Y reaching to the three cities, is already electrically operated and the rest soon will be. As a result of the summer's work a considerable amount of interesting information with reference to inductive interference and three-phase lines under the peculiar Italian conditions was collected, and a modified route which would be free from disturbance with certain precautions was suggested.



PROF. C. F. SCOTT

Otto Snyder, who for the last three years has been general superintendent of distribution for the Adirondack Electric Power Corporation, with headquarters at Glens Falls, N. Y., has recently been made in addition general superintendent of the commercial department of the Adirondack Power & Light Corporation, the new corporation formed by the merger of the Adirondack Electric Power Corporation and the Mohawk Edison interests. This new company does business in Schenectady, Schaghticoke, Amsterdam, East Creek, St. Johnsville, Watervliet, Ballston Spa, Saratoga Springs, Glens Falls, Lake George, Oneida and Canastota. The power load under Mr. Snyder's jurisdiction has been increased to more than 40,000 kw. with annual sales amounting to more than 200,000,000 kw.-hr. Sales of electrical merchandise annually exceed $1,000,000.

Trade and Market Conditions

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

Almost No Recession in Demand for Transformers

POWER and distribution transformers continue in good demand. A leading manufacturer is considering increasing his facilities, so great is the faith of the sales force in the future market. Inquiries and orders show little evidence of the business recession apparent in some fields. A representative of the ELECTRICAL WORLD found one of the largest plants in the country working full time a few days ago, with several months' orders on the books. Deliveries are quoted around five months on medium-sized power transformers and three months or less on distribution transformers. Both classes of transformers are in about the same demand.

Prices hold firm and raw material is in good supply, barring a shortage of tank iron and some scarcity in Egyptian cotton. It is doubtful if the shortage of cotton experienced earlier in the year can be made up before January. Large stocks of copper and sheet steel must be worked up by the manufacturers, it is said, before the buying of raw material at reduced prices can be reflected in factory costs. Wages have not been reduced to any extent as yet, nor have layoffs of men been required; in fact, employees are still being taken on in one of the large Eastern factories.

The importance of purchasing transformers with more regard to all-day efficiency is being emphasized in some circles. The high price of coal and the continuous core and line losses involved in scattered installations especially are leading the progressive buyer of transformers to study more carefully than hitherto the engineering characteristics of this class of equipment. In some cases, it is pointed out, the purchaser can afford to pay 15 to 25 per cent more in transformer first cost for higher all-day efficiency.

No Immediate Drop in Wiring Materials Prices Foreseen

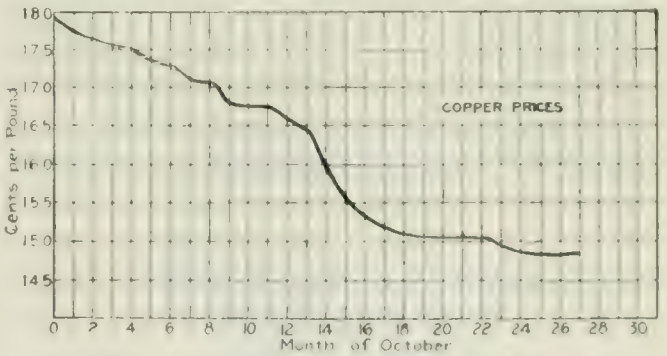
DURING a pre-election visit to a number of wiring-device factories a representative of the ELECTRICAL WORLD found a prevailing belief in the underlying soundness of the industry. A leading sales manager holds that with the election out of the way the prospect of large development in the country's business becomes excellent. Major interest attaches to the course of prices. One company reports a year's supply of raw material on hand; another has a large stock of raw material but one which is somewhat broken. A representative maker of switches for domestic and industrial service states that more business than he can comfortably handle is still coming his way. The point was made with much vigor that until the existing stocks of high-cost raw material are worked off there can be little foundation for any marked reduction in the manufacturer's prices unless labor costs should drop substantially.

The margin of profit is said to be small on this class of material in face of recent cost advances, and while combined failure of the buyer to enter the market would inevitably force prices downward in many lines, the producer of switches and sockets maintains that today's prices are justly supported by the manufacturing conditions. Even if a sharp reduction occurred on wiring devices, for instance, it is urged that the expansion of building operations would not be affected much. Bricks and lumber advanced to a point 500 per cent above the pre-war level, it is pointed out, and these have fallen back to about 200 per cent above 1914 prices. Wiring materials represent less than 1 per cent of the total cost of a modern residence, and current prices are about 100 per cent above pre-war figures. Most observers hold that there is absolutely no ground for somber-tinted forecasts as to the wiring-device business of the coming year, and if reasonable-sized orders soon begin to be placed, perhaps with some flexibility as to price settlements on a fair basis to all concerned at the time of future delivery, this branch of the industry will go forward to prosperity.

Copper Goes Below Pre-War Level in October

WHILE a slight recession has been under way in copper prices since July, the heavy break did not come until late in September and continued through October. As October drew to a close copper had once more gone below 15 cents and at this writing it is half a cent below the 1906-1913 average of 15¼ cents. The large producers had accumulated enormous stocks of metal during a year of small buying and finally found that the pressure of carrying this inactive material was becoming too great.

It is doubtful if the rapid decline has stimulated any large market. In the electrical industry particularly the manufacturers have stocks of expensive metal and are inclined to withhold all buying until their stocks have been disposed of. Indications are that prices will go lower. It is probable, however, that additional cuts will begin to tempt the speculative interests. Consumer demand is entirely lacking and except where absolutely necessary will in all probability not appear until after the first-of-the-year inventory. When the metal reaches 14½ cents the speculators will probably begin to take notice. It is doubtful, however, if this element can force the market higher with a heavy consumer demand.



RAPID DECLINE OF COPPER SHOWS LOSS OF 3¼ CENTS IN FOUR WEEKS

Copper producers seem determined to go as far as is necessary to develop copper buying. Early in 1919 when buying was desired the market was cut to 14½ cents or about 4 cents below the real buying level. The market, however, very quickly adjusted itself and the upward momentum carried it beyond its rightful level for a few months.

The accompanying graph was prepared from the daily quotations of the *Engineering and Mining Journal*. These figures are for electrolytic in large quantities, f.o.b. mine. For consumer cost there should be added from 0.15 cent to 0.25 cent per pound to pay for delivery charges.

Relation of Raw Materials, Labor and Overhead to Falling Prices

LOWER prices of electrical goods, manufacturers state, are dependent upon two factors—costs of raw materials and costs of labor. Certain of the raw materials, such as copper, cotton, steel and wool, have dropped very sharply. Copper, for instance, which is probably the most important of raw materials in the electrical field, is down now to the pre-war level. Cotton has dropped 50 per cent from the peak. It is doubtful, however, if much of this lower price material has yet found its way into finished electrical equipment. In fact, because of large stocks on hand it is doubtful if, in general, any but high-priced materials will be fabricated during the remainder of the year. There seems, therefore, little reason to expect any very marked recessions in price by manufacturers in the immediate future on account of lower prices of raw materials.

On the score of labor there appears to be a steadily decreasing unit cost. It is true that wage rates are as high as ever, but there is almost none of the expensive overtime work. Besides, electrical manufacturers in numerous lines have commented in the past few weeks on the increased production of the individual workman. Where labor charges are a very large part of the unit cost some material reduction in production cost is materially resulting.

There is a question, though, as to how much price relief can be expected from lower labor costs. Production is not so high as it was, and consequently the item of overhead per unit of production is increasing. In other words, where a saving has been effected by increased labor efficiency there is the probability that overhead costs may be an offsetting factor.

Lower prices, however, are bound to come eventually. The order of their coming will probably depend upon the relation of raw-materials cost to total-production cost. Where the raw materials are the most important factor, as in wire, the recession in price can be expected to come the earliest. As a matter of fact wire is already on the down grade. Where the article is finely fabricated and labor is the most important element of cost recessions will probably be longer in coming.

All of this, however, is predicated on at least a fair demand. Should the demand drop so low as to make overhead too large a part of the unit cost, then, of course, prices will fall in order to stimulate demand and increase production.

Friction-Tape Producers See No Big Price Drop Before January

ACCUMULATION of raw material and increased production, coupled with a moderate falling off in orders, have resulted in greatly improved delivery conditions in the friction tape market. A representative manufacturer informed the ELECTRICAL WORLD a few days ago that he could easily handle orders as large as 50,000 lb. a week, quoting seven to ten days' delivery. Factory stocks are not being built up, however, the policy being to supply the jobbers with standard tapes for distribution. The price question is the chief obstacle to larger business. The cost of cotton sheeting has eased off somewhat, but the mills are still heavily loaded with orders and no marked tendency toward sharp declines can be seen in the present price of raw material.

One manufacturer pointed out that no material price reduction on friction tape is to be expected before January. Wages are maintained at the high level attained some time since, and the cost of coal purchased under a five-dollar contract has increased to $18 and $21 per ton in this plant within a few months. A very heavy demand for rubber hose has set in, and tape manufacturers making diversified products are less affected by fluctuations in buying than are producers of a few very limited lines. Tape prices, it is said, are not figured upon the maximum price of cotton sheeting to the manufacturer, and for this reason quite a substantial decrease in raw-material cost would be required to have much effect upon the quotations offered jobbers. Current prices run from 60 to 70 cents per pound. Recent suggestions as to the desirability of using white and gray tapes have borne good fruit, and less than 1 per cent of the tape sold by a large producer is now white. Labor conditions are good, and so far it has not been necessary to lay off employees to any extent in this field. Few cancellations are being received, although in several cases jobbers have shown some sluggishness in ordering on account of the slow movement of tape from their shelves.

Progress in Standardizing Washing-Machine Motors

AT A MEETING of the standardization committee of the Power Club and the American Washing Machine Manufacturers' Association in Chicago, Oct. 25, it was discovered that a great deal of difficulty will be experienced in finding a frame which can be standardized for washing-machine motors without extensive changes in manufacturing processes. As a result of the discussion it is deemed possible to standardize on the shaft diameter and length of extension, though no dimensions were decided on. The meeting was a progress meeting, and further studies are to be carried out. The study is directed at mechanical rather than electrical standardization so that motors of any manufacture can be used with various washing machines without modification of machine or motor mounting designs.

Metal Market Situation

PRODUCERS seem to be holding rather firmly to a 15-cent price for copper delivered over the remainder of this year. Although little or no actual change in the market is evident, their position is apparently stronger because of the greater number of inquiries that are being received. Copper at 15 cents is said to be below the level of producing costs for all but the largest companies. For this reason it is reported that some dealers instead of selling are actually buying copper. Some considerable sales have been made at 15 cents for early delivery. For shipment over January and February of next year slightly higher prices are asked, approximately 15.25 cents being quoted.

The outside market is virtually quoting on a level with producers' prices now, and greater competition is felt among sellers in an effort to liquidate stocks, even at no profit or actual loss. London standard spot copper continues to recede, falling £½ this week to £91 per ton.

The position of tin has again improved, an advance of one-half cent a pound being recorded. Spot zinc declined a fraction of a cent the past week. The scrap-metals market shows no betterment as yet. Foreign arrivals of scrap metal have drugged the market for one thing, and further price drops are recorded this week. Dealers' stocks are very large.

NEW YORK METAL MARKET PRICES

	October 25	November 25
Copper	£ s d	£ s d
London, standard spot	91 10 0	91 0 0
	Cents per Pound	Cents per Pound
Prime Lake	Nominal 15 50	Nominal 15 50
Electrolytic	15 00-15 25	15 00
Casting	14 75	14 50
Wire base	17 50-18 00	17 50-18 00
Lead, trust price	7.25	7.25
Antimony	6 37½	6 37½
Nickel, ingot	43.00	43 00
Sheet zinc, f.o.b. smelter	12.50	12.50
Zinc, spot	7.50	7.40
Tin	39 50	40 00
Aluminum, 98 to 99 per cent	32.90	32 90

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	13 00-13 50	12.00-13 00
Brass, heavy	7 00- 7 50	6 50- 7 00
Brass, light	5.50- 6 00	5.00- 5.50
Lead, heavy	5.50- 5.75	5.25- 5.50
Zinc, old scrap	4.00- 4.50	4.00- 4.50

THE WEEK
IN TRADE

EXCEPT in the Middle West, no improvement has been noticed in the electrical market. Things generally seem to be quiet. In the East prices are cut to produce sales, but elsewhere there seems to be a greater hesitancy to take such a step.

Stocks are piling up, and even in such lines as porcelain, iron conduit and hollow ware better deliveries are beginning to make conditions easier.

No change is seen in the credit or collections situation, nor was any really expected prior to election. The amount of new building keeps contracting. Labor is becoming more efficient and more plentiful. Manufacturers in the electrical line are beginning to lay off men as the demand drops. In some factories this is being postponed by building up factory stocks.

The trade is looking forward to a continued dull winter season, but with a decided change for the better in the spring.

NEW YORK

Business on the whole is just about moving and no more, though exceptions are presented where diligent efforts are resulting in good sales. On steel goods, such as conduit, outlet boxes, lock-nuts and bushings, demand continues strong and the market remains undersupplied. On other material, such as wire, loom, armored cable, etc., efforts are concentrated on keeping down the amount of surplus stock.

A number of cancellations to jobbers are reported, and some price cutting on overstocked lines, especially wire, is being resorted to in an effort to liquidate supplies. The view of the situation expressed by many jobbers is optimistic, however, as in these cases the present market is said to have been foreseen and preparations made to keep down inventories.

Lamps are moving well with some sizes short. The end of the daylight-saving period is expected to boost sales. Heaters are in good demand, but holiday sales of appliances in several instances are not expected to be so large as in other years. Collections have been steadily lengthening and on the whole are very poor at present, with more attention given to pushing accounts.

Porcelain.—A representative jobber quotes 3-in. tubes at $11 per 1,000, two-wire unglazed cleats at $25 per 1,000 and "Nail-it" Knobs at $30 per 1,000 net, in barrel lots. Considerable scarcity exists.

Lamps.—The discontinuance of daylight saving is expected to augment demand, which some jobbers report good and others only fair. General stocks seem good, but certain sizes are frequently short. Some complaint is heard regarding supplies of 40-watt B lamps, 100-watt type C and round-bulb lamps.

Conduit.—Construction work in the metropolitan district has caused demand to hold up strongly. Stocks are low, especially in the small sizes, with shipments very irregular. Quotations range all the way from $85 to $97 per 1,000 ft. for ½-in. black, and from about $110 to $133 per 1,000 ft. for ¾-in. black.

Flexible Armored Conductor.—The local market is almost shot to pieces. Jobbers are having considerable difficulty in keeping down stocks. Cutting of prices prevails, No. 14 two-wire being obtainable as low as $90 per 1,000 ft.

Non-Metallic Flexible Conduit.—Some distributers are overstocked as demand is weak at present. Price cuts are being made. A representative jobber quotes $30 per 1,000 ft. for ½-in. and ⅝-in.

Rubber-Covered Wire.—Although in a few instances good sales are reported as the result of diligent efforts, general demand is weak and prices are soft. Stocks are large though kept within bounds. Reports are current of No. 14 selling as low as $9 per 1,000 ft., and one bona fide quotation of $9.35 in 25,000-ft. lots was made; but the general market still holds about $10 to $10.50 for single-braid. A large distributer has just received word of a drop in base price from 26 cents to 20 cents.

Outlet Boxes.—Considerable scarcity exists under strong demand, and stocks are poor. The discount quoted on galvanized boxes is 25 per cent and on black 30 per cent.

Lamp Cord.—The price of silk cord ranges from $48 to $50 per 1,000 ft., while cotton cord, light, is quoted at from $32 to $35, and heavy from $37 to $40 per 1,000 ft. Demand is only fair.

Heaters.—Sales are fairly heavy, one jobber selling more than 3,000 last month. Shipments are coming through nicely, but the size of stocks varies greatly.

Heating Appliances.—Electric irons are plentiful, but some jobbers are short of percolators and heating pads, while one large company is overstocked on the whole line. Demand varies from fair to excellent, but the view is expressed in several quarters that Christmas sales will not be up to normal. Shipments of goods are on a schedule basis.

Lock-nuts, Washers and Bushings.—The market is undersupplied. Demand is reported good and stocks are not large.

Pole-Line Hardware.—The Electric Service Supplies Company increased the price of certain galvanized insulator pins 5 per cent in the latter part of October owing to the cost of malleable iron. On some types of cross-arm braces, etc., the company reduced prices 5 per cent at the same time.

CHICAGO

A decided feeling of optimism is noted throughout the industry this week owing to the fact that the gradual shrinking of business seems to have been checked and that inquiries in most lines show a decided increase. The campaign of education as to the sound foundation of present prices in the industry being carried on by jobbers and manufacturers is bearing fruit, and the feeling is general that the worst of the slump has been reached.

Inquiries by the railroads, particularly for power apparatus, are coming in in gratifying numbers. Talk of wheat strikes has complicated the collection problem in the agricultural districts, but no serious condition has arisen. Some difficulty is reported in financing farm-power lines.

Power Apparatus.—Marked increase in the volume of inquiries for large size motors—above 5 hp.—is noted this week, particularly from railroads. Manufacturers are able to ship various sizes above 15 hp. from stock, and delivery on those sizes not in stock ranges around ninety days. Much speculation as to the future of prices is heard, but no indications of a cut can be seen.

Transformers.—A sharp drop in transformer demand for farm-power use has been felt. The attitude of the farmer, who seems to have decided to sit tight and await the future of prices, has served to delay several rural-power distribution projects and to cause some buyers of large lots of transformers to request delayed delivery. Business in large-size indoor transformers remains about normal.

Copper Wire.—The most recent quotation on No. 8 bare wire is $24 per 100 lb. in 200-lb. lots, and that on No. 6 is $23. Weatherproof is now $31 per 100 lb. for No. 12 and $29 per 100 lb. for No. 10, triple-braid solid, in 500-lb. quantities. Demand remains normal and supply prompt.

Galvanized Strand.—Factory conditions seem to be improving as deliveries are now promised in thirty to sixty days on all sizes. Demand is apparently abnormal, but the difficulty in obtaining stock is probably causing some duplication of orders. Orders are being accepted on an open price basis only.

Tools.—Supply of lineman's tools is steadily improving. Klein tools are promised now in from thirty to sixty days, whereas two months ago no definite promise could be made. Orders continue to be placed in large volume at date of shipment price.

Steel-Taped Cable.—Trouble in obtaining steel tape for armoring has delayed production to such an extent that deliveries are uncertain. Demand from municipalities remains strong and prices are still held open awaiting developments.

Heating Appliances.—Retail sales show some increase in the past week, and inquiries for Christmas trade are very numerous, giving the impression that holiday business is going to be good. Jobbers are in position to supply all demand, and prices are firm.

Washing Machines.—A feeling of optimism is felt this week throughout the industry, based on the fact that retail sales are improving. A new inclosed-type machine is being marketed at a retail price of $225. Inquiry for the highest class machines for Christmas trade is lively with all dealers.

BOSTON

Business continued uneven at the close of last week, with slackness in some lines and vigorous activity in others. Boston jobbers are still handling a good volume of trade, although the demand for fast-moving supplies has quieted down decidedly. In southern New England distributers report rather dull conditions, accompanied by curtailment in manufacturing circles. Where overstocks exist prices are relatively weak, and wire sagged off sharply last week to lower levels than for some time. Only a small amount of curtailment has thus far been observed in New England electrical factories and very little laying off of labor. Improved production is widely noted among employees. Despite uncertainties as to prices, opinion is widely prevalent that the outlook for business is excellent. Collections are fair, even in localities where the volume of trade is considerably reduced. Stocks are running overfull in many lines, and manufacturers report many requests for postponed shipments, with some cancellations also. Deliveries are greatly improved in most lines, although rigid conduit and small motors are still far behind. In many quarters there has been marking of time until the election ceased to be an issue.

Wire.—Weatherproof wire dropped to a 23-cent base last week, and local stocks of rubber-covered wire sold down around $9 to $9.50 per 1,000 ft. in 5,000-ft. lots of No. 14, one sale as low as $8 being reported from Connecticut. Bare wire fell to 18½ to 19 cents base. Demand is only fair.

Flexible Armored Conductor.—This material is in good supply, with current quotations around $85 per 1,000 ft. in 5,000-ft. lots, single-strip, No. 14. Not much change in demand is noted.

Motors.—Shipments are improving on small motors as manufacturing facilities gradually begin to overtake the demand. In the textile and leather industries a good deal of reconstruction of motor drives is under way.

Fuses.—A brisk demand is noted and one of the leading manufacturers reports inability to fill orders with satisfactory speed. Reductions in the price of brass have not yet been reflected in fuse prices, and stocks are none too large.

Sockets.—Jobbers are buying little schedule material just now, and many cancellations are being received by manufacturers. Improved demand is anticipated before long, however. Prices are steady, with the following typical case-lot quotations: Pulls 50 cents net, keys 28 cents, and keyless sockets 26 cents.

Rigid Conduit.—Pipe is coming into New England in a little better volume. A relaxation of prices is expected in some quarters, but speaking generally, stocks are not anywhere near normal.

Lightning Arresters.—Business is brisk, and it is difficult to obtain shipments from manufacturers.

Oil Circuit Breakers.—Larger sizes are handicapped on delivery on account of the shortage of steel castings. Orders are coming in well and both central-station and industrial improvements are responsible.

Radiators.—Stocks are still equal to the demand, owing largely to long-continued warm weather. Retail displays of radiant heaters are exceptionally extensive. Prices are steady.

Appliances.—This trade holds up well in the main, but manufacturers are not quite so hard pushed in some lines. Stocks of washers and cleaners are large, and evidences are appearing that recent shortages in hollow ware are being made up. Generally, prices are firm, but in the retail trade some cuts are encountered here and there.

ATLANTA

A slight increase in the price of cotton during the past few days has lent a more optimistic tone to the rural districts and will, in all probability, stimulate ginning and marketing of the product. This should help collections. Demand for building material is light, and while electrical jobbers report that supplies of electrical material required in this line continue to move satisfactorily there has been a considerable falling off in the number of new orders. Hardware-store sales in the Sixth Federal Reserve District show an increase in all states, except Louisiana and Florida, where reductions of 7½ per cent are reported. This condition is similar to that existing in the electrical jobbing trade. Building permits of eighteen principal Southern cities for September number 1,903, valued at $3,839,397, an increase of $346,000 over September, 1919.

Stocks of materials continue to be received in growing quantities, and at the recent meeting of the Southern jobbers it developed that they were in a fair way to find themselves overstocked in loom, wire, key sockets and socket specialties.

Wire.—A sharp break occurred in the market on Oct. 28, the price of rubber-covered falling to 20 cents and weatherproof to 22-cent base. Large stocks are reported throughout the territory, but orders are only fairly satisfactory.

Fans.—New fan prices have just been announced, desk and bracket fans being increased from 5 per cent to 10 per cent and ceiling fans from 10 per cent to 20 per cent over last year. The ceiling-fan business in this section continues fair, as orders from the southern portion of the territory are received throughout the winter months. Stocks are reported in fair condition.

Christmas Specialties.—Jobbers report retailers placing satisfactory orders for nearly all lines of Christmas goods. Hollow ware, which is beginning to come in in limited quantities, is reported quite popular. Toys are also in considerable demand.

Sewing Machines.—The dullness reported in this line several months back continues. Some jobbers express the opinion that this specialty will be handled in future largely by the regular sewing-machine trade. All jobbers have good stocks on hand at present and are not placing new orders.

Cross-Arms.—Fair stocks of cross-arms are on hand and, like all other pole-line material, are moving satisfactorily, fir arms of the standard type being the most popular. Prices, lots less than 1,000 linear feet, two-pin, 3-ft., 79 cents; four-pin, 4-ft., $1.05; six-pin, 6-ft., $1.59. Pins, 1¾ in. x 8 in., $3.50 per 100; 1¾ in. x 9 in., $6 per 100.

Porcelain.—A slight improvement in the supply of porcelain is to be noted, one of the largest jobbers reporting that a generous supply of knobs, tubes and cleats has recently been received. Prices: "Nail-it" knobs, $4.65 per 100; $\frac{5}{16}$-in. x 4-in. tubes, standard packages, $1.77 per 100; cleats, two-wire, unglazed, $2.50 per 100.

ST. LOUIS

The electrical market here has been quieter this week than last week, some jobbers reporting sales almost as small as those of their poorest week in September. The October volume of business will measure up well, however, with that of the preceding month, which was quiet also.

Some readjustment has already taken place in the St. Louis market, copper wire being considerably weaker than it was three weeks ago. The sentiment is general that loom and porcelain are due to follow, practically all St. Louis jobbers having big stocks of both. However, 15 per cent is the maximum decline expected on most articles, which compares very favorably with the cut of from 35 to 50

per cent that is now prevailing in the textile market here.

Stocks are in very good condition on most items and overstocks of others are accumulating because of cancellations and good deliveries from manufacturers. Retail demand is very light, and utilities and industries are coming very rapidly to the point where they are buying only for maintenance work and to finish installations started some time ago. Jobbers report that the buying even for maintenance work is closer than it was a year ago.

Stamped-Steel Boxes.—Stocks are spotty, some jobbers reporting them scarce and hard to get, others saying they have fair stocks and can get fair deliveries from manufacturers. The demand is good considering the supply, as there is still a fair amount of rewiring going in.

Rigid Conduit.—Stocks of ¾-in. black iron conduit show signs of improvement after being virtually off the market for several weeks. It is still hard to obtain, however, and the ½-in. size is extremely scarce. Larger sizes are easy, but the small galvanized conduit is short. Prices are steady at $80 per 1,000 ft. of ½-in. in lots of 5,000 ft. or more and $110 per 1,000 ft. of ¾-in. in lots of the same size. The 1-in. black is quoted at $148 per 1,000 ft.

Motors.—The motor situation shows very little change. Fractional-horsepower motors are plentiful with a slow demand. Large motors are fairly easy also, with normal deliveries. Sizes between 2 hp. and 20 hp. are harder to get. There is a strong demand being manifested for small industrial installations in the oil fields and in the rice-growing sections of the South.

Insulators.—Both 33,000-volt and 6,600-volt porcelain insulators remain scarce with a steady demand. Some jobbers report public utilities ordering ahead for extensions contemplated for next spring. Prices are stationary.

Washing Machines.—Some jobbers report better demand than others, but on the whole the last two months have seen a very slow business. Stocks are large but prices are remaining firm.

Conduit Fittings.—These are moving slowly and there are large stocks in jobbers' hands. Prices are steady.

Irons.—Stocks here are spotty, but jobbers can get immediate delivery from manufacturers to supply all their needs. Dealers report a fair demand.

Holiday Trade.—From present indications this will be considerably smaller than last year, unless there is an eleventh-hour rush by dealers to fill out their stocks. Some jobbers say that if the volume of holiday trade is 75 per cent of what it was last year they will be satisfied.

SALT LAKE CITY—DENVER

This week records little if any change in the status of the electrical trade. Neither dealers nor jobbers can see very far ahead with reassuring certainty. They are trying to play the game safely by meeting the demands as they arise and refraining from speculative plunging. Wholesale houses are trying hard to unload excessive stocks, while dealers seem to be risking losses on price advances rather than take on merchandise for which there is no demand in sight. Dealers that have been consistent and persistent advertisers are noting a steady increase in their volume of trade. A merchant typical of this class reports a 9 per cent increase in October over September. He admits, however, that vigorous selling methods are required.

Demonstrating in the homes of prospective buyers is proving an effective selling method and is being done very extensively by dealers. A liberal credit arrangement is often the clinching argument in the sale of such electrical utilities as vacuum cleaners and washers. A decided pick-up in trade is looked for at holiday time, and considerable preparation is being made accordingly. During the past month dealers have noted that the retail trade has fluctuated with the changing spells of fair and stormy weather. Sunny days bring the shoppers out, while storm has a very depressing effect on business. Many electrical workers are having to seek employment in various other fields on account of inactivity in all lines of building. Merchandise is abundant in all commercial lines, while electrical products required in building continue short.

SEATTLE—PORTLAND

Electrical supplies in the Seattle and Puget Sound territory are moving as well as could reasonably be expected. Stocks continue to improve in most lines, with the exception of motors, rigid conduit and porcelain. Construction work during the past week showed further decrease, although authorities insist that building prospects were never brighter. Material, with the exception of cement, is fairly plentiful, and the supply of building labor far exceeds the demand. The disorganization subsequent to the adoption of the open-shop policy by master builders apparently has passed.

Portland manufacturers report that while business is active, it is appreciably slower than it has been. Stocks there are not improving materially. A shipment of black iron conduit has been received which puts that line in excellent shape for a time. The sale of household appliances is showing further improvement as is also the lamp movement. Price adjustments due to the increased freight rates have practically all been made. These freight increases have in many instances been absorbed by the jobbers, in most cases on broken-package quantities, but in standard quantities in some cases a slight additional charge has been made. Washing machines have had a slight increase because of freight. On heating appliances, however, there has been no additional charge. The credit condition continues to be in bad shape. Contracting business in general is satisfactory, although some contractors have very little to do. Some dealers appear somewhat pessimistic, but in general those who hustle find all they can take care of.

Holiday Toys.—Seattle jobbers have not accumulated or ordered very large stocks, as the movement of toys in past years did not warrant the step.

Portable Lamps.—In expectation of a heavy holiday demand jobbers placed fairly large orders and these are beginning to arrive. Silk shades have been stocked more heavily than last year. Retailers' orders are just beginning to come in, and from indications sales will exceed those of former years.

Water Heaters.—These are selling better than was originally expected. Stocks are in good shape and replacements are coming through satisfactorily. Prices, contrary to expectations, have not advanced materially.

Electric Ironers.—Propaganda by jobbers and window demonstrations by dealers are stimulating sales. The field has not been much worked in this section, but the trade is beginning to realize the possibilities in this line. The price is all that is holding down the volume.

Schedule Material.—In spite of decreasing residence construction demand is fairly active for repair and extension work. Prices are steady and stocks are in fair condition.

SAN FRANCISCO

Light buying is the rule, and examination of jobbers' orders reveals the fact that unit packages and coil lots predominate. Early rains have encouraged the belief that this winter will be the long-awaited and hoped-for wet winter. An unusually hot spell has put the necessary finishing touches on the fall crops.

Rubber-Covered Wire.—The present price on No. 14 single-braid solid is $12 per 1,000 ft. in 5,000-ft. lots, in which most of the sales are made. Local stocks are excellent, not only in the standard house-wiring sizes but also in unusual strandings and braidings.

Vacuum Cleaners.—This is again the most popular household device, good sales being made through the practice of assigning active salesmen on each make to aid the dealer in his efforts. These flying circuses are accomplishing results now, although whether such a method of selling produces permanent effects is yet to be seen.

Lamps.—Stocks are good and factory deliveries prompt. The approach of shorter daylight periods has produced increased buying and accentuated the already keen competition for new and renewed contracts.

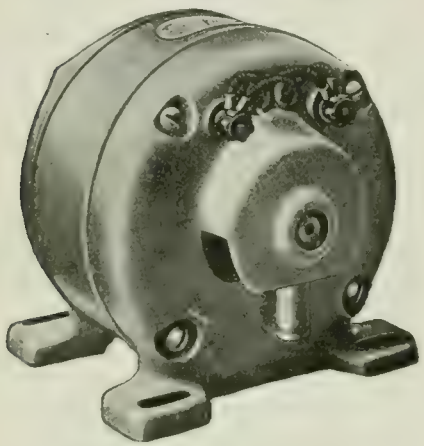
Reflectors.—Industrial lighting lines are depleted by the demand due to propaganda in support of better illumination.

New Apparatus & Appliances

A Record of Latest Developments
and Improvements in Manufacturers' Products
Used in the Electrical Field

Small Alternating-Current Motors

A line of "Twin-R" fractional-horsepower alternating-current motors for household and industrial applications

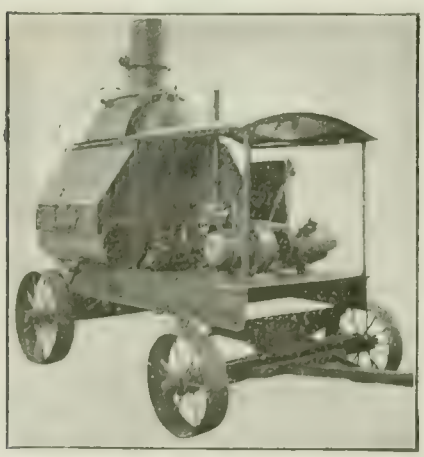


HAS SPLASHPROOF BEARINGS

has been put on the market by the American Radio & Research Corporation, Park Row Building, New York City. Production is concentrated for the present on ⅛-hp., ¼-hp. and ½-hp. sizes. They are wound for 110 volts or 220 volts.

Transportable Power Plant

A mobile power unit for driving small portable conveyors used in mining has been designed by the New York



COMPLETE GENERATING PLANT MAY BE HAULED AROUND

Engineering Company, 2 Rector Street, New York. This "Ludlum Dynamobile" consists of a Ludlum water-tube marine boiler, a steam turbo-generator unit, switchboard, boiler-feed pump, feed-water heater, condenser and, if desired, a superheater—all mounted on a steel frame carried on wheels. The outfit can be furnished for burning any kind of fuel. The combustion chamber is surrounded by the water-filled steam generating parts of the boiler. The sizes vary from 10 kw. to 200 kw.

Flat-Coil Dial Resistance Boxes

The dial decade resistance boxes recently brought out by the Pyrolectric Instrument Company, 636 East State Street, Trenton, N. J., are made up of ten flat coils arranged one above the other on a brass core which is held by two bakelite ends. These flat coils are impregnated with moisture-proof wax. The dials are made with a resistance which can be varied in ten steps. The total resistance is 1 ohm in the smallest size and 1,000 ohms in the largest. Units are made to contain from one to five dials in one case.

Magnetic Separator

A separator for removing iron from non-magnetic material is being manufactured by the Butte Electric & Manufacturing Company, 534 Folsom Street, San Francisco, Cal. The material is passed over an electrically magnetized drum on a conveyor belt, the non-magnetic material falling by gravity into a suitable receiver while the magnetic material is held against the belt until it leaves the drum, at which time it drops off and may be collected in another receiver. The drum comes regularly in sizes of 12 in. in diameter and from 14 in. to 24 in. in length.

Notes on Recent Appliances

Washing Machine

A washing machine has been placed on the market by the Vulcan Manufacturing Company, 1511 Cypress Street, Kansas City, Mo.

Cut-Out and Switch Box

A metal cabinet for inclosing cut-outs and switches has been placed on the market by the United Metal Box Company, 514 West Forty-sixth Street, New York City.

Flashlight

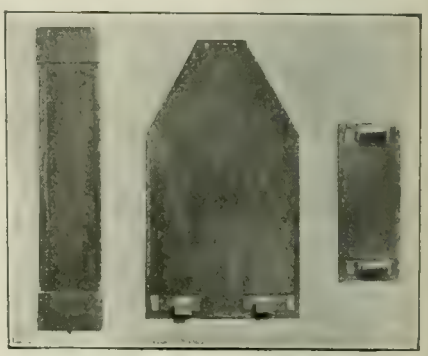
A flashlight with a luminous button has been placed on the market by the United States Electric Manufacturing Company, 300 West Thirty-seventh Street, New York City.

Extension Holds Cord Clear of Fixture

A switch extension for bringing the pendent switch or the pull switch clear of the lighting fixture has just been developed by the St. Louis Brass Manufacturing Company, St. Louis, Mo. The extension is in the form of an arm, made of steel, zinc-plated and rust-proof, to be attached to the junction box or screwed to the ceiling.

Heating Units for Irons, Radiators, Etc.

Heating units for use in radiators, flatirons, water vessels, etc., have been developed by the Prometheus Electric Company, 511 West Forty-second

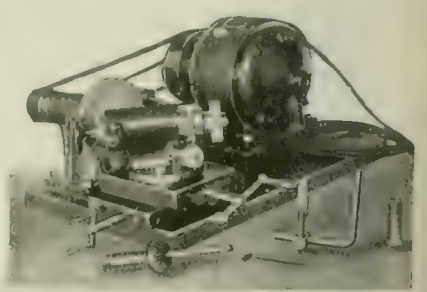


HEATING UNITS FOR APPLIANCES

Street, New York City. These units are made by a process of coating mica, producing a flat surface the entire area of which gives off heat. The units illustrated herewith are a standard radiator unit of 500 watts capacity, a 5-lb. flatiron unit rated 350 watts and a water vessel unit rated 150 watts.

Electrically Driven Automatic Valve Grinder

An electrically driven valve grinder with attachment for grinding a reseating tool has recently been introduced to the automobile trade by the Franklin Machine Tool Company, Springfield, Ohio. There are three units to the machine, the ¼-hp. Westinghouse driving motor, the grindstone and the valve



BOTH VALVE AND GRIND WHEEL TURN

holder, which also has an attachment for holding the reseating tool. The grindstone and valve holder are attached by belt drives to motor and valve lip and stone turn against each other.

MANUFACTURERS' ACTIVITIES

Record of Changes Affecting Sales and Distribution Together with Trade Personals and Notes on Foreign Trade, Jobbers' News and New Trade Literature

THE WADSWORTH ELECTRIC COMPANY, Covington, Ky., has just completed its plans for recapitalization from $150,000 to $500,000.

CHARLES F. NORTON has returned to the Howell Electric Motors Company, Howell, Mich., as general manager under the enlarged program of expansion. Mr. Norton was Cleveland manager of the ELECTRICAL WORLD. Mr. Norton was one of the founders of the Howell company, going from that company to the ELECTRICAL WORLD staff in 1919.

GENERAL ELECTRIC COMPANY OFFERS STOCK TO EMPLOYEES.—Under authority conferred by its shareholders at a recent meeting, the General Electric Company offers to its employees the privilege of subscribing for one to ten shares of its capital stock at the price of $136 per share. There will be a credit, amounting to $20 per share, against the subscription price, which will represent a net return substantially the same as that which would be enjoyed by any one purchasing stock on an installment plan, paying interest on deferred installments and receiving cash and stock dividends. Certificates of stock will be issued to the subscribers only when payments, including any other credits, amounting to $116 per share shall have been made. If the number of shares subscribed for shall exceed the number of shares available for subscription, the company reserves the right to reduce any or all subscriptions in excess of one share. Payments will be made by deductions from salary or wages in twenty-nine monthly installments of $4 for each share subscribed for or in 116 weekly installments of $1 for each share subscribed for. A subscriber may withdraw from his subscription agreement any time prior to his decision to make final payment and take his stock certificate. In case of withdrawal the total amount paid by him by deductions from salary or wages, plus interest at the rate of 7 per cent per annum, will be refunded. The same procedure will be followed where a subscriber ceases to be an employee before his payments are completed.

FRANKLIN P. WILDS has severed his connection with the Irvington Varnish & Insulation Company to become vice-president of the Standard Insulator Company, Rutherford, N. J., manufacturers of varnished combric, oiled paper, oiled silk and various kinds of varnished treated tapes. Mr. Wilds was formerly with the Mica Insulator Company, the Linonite Company and the Keene Mica Products Company, and for the past ten years has been with the Irvington Varnish & Insulator Company.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY has announced that negotiations are being closed for the purchase of the plant and property of the Independent Lamp & Wire Company at Rochester, Pa. Although this plant was formerly used for the manufacture of glassware, the Westinghouse company plans to utilize it for the production of micarta materials of all kinds, as well as repair parts for electrical machinery. This plant has a total floor space of upward of 130,000 sq.ft.

R. H. RICE DENIES WAGE CUT IS PLANNED.—Neither wage cutting nor a general lay-off is considered by the Lynn works of the General Electric Company, declared R. H. Rice, manager of the plant, at a meeting of employees' representatives last week. About 200 were in attendance at a supper, which was followed by a talk on production by J. M. Davis, production manager of the Lynn factory, and Mr. Rice's address on the business outlook. The latter pointed out that business is decreasing, but that a large volume of orders still remains on the company's books. He appealed to the employees to give reasonable service in the delivery of these orders, thus enabling the plant to "carry on" until the tide of business returns. Mr. Rice said that if orders are neglected and deliveries lengthened unduly, orders will be canceled and the good will of customers lost. For months the plant has been working on parts of equipment which cannot be immediately applied to shipments and the time has come to call a halt on such work. Manager Rice said that while some employees would have to be laid off, the number will be made as small as possible and the time cut as short as possible. He vigorously denied that the plant would be shut down longer than necessary to take the regular November inventory.

HEATER CORD STANDARDS.—Pages for the Underwriters' Laboratories' code for electrical appliances giving the new standard for heater cord were distributed very recently. This standard was recently adopted by the industry-conference for rubber-covered wires and cables and by the laboratories' electrical council, and it supersedes all instructions previously issued on this subject.

J. L. LONG has secured from L. M. Grant and others a controlling interest in the Continental Pipe Manufacturing Company, manufacturer of wooden flumes, Seattle, Wash. Mr. Grant is no longer with the company.

THE PIERCE FUSE CORPORATION OF BUFFALO, N. Y., announces the appointment of Emory M. Coffin as sales manager, succeeding P. S. Klees.

THE KENTUCKY ELECTRIC LAMP COMPANY, Owensboro, Ky., has purchased the license, machinery and good will of the Davis Tungsten Lamp Company, Weehawken, N. J., making possible a great increase in the production of tungsten lamps. The affairs are in charge of Roy Burlew, formerly sales manager of the Novelty Incandescent Lamp Company, and the factory is under the supervision of M. E. Pierson, formerly superintendent of the Novelty company. Joseph Kay, of Emporia, Pa., is president, and A. Brady, of Emporia, is treasurer. The sales offices and factory will continue at Owensboro, Ky.

THE J. B. ENGINEERING SALES COMPANY has been appointed Connecticut sales agent of the Conveyors' Corporation of America, formerly the American Steam Conveyor Corporation. Offices are at 60 Prospect Street, Hartford, Conn. This company is owned by John Breslau, formerly sales engineer, manager of publicity and production manager of the Terry Steam Turbine Company. The J. B. Engineering Sales Company is sales agent for the Griscom Russell Company and the Terry Steam Turbine Company in Connecticut.

THE YOUNGSTOWN SHEET & TUBE COMPANY has just put in operation a plan whereby employees may subscribe for stock, to be paid for in installments, at fifteen points less than the market. The plan further provides for permanency of employment by giving the employee who keeps his stock a bonus of $5 per share for five years after the stock has been paid up.

THE EDISON LAMP WORKS of the General Electric Company announces that permanent installations of the industrial lighting exhibit are being arranged in the larger industrial centers. A series of portable exhibits, plans for which will be announced later, will take care of those sections not reached by the permanent installations.

E. C. STOCKDALE has returned to the Page & Hill Company as general sales-manager, with present headquarters at 19 South LaSalle Street, Chicago. For the past two and a half years he has served in the army in one branch and another and rose to the rank of lieutenant colonel. Colonel Stockdale, prior to entering the pole industry in 1914, was purchasing agent with Stone & Webster in the construction of the plants of the Mississippi River Power Company at Keokuk, Ia., and the Minneapolis General Electric Company. He opened up the Chicago office of the Page & Hill Company Jan. 1, 1914, and remained there in charge until he entered the service in May, 1917.

THE VAN DORN ELECTRIC TOOL COMPANY, Cleveland, Ohio, is marketing in Ohio a new issue of 8 per cent cumulative preferred stock. This company, which makes portable electrically driven tools, was organized in 1913 to take over the tool-making department of the Van Dorn & Dutton Company. Its sales for the last four years ended June 30 have been: 1917, $445,997; 1918, $714,705; 1919, $1,031,513; 1920, $1,190,815.

THE BENJAMIN ELECTRIC MANUFACTURING COMPANY Canadian and American representatives held a meeting recently at Niagara Falls, Ontario, to discuss and draw up 1921 sales plans. Changes in and addition to the Benjamin products were suggested.

NEW METHOD OF PACKING MINIATURE LAMPS EFFECTS ECONOMY IN SPACE AND COST.—Following a great deal of experimental work, the Edison Lamp Works of General Electric Company announce a new method of packing Edison miniature "Mazda" lamps that is said to be a great improvement over the old. The system is similar to the method of packing large tungsten lamps adopted by the company in the recent past. The principal advantages claimed for the new method are a saving of about 40 per cent in weight and 60 per cent in space, the elimination of excelsior, reduction of breakage in handling and greater ease in making up an assortment of miniature lamps. Under the old method of packing there were five lamps to a carton, and each lamp was placed in a "Climax" wrapper and the cartons packed with excelsior in an outer container. The wrapper enabled the lamp to fall out and gave no protection to the end of the bulb. Hence an individual lamp carton was used on each lamp, but these did not give sufficient cushioning effect to prevent breakage. The difficulty was solved by the development of a wrapper consisting of a strip of corrugated paper to which was fastened a piece of smooth paper. The lamp is rolled up in the wrapper and the ends of the smooth paper twisted to hold the lamp in place. The twisted ends incidentally protect the tip of the bulb and the wrapper thus gives reasonable protection from breakage, it is stated. To find a paper tough enough not to tear and yet fine enough to allow printing on it offered some difficulty, but these wrappers are now being made by an automatic machine which turns out 80,000 per day. Tests to determine the efficiency of the new wrappers in preventing breakage have shown excellent results. Handling, which resulted in about 4 per cent breakage with the old-style packing, showed no lamps broken with the new. As an example of the saving in space and weight that is also effected, a representative size with the old excelsior packing weighs 7 lb. and takes up 2,362 cu.in. of space in a 100-lamp box, while the new system of packing for the same lamp and in the same quantity shows a weight of 6 lb. and only 960 cu.in. of space. These factors are expected to mean considerable economies in the cost of shipping and stock space required. The shortage of paper is having its effect on the supply of cartons available, and recently, it is said, rather than hold up orders the company shipped some types of lamps in odd-sized outer boxes.

GENERAL ELECTRIC BILLING AT $267,000,000 RATE.—The General Electric Company's billings for the first nine months of this year amounted to approximately $200,000,000, it is reported. At this rate billings at the end of the year would amount to about $267,000,000, compared with $229,900,000 last year. Total bookings for the nine months were between $255,000,000 and $260,000,000, or at an annual rate of about $345,000,000. Incoming orders have thus been greater than shipments by at least $55,000,000. At the first of the year the company had unfilled orders on its books amounting to $98,880,000.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A commercial agent in Serbia (No. 33,965) [illegible]

for the Balkans and later to open branches in Zagreb, Sofia, Bucharest and Piraeus, and maintain industrial exhibits and a warehouse for the promotion of the sale of American products, including electric motors and accessories.

A commercial representative in Australia No. 33,966) desires to purchase or secure an agency for the sale of electrical household devices. Quotations should be given f. o. b. New York, San Francisco or Vancouver. Payment to be cash against documents on arrival of shipment.

Trade Publications

PUMP CONTROL APPARATUS.—The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has issued its publication No. 860, covering control apparatus for pumps, compressors and similar service.

ELECTRIC HOISTS.—The Sprague Electric Works of the General Electric Company, 627 West Thirty-fourth Street, New York, has issued bulletin No. 48,961, covering floor-controlled electric hoists.

WELDING AND CUTTING APPARATUS.—The Bastian-Blessing Company, West Austin Avenue, Chicago, has issued catalog No. 20, covering "Rego" welding and cutting apparatus.

STOKERS.—The Illinois Stoker Company, Alton, Ill., has issued an illustrated fifty-page catalog and data book covering Illinois stokers for use with either natural or forced draft.

METERING TRANSFORMERS. — The Packard Electric Company, Warren, Ohio, has issued a sixteen-page illustrated bulletin, No. 208, on "Metering Transformers," describing the weatherproof and switchboard types of the single-phase, two-phase and three-phase potential and current transformers.

WIRE AND CABLE.—The Habirshaw Electric Cable Company, Yonkers, N. Y., has printed a manual of wires and cables giving in readily accessible handbook form information or names, types and description of wires and cables on the manufacture of rubber-covered wire and on the wiring of buildings.

COMMUTATOR STONES.—The Martindale Electric Company, Cleveland, Ohio, has issued a folder which describes and prices its "Handy" natural stones and also the new "Imperial" artificial stones which have just been placed on the market for grinding commutators.

New Incorporations

THE ELECTRIC SUPPLY COMPANY, Mercedes, Tex., has been incorporated with a capital stock of $10,000 to deal in electrical supplies. J. H. Jacobson and others are the incorporators.

THE SAFETY FUSE HANDLE COMPANY, Richmond Hill, N. Y., has been incorporated with a capital stock of $16,000 to manufacture electrical apparatus. G. R. Cohen, S. Green and E. V. Glucke, all of Richmond Hill, are the incorporators.

THE A. J. DEER COMPANY has been incorporated in Delaware by A. J. Deer, L. G. Robbins and C. M. Nevins to manufacture electric coffee mills, roasting machines, etc.

THE JEFFERSON POWER COMPANY of Watertown, N. Y., has been incorporated with a capital of $50,000 by D. M. Anderson, D. C., Middletown and E. E. Martin.

THE HANNITE COMPANY, of Columbus, Ohio, has been chartered with a capital stock of $10,000 to hold patents on and sell the rights to manufacture a new electrical insulator which will go under the name of "Hannite" patents on which are now pending with the Patent Office at Washington. The incorporators are T. L. Hanson, R. G. Martin, D. N. Postlewaite, E. Hauck and H. H. Orr.

THE MIDDLEFIELD ELECTRIC LIGHT COMPANY, Middlefield, Ohio, has been chartered with a capital stock of $10,000 to manufacture and sell electrical energy for lighting and power. The incorporators are J. E. Johnson, H. C. Johnson, Hattie S. Johnson, S. M. Johnson and Viola Johnson.

THE WEST LEBANON ELECTRIC LIGHT & POWER COMPANY of Ohio is a new central-station company which has been incorporated with a capital stock of $35,000 by Drs. George and John Snively, Jacob Minser, Elva E. Budd and Elmer Hofacre.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

FRANKLIN, N. H.—The Laconia Gas & Electric Company, Laconia, is considering the development of water power at Profile Falls on the Smith River, north of Hill Village, and bringing electric power to Laconia to supply the need of additional electric energy in Franklin.

FALL RIVER, MASS.—The Fall River Electric Company has voted to petition the Public Utilities Commission for permission to increase its capital stock to $2,850,000 by issuing 7,000 shares at $100 par, the proceeds to be used for new and proposed construction.

Middle Atlantic States

WHITEHALL, N. Y. — The Champlain Silk Mills contemplates the installation of a 300-kw. generator and a 400-hp. waterwheel.

SOUTH ORANGE, N. J.—The Board of Trade has decided to start a movement for the installation of an electric street-lighting system. Raymond Connolly is a member of the civic committee in charge.

RISING SUN, MD. — Citizens of this place have subscribed to $25,000 bonds for a new electric light plant.

WASHINGTON, D. C.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., contemplates the installation of a turbo-generator and switchboard equipment at Bellevue. Also the erection of radio compass buildings at the following places: Cape May, N. J., Cape Hatteras, Cape Lookout, Poyner's Hill, N. C., Hog Island and Virginia Beach, Va.

WASHINGTON, D. C.—Applications for preliminary permits or licenses under the water-power act have been filed with the Federal Power Commission as follows: Alaska Endicott Mining & Milling Company, care of John B. Marshall, Juneau, Alaska; William Park Mills, care of P. S. Brown, 697 Montana Building, Missoula, Mont.; Spirit Lake Railway & Power Company 110 East Twelfth Street, Vancouver, Wash.; Wenatchee Commercial Club, Wenatchee, Wash.; United Mills Company, Hickory, N. C.; Rock Creek Power Company, Missoula, Mont., and H. H. Wadsworth, Holbrook building, San Francisco, Cal.

North Central States

LAKEVIEW, MICH. — A committee of business men of Lakeview has appointed Oliver Edgar, construction engineer, to prepare estimates for a power plant.

CLEVELAND, OHIO.—The Chesterland Light & Power Company, recently incorporated, contemplates furnishing light and power to the residents along Mayfield Road from Scotland to Hunkburg, a distance of about 14 miles. W. W. Davies, National City Building, is in charge.

EAST YOUNGSTOWN, OHIO.—The city officials are considering the submission of an issue of $15,000 in bonds to the voters, for the installation of a police signal and call system. Anthony Julius is clerk.

PIQUA, OHIO.—The County Commissioners have granted a twenty-year franchise for a transmission line through Newberry, Newton and Union to the plant of the Buckeye Power Company, Covington.

CHICAGO, ILL. — Contract will soon be awarded by the Commonwealth Edison Company, 72 West Adams Street, for the erection of a power plant on 100th Street at Commercial Avenue, to develop 200,000 kw., at a cost of about $5,000,000. Marshall & Fox, 721 North Michigan Avenue, are architects.

ALBANY, WIS.—Bids will be received by W. G. Kirchoffer, engineer, 31 Vroman Block, Madison, until Nov. 12, for furnishing and setting one centrifugal pump, with capacity of 160 gal. per minute against a 165-ft. head, motor and controlling apparatus for the water-works plant.

VERONA, WIS.—The Verona Light & Power Company contemplates the purchase of transformers in connection with the transmission line to be erected at a cost of about $15,000. F. M. Conlee, Washington Building, Madison, is engineer.

WEST BEND, WIS.—Plans are under way by the Federal Engineering Company, Stephenson Building, Milwaukee, for the erection of a boiler and power house on Main Street for the West Bend Aluminum Company, to cost about $75,000.

HAMILTON, KAN.—Estimates are being prepared by J. H. Johnson, engineer of the state inspection department, for a new light plant at this place.

LIBERAL, KAN.—The City Council will receive bids until Nov. 9 for two centrifugal pumps for 365-ft. head, direct-connected to 75-hp. motors, etc. The cost is estimated at $98,000. Ruckel Engineering Company, Hutchinson, is engineer.

MONTEZUMA, KAN. — Bonds to the amount of $8,000 have been voted for the erection of an electric light plant. The issue of additional bonds to the amount of $15,500 will be submitted to the voters.

Southern States

FORT MYERS, FLA.—Peter Schutt and associates, Bradford Hotel, will receive bids early in December for the erection of a hotel to cost between $400,000 and $500,000. The installation of a small electric plant is under consideration. F. J. Kennard, American Bank Building, Tampa, is architect.

MARTIN, TENN.—Bonds to the amount of $150,000 have been voted for the erection of electric light and water plants.

PASCAGOULA, MISS. — Bonds to the amount of $25,000 have been voted for the installation of electric light and water systems in this city.

Pacific and Mountain States

CHEWELAH, WASH.—An ordinance has been passed granting the Stevens County Power & Light Company, Colville, the authority to erect and maintain all appliances necessary for the transmission of electrical energy to this place.

BAKER, ORE.—The Eastern Oregon Light & Power Company contemplates the extension of its service to the White Swan Mines.

KLAMATH FALLS, ORE.—The California-Oregon Power Company plans to increase the capacity of its Prospect plant on Rouge River from 4,700 kw. to 20,000 kw.

PORTLAND, ORE.—The Portland Railway, Light & Power Company contemplates the construction of a $4,000 temporary substation to take the place of its Northern Hill station, destroyed by fire; a permanent structure to cost about $35,000 will be erected at a later date. Fire at the Cazadero hydro-electric plant also destroyed two generators and other equipment amounting to $6,000.

WALLOWA, ORE. — The Nibley-Minnaygh Lumber Company has applied to the state engineer for permission to divert 300 sec.-ft. of water from the Wallowa River for generating electric power for lighting plant, sawmill, etc. The cost is estimated at about $15,000.

EL CENTRO, CAL.—The plant of the Holton Power Company is to be overhauled and placed in first-class condition.

LOS ANGELES, CAL.—The Los Angeles Railway Corporation, Sixth and Main Streets, contemplates improvements, including the erection of three substations to cost about $500,000 and the renewal of overhead equipment about $300,000. G. J. Kuhrts is general manager.

LOS ANGELES, CAL.—J. Harvey Pierce has applied to the State Railroad Commission for permission to divert 10 sec.-ft. of water from streams in Mono County for the development of 595 hp.

PASADENA, CAL. — The Chamber of Commerce is circulating a petition for the installation of an ornamental street-lighting system along West Central Avenue.

RIVERSIDE, CAL.—The Southern Sierras Power Company contemplates the development of 5,793 hp. in San Bernardino

County, by diversions from several creeks. The cost is estimated at $500,000, including conduit, dam and wasteway.

SAN DIEGO, CAL.—The San Diego Consolidated Gas & Electric Company contemplates the diversion of water from the west fork of the San Luis Rey River for the development of 775 hp. The cost, including a 3½-mile conduit and dam, is estimated at $235,000.

SONORA, CAL.—Application has been filed with the Recorder of Tulomne County by Frank B. Pattee of Oakdale and Samuel Bernhard of San Francisco for utilization of part of the natural flow of the Stanislaus River for the development of 9,600 hp. Plans include the erection of a power plant and dam. Estimated cost about $2,000,000.

SALT LAKE CITY, UTAH.—The City Commission has instructed the city recorder to advertise for bids for extensions to the ornamental street-lighting system.

DOUGLAS, ARIZ. — City Engineer Bane has estimated $5,200 as cost for the proposed ornamental lighting system on lower G Avenue.

PRESCOTT, ARIZ.—The Prescott Gas & Electric Company contemplates extension to its electric distribution system at a cost of about $34,000. Plans include transformers, meters, etc.

Canada

STAVE FALLS, B. C.—It is reported that the Western Canada Power Company has plans under way for raising the level of the storage dam at this place which will allow for the installation of a 13,000-hp. electrical unit at the company's power house, to cost about $200,000.

CARMAN, MAN.—The ratepayers of this place voted on extending the hydro-electric power line to Carman.

WINNIPEG, MAN.—The Winnipeg Electric Company contemplates an issue of preferred stock for expenditure on the plant and for the completion of certain extensions.

GRAND FALLS, N. B.—The International Paper Company, Three Rivers, Que., contemplates the development of water power at this place.

MONTREAL, QUE.—The Riordan Pulp & Paper Company of Montreal contemplates the development of 250,000 hp. on the Quince River.

Miscellaneous

MORWELL, AUSTRALIA.—Bids will be received by the secretary, Electricity Commissioners, State of Victoria, 673 Bourke Street, Melbourne, Australia, until Feb. 24, 1921, for the erection of a generating and transmission plant at Morwell, to develop an initial capacity of 50,000 kw. and a maximum of 150,000 kw. Plans also include the erection of a 90-mile transmission line from Morwell to Melbourne, consisting, in the first stage, of one line of towers with two three-phase circuits, each having a capacity of 25,000 kw. Electrical installation equipment for Melbourne is listed as follows:

Specification No. 32 — Three 25,000-kw. turbo-alternator sets complete with condensing plant, pumps and all necessary accessories; generators to be wound for 11,000 volt, three-phase, 50-cycle, 1,500 r.p.m. As an alternative 12,500-kw. sets will be considered at 3,000 r.p.m. In the same specification one 600-kw., 400-volt, three-phase, 50-cycle, 3,000 r.p.m. turbo-alternator is called for.

Specification No. 33.—Transformers and switchgear for controlling the above generators and also two high-tension lines. The transformers are to be of the single-phase, water-cooled outdoor type, 9,260 kva., each stepping up the voltage from 11,000 to 132,000, connected delta-star neutral permanently earthed, all the switchgear to be of the outdoor type, and the necessary control panels, conduits, control cable and galvanized steel work as called for in this specification.

Specification No. 34. — Seven hundred miles of 37/14 S. W. G. wire (area 0.182 sq.in.). Or Specification No. 37.—Seven hundred miles of aluminum steel reinforced cable (alternative).

Specification No. 35.—Eight hundred and fifty suspension and one hundred strain towers, normal span, 700 ft. Or Specification No. 38.—Five hundred and fifty suspension and seventy-five strain towers, normal span 1,056 ft. (alternative).

Specification No. 36.—Fifty thousand suspension units to be made up into strings of seven and eight, suitable for 132,000 volts (for copper cable line). Or Specification No. 39.—Forty-five thousand suspension units to be made up into strings of seven and eight (for aluminum cable). (Alternative.)

Specification No. 40.—One hundred and twenty-five miles ⅜-in. double galvanized steel cable.

Specification No. 41—Complete installation of terminal station in which is included: Two 15,000-kva. synchronous condensers; two banks of 30,000-kva. water-cooled transformers, 120,000 to 22,000 volts, connected delta-star neutral point earthed through a resistance; one 12,000-kw. frequency changer, 22,000 volts, 50-cycle, 20,000 volts, 50-cycle; two banks of 6,000-kva. water-cooled transformers, 22,000 volts to 6,600 volts; necessary 120,000-volt to 22,000-volt, 6,600-volt outdoor type switchgear; also control panels, cables, conduits, control wiring and all steel work.

Specification No. 42.—Complete installation of three substations, in which are included banks of 3,000-kva. and 6,000-kva. transformers, outgoing and incoming overhead and underground feeders. All this equipment will be of the indoor type.

Specification No. 43.—Two thousand steel telephone poles, approximately 35 ft. high, to carry two telephone lines and one 22,000-volt feeder line between Morwell and Melbourne.

Specification No. 44.—Complete installation of telephone apparatus at the power house, terminal station and along the route of the transmission line. At the power station and the terminal station there will be in each a C. B. board, suitable for thirty lines, to be extended at a later date to 100 lines; also all necessary high-tension telephone apparatus suitable for a telephone line operating in the vicinity of the 132,000-volt transmission line.

The total cost of this project is estimated at $15,000,000. A number of bid forms and specifications have been forwarded to the Commercial Intelligence Branch of the Department of Trade and Commerce, Ottawa, Ontario. Copies of the specifications may also be seen at the offices of the Canadian Manufacturers' Association, 42 St. Sacrament, Montreal, and at Traders' Bank Building, Toronto.

Record of Electrical Patents

Notes on United States Patents

(Issued Oct. 26, 1920)

14,966 (reissue). MACHINE FOR MARKING SHOE UPPERS; Arthur W. Brice and Irving E. Booth, Rochester, N. Y. App. filed April 19, 1916.

14,967 (reissue). SYSTEM FOR THE TRANSMISSION OF INTELLIGENCE; Raymond A. Heising, East Orange, N. J. App. filed Oct. 9, 1915.

1,356,546. CIPHERING SYSTEM; Lyman F. Morehouse, Montclair, N. J. App. filed Dec. 4, 1918. Applicable to printing telegraph.

1,356,592. TELEGRAPH SYSTEM; John H. Bell, South Orange, N. J. App. filed Nov. 22, 1917. Duplex.

1,356,598. AUTOMATIC ALARM VALVE; Edmund A. Cahill, Kansas City, Mo. App. filed May 9, 1917. Warns that water valve is open.

1,356,603. TROLLEY-WIRE GUARD; Emard A. Croston and Kamimier Chrobak, Rosemont, W. Va. App. filed June 11, 1920. To safeguard miners.

1,356,611. CUT-OUT PLUG; John W. Egan, Toronto, Ontario, Canada. App. filed Oct. 15, 1919. For toasters, irons, etc.

1,356,617. ELECTRICAL RESISTANCE ELEMENT; Frederick M. Goddard, Brooklyn, N. Y. App. filed March 12, 1920. Crystal type.

1,356,622. SWITCHBOARD; Alexander M. Habrich, Chicago, Ill. App. filed Aug. 13, 1917. Telephone.

1,356,626. SELECTIVE SIGNALING SYSTEM; John A. Hulit, Chicago, Ill. App. filed March 16, 1912. Telephone.

1,356,634. RHEOSTAT FOR TELEPHONIC INSTRUMENTS; Henry Koch, Jamaica, N. Y. App. filed Oct. 20, 1919. For deaf persons.

1,356,639. TELEPHONE-EXCHANGE SYSTEM; Alben E. Lundell, New York, N. Y. App. filed Nov. 14, 1916. For ringing.

1,356,643. TELEPHONE SYSTEM; James L. McQuarrie, Montclair, N. J. App. filed Dec. 27, 1918. Ringing.

1,356,654. MEASURED-SERVICE TELEPHONE SYSTEM; William W. Owen, Elgin, Ill. App. filed May 7, 1917. Subscriber's meter.

1,356,655. MEASURED-SERVICE TELEPHONE SYSTEM; William W. Owen, Elgin, Ill. App. filed July 30, 1917. Subscriber's meter.

1,356,686. MEANS AND METHOD FOR SECRET SIGNALING; Harold D. Arnold, East Orange, N. J. App. filed Dec. 30, 1916. By apparently steady light beams.

1,356,701. SECRET TELEGRAPHIC SYSTEM; Augustus J. Eaves, New York, N. Y. App. filed June 24, 1918. Prevents interception.

1,356,704. TELEPHONE-EXCHANGE SYSTEM; Clarence B. Fowler, New York, N. Y. App. filed Jan. 27, 1919. Manual connected to automatic.

1,356,720. LIGHTNING ARRESTER AND MOUNTING; Ernest H. Jacobs, Chicago, Ill. App. filed June 17, 1918. Gap in line with circuit and choke coil at right angles.

1,356,751. RADIO-SIGNALING APPARATUS; Roy A. Weagant, New York, N. Y. App. filed July 12, 1918. Eliminates static effects.

1,356,752. RADIO-SIGNALING APPARATUS; Roy A. Weagant, New York, N. Y. App. filed July 12, 1918. Static disturbances balanced out.

1,356,753. STORAGE-BATTERY-CHARGING SYSTEM; Edward F. Andrews, Chicago, Ill. App. filed Jan. 8, 1917. Prevents overcharge.

1,356,763. OSCILLATION GENERATOR; Ralph V. L. Hartley, New York, N. Y. App. filed June 1, 1915. Radio.

1,356,767. APPARATUS FOR AND METHOD OF TRANSMITTING PHOTOGRAPHS AND OTHER PICTURES TELEGRAPHICALLY; James E. Homans, New York, N. Y. App. filed June 4, 1915. Over ordinary service lines.

1,356,818. HEATING APPARATUS; William S. Hadaway, Jr., New Rochelle, N. Y. App. filed July 11, 1917. For heating vapor.

1,356,846. HUMIDIFIER; Daniel H. Young, Manchester, Iowa. App. filed Feb. 10, 1919. Electrical heating.

1,356,881. ELECTRIC HOT-WATER HEATER; Richard P. Osgood, Windsor, Vt. App. filed June 24, 1920.

1,356,933. INDUCTION MOTOR; Campbell MacMillan, Schenectady, N. Y. App. filed May 31, 1917. Multispeed.

1,356,934. MULTISPEED INDUCTION MOTOR; Campbell MacMillan, Schenectady, N. Y. App. filed May 31, 1917. Simplified connections.

1,356,935. MULTISPEED INDUCTION MOTOR; Campbell MacMillan, Schenectady, N. Y. App. filed May 31, 1917. Simple connections.

1,356,936. INDUCTION MOTOR; Campbell MacMillan, Schenectady, N. Y. App. filed May 31, 1917. Means for increasing torque.

1,356,965. ELECTROTHERMAL BLANKET; Phyllis E. Charles, Victorville, Cal. App. filed June 15, 1918. Surgical.

1,356,975. MAGNETO; René G. L. Dusuzeau, Billancourt, France. App. filed April 24, 1917. Rotating inductor.

1,356,977. ELECTRIC CELL; Charles Fery, Paris, France. App. filed Feb. 19, 1918. No local action.

1,357,008. MAGNETO; John R. Stark, Racine, Wis. App. filed Dec. 8, 1917. Movable inductor.

1,357,016. COMMUTATOR CONNECTOR; Thomas Zimmerman, Cleveland, Ohio. App. filed Nov. 12, 1915. Connects leads to bars.

1,357,019. ELECTRICALLY HEATED WATER SERVICE AND SYSTEM; George Alexander Northcote, and James J. Rafferty, Hawthorn, Victoria, Australia. App. filed Sept. 26, 1918. Hot water at short notice.

1,357,080. BRAZING MACHINE; Robert J. Peck, Key West, Fla. App. filed March 26, 1920. To braze ends of strips of metal.

1,357,126. ELECTRIC CELL FOR MINERS' LAMPS AND FOR SIMILAR PURPOSES; Theodore Stretton, Cardiff, Wales. App. filed Aug. 11, 1919.

1,357,142. RECTIFIER; George N. Blanchard, San Francisco, Cal. App. filed July 28, 1919. Employs interrupted jet of mercury.

1,357,156. METHOD OF WELDING CHAIN LINKS; Claes W. Hedin and Erland A. Ljustin, Sweden. App. filed March 17, 1920. No [illegible]

Directory of Electrical Associations

Printed in the First Issue of Each Month

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co.

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The Election and the Political Outlook

ELECTION day has come and gone, and as a result of the Republican landslide it is reasonable to assume that official Washington will hereafter shrink within the confines of the District of Columbia. The change of administration may mean much or may mean little to the country. Certain it is that miracles cannot be performed by merely changing parties, nor can the country's enormous debts be liquidated by resolutions or wishes. The whole world is steeped in debt, filled with unrest and is lacking in materials and comforts. Nothing short of increased production can save it, and if the new administration will take steps to insure greater productivity and efficiency by unfettering business and stimulating labor, peace and prosperity will in fact ensue. Our foreign trade will depend in part on the needs of the outside world and its ability to pay, and in part on our political and civic relationship to it.

Will Illinois Utilities Become a Political Football?

IF THE campaign arguments of Len Small, the newly elected Governor of Illinois, are to be taken at face value, the utilities of that state will soon be without a regulating commission. It must be remembered, however, that the victory was won as part of a tremendous national landslide, and that it is the Legislature and not the Governor that makes or unmakes laws. Hence the apparent indorsement of the proposal to abolish the commission may not be so strong as it would otherwise seem. At any rate, it is to be sincerely hoped that a controversy which has developed largely from the street-railway situation in Chicago will not result in making a political football of the utilities of the entire state. The principle of regulation is too well established to be thus ruthlessly cast aside.

Moral Obliquity in Business

WIDESPREAD cancellation of contracts indicates a diseased condition of business morals which will sooner or later be reflected in litigation in the courts. Certainly no community or business can exist and prosper where contractual engagements carry no binding obligations. One great fault found with labor is that it will not live up to its agreements and will strike on the least provocation. It is generally assumed that general business is not tainted with such practices. However, recent events indicate that in some sections contracts, like labor agreements, are mere scraps of paper. Without regard to the financial loss entailed upon the manufacturer or to the salability of the goods, cancellations of contracts are being made with impunity. Of course, legal covenants can be enforced, but in many instances manufacturers may deem it wiser as a matter of policy to wink at the infractions. This, however, only makes matters worse and eventually leads to business chaos. There must be a greater recognition of the integrity of contracts. In the opinion of Roger W. Babson, the statistician, the prevailing moral obliquity is amenable only to religion. He contends that the religion of communities is really the bulwark of business and that the value of investments depends not upon the strength of banks but rather upon the strength of churches.

The Stage Is Set for Action

THE stage is set. Next Thursday the Engineering Council of the Federated American Engineering Societies meets in Washington for the first time. Sixty thousand engineers will be represented. We urge those who attend the meeting to spend their time in an honest effort to secure a broad and fundamental program of endeavor for the federation and not to lock horns or waste precious time in argument on small detail. For years the engineers of this country have talked of such an organization. The action taken next week will demonstrate their ability to work together for a common cause.

Educating the Security Holder

AT PRESENT the securities of most electric light and power companies are very attractive. The prices are low and the yield is high, and as the cost of commodities decreases the value of the securities will naturally be enhanced because of the greater purchasing power of the dollar. To enable all electric light and power companies to bring this situation forcibly to the attention of security holders, publicists and men of standing in the various communities, the National Electric Light Association has issued a series of booklets dealing with the subject in an authoritative and convincing way. While the booklets are chiefly of financial interest, they also have a public policy angle which must not be lost sight of. Needless to say, every public utility manager will want a plentiful supply of the booklets for local distribution. The necessity of continued expansion of utility service and of improving the credit of the companies is obvious to those in touch with conditions, and for the purpose of spreading this information the booklets are excellent. However, to be efficacious they must be placed in the hands of the responsible citizens of every community.

Definite Fuel Clauses Important

A TENDENCY toward inserting fuel clauses of indefinite phraseology has been observed lately in a few central-station energy rate schedules and contract addenda. The practice has not become at all widespread, but it should be nipped in the bud. In this important department of public relations every modifying clause in rate determinations should be as simply and as clearly expressed as executive and engineering intelligence can insure. When the technical clarity of the fuel clause is established let the lawyers be called in, if necessary, but not until the objects sought are put down in black and white in a way that is understandable by engineers of average training and experience and explainable to purchasers of reasonable enlightenment. When considered as a means of maintaining good relations between utilities and their patrons, mere general statements about the rates going up and down in proportion to the cost of fuel are not to be compared with exact language setting forth the precise modifications entailed per unit of energy sold as production costs vary.

Interconnection Enables Better Use of Reserve Equipment

SOME interesting facts regarding the power supply in the territory east of the Alleghanies, including western Pennsylvania and eastern Ohio, are disclosed this week in a brief paper by Captain Whitsit reporting an investigation made for the War Industries Board. As every one knows, this is a region of intensive industrial development and yet one in which water power necessarily plays a somewhat insignificant part. The central stations in the power plants through this territory have an aggregate rating of about 750,000 kw., and their output in 1918 was nearly 2,500,000,000 kw.-hr. The significant fact appears, too, that during that year the sum of the power peaks reached 568,000 kw. There was therefore a total of 200,000 kw. reserve capacity, mostly unavailable through lack of interconnection. The plants that went to make up the aggregate showed enormous variations in efficiency, and besides a large capacity in isolated plants which will probably take central-station service later there is a very big total of generating equipment in some of the larger iron and steel companies which is not likely to be replaced. As things are now moving Captain Whitsit estimates that in six or seven years the total peak on the central-station systems, apart from the needs of the steel industry and of electric railways, will run over 1,000,000 kw., while the total added power demand will go to 1,400,000 kw., nearly double the present rating of the central-station systems.

The chief recommendations made are that new equipment should be installed at the points most available from the standpoint of coal supply and condensing water. Here is characteristically a region which should depend on coal at or near the mouth of the mine. The best locations apparently lie along the Ohio and some of its tributaries. There are some possible hydro-electric developments in western Pennsylvania which might be brought into line with existing or future steam-power plants with good results. The ultimate capacity of these hydro-electric possibilities bulks rather large according to Captain Whitsit, reaching something like 800,000 kw., or a rating fully equal to the total capacity of the existing central stations. From an economic standpoint such hydraulic developments are likely to pay, since with the increasing cost of labor and fuel hydro-electric plants will afford an increasing advantage. They must, however, be worked in harmony with the original steam plants to obtain the best results, because in years of low water the possible developments will fall very far below the average conditions just noted. The situation in the region here considered is distinctly different from that in the Southern States, where the hydro-electric plants are able to bear a far larger proportion of the aggregate burden.

Construction Accounting and Economy

EXPERIENCE has shown that in very many cases systematic attention to construction accounting is productive of considerable economies. It is, however, necessary to take an extremely common-sense view of this and all other systems of accounting, making, so to speak, the punishment fit the crime. Unless operations are on a very large scale, the segregation of items which in themselves may well be considered separately becomes impracticable, and details have to be lumped, to the shortening of a generalized schedule like that which we publish in this issue. Clerical detail may thus be saved without losing any of the real information which a schedule is intended to present. The same principle of common-sense adaptation of means to the situation runs through the whole scheme of accounting. It would be really interesting to know the relation of accounting costs to general costs in some central-station systems which we could mention, to say nothing of other forms of business. There comes a time when it costs more to preserve details than the details are worth; hence we emphasize the fact that orderly, systematic schedules like those presented on Oct. 30 should never be slavishly followed without reference to the existing situation, having in mind especially the need of such records and the cost of maintaining them.

Making Overhead Welds Successfully

UNLIKE ordinary welding, overhead welding has to contend with the force of gravity, which acts against the deposition of metal and renders it difficult to retain molten metal on the working surface. This fact must be taken into consideration if satisfactory overhead welds are to be made and operations so conducted that full utilization shall be made of the forces, whatever they are, that really cause the transition and retention of the molten metal.

Some new ideas that may be useful in a consideration of the technique of making such welds are presented in this issue by O. H. Eschholz. For instance, he points out that the globules successively formed at the electrode end must be made to coalesce with the pool above. This depends on the difference between the surface tensions of the positive and negative terminal materials; therefore the physical characteristics of the metal in the electrode must be different from those pertaining to the work. Furthermore, the surface of the electrode must not be allowed to become wetted with melted material, else the fresh material would cling to the electrode instead of going to the work. The cohesive force between the liquefied globule at the end of the electrode

and the electrode itself depends on many things composition, area of contact, arc current and length. Above all, success turns on the skill of the operator in working off the molten material before gravity gets him into trouble. What data are available regarding the effect of composition of electrode indicate, as might be expected, that small impurities and occluded gases tend to decrease the cohesion between the solid and melted matter and make it easier to lay on successive globules.

New Aspect of Lightning Protection

MOST operating men have been of the opinion that an overhead distribution system with dense load and many transformers offers a better target for lightning discharge than one with scattered load. A recent investigation by D. W. Roper, reported in this issue, however, makes it evident that where a lightning arrester is installed at each transformer the lightning has a multiplicity of paths through which the voltage gradient of the atmosphere may be smoothed out when the density of the lighting arresters is high with less trouble at the transformer. From careful tests made on the 4,000-volt, 60-cycle distribution system of the Commonwealth Edison Company, it appears that the density of lightning arresters on this system is far more important than the actual type of arrester used. Curves show that where the density of transformers and arresters is 200 per square mile, not only is the percentage of disturbance due to lightning greatly reduced, compared to a density of 100, but the actual number of interruptions is cut nearly in half.

Of equal importance is the matter of protecting underground cables. Where these cables are connected to the overhead lines there is a transition point which is especially susceptible to lightning disturbances and which has given serious trouble in the past. The results obtained by Mr. Roper indicate that underground cables can be effectively shielded from lightning by increasing the density of arresters in the vicinity of the point at which the cable emerges.

One cannot help reflecting on the futility of laboratory tests of arresters for such a system as this. Tests made in the laboratory may eliminate some weaknesses and undesirable features, but the only complete test, apparently, is in actual service. This is particularly important with low voltage since it is difficult to design arresters for 4,000-volt circuits, bearing in mind the high voltages which occur in connection with actual lightning discharges. Too much emphasis cannot be laid upon the value of systematic study or research in the great laboratories of practical operating companies. Intelligent study in the field is bound to bring out the important considerations, if not the actual solutions.

So far it is safe to say that the results are more or less applicable to other systems operating under somewhat similar conditions, but great care should be exercised in extending the conclusions to systems with conditions unlike those in Chicago. For instance, it was found that one type of arrester was considerably more effective in Chicago than the others; but it may easily be conceived that pole-line construction and local conditions may influence such a result. The only way to find out what arrester is satisfactory for a particular system in the present state of our knowledge of the subject is to conduct a complete test under the actual conditions imposed by the service.

Among the important conclusions drawn from the Roper tests is that trees and buildings constitute effective barriers against lightning discharges. The records in Chicago show that many transformers have been completely shielded from lightning by their presence.

We recommend to operating men particularly a study of the conclusions outlined by Mr. Roper, together with his suggestions for lightning-arrester specifications. These may be said to form the basis for a complete study of the average alternating-current distribution system. Further experience would be desirable to show whether an increased density of arresters would prove equally effective in protecting underground cables up to 25,000 volts from trouble at the cable pole, as Mr. Roper suggests in his report.

Standardizing Electrical Symbols

ELECTRICAL symbols constitute a sort of sign language which engineers and electricians use from day to day. They should be easily intelligible, without ambiguity, and to be of maximum use they should mean the same thing in different organizations and various parts of the country. They would also form a powerful link toward international interchange of ideas if an international code could be decided upon. There have been half-hearted attempts at standardization of symbols in the past, but in our own country there still is a wide variation in practice, in spite of the extent to which the designer, the construction man and the shop man use them. It is important, then, that particular attention should be given to the list printed elsewhere in this issue of some eighty-three symbols which have been tentatively agreed upon for submisson to the International Electrotechnical Congress. We are assured that constructive criticism will be welcomed by the American representatives to that congress, as is, indeed, indicated in the notice which accompanies the symbols.

Considerable work has been done in developing symbols abroad, particularly by the British, Swiss and Italians, and some of their suggestions, though differing widely from American practice, deserve the fullest consideration. For instance, the representation of a transformer winding by a circle, which has long been the practice in Switzerland and Italy, at first may seem revolutionary; but reference to item No. 43 in the list referred to shows at a glance how easily transformer windings may be indicated by this method and how clearly the symbols represent the thing for which they are intended. Interlinking the circles suggests immediately the interlinkage of primary and secondary windings through the magnetic flux. While both methods of representing transformers might be used, one is preferable.

The exact representation of brushes for direct-current machines appears to be open for discussion. It is hoped also that due consideration will be given to American symbols for lightning arresters and to some others which have been added to the proposed list with proper annotations. The list in its present form is by no means complete, but it represents a start in the right direction, and if this much can be agreed upon the rest will follow readily. The adoption of international standard symbols, while entailing some sacrifice all around, should be earnestly supported and will result in smoothing the path for coming generations.



Edwin Musser Herr

An executive-engineer who represents a rare combination of managerial ability and engineering experience and stands at the head of one of the largest organizations in the world producing electrical machinery and steam prime movers

BY FORCEFULNESS of character, faithfulness of trust and the will to undertake and solve a problem, no matter how difficult, E. M. Herr as a young man attracted the attention of the late George Westinghouse, with the result that he is now president of one of the largest electrical manufacturing companies in the world, the Westinghouse Electric & Manufacturing Company. Mr. Herr came into the electrical industry by way of the railroad field. He was born in Lancaster, Pa., May 3, 1869, and as a boy learned to be a telegraph operator. When he had reached the age of sixteen his father suffered financial reverses, and this knowledge of telegraphy enabled the youth at once to find work in which he rapidly forged ahead. Shortly afterward he became a telegraph operator for the Union Pacific Railroad at Deer Trail Station, Col., and a little later was made station agent. His desire to get ahead in the railroad business prompted him to go East for a technical education. He worked his way through the Sheffield Scientific School of Yale University and was graduated in mechanical engineering in 1884. After a year's apprenticeship with the Chicago, Milwaukee & St. Paul Railway, he was until 1890 with the Chicago, Burlington & Quincy, rising to the position of superintendent of tests, then superintendent of telegraph, and finally at the age of twenty-nine division superintendent. He went back to the Chicago, Milwaukee & St. Paul as division master mechanic for two years. There followed two years in the locomotive business in Chicago and then a year in Russia, when, in 1896, he became associated in the electrical industry with George Gibbs as general manager of the Gibbs Electric Company of Milwaukee, Wis. However, shortly afterward he returned to railroading as superintendent of motive power and machinery for the Chicago & Northwestern. After about ten years spent in this work and another year with the Northern Pacific he forsook railroading in 1898 to become assistant general manager of the Westinghouse Air Brake Company. A year later he was promoted to be general manager. This position he held until the summer of 1905, when he was elected first vice-president of the Westinghouse Electric & Manufacturing Company. Six years later he was elected president, an office that he has filled ever since.

While by experience Mr. Herr is essentially a railroad man, still he is an important factor in the electrical industry, guiding as he does the production and engineering effort of an organization that will bill during this fiscal year approximately $175,000,000 worth of engineering products. The electrical industry goes forward in very large measure as a result of the engineering development accomplished by the manufacturers and the general high standards of equipment, and to the men like Mr. Herr who direct the efforts of those progressive institutions the electrical industry owes a large debt of gratitude. Not long ago the Japanese government in recognition of this debt bestowed on Mr. Herr the Order of the Rising Sun.

Clearing House for Five Stations*

To Handle Output of Installations with Combined Rating of 400,000 Hp. Many New Ideas Have Been Incorporated in Echota Substation of Niagara Falls Power Company Unit Layout Employed Standard Oil Switches Adapted to Semi-Outdoor Conditions

By J. ALLEN JOHNSON
Electrical Engineer Niagara Falls Power Company



EXTERIOR OF ECHOTA SUBSTATION, SHOWING FIVE SWITCHING BAYS AND INCOMING LINES FROM NIAGARA FALLS GENERATING STATIONS

THE Echota substation of the Niagara Falls Power Company, just off the Niagara River about 2½ miles above the Falls, was purposely located† where it is in order that it might be conveniently connected with the 400,000 hp. in Canadian and American generating stations which it serves as a clearing house and feed Buffalo and the industrial district around Niagara Falls. The Canadian and American systems are also tied together through the circuits of the Buffalo General Electric Company, which receives power from both sources over independent transmission lines. All of the stations are now being operated in parallel, including also the 65,000-kw. steam station of the Buffalo General Electric Company.

The Echota substation of the Niagara Falls Power Company is intended to serve three functions—(1) to subdivide and distribute the power from the new plant, (2) to serve as a clearing house for the output of the five generating stations, aggregating 400,000 hp., and (3) to act as a future stepdown transformer station.

Inasmuch as the primary function of this station is to distribute the power of the new plant, it was decided to preserve the unit arrangement in its construction. The station was accordingly laid out in units of a nominal capacity of 32,500 kva. Five of these units were constructed, three for the new plant and two for interconnection with other generating stations. A control building containing the switchboard apparatus was also erected. The general wiring diagram shows the arrangement of the main circuits; the physical layout of the structure is similar to that of the diagram. The general scheme is that of a main tie bus running lengthwise of the building with the unit lateral buses joining it at right angles. In this manner the over-all length of the building was very materially reduced and the spacing between units kept down to just about that which will later be required for the step-down transformers, specifically 26½ ft. (8 m.).

The prime consideration in the general layout of this station was provision for growth. The various elements of the structure are so placed that each one is capable of almost unlimited extension without interfering with the others; that is to say, each of the power units can be extended, the number of such units can be increased, and the length of the control building which houses the switchboards can also be increased accordingly, without interference with one another.

The five units or bays and the control building are connected at one end by a narrow building or passageway which contains the incoming line protective equipment and serves as a distributer for the control wiring, piping, etc., and as a means of access between the control building and the several unit bays. The main operating portion of the station is concentrated on the second floor, where the oil switches with their "disconnects" and the control room are. There is little or nothing on the third floor which demands operating attention.

The ground floor contains current and potential transformers and feeder disconnecting switches which require attention or manipulation but seldom. Upon each of the unit bays is a subway for distribution of cables. This connects at each end with longitudinal subways.

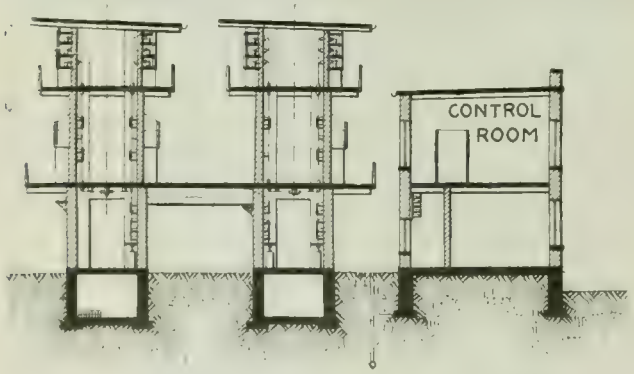
Starting from the control room, the first two bays are intended to provide for the receiving and distribution of power from station No. 3, Hydraulic plant. The other three bays are primarily for the distribution of power from the three new units, and into each of two of these bays is also connected an overhead circuit from the Niagara plant over which the flow of power is likely to be in either direction.

*Sixth and last installment of a symposium on the 400,000-hp. extension to station No. 3 of the Niagara Falls Power Company. (See Sept. 18, Oct. 2, Oct. 16, Oct. 23 and Oct. 30 issues of the Electrical World.)

†See page 873, Oct. 30.

A radical departure from the usual station construction is the placing of all oil circuit breakers on the outside of the building walls; in other words, the main bus and switch structure walls are utilized as the walls of the building, all high-tension connections being upon the inside, where they are thoroughly housed and protected against the elements, and the oil switches upon the outside, where explosions and oil fires can do a minimum of damage. Galleries are provided on the outside for access to the oil switches, which are protected from the weather by suitable housings.

As this station is a very important one in the system, serving, as it does, as the general point of concentration for the output of the five contributing generating stations aggregating 400,000 hp. in capacity, great care was taken in its design to minimize to the greatest possible extent the hazards inherent in the operation of such a station. To this end the different electrical elements of the structure are separated and isolated to the greatest possible extent. In the first place, each unit bay is a separate building, as is also the control building. On the outside of the unit bays the oil switches are on one floor, the bus on another. On the inside the disconnecting switches for isolating oil switches are on one floor and the potheads for outgoing

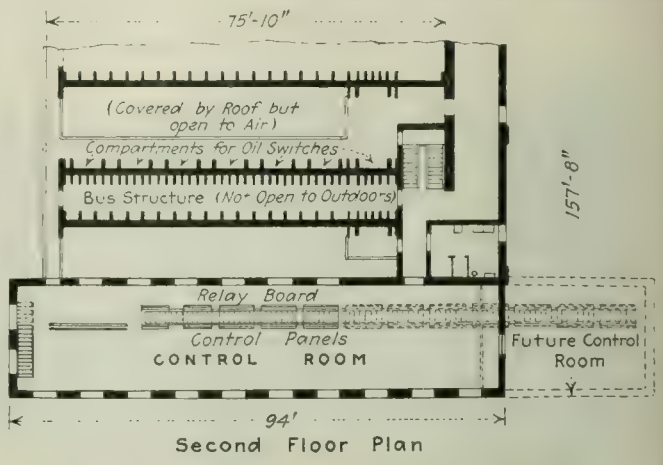


LONGITUDINAL SECTION OF ECHOTA SUBSTATION, SHOWING TWO BAYS AND CONTROL ROOM

cable feeders are on another. The main and reserve buses are completely isolated from each other. Wherever the connections pass through walls or floors substantial porcelain bushings are used, sealed with cement compound so that there is no possibility of an arc being carried through the walls or from floor to floor. All phase connections are separated by brick and concrete barriers and are completely covered by compartment doors except where ventilation outlets are provided, so that accidental contact is virtually impossible.

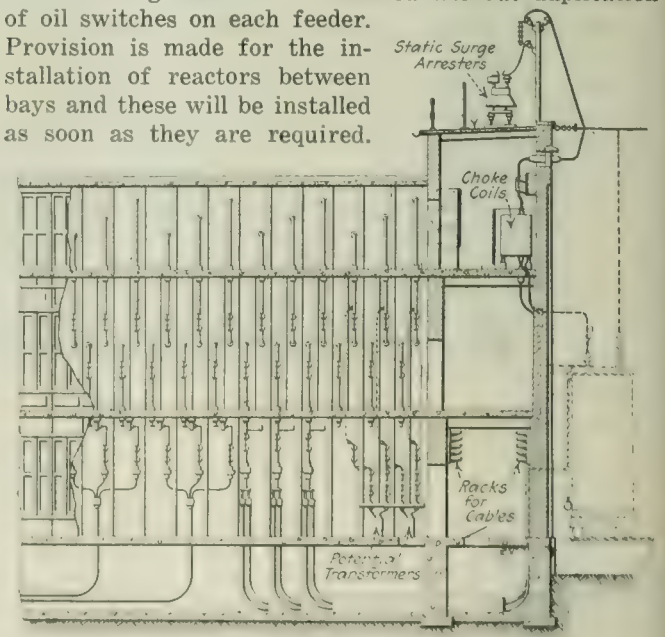
Arrangement of Circuits.—Each incoming line, consisting of two parallel circuits, passes first through disconnecting switches, after which the two circuits are combined into one and pass through a set of choke coils for lightning protection. The "disconnects" and choke coils are installed on the third floor of the connecting passageway in brick compartments. The lightning arresters, which are connected immediately outside of the disconnecting switches, are on the roof of the passage.

After leaving the choke coils the leads enter two 1,250,000-circ.-mil lead-covered cables in parallel which pass down the outer wall of the passage to the subway, thence across and up to the first floor of the unit bay. Here they emerge from the cables through potheads and connect to copper bars, which then pass through current transformers. Immediately above the current transformers are disconnecting switches above which the circuit divides, one side going through an oil circuit breaker to the main bus, the other side through a similar breaker to the unit reserve bus. In each bay provision is made for six outgoing feeders. Each of these connects to the main bus through an oil circuit breaker and to the reserve bus through disconnecting switches. The function of the reserve bus is twofold—(1) it serves as a true reserve bus from which all



PLAN OF CONTROL ROOM AND ONE BAY AT ECHOTA

feeders can be supplied temporarily through the reserve-bus switch in case it is desired to clear the main bus for any purpose; (2) the reserve-bus switch serves as a substitute switch for any individual feeder switch which may be out of service. In this manner duplication of the switching facilities is obtained without duplication of oil switches on each feeder. Provision is made for the installation of reactors between bays and these will be installed as soon as they are required.



TRANSVERSE SECTION OF ONE END OF ECHOTA SUBSTATION

Oil Switches.—Owing to the great importance of this station in the general scheme of distribution, both present and future, it was determined to insure the greatest possible degree of reliability in the oil switches. Accordingly both of the chief manufacturers were asked for a recommendation on this basis, resulting in the proposal of two radically different types of oil switches, namely, the Westinghouse type CO-2 and the General Electric type H-9. Owing to the absence of operating

experience with these switches, it was found impossible to establish definitely the superiority of either one over the other, and it was decided so to construct the station that either one could be used. This was accomplished by slight modifications in the standard assembly of both types, and it was decided to install at the start a number of each type in order that actual operating experience might be had with both.

The General Electric switch is assembled with the oil pots staggered and all connections brought out at the back of the switch with center-to-center spacing of 9 ft. (2.7 m.) between adjacent switches.

In the case of the Westinghouse switches the same spacing of terminals was accomplished by a special design spreading the leads apart above the oil pots before passing through the wall. Thus an arrangement was arrived at whereby both of these radically different types of circuit breaker could be installed in the same width with the terminals equally spaced, so that either type of switch can in future be substituted for the other, should the type installed prove inadequate. Of the five bays, four are equipped with Westinghouse type CO-2 circuit breakers and one with General Electric type H-9.



OXIDE-FILM LIGHTNING ARRESTERS ON OUTGOING LINES AT ECHOTA SUBSTATION

Safety Features.—Objection has sometimes been made to this type of construction—in which the oil switches and their corresponding "disconnects" are placed upon opposite sides of a solid wall—that it is possible for the operator to open the wrong "disconnects" by mistake. This error may occur in two ways—either he may select the wrong group of "disconnects" or he may accidentally get one "disconnect" on an adjacent oil switch. In this installation both of these errors have been made impossible by the following means:

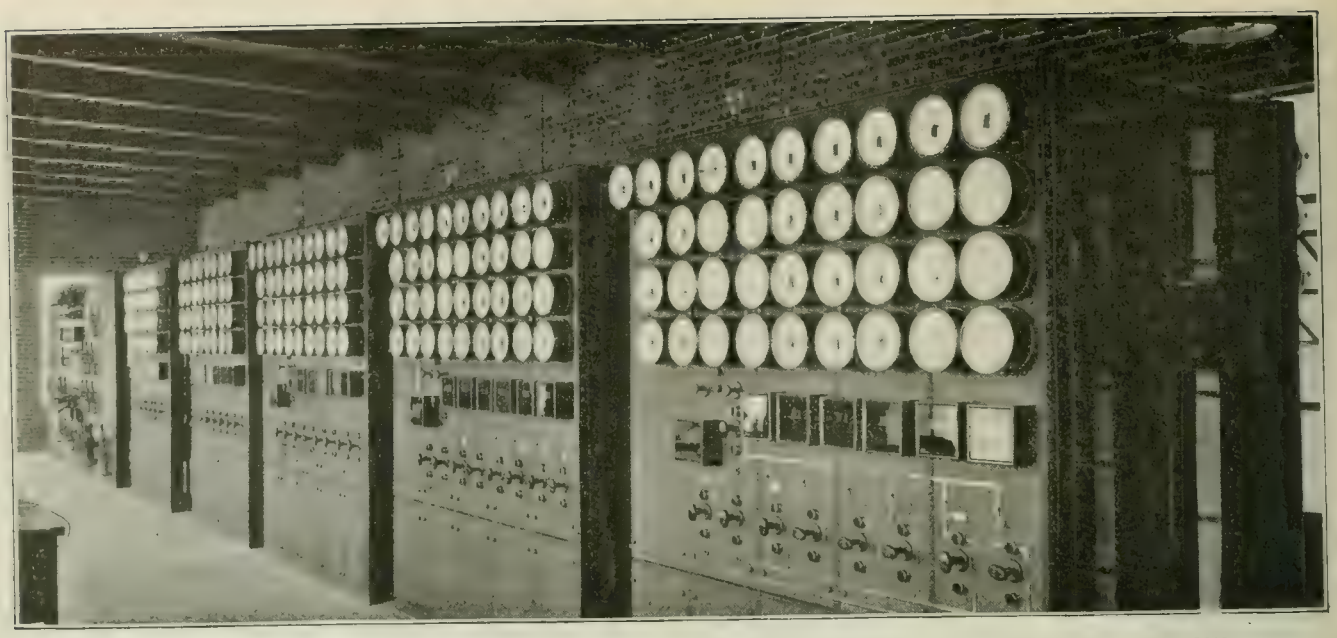
First, the doors covering the disconnecting switches are all hinged at one side and all six doors associated with each oil switch are fastened together by a wooden bar which is hinged to their free edges. Thus, when it is desired to obtain access to the "disconnects" associated with a circuit breaker, all of the six doors are operated together. It is therefore impossible for an operator to obtain access to a "disconnect" of an adjacent circuit breaker.

Second, there is attached to each circuit breaker a shaft extending through the building wall carrying on its inside end a short cross-bar. When this bar is in a horizontal position it engages the edge of one of the disconnecting-switch compartment doors in such a way that the group of doors cannot be opened. This device is so connected to the oil-switch mechanism that it occupies this position when the oil switch is closed. Upon the oil switch being opened the shaft is turned through an angle of 90 deg., so that the crossbar assumes a vertical position, which releases the disconnecting-switch compartment doors. Thus it is impossible for the operator to gain access to the disconnecting switches until the oil switch is in the open position. Provision is made for removing the crossbar by means of a special tool in case it is necessary for some special reason to gain access to the "disconnects" while the oil switch is closed.

On the reserve-bus side of the disconnecting switch alley, where there are no oil switches, there is, of course, no opportunity to employ this interlocking scheme; but the six corresponding doors are fastened together in the same manner as on the main-bus side. The same scheme of operating the doors in groups is also employed on the lower floor for the compartment doors, giving access to the feeder "disconnects," current transformers and cable potheads.

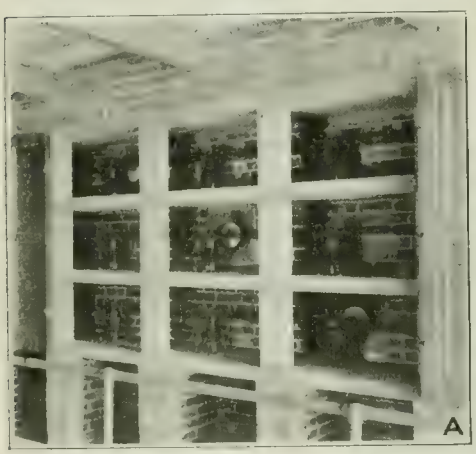
Control.—As shown by the illustrations, the control building is placed at one end of the series of unit bays and parallel to them. On the lower or ground floor are a small office, an entrance hall, a workshop or store room, a storage-battery room and a motor-generator room, also a longitudinal passageway for control wiring. The second floor is entirely occupied by the control room. The switchboards consist of vertical panels of natural-finished black "Linstun" and are divided into five sections corresponding with the five main bays, in addition to a house-service section. Back to back with the control boards, with a 4-ft. (1.2-m.) aisle between them, are the relay and terminal boards. A group of five panels controls each of the three bays connected with the new units—a bus-tie panel, an incoming-line panel and three fender panels, each controlling two feeders. A similar group of four panels controls each of the other two bays. A dummy bus indicates the connections. The bus-tie panel is equipped with three ammeters, a wattmeter and a reserve-bus voltmeter; the incoming line panel with three ammeters, a wattmeter, power-factor meter, main-bus voltmeter, line voltmeter and synchroscope. Each of the feeders is equipped with three ammeters and a wattmeter. Each instrument and relay is provided with a complete set of calibrating link terminals mounted upon small panels on the rear of the main panels.

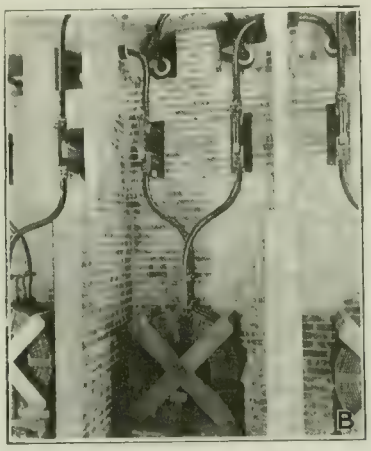
The vertical wiring on the back of the switchboards is carried in troughs made up of two ¾-in. (1.9-cm.) angle sides with "Linabestos" back, the troughs being 3½ in. (8.9-cm.) wide. After the wiring was completed these troughs were equipped with removable sheet-metal covers. The advantages of this system of wiring are safety, accessibility, neatness, ease of installation and flexibility. Furthermore, the wires being entirely free from the panels, the latter can be easily removed,

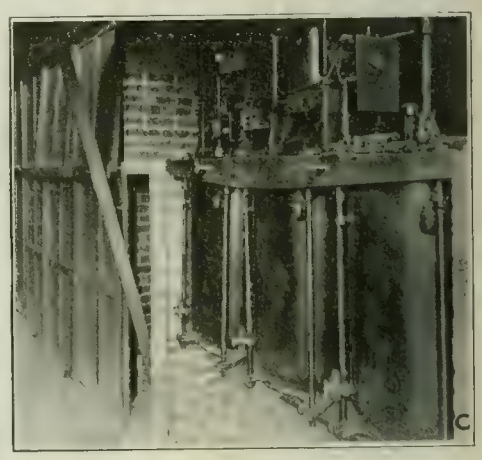


GROUPING OF INSTRUMENTS AND ANNUNCIATORS ARE FEATURES OF CONTROL BOARD AT ECHOTA SUBSTATION

The instruments are arranged so that confusion in reading will be avoided. At the top of the board are lamps and below the instruments are annunciators which indicate switches which open automatically.







A—TYPICAL SECTION OF A BUS COMPARTMENT. B—CHOKE COILS IN SERIES WITH OUTGOING LINES AT ECHOTA SUBSTATION. C—ONE TYPE OF CIRCUIT BREAKER EMPLOYED AT ECHOTA



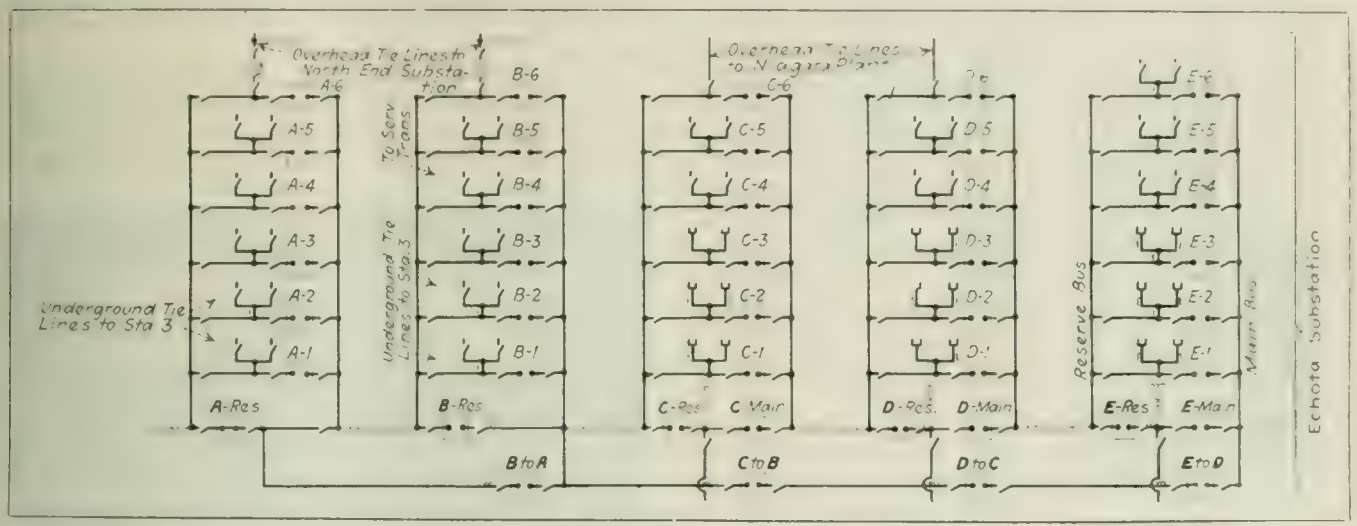


BACK TO BACK WITH THE CONTROL BOARD SHOWN ABOVE ARE THE RELAY PANELS

In the aisle between the control and relay boards are control wire troughs and test terminals. Normally the troughs are covered, but one is shown open.

if required, by merely disconnecting the wires from the instruments and control devices.

At their point of departure from the board, all control wires pass through terminal links on the lower panels of the relay boards. After leaving the switchboard the control wires are carried in three-conductor cables covered with flame-proof braid and laid in steel pans or troughs mounted one above another on brackets fastened to the wall of the building. Upon reaching the point where the unit bays join the longitudinal passageway the pan for each unit passes through an opening in the wall of the passageway and continues along the outside wall of the bay under the oil-switch gallery. From this pan to the current and potential transformers, oil-switch controls, etc., the control wires are carried in conduit buried in the walls and floors of the structure. By this construction the control wiring is made accessible throughout its entire length, with the exception of the short portion in conduit, and at the same time an enormous amount of conduit work is avoided. The construction is much less expensive and



SCHEMATIC CONNECTIONS OF SWITCHES AT ECHOTA SUBSTATION, SHOWING UNIT LAYOUT AND LINES FROM THE HYDRAULIC STATION EXTENSION AT THE BOTTOM

protection is provided between the two pairs of cables by means of suitably connected current transformers and low-current relays. In other cases ground relays are installed, connected in the current-transformer neutrals. Overload relays are also installed on all feeders. All relays are of the Westinghouse induction type, the 5-amp. size being used for overload and the 1-amp. size for differential and ground protection.

A somewhat unusual feature in connection with the relay system is the installation of annunciators on the switchboard with the drops connected in series with the tripping circuits of the various relays. By this means it is possible to know at once upon the tripping out of a circuit breaker just which relay was responsible. This immediately gives an indication of the nature and in certain cases of the location of the trouble. It also furnishes the means of keeping tabs on the operation of the relays. Although the station has been in operation only a few months, the value of this feature has already been amply demonstrated.

In the equipment of this station the Westinghouse Electric & Manufacturing Company furnished all of the switchboards and all of the oil switches with the exception of those for one unit bay, also current and potential transformers, choke coils, motor-generator sets and storage battery. The General Electric Company furnished oil switches for one bay and the lightning arresters. Bus supports and disconnecting switches are of the "Franklin" design manufactured by the Electrical Development & Machine Company.

occupies much less space than would the conduit necessary to convey an equal number of wires.

For the operation of the control circuits there are provided two 14-kw. motor-generator sets and a 120-amp.-hr., 220-volt storage battery. The control is normally carried on one of the motor-generator sets and the battery held as a reserve.

Relay Protection.—The incoming lines from the new generating station are each equipped with overload, ground and reverse-power relays. The overload relays are arranged to trip both the main and reserve-bus circuit breakers, but the reverse-power relays trip only the main-bus switch. At present the reverse-power relays are Westinghouse type CR, but it is proposed to substitute for these type CW relays so connected as to operate on low power factor, lagging current feeding from the substation toward the generating station. This is for the purpose of tripping the line switch in case of the accidental loss of the field of the generator and also to enable the line switch to trip on less than full-load current in the reverse direction. The bus-tie switch is equipped with overload relays. Feeder switches are relayed in two different ways, according to the nature of the feeder supplied. In certain cases where a feeder consists of four parallel cables split-conductor

The design and construction of this development were undertaken and largely carried out under the stress of war conditions. The design was in many instances influenced by these conditions, and many possible refinements were doubtless omitted owing to lack of time and men to carry them out. In spite of these conditions the results have been satisfactory as witnessed by some months of entirely successful operation.

The writer desires to express his appreciation of the hearty co-operation accorded him by the manufacturing companies and all those who furnished materials for the work, and also of the work of his staff, which made up in loyalty and enthusiasm what it lacked in numbers. Especial credit is due to his assistant, R. T. Henry, to whose versatility and practical genius are due many of the details of design as well as their application.

Overhead Arc Welding

Welding Overhead Surfaces Entirely Practicable if Operator Understands Principles—Tests of Finished Welds Show Tensile Strength Comparable to Ordinary Downward Welding—Training of Operators in Overhead Work

By O. H. ESCHHOLZ
Material and Process Engineer Westinghouse Electric & Manufacturing Company

A UNIQUE and important property of the metallic electrode arc-welding process is the ability to deposit metal at will either on a flat (downward), vertical or overhead surface. Under the extreme condition of overhead deposition, when the force of gravity is opposing metal transfer, greater manipulative skill is required than when gravity partly or completely assists deposition, as in vertical or downward welding. The degree of skill required for overhead welding, however, is not impossible of attainment when the operator has been properly instructed in the characteristics and manipulation of the arc.

The enlarging field of welding has increased the demand for overhead welds, the most typical of which are encountered in locomotive, ship, tank and building construction. Many such welds are now giving excellent service. Examination of occasional failures reveals as their primary cause an improper use and manipulation of welding materials due chiefly to inferior or indifferent operators. In the repair of locomotive fireboxes it has been common practice to weld the overhead butt joint autogenously between the crown and the flue sheet. The service records of many such welds clearly demonstrate the adaptability and value of the arc process. Nevertheless, owing partly to the greater skill required and partly to the characteristic exaggerated conception of ability possessed by undeveloped welders, unsatisfactory fusion may result when adequate supervisory control is lacking. Overhead deposition is chiefly dependent upon arc phenomena overcoming gravitational force acting on the material of the pencil electrode. The facility with which deposition is accomplished is a function of arc current and arc length, as well as choice of electrode diameter and electrode material.



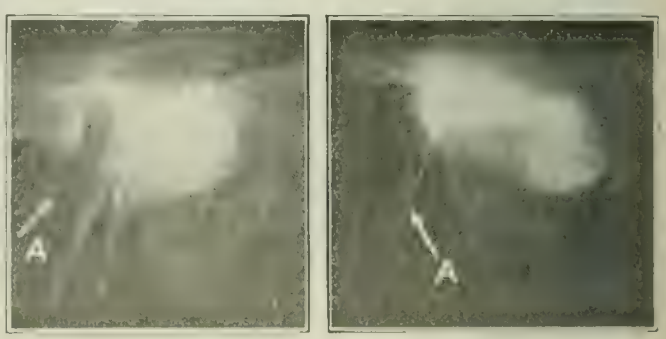
FIG. 1—LIQUEFIED GLOBULAR END OF WIRE ELECTRODE

Note the relatively smooth surface and solid metal in section. The retaining force is determined by size of globule, area of contact between liquid and solid metal and intensity of the forces of cohesion and surface tension.

Upon establishing an arc between an overhead surface and a suitable wire electrode the material at each arc terminal is liquefied. The metal at the positive or plate terminal forms a pool, while that at the wire or negative terminal develops rapidly into a globule.* Fig. 1 shows the appearance of the surface and section of a globule formed on the electrode end. This globule, however, is too large to facilitate deposition, that shown in the arc photograph (Fig. 2) being more typical of good practice. To convey this globule to the plate the lifting force must exceed the retaining forces of gravity, cohesion and surface tension at the wire perimeter. Obviously the problem of transferring the globule may be simplified by decreasing the forces tending to retain the globule on the electrode end.

By producing only small globules the weight of liquid metal may be held to a low value. As the size varies, within limits, with the arc length, the maintenance of a short arc of from $\frac{1}{16}$ in. to $\frac{3}{32}$ in. (1.6 mm. to 2.4 mm.) will therefore insure a controllable globule weight. Other factors determining the magnitude of the total retaining force are the unit surface tension, unit cohesion and the contact area between the liquid globule resting on the solid end of the pencil electrode and the electrode.

The surface tension and cohesion between the solid wire and its molten end are decreased by the presence of solid, liquid and gaseous impurities at the boundary. Quantitative information on this subject is not available.



FIGS. 2 AND 3—APPEARANCE OF ARC STREAM, DEPOSITED MATERIAL AND ELECTRODE END

In Fig. 2 is shown a short arc ($\frac{1}{16}$ in.). The globular end of the electrode as well as the layer of deposited metal can be seen. With the long arc ($\frac{1}{8}$ in.) of Fig. 3 no deposited metal is evident.

Experience, however, has shown that these forces are reduced by the phenomena occurring when small quantities of iron oxide, iron carbide, manganese, etc., and occluded gases are present in the electrode during the deposition process.

The total surface tension and the total cohesive force are proportional to the area of contact between the liquid and solid or plastic metal. It is obvious that these decrease with the diameter of the electrode and also with the total energy developed, and therefore with the arc current. The facility with which the electrode surface becomes "wetted," thereby affecting the contact area, varies with its analysis, melting temperature, physical properties of the surface and the current density. A satisfactory evaluation of the importance of each of these factors has not been made, although it is well known that different types of electrodes employed for downward deposition vary greatly in their "wetting" action and therefore in their characteristic retaining force and ease of overhead deposition.

From this analysis it is evident that when the super-

*"Metal Deposition in Arc Welding," ELECTRICAL WORLD, June 26, 1926, p. 1299.

visor determines the material, size of electrode and welding current to be used the only variable affecting the magnitude of the retaining force controllable by the operator is the arc length. Skill in the maintenance of the proper arc length may be readily developed, while a check on its continuous employment may be had by the meter indication of arc voltage or the ringing of a buzzer connected across the arc when the maximum permissible arc length has been exceeded.

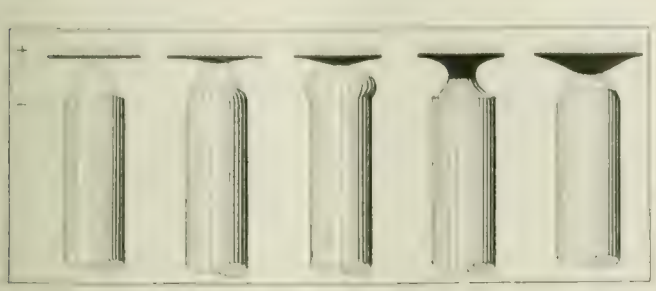
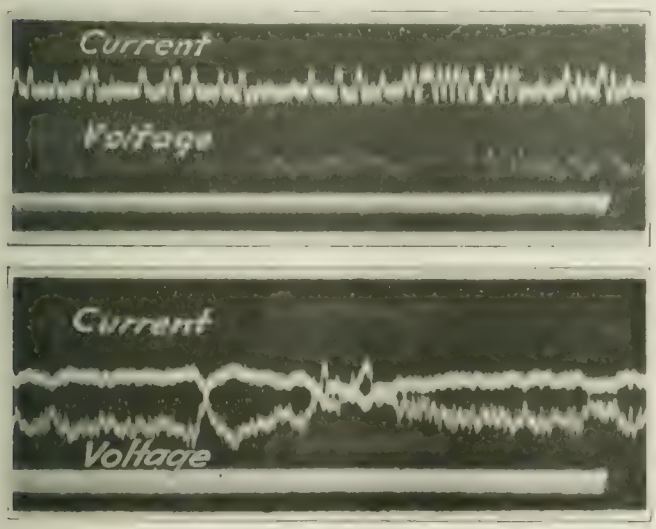


FIG. 4—SEQUENCE OF DEPOSITION PHENOMENA IN OVERHEAD WELDING

Duration of cycle from 0.64 second to 0.03 second, depending on electrodes, current, arc length, etc.

The lifting force is, comparatively, a fixed quantity, since the material and thermal characteristics of most overhead joints vary but little. The total lifting force is a function of the surface contour and of the area puddled by the positive crater. It is also dependent upon the "wetting" characteristic which facilitates the adhesion and spread of the electrode globule on making contact with the puddled surface. The rate at which the plate metal absorbs heat energy from the deposited metal determines the rate of congealing of the electrode metal and therefore is a factor in determining the magnitude of the lifting force. Heating an overhead joint locally helps to start layer deposition, since it facilitates the initial production on a cold plate of a "wetted" surface to which the globule must be attached



ON VOLTAGE AND CURRENT

In the upper figure is shown the effect of a short arc, the current peaks indicating short-circuiting of the arc stream by globule growth and subsequent deposition. The absence of these short-circuit peaks is evident in Fig. 6, which shows the effect of the long arc. No metal is deposited in the latter case.

by the forces of surface tension and adhesion. However, if the joint temperature is uniformly increased to a high value, deposition will be retarded since the rate of congealing of deposited metal is decreased.

The cycle of deposition appears to be as follows:

1. Metal at each terminal is liquefied upon striking an arc.
2. The molten electrode end assumes an approximately spherical form, due to the well-known phenomena of surface tension causing a fluid material to contract into the smallest volume.
3. This globule enlarges, with continued application of energy, until with the aid of electrode manipulation its upper surface is brought into contact with the overhead pool, thereby short-circuiting the arc stream and causing the lifting forces to act upon it.
4. Forces of surface tension and adhesion at the contact area between the overhead plate and the globule cause the globule to change its form and spread over the plate surface.
5. As the metal spreads, the area in contact with the plate increases and therefore the lifting forces are also increased, causing an acceleration in metal transfer. These forces act until the globule is lifted off the wire electrode end, when the short circuit is broken and the arc re-established.

This deposition sequence is shown graphically in Fig. 4. In Figs. 2 and 3 short and long arcs are shown respectively. Bare mild-steel electrodes were used for the deposit tests. The globular growth is

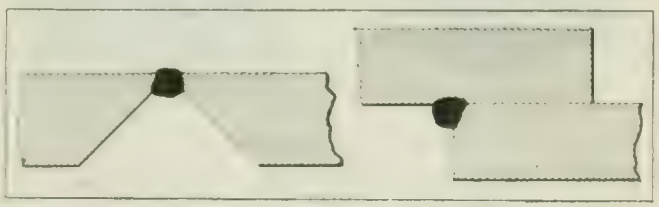


FIG. 7—THE FIRST DEPOSITED LAYER SHOULD FUSE TOGETHER ABUTTING MEMBERS AS SHOWN

visible on both electrode ends. However, the short arc employed in Fig. 2 permits, with the electrode manipulation, bringing the surface of the globule readily into contact with the plate during the period when the retaining force is small. The layer of deposited metal as well as the arc crater are clearly visible in the illustration.

To bridge the arc gap shown in Fig. 3 a larger globule is required. The size of this globule produces a retaining force which exceeds the lifting force and thereby prevents metal transfer. With continued application of energy and the maintenance of such a long arc, the accumulating liquid metal either drops off the end of the electrode or flows down its side. The striated appearance of the electrode surface in Fig. 3 is caused by the metal flowing from the end.

In Figs. 5 and 6 are shown instantaneous variations in arc current and arc voltage when holding the short and long arcs shown in Figs. 2 and 3. The instant at which the globular growth short-circuits the arc is identified when the arc-voltage record drops to nearly zero and the arc current attains maximum value. The frequency with which this occurs indicates that approximately twenty-five globules are being deposited each second. In Fig. 6 the voltage and current records indicate the normal variation in arc length as determined by electrode manipulation and globular growth, but they do not indicate contact between the plate and the electrode as shown in Fig. 5. The deposition rate is therefore nearly zero, only metal being deposited by the condensation of a small amount of metallic vapor. As

the amount deposited is small it is not visible on the plate surface shown in Fig. 3.

It is preferable to select candidates for overhead welding from operators who are competent downward welders.†

The first step in the training of such welders consists in demonstrating and explaining phenomena of metal transfer. The second step involves the change in deposition facility with change in arc length, arc current, electrode diameter and electrode material. It will be found that the usual skilled downward welder is quick to appreciate and recognize the bearing of these factors on overhead deposition. Deposition skill should first be developed on a vertical surface, then on a plate inclined 45 deg., and finally on a flat over-

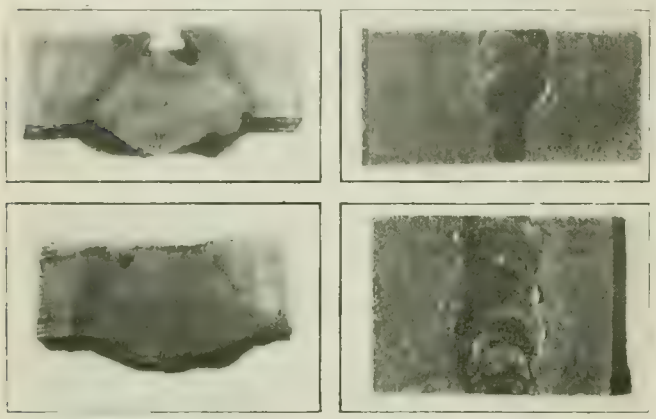


FIG. 8—INCOMPLETE AND COMPLETE FUSION OF V

Section through zone B of Fig. 9 and a surface view of the weld showing result of incomplete fusion. In lower photograph is shown section through zone C of Fig. 9 and a surface view of the section where fusion was good.

head surface, with the operator holding in each case a short arc $\frac{1}{16}$ in. to $\frac{3}{32}$ in. (1.6 mm. to 2.4 mm.), or 18 volts to 20 volts, with $\frac{1}{8}$-in. (3.2-mm.) diameter bare mild-steel gas-free electrodes and an arc current of 100 amp. The metal should be deposited in continuous layers on a $\frac{1}{8}$-in. (3.2-mm.) thick plate. The employment of a light-weight electrode holder, designed to protect the operator from falling hot metal, as well as to remain cool in service with a minimum cable drag while holding the electrode perpendicular to the surface to be welded, will be found both to expedite and greatly facilitate overhead deposition.

Electrodes vary greatly in their overhead deposition characteristics. Metal may be deposited with some types at the rate of two globules a second; with others this may be as high as thirty a second. The penetration of the deposited metal into the plate appears, however, to decrease somewhat with increase in globular deposition rate. Owing to the facility with which the surfaces of some types of electrodes become "wetted," the globular retaining forces are so large that overhead deposition is impracticable. In view of these differences in deposition performance, the operator should become familiar with the characteristics and manipulation of a variety of bare and covered electrodes available on the market. To obtain fusion it is necessary to secure penetration, crater depth, minimum overlap, etc., as in the case of downward deposition.‡

The use of a low current, of the order of 100 amp., produces a slow and easily controllable globular growth and deposition. After the operator succeeds in developing deposition control under this condition, arc current and electrode diameter should be gradually increased to values approximating those employed for downward welding. The operator, however, will then find that an electrode length of only 6 in. (15 cm.) (approximately) will be readily deposited, the deposition of the remainder becoming increasingly difficult owing to the fact that the hot, inclosing convection currents of air and arc gases, as well as the internal energy consumption due to the resistance of the wire, serve to preheat the electrode and cause the melting rate of its terminal to increase. It has been found that the electrode may be kept comparatively cool, and therefore maintain an approximate constant melting rate throughout the deposition period, by giving it as well as the arc terminal either an oscillating or a circular movement. Such a movement disturbs the hot sheath of gas in contact with the electrode and permits the influx of cooling air. By employing this manipulative expedient it is possible to deposit the metal continuously from 12-in. (25.4-cm.) lengths of electrodes $\frac{1}{8}$ in., $\frac{5}{32}$ in. and $\frac{3}{16}$ in. (3.2 mm., 4 mm. and 4.7 mm.) in diameter when employing arc currents of respectively 125, 150 and 175 amp.

OVERHEAD WELDS

These are commonly butt or lap joints. In designing a structure perference should be given to the lap joint because it is more easily welded. The overhead butt joint is prepared similarly to the downward butt joint. It is usually scarfed from 60 deg. to 90 deg. and a "free distance" of from $\frac{1}{16}$ in. to $\frac{3}{32}$ in. (1.6 mm. to 2.4 mm.) separates the adjacent sections. To maintain these in place, the plates are tacked together at intervals of 2 ft. (0.61 m.), when the rigid assembly system is used, and the metal deposited in layers by

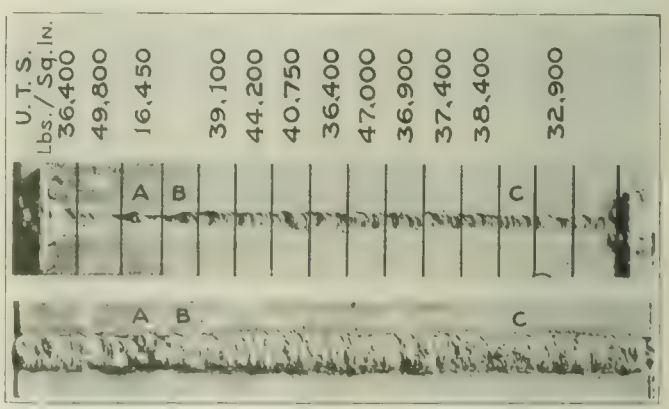


FIG. 9—APPEARANCE OF TOP AND BOTTOM OF OVERHEAD BUTT-WELDED PLATES

This weld was made after an experienced downward welder received several days' training in overhead welding. Bare mild-steel electrodes of $\frac{1}{8}$-in. diameter were used with a current of 125 amp. Tests were made to determine the ultimate tensile strength by cutting strips from the plates as shown by the markings. The average strength was 45,600 lb. per square inch for one test and 39,150 lb. per square inch for another. Zones B and C are shown in detail in Fig. 8.

the "step-back" method to avoid excessive heating of the plate and consequent high internal cooling stresses.

The successful welding of an overhead butt joint is chiefly dependent upon the completeness with which the initial layer fuses together the apex of the V. In Fig. 8 are shown sections through correctly fused abutting members and it illustrates the characteristic

† Training Arc Welders, Electrical World, Sept. 27 and Oct. 4, 1919.

‡ Overhead Arc Welding, Transactions A. I. E. E., March 1919.

appearance of a section wherein the first layer failed to fuse the abutting plate edges. Such failure may be attributed to the indifference of the operator in controlling arc length and applying deposited metal, too low an arc current, and either too great or too small "a free distance." An inspection of the surface frequently reveals poor workmanship and suggests the cause.[1]

It is now recognized that in downward welding, layer and tier deposition of metal give the most satisfactory joint characteristics. This is due to the fact that each deposit is reheated by the superposed metal and then cools at a slower rate than if exposed fully to the atmosphere. This partial annealing serves to refine the grain and relieve internal cooling stresses. The writer therefore wishes to advocate a similar procedure for overhead welding, particularly as it is now general practice to fill the area between scarfed surfaces completely as the welder progresses along the joint. It is known that this procedure increases internal stresses, decreases ductility, and tends toward warping of the structure.

The plates shown in Fig. 9 were welded after the operator had had but two days' practice in overhead deposition. After several days' further practice the same operator butt-welded ¼-in. (6.4-mm.) and ½-in. (12.7-mm.) boiler plates overhead, scarfed to 90 deg. The data show that a conscientious and properly instructed operator will produce overhead welds having characteristics comparable with those made in more favorable positions and there is a uniformity of tensile strength throughout the length of the weld.

[1] "Inspection of Metallic Electrode Arc Welds," *Mechanical Railway Engineer*, July, 1919.

Power Service for a Middle West Section

Survey in Western Pennsylvania and Eastern Ohio by Power Section of War Industries Board Indicates an Aggregate Power Peak Demand During 1918 of 568,000 Kw. and a Total Central-Station Output in This District of 2,440,000,000 Kw.-Hr. Estimated Increased Peak Load of 1,000,000 Kw. by 1927

By CAPT. LYLE A. WHITSIT
Assistant Engineer Division of Power and Transmission, Super-Power Survey

DURING the war period of 1917 and 1918 a serious power shortage developed in the western Pennsylvania and eastern Ohio districts, and steps to remedy this condition were initiated by the Power Section of the War Industries Board. This investigation resulted in a program for the addition of 300,000 kw. of new equipment to be placed in operation during 1919. The power shortage was somewhat relieved by co-operation between the various central-station systems and by co-operation also with the customers. The occurrence of the influenza epidemic, which depleted the labor resources of the manufacturing companies, and the signing of the armistice in November, 1918, prevented the accumulation of a power demand in December of that year that might have been beyond the capacity of the central stations.

The total generator rating in the power plants of the district, including the cities of Cleveland, Lorain, Akron, Warren, Youngstown, Alliance, Canton, Massillon, Mansfield, Newark, Coshocton, Pittsburgh, Connellsville, Wheeling, Windsor and others, amounted to about 773,000 kw. on the first of January, 1919. The total output from these stations in 1918 was approximately 2,440,000,000 kw.-hr., and the aggregate of the various power-peak demands during 1918 was 568,000 kw. Although these figures indicate reserve capacity, the actual distribution and the interconnection of systems were not such as to relieve the 1918 shortage in the Pittsburgh district.

The plant cost of power, including only coal, labor and plant repair costs, varies in this district from something less than 5 mills per kilowatt-hour to 25 mills in the inefficient central-station plants. The cost of coal delivered, which in 1914 varied from $1.06 to $1.72 per ton, increased to $2.79 and $4.20 per ton in 1918.

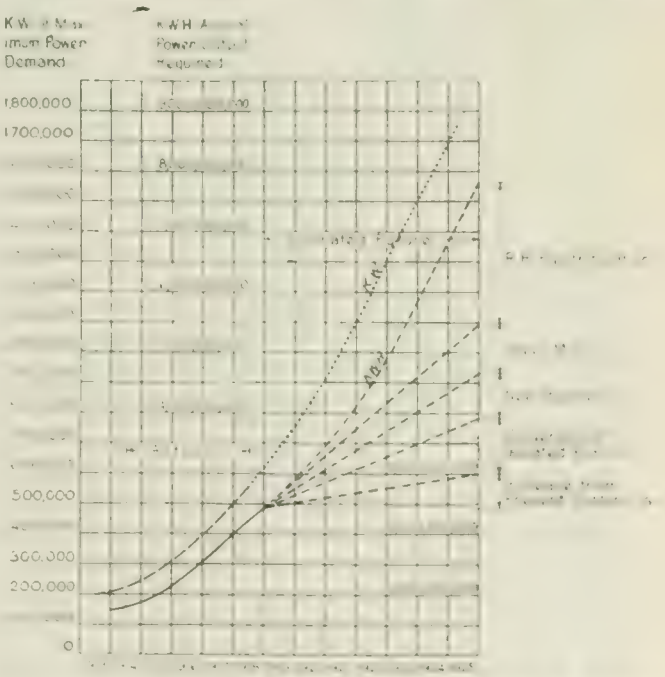


FIG. 1—TOTAL POWER OUTPUT AND MAXIMUM POWER DEMAND OF CENTRAL STATIONS OF WESTERN PENNSYLVANIA AND EASTERN OHIO DISTRICT

Coal consumption per kilowatt-hour generated varied from 1.8 lb. (0.8 kg.) in the efficient plants to 9.2 lb.

[1] This is an extract from a report on an investigation of the power service of western Pennsylvania and eastern Ohio, which Captain Whitsit, formerly of the Power Section of the War Industries Board, made during the latter part of 1918 and first part of 1919 under the authority of the Power Section, the investigations of which were under the supervision of Frederick Darlington, consulting engineer. Captain Whitsit is now engaged on power and transmission studies in connection with the Super-Power Survey for the Boston-Washington district.

(4.1 kg.) in the older and less efficient plants. There is such a wide variation in the rate of coal consumption and the cost of manufacturing power between the modern efficient plants with units of large rating and those of the older plants with inefficient and small-sized units that great economy can be effected by generating the power of the present inefficient plants by means of an efficient equipment of large-sized units in the power plants which have been contemplated at Windsor, Cheswick, Springdale and elsewhere. If the power now generated by the inefficient plants in the western Pennsylvania and eastern Ohio districts with a coal consumption rate of 2½ lb. (1.13 kg.) per kilowatt-hour, and a power manufacturing cost of more than 5 mills per kilowatt-hour were generated in efficient plants at a coal consumption of 1.8 lb. (0.8 kg.), there is a possible annual saving over 1919 figures of 796,000 tons of coal per year and of $6,950,000 annually in plant operation cost.

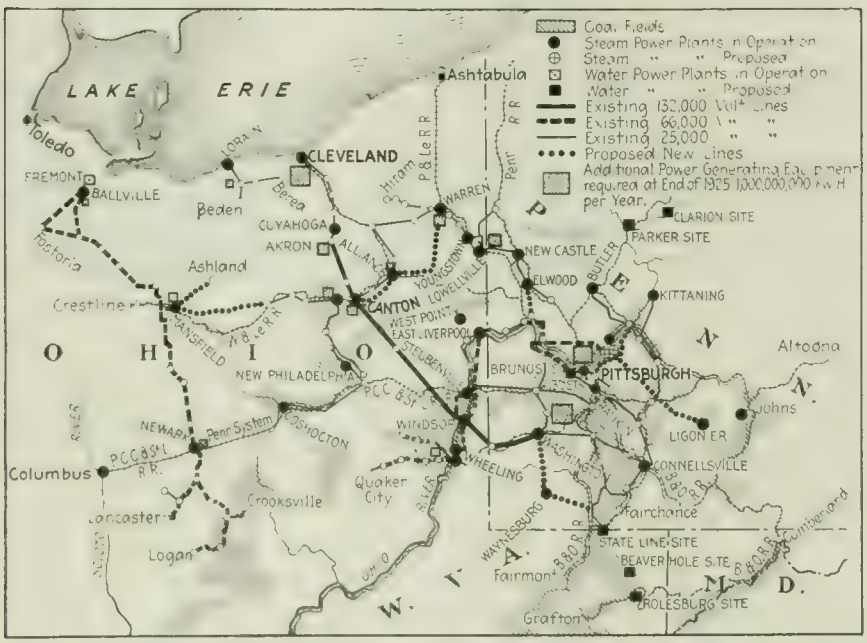


FIG. 2—ECONOMIC POWER PRODUCTION REQUIRES ABUNDANCE OF COAL SUPPLY IN JUXTAPOSITION WITH AMPLE WATER SUPPLY

Exclusive of generating equipment in the larger steel companies, there exists in the district approximately 700,000 kw. of generating equipment installed in isolated power plants, of which, it is estimated, 460,000 kw. may be economically replaced by central-station service during the next five to seven years. This, with proper consideration for the diversified character of the isolated service, will increase the peak loads upon the central systems 205,000 kw. The power which is now generated in these isolated plants is estimated to consume 9 lb. (4 kg.) per kilowatt-hour. If the power were furnished by central-station systems, there is possible a further conservation of coal, in addition to that given above, of 3,250,000 tons per annum and a probable saving in the manufacturing cost of power of $18,000,000 per year.

In addition, it is estimated that there is some 800,000 kw. of generating equipment, including electric, gas and steam power, in the larger iron and steel companies in this district. In view of the fact that steel companies have byproduct fuel and waste heat, it is not probable that more than half of this will ever affect central-station service. This would increase the peak demand by 180,000 kw.

Central stations of this district serve a large industrial manufacturing load. Of their total output some 15 per cent was used for lighting, 65 per cent for power requirements and 20 per cent for trolley service. Load factors of the various systems vary from 38 to 61 per cent, with a weighted average of 49.7 per cent for the district. The average diversity factor is about 45 per cent.

Fig. 1 shows an estimated increase in annual power requirements for the district to and including 1926. It indicates a total increase in the present lighting load of 60 per cent for the five- to seven-year period. It is equivalent to an increase of 10 per cent compounded annually and includes the increased demands of present customers and new lighting business. The increased electrical energy to meet the power-load requirements of present customers is 13 per cent, which is equivalent to an annual compounded rate of 2 per cent. This does not include the energy required to meet the power load of isolated plants which have previously generated their own power but which may reasonably be expected to solicit central-station service within the period named, nor does it include the power requirements of new industrial extensions.

These items were arrived at separately from estimates prepared by the individual companies and aggregate amounts which are equivalent to about 50 to 60 per cent of the present power load. The increased energy requirements for trolley operations are taken as 20 per cent for the period, as being an average between the extremes of 15 and 25 per cent of the 1918 railway load.

On the above assumptions the total peak on the central-station systems for the year 1927 will be 1,100,000 kw., exclusive of requirements from steel companies and for railroad electrification. Adding to this 100,000 kw. for steel company requirements and 200,000 kw. for railroad electrification will give a total estimated peak of 1,400,000 kw. The present installed rating of central-station systems on Jan. 1, 1919, was about 770,000 kw. The present program of the central-station companies will add about 300,000 kw., which is only sufficient to replace the present inefficient equipment, whose operation should be discontinued. Of the 770,000 kw., 170,000 kw. should be considered as reserve capacity, leaving 600,000 kw. available for carrying peak load, which will take a portion of the estimated future peak of 1,400,000 kw. New equipment is required to carry the remaining 800,000 kw.

In order to meet the power requirements for the next five to seven years it is recommended that the program which the central-station systems have started be actively carried out and extended. To produce the cheapest power in this district it is necessary that power plants be located at points where abundance of coal supply is available and an ample amount of condensing water is assured. Fig. 2 shows the location of some of the coal resources as they have been made

evident by existing commercial coal mines. The map also shows, through the principal rivers drawn thereon, the more important sources of condensing water. Some of the rivers are, however, limited by low summer flow accompanied by high-water temperature. The most feasible locations will, therefore, necessarily fall along the Ohio River and its main tributaries. The plants at Windsor and Springdale and the proposed plant at Cheswick meet with these conditions. They are on the Ohio and Allegheny Rivers and have adjacent to the plants coal mines of ample capacity for twenty-five years. Locations next in importance to those on the Ohio and Allegheny Rivers are West Pittsburgh on the Beaver River, Warren on the Mahoning River, points on the Youghiogheny River and Bolivar on the Tuscarawas River. The selection of the latter locations, though less favorable than the former, may be required because of the localized power demands.

This report recognizes that hydro-electric power which is available on the Clarion and Cheat Rivers and other proposed developments in western Pennsylvania, if operated in conjunction with existing steam-power systems, compares favorably at the present time with the production of power in additional steam plants of modern design. With the increasng cost of labor and fuel, which will raise the cost of power at a faster rate in steam plants than it does in hydro-electric plants, future comparisons will be more in favor of hydro-electric plants than at present. It is therefore recommended, in the provisions for generating additional power, that serious consideration be given to hydro-electric power resources. With a peak of 1,400,000 kw., the annual amount of power required is 6,000,000,000 kw.-hr. The top 800,000 kw. of the load curve, which is 57 per cent of 1,400,000 kw., would require 35 per cent of the total power in kilowatt-hours, or 2,100,000,000 kw.-hr.

The Clarion River development will furnish 300,000 kw. of power capacity and 650,000,000 kw.-hr. of power in a year of average stream flow, and the total Cheat River development will furnish 500,000 kw. of capacity and 1,350,000,000 kw.-hr. of power in a year of average stream flow, making a total for the development of these two rivers of 800,000 kw. in capacity and 2,000,000,000 kw.-hr. in a year of average stream flow. With the development of Cheat River power, the increased power requirements in the vicinity of Cumberland, Md., and Fairmont, W. Va., will draw upon this source for some of its power. There are other water powers in West Virginia and western Pennsylvania which may compare favorably with those considered in this report. Information, however, was not available which would warrant making any recommendations regarding them.

In a year of minimum stream flow the developments on the Clarion and Cheat Rivers would furnish only 1,290,000,000 kw.-hr. of power, which is 21½ per cent of the total 6,000,000,000 kw.-hr. It corresponds to 43½ per cent of the top portion of the load curve, or 610,000 kw. In other words, in a year of extreme low water 190,000 kw. of reserved steam capacity would be called upon to make up the deficiency of water power available in a year of average stream flow.

An important fact learned in the operation of the power systems during the war period was the decided advantage afforded by the thorough interconnection and unified operation of central-station systems. This made possible the use of excess capacity in one location or of one system in other locations or systems where there was a scarcity of capacity. It further made accessible reserve capacity in any one system for breakdown and emergency conditions in other systems, thus reducing the total reserve required.

At the present time increased economies in power production are obtained by the construction and operation of units of large capacity with the abandonment of units of small size, or at least using them only for emergency and for peak loads. Reliability obtained in modern transmission-line construction makes possible the realization of other economies obtained by the suitable location of power plants convenient to coal deposits and condensing water. Economies will increase with the increased size of power stations up to a capacity of 300,000 kw. As Pittsburgh has grown to be a great center of industrial manufacturing, so the Ohio River district and its resources furnish the picture of some time becoming an immense center for the manufacture of power whose products will be distributed by transmission lines to meet the requirements not only of western Pennsylvania but also of Ohio and Indiana and westward until they meet the competition of other large super-power plants with equal natural resources in coal and condensing water.

Electrical Symbols Proposed for International Adoption

Complete Set Adopted by Advisory Committee for Consideration at Next Plenary Meeting of International Electrotechnical Commission

AN IMPORTANT step toward the general use of standard electrical symbols was taken at the recent Brussels meeting of the International Electrotechnical Commission. A tentative list of symbols was adopted for consideration at the next plenary meeting of the commission. This list is published on page 972 in full, together with some parallel symbols commonly used in this country which may yet receive favorable consideration when final action is taken.

The proposed symbols are published at this time, by courtesy of the I. E. C., for the purpose of affording ample opportunity for full discussion.

Perhaps the most striking proposal in the list is the use of circles for transformer windings as shown in several items beginning with 39. The idea is completely new to most American engineers, but the simplicity of the diagrams thus drawn recommend themselves for full consideration, both from the viewpoint of the man who makes the diagram and the man who reads it. In items 53, 54, 63 and 67 are alternative proposals inserted by the editor to show what appears to be a simpler symbol than that proposed in the official report of the advisory committee. These alternatives may be said to be representative of American practice.

Beginning with item 21, two symbols are shown in many instances, one for use in single-line and the other for complete wiring diagrams.

As a basis for presenting American practice the paper on symbols by E. J. Cheney, read at the last midwinter convention of the A. I. E. E. and abstracted in the ELECTRICAL WORLD for Feb. 28, was used by our representatives on the advisory committee on symbols. Dr. C. O. Mailloux was chairman of the American delegation as well as being president of the I. E. C., and Dr. P. G. Agnew was secretary.

Electrical Symbols Recommended to International Electrotechnical Commission

(See page 971)

SYMBOLS PROPOSED FOR INTERNATIONAL USE

I-Diagrammatic Elements

1 Two-phase three-wire
2 Two-phase four-wire
3 Three-phase mesh-connected
4 Three-phase star-connected
5 Double three-phase mesh-connected
6 Double three-phase star (zigzag)-connected
7 Six-phase mesh-connected
8 Six-phase star connected
9 Neutral wire brought out
10 Three-phase star-connected with neutral wire brought out

II-Symbols

a-Italian-b-British-c-The circle representing transformer windings has been used by the Swiss and Italians for many years.
d-Thin line is positive-e-f-g-h-American

1 Generating station (thermal)
2 Generating station (hydraulic)
3 Generating station (mixed thermal and hydraulic)
4 Substation (general)
5 Substation with transformers
6 Substation with rotating machinery
7 Substation with battery
8 Substation with rotating machinery and transformers
9 Substation with switch gear only
10 Armature poles
11 Field poles
12 Segment poles
13 Alternating and direct current
14 Underground lines
15 Overhead lines (optional)
16 Wires crossing in contact or feeding
17 Wires passing near in contact
18 Wires connected
19 Earth connection
20 Condenser with capacity
21 Motor generator set
22 Rotary converter
23 Radial brush or tangential brush, as preferred by each national committee, thus:
24 Generator or motor with series excitation
25 Generator or motor with shunt excitation
26 Generator or motor with compound excitation
27 Alternating-current generator, single-phase
28 Alternating-current generator, two-phase
29 Alternating current generator, three phase
30 Alternating current generator, three phase mesh connected
31 Alternating-current generator, star connected
32 Alternating current generator, star connected, neutral wire brought out
33 Asynchronous motor
34 Synchronous motor
35 Series Alternating-current motor
36 Repulsion motor
37 Machines coupled, for example:-motor-generator two separate machines coupled
38 Rotary converter
39 Alternating-current transformer (general)
40 Current transformer
41 Pressure transformer
42 Three-phase transformers: Mesh-mesh, Mesh-star, Star-star
43 Three single-phase grouped
44 Auto-transformers
45 Battery (general)
46 Primary cell
47 Secondary battery
48 Incandescent lamps
49 Arc lamps
50 Busbar
51 Spark gap (general)
52 Lightning arrester (general)
53 Horn gap arrester
54 Electrolytic arrester
55 Condenser
56 Contact
57 Variable condenser
58 Inductance (general)
59 Variable resistance
60 Variable air-core inductance
61 Iron-core inductance (choke coil)
62 Liquid resistance
63 Electromagnet
64 Switch
65 Air-brake switch
66 Multiple pole switch
67 Two-way switch, single-pole
68 Two-way switch, double-pole
69 Oil-immersed switches
70 Ammeter
71 Voltmeter
72 Wattmeter
73 Frequency meter

Lightning Protection of 4,000-Volt Lines

That the Density of Lightning Arresters on an Electrical Distribution System Is Far More Important than the Type of Arrester Is Shown by Investigation Experience Does Not Bear Out the Conclusions Drawn from Laboratory Tests of These Arresters

ALTHOUGH it has generally been the opinion of operating men that distribution systems with a high density of transformers—that is, a large number per square mile—will be subject to more frequent interruptions due to lightning trouble than will systems with proportionately fewer transformers, tests carried out on the extensive 4,000-volt, 60-cycle distribution system of the Commonwealth Edison Company indicate that such is not the case where each transformer is protected by a lightning arrester. Curves have been plotted to show that where there were 100 transformers and arresters per square mile the average number of burned-out transformers amounted to 1.67 per cent per annum, whereas in areas where the density reached 200 the burn-outs reached only 0.5 per cent, an actual reduction from seventeen to ten burn-outs. The importance of the density of arresters on this system was brought out by D. W. Roper in a paper entitled "Studies in Lightning Protection on 4,000-Volt Circuits—II,"* presented at the meeting of the American Institute of Electrical Engineers held in Chicago yesterday. Mr. Roper also showed that the same principle applies to cable poles where underground cables are connected to the overhead system, namely, that there should be a high density of arresters in the vicinity of these poles in order to keep the underground system comparatively free from lightning interruptions. Laboratory tests of arresters fail to take account of these considerations.

Characteristics of the System Investigated

The system of distribution on which these investigations were made is a four-wire, three-phase installation, with the neutral grounded only at the substations and with 4,000 volts between phases. Single-phase transformers are used almost exclusively and are connected between the phase and neutral wires. Power and lighting customers are supplied from the same primary mains, but the very large customers are connected to a 12,000-volt system. The feeders are all No. 0 wire and the mains No. 6. About 85 per cent of the feeders and 15 per cent of the mains are underground, while about 99 per cent of the transformers are on poles and the rest in manholes or vaults. At single transformer installations a 2,400-volt arrester is connected to the same phase wire as the transformer and a 300-volt arrester to the neutral wire. Where three transformers are installed for a power service there are three 2,400-volt arresters, one connected to each phase, and one 300-volt arrester to the neutral wire. Arresters are thus installed on the same poles with transformers. The lightning arrester ground consists of ½-in. (1.25-cm.) galvanized-iron pipe, 10 ft. (3 m.) long, driven into the ground at the base of the transformer pole. Secondary circuits are usually less than one block long, and the secondary ground is similar to the lightning-arrester ground, but is installed on the next pole. Where there are four primary wires in an alley they are installed on the top arm and the secondaries on the second arm. Where there are only two primary wires the lightning secondaries may be installed on the same arm. More than 80 per cent of the poles are owned and operated jointly with the telephone company. This distribution system at present includes about 100,000 poles, 20,000 transformers, with a total capacity of 270,000 kva., 6,500 conductor-miles of overhead primary-line wire, 2,200-conductor miles of underground cable and 2,500 cable poles. The system serves about 400,000 customers.

A very comprehensive study of this extensive system enabled the author to segregate various factors in lightning troubles and study the effects of each. Many other important conclusions were arrived at and these are summarized below:

In Fig. 1 are shown electrical diagrams of all the lightning arresters used in the investigation, and the letters shown are used throughout the investigation to distinguish the various arresters. Fig. 2 shows graphically the number of transformers on the system over a period of years as well as the percentage of transformer primary fuses blown and transformers burned out by lightning each year. The increase in percentage of fuses blown during the year 1918 and 1919 was known to be difinitely due to other causes than lightning.

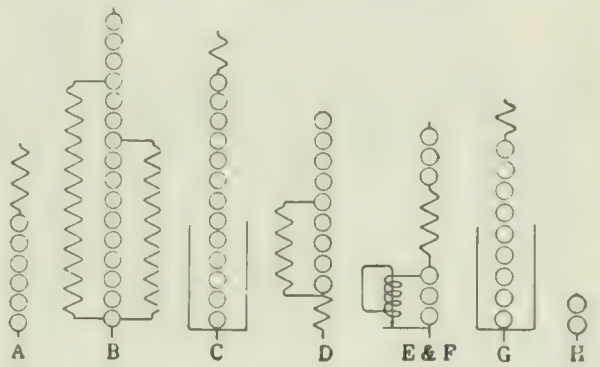


FIG. 1—LIGHTNING ARRESTERS USED IN INVESTIGATION

Type *G* was installed in 1920, while *H* represents the 300-volt arrester installed at the neutral.

From the previous paper and subsequent studies it appears that the factors that might affect lightning-arrester performance are as follows: (1) The system of distribution and the grounding of the neutral; (2) primary terminal boards; (3) the shielding effect of trees, buildings or wires of other companies; (4) the resistance of the lightning-arrester ground connection; (5) the make of the transformer; (6) the size of the transformer; (7) the age and previous service record of the transformer; (8) variation in the distribution and intensity of the lightning; (9) the density of lightning arresters; (10) the design of the arrester.

An investigation of the records demonstrated beyond question that the shielding effect of trees or buildings immediately adjacent to the lines considerably reduced the amount of damage on these lines from lightning. This was shown by the following facts:

(a) The percentage of poles in the distribution sys-

*The first paper of this series was published in the *A. I. E. E. Transactions* in 1916, page 655, and ELECTRICAL WORLD, May 27, 1916.

tem shattered by direct strokes is extremely small, being of the order of one four-hundredth of 1 per cent. This is very much smaller than the corresponding percentage in the case of transmission-line poles belonging to the same company in the flat open country in the southeastern portion of the city.

(b) An investigation of the conditions surrounding the installation of 97 out of 529 cases covered by this

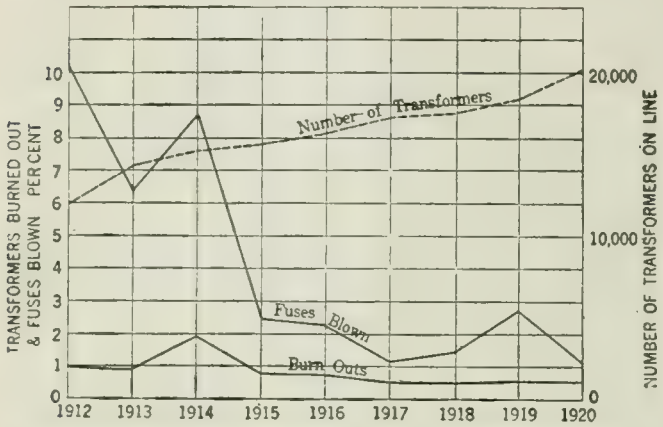


FIG. 2—TRANSFORMER TROUBLE OVER A PERIOD OF YEARS

study where transformers were burned out by lightning failed to reveal a single case in which the primary wires adjacent to the transformer were overshadowed by high trees or buildings immediately adjacent. It appeared that no type of arrester was at any serious disadvantage so far as the shielding action of trees and buildings was concerned.

With the idea that some of the transformer burn-outs might have been due to ground connections of too high resistance, the resistance was measured at ninety-seven locations where the burn-outs occurred. In the same vicinity the resistance of 2,770 grounds, both lightning-arrester and secondary, was tested in 1916; but it was found that the resistance of the lightning-arrester grounds at the points where the ninety-seven transformers were burned out by lightning averaged only slightly above the resistance of the much larger number tested three years earlier. It therefore appears that the burn-outs were not due to particularly bad ground connections.

High Density of Arresters Reduces Trouble

For the purpose of investigating the effect of density of arresters in the distribution system on lightning disturbances, the system was divided into 192 sections, and the curve shown in Fig. 4 was plotted from the record of the number of transformers and arresters and burn-outs due to lightning in each of these districts. It will be noted that in about one-sixth of these sections the points are on zero line of burn-outs, showing that there were no burn-outs whatever in these sections during the five-year period. This curve shows that the density of lightning arresters has a very important influence on the results attained. If it be assumed, for example, that there are 1,000 transformers installed in an area of 10 square miles, each protected by an arrester on the same pole, and that later the number of transformers in this area is doubled and at the same time uniformly distributed, it should be observed that the percentage of burn-outs has decreased 1.67 per cent to 0.5 per cent, and that the actual number of burn-outs has decreased from seventeen to ten per annum. In other words, a doubling of the number of transformers and arresters in a given area will not result in more transformers being burned out by the lightning per year, as might be supposed, but will result in an actual reduction of about 40 per cent in the number of such burn-outs per year.

The data for each type of arrester were then plotted in a similar manner, but this resulted in curves which crossed each other in a confusing manner. While the curves appear to be accurate, there is no physical reason why one type of arrester should be better than another at one density and poorer at another density. The curves were therefore plotted on logarithmic paper and were found to be straight lines. The mid-point was found for each arrester and parallel straight lines were drawn through the points thus obtained, giving the curves represented in Fig. 5. It is believed that these curves represent the performance of each of the arresters with varying densities, and the most troublesome variable—that is, the variation in the distribution and intensity of the lightning—has been thus eliminated by the method of assembling the data and drawing the curves. From these curves it will be seen that the performances of four of the arresters, designated as *C*, *D*, *E* and *F*, are so close together that the differences may be considered as well within the possible errors of observation.

It will be noted that the ordinates for curve *B*, in Fig. 5, are about 40 per cent below the corresponding ordinates of the average of curves *C*, *D*, *E* and *F*. This arrester *B* is one of the oldest types on the lines and is fairly well distributed over a wide range of density.

The data showing the relation between the density of arresters and the percentage of primary fuses blown by lightning were treated in the same manner as for transformer burn-outs, giving curves which showed that these arresters were effective in the order *B*, *A*,

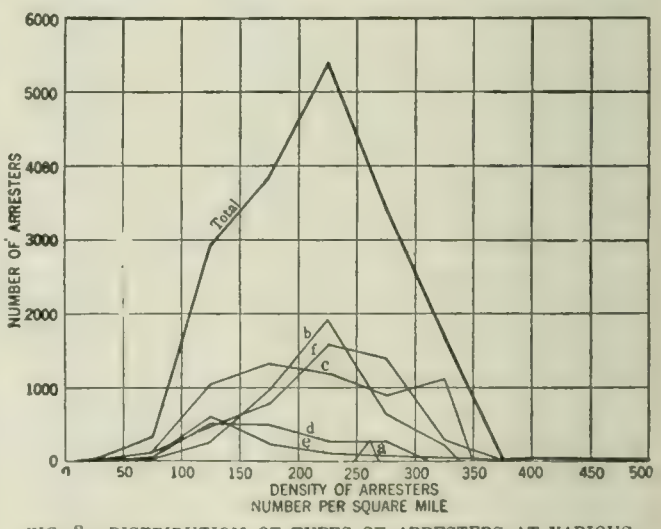


FIG. 3—DISTRIBUTION OF TYPES OF ARRESTERS AT VARIOUS ARRESTER DENSITIES

As far as possible each type was used over a wide range of arrester densities in order to separate the effects of type of arrester and arrester density on lightning interruptions.

F, *C*, *D* and *E*; that is, the number of fuses blown at any density was greatest for arrester *E* and least for arrester *B*. On account of the fuse trouble experienced in 1918 and 1919, as mentioned before, the percentage of fuses blown which in the last two years has been ascribed to lightning is known to be higher than the actual figure. The trouble was eliminated by the change of all fuses to a new type during the latter

months of 1919 and the earlier months of 1920. The marked reduction in the percentage of fuses blown by lightning in 1920 indicates that this particular form of fuse trouble has been eliminated. The principal cause of the blowing of transformer primary fuses in lightning storms is the arcing across the bushings where the primary wires enter the transformer case, and the scars from these arcs can generally be located. Some of the transformer manufacturers have increased the size of these bushings in their later designs, and the Commonwealth Edison Company's records indicate a considerable reduction in the amount of trouble from this cause with the enlarged bushings.

PROTECTING UNDERGROUND CABLES

As indicated in the description of the system, about 25 per cent of the primary feeders and mains are underground and there are about 2,500 cable poles where the underground feeders or mains are connected to the overhead wires. At all of these cable poles each of the cables is protected by an arrester installed on the cable pole in a manner similar to those installed on transformer poles. These arresters have not been included in figuring the density of arresters for the protection of transformers.

It is common knowledge in Chicago that some years ago, when the number of substations supplying the system was only one-fifth of the present number and when the average distance between transformers was considerably greater than at present, there was a large percentage of cable troubles due to lightning. The records show that, although the load has increased more than tenfold since that time and the number of cable poles has probably increased in an even greater ratio, the annual number of burn-outs of such cables due to lightning has not increased and has probably been reduced. This information, together with the curve in Fig. 4, leads to the conclusion that the arresters which have been installed on these lines for the protection of transformers must also assist in the protection of cables connected to the overhead lines. It also appears that the arresters installed on the cable poles must assist in the protection of neighboring transformers.

In cases where lightning arresters are installed at points where high-voltage cables are connected to overhead lines no company installs more than a single arrester. In Chicago there are a number of such cable poles on 12,000-volt and 20,000-volt cables, and the proportion of burn-outs of these cables due to lightning is around 10 per cent per annum, while in the 4,000-volt cables it is a small fraction of 1 per cent. In view of this experience it appears that a very considerable reduction of the percentage of such burn-outs can be obtained by the installation of additional arresters in the vicinity of the cable pole.

AN ARRESTER OF PROMISING CHARACTERISTICS

The earlier types of lightning arresters were all made with metal parts inclosed in a wooden case, but early in the period covered by these investigations a type of arrester was brought out which was self-contained; that is, the metal and other current-carrying portions of the arrester were assembled in a porcelain casing, which did not require an external wooden box for protection. The gaps in this new type, instead of being between brass points or spheres, are between circular parallel plates so that a number of successive heavy discharges will not seriously alter the total length of the gaps. Experience with these arresters pointed to the conclusion that they have many advantages over the wooden-box type besides a considerably reduced annual maintenance charge. Based on the experience obtained in these investigations, the following tentative specifications may be offered:

1. The arrester must consist of a number of gaps in series with or shunting a resistance so adjusted that the dynamic

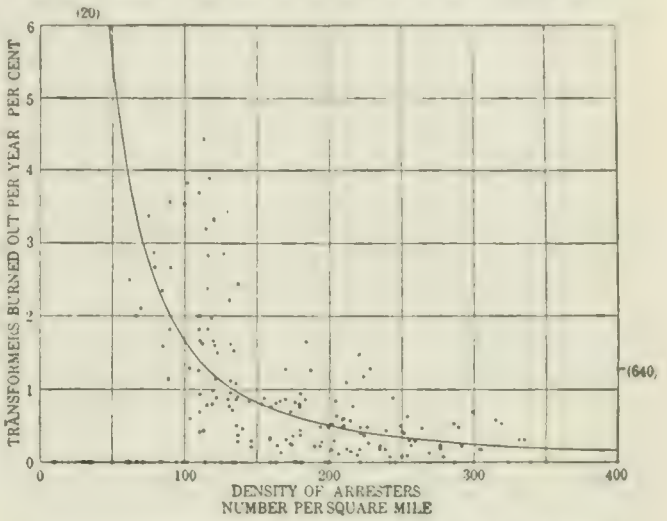


FIG. 4—VARIATION OF TRANSFORMER BURN-OUTS WITH ARRESTER DENSITY OVER FIVE-YEAR PERIOD

arc following the lightning discharge will be quickly broken without damage to the arrester.

2. The resistance rod must have the resistance uniformly distributed throughout its length.

3. The amount of resistance in the rod should not be seriously affected by repeated heavy discharges.

4. The leads for connecting the arrester to the line should leave the arrester so that they will form drip loops, and the leads should be so arranged that the arrester can be connected to a line wire on either side of the arrester.

For low maintenance cost the following are available:

5. The inclosing case should be of fireproof insulating material that is not affected by the weather. It should be constructed so as effectively to protect the metal box from weather and prevent accumulation of dust from the gaps.

6. The gaps in the arrester should be between parallel plates, disks or rings.

7. The arrester should be constructed so that in case of failure to break the dynamic arc the inclosing case will be shattered by heat, thus giving visible evidence of trouble.

8. The arrester should be without moving parts or parts which require inspection, renewal or adjustment and should preferably be made in the form which cannot be inspected or repaired without removing it from the pole.

The experience with the arresters covered by this investigation indicates that several types of arresters are now available which comply with all of these specifications. The annual maintenance cost has up to the present time averaged well below 1 per cent per annum and is practically confined to replacing of damaged arresters.

THE WHOLE STUDY SUMMARIZED

The conclusions from the investigations described in this paper, together with the more important conclusions from the previous paper, some of which have been modified and extended by these investigations, may be summarized as follows:

1. Transformer troubles during lightning storms may be reduced (a) by the removal of transformer primary terminal boards, (b) by the installation of

lightning arresters, (c) by the use of larger bushings on the primary leads of transformers.

2. Lightning arresters installed on transformer poles are considerably more effective than if installed on the line poles.

3. Even in the most severe lightning storms, which apparently cover the given territory quite completely, there will be numerous extended areas within this territory which will be entirely free from lightning disturbances. Careful records extending over a period of several years are, therefore, necessary in order to determine definitely whether immunity from troubles due to lightning should be attributed to the efficiency of the lightning protection or to the absence of lightning.

4. There is a very marked improvement in the effect of lightning-arrester protection with an increase in density, and this effect is such an important factor in their performance that no accurate comparison of the

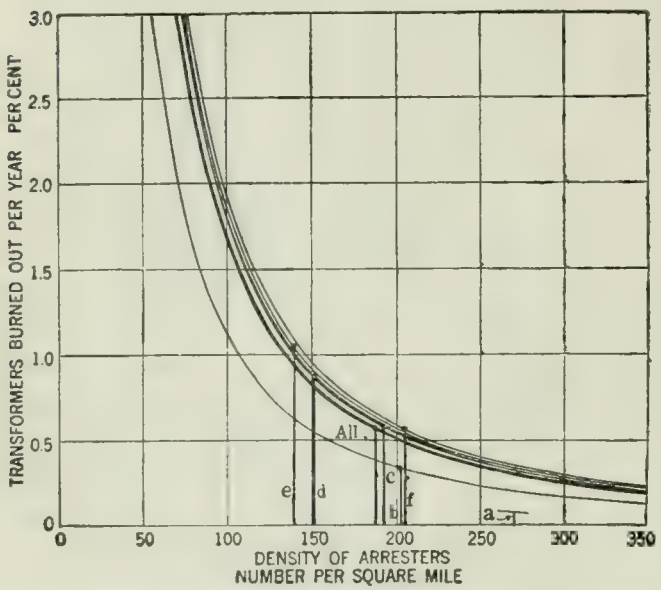


FIG. 5—PERFORMANCE OF INDIVIDUAL ARRESTERS AT DIFFERENT ARRESTER DENSITIES

The original data yielded curves which crossed each other. The curves were separated, however, by a fairly rational method.

relative merits of various types of arresters can be made without giving it proper consideration.

5. Where the density of transformers and arresters on the same pole is high the total combined effect of all of the adjacent arresters is greater than that of the arrester on the same pole with the transformer.

6. In districts where transformer density is materially below 100 per square mile, and where continuous service is important, it will probably be found desirable to install arresters on line poles in addition to an arrester on the same pole with each transformer; where the local density is about 50 per square mile or lower, the installation of such additional arresters will probably be warranted by the reduction in operating expenses.

7. The increase in the density of lightning arresters also results in a marked decrease in the percentage of burn-outs due to lightning of underground cables connected to overhead distribution circuits, and the percentage has been reduced below one-tenth of 1 per cent per annum with the density averaging about 200.

8. In the case of high-voltage cables operating at voltages up to 25,000, with one arrester at the cable pole, the installation of additional arresters in the vicinity would in all probability cause a marked reduction in the percentage of burn-outs of such cables due to lightning.

9. The density of arresters, the shielding effect of high buildings and trees, and perhaps other features, have such an important effect on the amount of trouble from lightning that no accurate comparisons of the results secured in different cities can be made without giving due consideration to all conditions under which the lightning arresters are installed.

10. For use in the protection of transformers in districts where each transformer is protected by an arrester on the same pole, and where the density of arresters ranges above 200 per square mile, the most economical arrester of the several types covered by this investigation is probably the cheapest arrester. It is entirely possible and even probable that the local conditions will have an important bearing in determining the best type of arrester to be used in any given locality, and that where the amount of shielding from buildings, trees, etc., is very slight and where the securing of adequate ground connections for the arresters is expensive, it would be preferable, even in areas of low density, to use arresters whose discharge capacity is considerably greater and whose discharge potential is considerably lower than the arresters covered by these investigations and to confine the installation of the arresters to the transformer poles.

11. It is possible by carefully distributing the various types of lightning arresters over a large area and by obtaining the results of the performance of arresters over a period of years to get data which will permit a comparison of the relative merits of the several types of lightning arresters as protective devices.

12. It is entirely possible to make lightning arresters of the self-contained type—that is, of a type not requiring an external protecting box and so constructed as not to require or permit inspection. The annual maintenance cost of such arresters is practically limited to the replacing of damaged arresters, and the total annual maintenance cost as indicated by an experience of five years with several thousand of them is well below 1 per cent of their original cost of installation.

13. A change in the form of lightning-arrester gap from a cylindrical or spherical shape to parallel flat surfaces appears to result in a form which allows repeated heavy discharges without requiring renewal or adjustment of the parts. This has been an important factor in changing the design from a type requiring annual inspection, renewal and adjustment to a type which does not permit or require such annual attention.

14. The four types of arresters which have been designated by the letters *C*, *D*, *E* and *F* (see Fig. 1), and which consist essentially of a resistance in series with a number of gaps, together with such additional features as antennas, compression chambers, expulsion chambers and solenoids to vary the length of the gap following dynamic discharge, appear to have equal value in protecting line transformers.

15. The type of arrester designated by *B*, which consists of a large number of gaps in series without any resistance, in addition to two other paths through a high and a low resistance shunting a large and a small number of gaps, appears to be a considerably better protective device than arresters designated by *C*, *D*, *E* and *F*, due to features of its design.

16. With the data in this paper it should be possible to estimate cost and results of lightning protection in Chicago with same degree of accuracy as characterizes the

estimates of cost of construction or maintenance of overhead lines, when the figures are averaged over a period of years.

17. The shielding effect of high buildings, trees and other similar features which might be considered as determining the exposure of the lines to lightning has an important bearing on the amount of damage that will be caused by lightning. In local areas of a distribution system which have for years shown a high percentage of troubles caused by lightning it will probably be found that a large percentage of troubles is due to the lack of shielding from the surroundings or to a low density of arresters, and that the trouble can be materially reduced by increasing the density of the arresters in the locality.

18. Great caution should be used in attempting to compare the results secured by lightning-arrester protection in Chicago with results secured in other localities without giving due consideration to all of the factors which might affect lightning-arrester performance.

Readers' Views and Comments

Pioneer Electrical Canal Haulage

To the Editor of the ELECTRICAL WORLD:

SIR: I am glad to see in your obituary notice of Richard Lamb reference, though brief, to his pioneer work in the effort to electrify our American canal system. That is, I fear, a well-nigh forgotten episode in electrical development of a very novel character, but let us hope it is not a closed chapter.

Mr. Lamb, as a young civil engineer with unusual inventive ability, was interested in the reclamation of the famous Dismal Swamp of his native Virginia, and his attention was arrested by the desirability of some method of "snaking" or hauling logs out of its recesses through the tortuous pools and shallow waterways. From that he proceeded by natural stages to a consideration of the canal haulage problem.

In this field Lamb began his experiments on the Raritan Canal, at Trenton, N. J., where more than twenty-five years ago he installed an ingenious system along the towpath. It consisted of pole or tree brackets carrying a steel-copper cable presenting a good bearing and wearing surface for truck wheels to ride on and affording excellent conduction for the operating current. Over this cable, by means of a truck hung vertically, a motor traveled, so working as to pull on the traction cable wound around a sheave, parallel to the bearing cable. The tow rope was attached to the Samson post of the canal barge, and the hanging frame of the motor carried also a kind of "bosun's chair" in which the motorman sat. Details and illustrations will be found in "Electrical Boats and Navigation" (Martin and Sachs, 1894) and in your own pages of that period.

Similar work was done by Lamb on the Erie Canal at Tonawanda, N. Y., and on the Lehigh Canal, and it may be remembered that kindred attempts were also made a little later on other canal sections and systems. It is a pity that for some unexplained reason interest in this desirable development died out and was not revived during these critical times in transportation, when the frightful congestion on the inadequate railroads should have given one of our earliest public utilities—the canal—a new lease of life. Why has the enlarged, expensive Erie Canal system no electrification?

My friend Lamb, although he lost no small sum of money in his gallant efforts, never regretted that he had tried hard to make good in electrical canal haulage, almost alone and unaided.

New York City. THOMAS COMMERFORD MARTIN.

Auto-Transformers for Motor Starting

To the Editor of the ELECTRICAL WORLD:

SIR: In an article entitled "Auto-Transformers for Motor Starting," which appeared in your issue of Sept. 4, page 473, a statement was made which is likely to leave a wrong impression unless it be amplified. This statement appeared on page 474, and read as follows: "Referring to Fig. 2, the same auto-transformer applies both to a 100-hp., 1,200-r.p.m., and a 250-hp., 150-r.p.m. motor."

There are at least two important practical considerations which should be introduced as qualifying this assertion:

(1) In general, in a consistent line of induction or synchronous motors, the higher-speed machines will develop a greater percentage of full-load torque when started from a specified voltage tap than will the lower-speed machines. Therefore, assuming that the device connected to the 250-hp., 150-r.p.m. motor requires the same percentage of full-load running torque at the start as does the device driven by the 100-hp., 1,200-r.p.m. motor, the result will be that a higher voltage tap will be required for starting the low-speed motor than is necessary for the high-speed motor.

(2) Perhaps of greater importance is the fact that in the usual run of industrial motor applications the lower-speed drives are almost invariably associated with service requiring a much greater starting torque relative to the normal running torque than do the high-speed drives. As typical of the service probably encountered by a 250-hp., 150-r.p.m. motor there would be grinders, crushers, compressors, line shafts, etc.—*i.e.*, devices requiring approximately full-load torque at starting. Contrasted with this, typical service of the nature of 100-hp., 1,200-r.p.m., would include fans, blowers, centrifugal pumps, motor-generator sets, etc., ordinarily requiring appreciably less than half of full-load torque to start. Therefore, again to the second degree, the probabilities are that a higher voltage tap would be required for the low-speed motor than for the high-speed motor.

Hence, if the same auto-transformer were used alternatively for the two ratings cited, there is a strong probability that when serving the low-speed motor a much higher tap voltage would be necessary, and therefore the switch contacts and windings would be subjected to much more strenuous service than would be occasioned by use with the high-speed motor. Conversely, if the auto-transformer were especially designed for the case in hand, it would be capable of much cheaper construction for the 100-hp., 1,200-r.p.m. motor than for the 250-hp., 150-r.p.m. V. S. FOSTER.

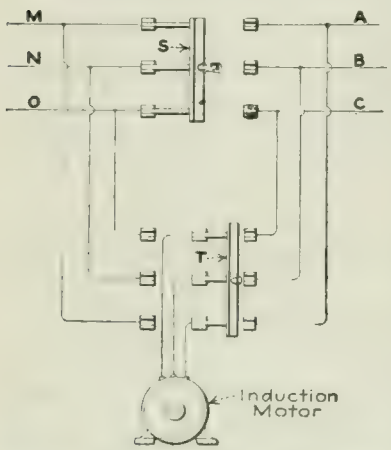
Canadian General Electric Company, Ltd.,
Peterboro, Ont.

Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Safe Method of Synchronizing

TO PREVENT mistakes when connecting a three-phase generator to another generator or system with which the first generator is to be synchronized a triple-pole, double-throw switch has been used by the writer in conjunction with an induction motor for indicating direction of rotation. The switch is placed near the ends of the two lines which it is desired to connect together and jumpers are run from the lines to the three blades of the switch which is shown at *T* in the drawing. The induction motor is connected to the inside terminals of the switch. The switch is first thrown to the right and the direction of rotation of the motor is noted, and then it is thrown to the left. If the direction of rotation is not the same in both cases, two of the conductors of one line are interchanged at switch *S* to make the directions of rotation identical. Then the oil switch at the first generator is opened and switch *S* is closed. After this one phase of the generator line is synchronized with one phase of the line, after which the oil switch may be closed. The advantage of using this plan comes from the fact that the wires running from the double-throw switch to the two lines are left connected after the directions of rotation have been checked, thus preventing any chance of connecting the wrong wires of the two lines together.



SCHEME PREVENTS CROSSING WIRES AFTER CHECKING PHASE ROTATION

Trail, B. C., Canada. R. H. N. LOCKYER.

About 2,000 Lb. Is Normal Working Load for Strain Insulators

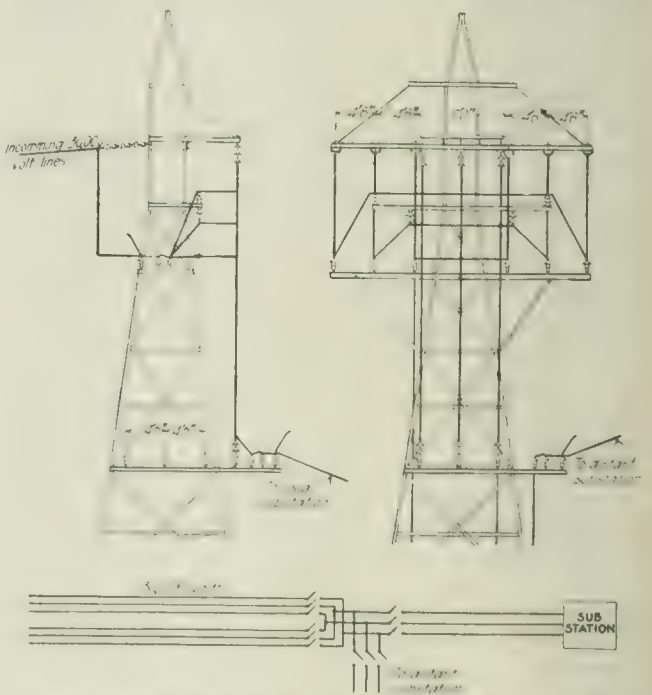
GENERAL insulator practice sanctions a normal working load of not more than 2,000 lb. (907 kg.) on strain insulators, although an occasional load, such as might result from wind and ice, reaching 3,000 lb. (1,360 kg.) is sometimes permissible. Present-day insulators might very easily stand occasional loads of 5,000 lb. (2,267 kg.), as the average ultimate strength of cemented cap and pin units is about 11,000 lb. (4,985 kg.). This is consistent with the usual practice in mechanical design wherein loads are based upon the elastic limit of the material to be used, which ordinarily is about one-half the ultimate strength. For important designs it is common practice to use a safety factor of two or even more, so that an actual load of 25 per cent of the ultimate strength is imposed. When account is taken of the fact that porcelain is far inferior to steel as a structural material, there appears no good reason why insulators should be expected to withstand the heavy loads which in times past have been placed upon them.

L. N. CRICHTON,
Supply Engineering Department.
Westinghouse Electric & Manufacturing Company,
East Pittsburgh, Pa.

Switches Mounted on Two-Circuit Steel Tower

TO SAVE the expense of erecting a switching frame, the two-circuit line tower shown here was adapted by the Cleveland Cliffs Iron Company, Michigan, for carrying four sets of disconnecting switches and the insulators on which circuits were run to the switches.

It was necessary at this tower to supply service from either or both of two incoming 30,000-volt transmission lines to a local substation and to a line going to a distant substation. The disconnecting switches for both of the incoming lines and for each of the substation circuits are mounted on steel members which were added to the structure. The rods for operating the switches extend to within a convenient distance of the ground. the base of the tower is inclosed by a wire fence which is not shown. This structure was installed at the direction of F. C. Stanford, electrical engineer for the company.



FOUR SETS OF DISCONNECTING SWITCHES MOUNTED ON TRANSMISSION TOWER

Larger Boiler Units and Combustion Chambers Increase Economy

LARGER and fewer boilers and larger combustion chambers are coming into more general use with consequent increasing efficiency. If possible, the average plant should preferably consist of not less than five or six boilers or more than about ten. Such concentration permits close supervision and the fullest possible use of recording instruments, since the cost of equipping a large boiler is little more than that for a small one. Recording instruments are regarded as essential for the close supervision necessary for high efficiencies.

Larger combustion chambers and the locating of the heating surface of the boiler as far as possible from the fuel bed, which modern developments in design have made possible, permit both high capacities and high efficiencies. In a few years Babcock & Wilcox boilers have had the distance from the bottom of the front headers to the floor line increased from 7 ft. (2.2 m.) to as high as 16 ft. or 18 ft. (5 m. or 6 m.), while Stirling boilers have had the distance of about 2.5 ft. (0.7 m.) from the center of the mud drums to the floor line increased 5 ft. to 12 ft. (1.5 m. to 3.6 m.).

Among the recently developed factors which permit the use of large combustion chambers are higher stoker efficiency, smaller relative area of outside radiating surface, smaller surface through which air can leak into the boiler, more efficient heating surface and smaller area of low-efficiency fuel bed along the furnace walls. These factors added to more careful supervision aid in maintaining the highest boiler efficiencies.

Modern practice is also calling for higher pressures. Larger boiler plants are now being built to operate at 250 lb. to 300 lb. (17.5 kg. to 21 kg.) pressure and higher, a number of plants for 350 lb. (24.5 kg.) pressure being in successful operation. Emphasis is being placed on the necessity of freedom from scale and deposit inside the boiler tubes if higher boiler ratings are to be obtained, it being necessary in many large plants to use only condensed steam for boiler feed and keep the make-up water to the smallest possible percentage, or to use evaporators to insure that no scale-forming matter enters the boilers. Treatment of raw water helps but does not remove the solids, except to some extent where settling tanks are used.

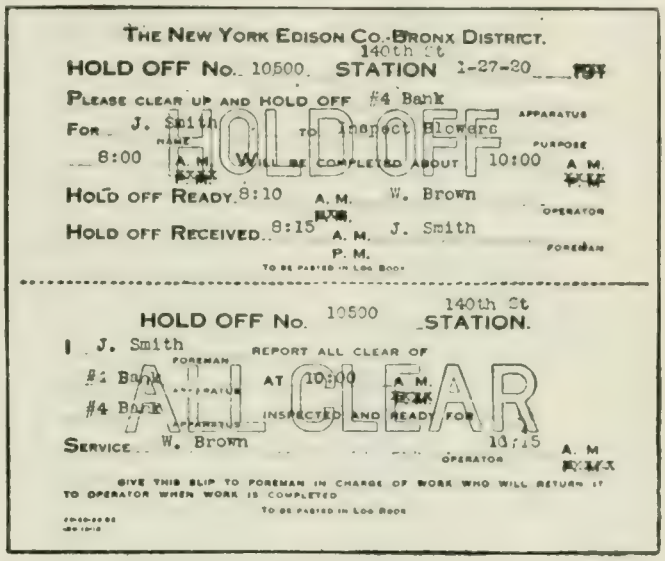
These comments were made in a paper recently presented before the station-operating committee of the Ohio Electric Light Association by R. E. Butler of the Babcock & Wilcox Company.

Hold-Off Tag Prevents Energizing Apparatus Being Adjusted

BY MEANS of the hold-off tag shown herewith operators of the New York Edison Company are warned not to put voltage on apparatus undergoing adjustment.

This tag consists of two parts, one demanding that the apparatus shall be held off the line and the other showing that the apparatus is clear and can be made alive. The first section is pasted in the station log book after permission has been granted from the operator to work on the apparatus, and when the work has been completed the second section is pasted in the book.

When work is to be done on a piece of apparatus the construction foreman fills out in detail the upper half of the tag, which is a request to keep the apparatus off the line, and names the man who will be working on the apparatus, the purpose for which the apparatus is to be held off, the approximate time when it is desired to have the apparatus killed and the approximate time of completion of the job. After the construction foreman fills out these items he hands the tag to the station operator, who takes the apparatus off the line and then records the time, signs his name and pastes this half of the tag in the log book. The lower half of the tag is kept by the construction foreman until the job is completed. It is then filled out by him in detail and handed to the station operator, who signs it and pastes it in the book, indicating that all is clear and the apparatus may be put in service.



HOLD-OFF TAG PASTED IN LOG BOOK WHILE APPARATUS IS BEING WORKED ON

Mounting Plate Saves Time in Replacing Instrument Transformers

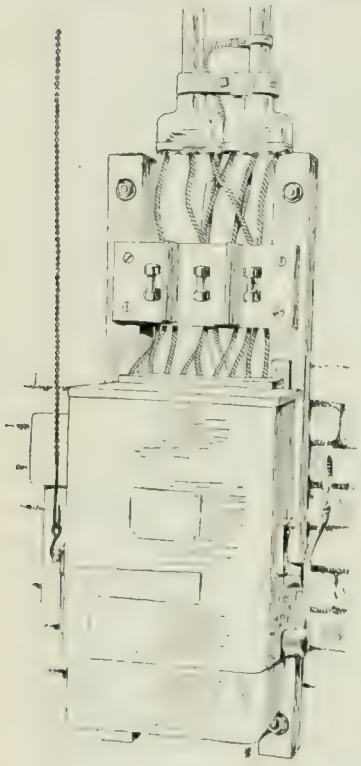
TO ENABLE instrument transformers to be quickly changed they are mounted on a plate drilled to accommodate all types in the stations of a St. Louis company. Trouble was formerly experienced in making quick changes of current and potential transformers of the air-cooled type owing to the very general practice of bolting the units directly to the walls, ceilings or steel of the building. As the design of this class of equipment is changed so frequently that a current or potential transformer can rarely be replaced with one of exactly the same type, it has nearly always been necessary to redrill the wall or steel work to accommodate the new transformer. This may cause serious service delays, and it is often a very dangerous procedure.

The adapter plate is of steel about 10 in. square by ¼ in. thick (25 cm. square by 6 mm. thick) and is supported by four corner bolts with pipe spacers which hold the plate about ¾ in. (19 mm.) away from the surface of the wall or steel work. The plate is drilled for every common size and type of current and potential transformer and has some extra holes drilled for good measure. Since this method of mounting has been adopted a transformer can be changed in a few minutes as the adapter plate eliminates all fitting and new drilling.

WALTER H. MILLAN,
Superintendent of Substations.
Union Electric Light & Power Company, St. Louis, Mo.

Industrial Applications

The Economical Utilization of Electrical Energy
in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required



Emergency Control Scheme for Motor-Starting Switch

FOR quickly stopping a pony planer in a New England carpenter shop a small chain is run from the motor-starting switch to a position in easy access of the operator at the planer. The chain is attached to the tripping lever of the starting switch as shown in the accompanying illustration. Such an arrangement allows the circuit to be interrupted and instantly stops the motor in case of emergency.

Careful Adjustment Advisable with Interpole Machines

CAREFUL checking and adjusting are necessary when installing direct-current generators or motors with interpoles. Such machines are usually designed to get more output from a given amount of material than non-interpole machines, and in general they are smaller for the same rating and often run faster. The commutators are smaller, the brush current density is higher, and the machines are highly sensitive to inaccuracies in the magnetic conditions. Trouble resulting from this cause usually shows up as sparking at the brushes.

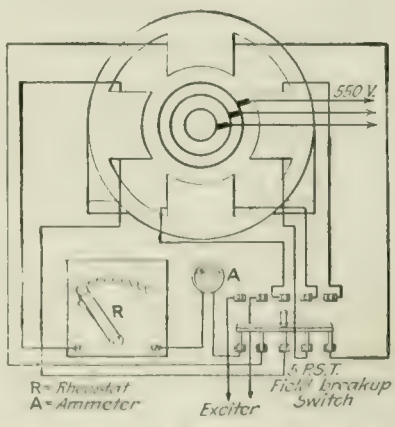
Observation of the following general precautions will help to get the best results: (1) Brushes must be accurately spaced around the commutator. The spacing is checked at the factory but should be rechecked before starting the apparatus. (2) The brush position must be on the neutral point, which is usually indicated by a mark on the brush gear. If it is not marked it should be determined and permanently marked. (3) The air gap between armature and poles should be accurately adjusted; that is, the armature must be correctly centered in the frame. (4) Strength of interpole often needs checking and adjustment in the field. This is best investigated by contact points on the commutator used with a low-reading voltmeter. (5) The compounding action of the main series field in an interpole machine is the same as in an ordinary machine, and the influence of the load on the terminal voltage (if a generator) or speed (if a motor) can be adjusted by the use of a shunt across the main series-field terminals. (6) For parallel operation with other machines, either interpole or non-interpole, the equalizer connection is made at the end of the main series winding and not directly to the armature terminal. All other essentials for parallel operation are the same as for ordinary machines.

As the commutator in this type of machine is given harder duty for its size, small irregularities or roughness which might cause no trouble and gradually cure themselves in an ordinary machine are liable to grow worse and cause sparking; hence the commutators must be kept quite true and smooth. Usually the best operation will be obtained with soft brushes and undercut commutator mica, the undercut or slotting being about $\frac{1}{32}$ in. (0.8 mm.) deep.

JAMES DIXON.
Reliance Electric & Engineering Company,
Cleveland, Ohio.

Changing a Generator to a Synchronous Motor

CONVERTING a 75-kw., 550-volt rotating-armature generator into a synchronous motor recently brought some unexpected difficulties to the writer's attention. It was first thought there would be trouble in making the motor self-starting. However, on account of the field pole pieces being solid and the machine not being equipped with damper bars, when the current was applied to the slip rings eddy currents were induced in the pole pieces which produced sufficient torque to bring the machine up to speed. During the process of starting the field was left open-circuited, which very soon resulted in the insulation on the field spools breaking down to ground, especially at the ends of the winding where the induced voltage was at a maximum. This induced voltage is set up by transformer action between the armature and field. The very instant current is applied to the armature this induced voltage is at its peak, and it gradually falls virtually to zero as the rotor approaches synchronous speed. In the above case this voltage was 800, which not only was dangerous to the winding but set up an extra hazard to the operators as the field switch was



FIELD BREAK-UP SWITCH PREVENTS HIGH VOLTAGE ON STARTING SYNCHRONOUS MOTOR

mounted on the face of the control panel. To eliminate this trouble a field break-up switch, as shown in the sketch, was mounted at the rear of the panel and operated from the front with a rod. This reduced the voltage to approximately 200 and permitted the machine to retain its proper starting torque.

Before installing this switch the plan of connecting a shunt on the field circuit was tried unsuccessfully. It is now a general practice with synchronous motors to shunt the field during starting with a shunt large enough to carry the no-load excitation current of the machine and having at least fifteen times the resistance of the field winding. Such a shunt and shunts of other resistance values were tried, but these prevented this machine from developing the proper torque and coming up to speed.

R. H. N. LOCKYER.

Trail, B. C.

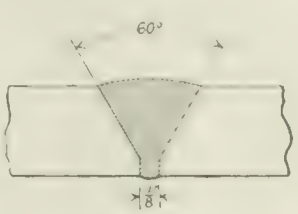
Speeds Attained in Electrical Hand Welding

SPEEDS attained in electrically butt-welding ½-in. steel plates, given in the accompanying table, are averages of a large number of tests. The pounds per hour deposited on work already lined up inside of buildings was 1.8 lb. (0.8 kg.) per hour, though this speed varied with the angle of the notch used. It will be noticed from the table that the greatest strength was obtained with a 60-deg. notch. In bending tests the 60-deg. weld bent through an angle of 15-deg. before cracks started, while a 30-deg. weld bent through only 9 deg. Although the feet welded per hour with a 30-deg. notch was more than one and a half times that with 60-deg. notch, the ultimate strength was considerably less. The speed in welding horizontal joints is about 80 to 90 per cent of that for vertical welding, and the speed of overhead welding is 60 per cent of the vertical speed. On an average about 70 per cent of an electrode was deposited in the weld, 18 per cent was wasted by scattering and 12 per cent was burned.

TIME, METAL, CURRENT AND ENERGY USED WITH WELDS OF DIFFERENT BEVELS ON ½-IN. PLATES

	Opening of Bevel in Degrees — 30	60	90	120
Ultimate strength, lb. per sq. in.	44,000	51,000	45,300	48,800
Angle of bend at which cracks start, deg.	9	15	13	14
Feet welded per hour	3.22	1.90	1.50	1.07
Electrode required per foot of weld, lb.	0.85	1.25	1.54	2.29
Electrode deposited per hour, lb.	1.82	1.61	1.82	1.81
Per cent of electrode wasted	34	32	21	26
Amperes	160	145	118	125
Circuit kilowatts	9.91	9.00	7.60	8.25
Kilowatt-hours per foot of weld	3.1	4.7	5.1	7.7

A type of notch which has been found to increase the speed of welding is shown in the accompanying figure. This notch has parallel sides extending a short distance from the bottom of the notch in place of the diverging sides in the ordinary type of notch. The speed of welding with such a notch was 2.8 ft. (0.84 m.) per hour against 2.3 (0.69 m.) ft. with the ordinary "V" notch, and only 0.9 lb. (0.4 kg.) of electrode was consumed per foot of weld against 1.1 lb. (0.49 kg.) in the common type of notch.



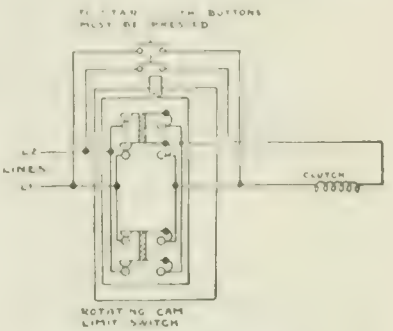
NOTCH FOR SPEEDY WELDING

Speed of welding with notch of this shape is 20 per cent greater than speed with the ordinary "V" notch, and electrode consumption is 20 per cent less.

This information was embodied in a paper prepared by William Spraragen, secretary of the engineering division of the National Research Council, for presentation before the American Welding Society at New York.

Magnetic Clutch and Button Control Make Toggle Presses Safe

TO ELIMINATE any possibility of operators being caught in toggle presses when reaching in to remove the finished product or to insert material, a Cleveland rubber company is using magnetic clutches operated by limit switches of the rotating cam type. The toggle presses are continuously running machines for making small molded rubber articles and operate at a certain number of cycles per hour. A definite time is allowed during each cycle for removing the finished article from the mold and inserting the new material before the platen of the press starts upward. Occasionally an operator does not move his hand away from the platen soon enough, the result being a severe injury when the platen moves forward toward the upper head of the press.



SAFETY AUTOMATIC CONTROL CONNECTIONS USED ON TOGGLE PRESS

To eliminate this hazard a magnetic clutch is installed on the driving shaft, which also carries a flywheel. One member of the clutch drives the press through a pinion and is bushed on the main driving shaft, to which is keyed the other clutch member. Upon disengaging the clutch while the press is operating the platen comes to rest almost instantly, making it unnecessary to stop the motor and flywheel. Connected in each circuit to the clutch are two push-button switches and a limit switch of the rotating cam type. The limit switch is directly connected to the driven member of the press, so that it makes a complete cycle for each cycle of the press. The push-buttons are mounted on the front of the press convenient to the operator.

To energize the clutch and start the press the operator must press the two push-buttons with his hands. This insures that his hands will be out of the danger zone. After the clutch has been energized the circuit is maintained by the limit switch, so that it is necessary to hold the buttons closed for only an instant when starting. The platen completes its upward stroke, and as soon as it starts downward the operator removes the molded product and inserts another batch of material for molding. If he has completed his work before the platen again begins to travel on its upward stroke, he simply holds both push-buttons depressed for an instant until the limit switch has time again to maintain the circuit for the clutch. Should he for some reason fail to complete this work before the platen begins its upward stroke, the limit switch will automatically release the clutch and stop the press.

The clutches, push-button switches and limit switches used on this installation were made by the Cutler-Hammer Manufacturing Company of Milwaukee, Wis.

Cleveland, Ohio. J. K. GOVAN.

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

Officers of Baltimore Company Maintain Open-Door Policy

THAT the officers of the Consolidated Gas, Electric Light & Power Company of Baltimore maintain at all times an open door for the visits of employees was emphasized by Vice-President Charles M. Cohn in an address to about 1,500 employees at the recent company rally given by the Baltimore Section of the National Electric Light Association. This attitude of the management of the company, he pointed out, is due to the realization that it is practically helpless without the organization backing it up, and it intends to deserve the active and cordial support of every employee of the company.

"It intends in the future as in the past," said Mr. Cohn, "to have an open-door policy. By this I mean that no matter if the doors of our offices happen to be closed in reality, you are always welcome to come in if you want to see and talk with any of us, and you may be assured that you will receive considerate treatment and that whatever you have to say will be listened to patiently and sympathetically. What you want done will be considered carefully, and while you may not always get what you want, you will always get a reason for our action and, if possible, you will get what you want.

"I wish to emphasize the policy of the management because I am fearful that many of our employees either through timidity or fear, or perhaps thinking we do not mean what we say, refrain from coming to see us even when they have the desire. Some few during the past year have come. We have been glad to see them, and in most instances they presented requests which were granted."

Cost of Coal Is 76 per Cent of Generating Expense

COST of coal was about 76 per cent of total operating expenses of a 63,000-kva. steam station in New England for the year ended June 30, 1920. A study of the cost sheets of this station show that the total operating expense was $849,891, of which $644,285 was expended for fuel, giving a fuel cost of 0.865 cent per kilowatt-hour produced at the plant, or virtually the same as the total unit production of the station a few years ago. The fuel expense amounted to more than seven times the station labor outlay, which was $87,495, or 0.118 cent per kilowatt-hour.

The total production cost for last year was 1.14 cents per kilowatt-hour. During the year the plant burned 100,097 tons of coal at an average cost of $7.17 per ton. The output at the bus in the year was 74,278,000 kw.-hr. The maximum load was 26,000 kw. and the yearly load factor 32.6 per cent. Two 20,000-kva., two 7,850-kva. and three 2,500-kva. turbo-generator sets comprised the main electrical units, and the boiler plant was a modern installation with water-tube units and mechanical stoking.

ITEMIZED COST OF PRODUCTION IN 63,000-KVA. PLANT

Coal	$644,285
Rentals	1,800
Oils, waste, packing	4,052
Water	1,844
Station wages	87,495
Station expense, tools, etc.	12,504
Station building repairs	16,254
Steam equipment repairs	69,134
Electrical equipment repairs	12,523
Total	$849,891

During the year some heavy steam-plant repairs were executed at a cost of $69,134. The remaining items in production, as the accompanying table shows, were of minor significance as compared with the amount expended for fuel.

Relation of the Investor to Public Utility Good Will

NEXT to financing and rates the most important problem occupying the attention of the electric light and power companies' executives is that of public relations and good will. Wherever these executives gather for conferences or conventions that part of the program devoted to this subject is met with extreme interest and attention. The National Electric Light Association, sensing this situation, has this year organized for the first time a national section devoted to public relations, and among its activities is that of bringing home to the people the truth that through their individual relationship either as consumers or investors the utilities are in a measure inseparably linked with their own prosperity and income. The last phase of this program is a series of four bulletins designed to instill in the minds of investors in public utility securities a true realization of the intrinsic worth of the electric service companies to the community and the consequent building up of their individual incomes. The pamphlets are to be distributed not only by the public utilities but also by investment bankers dealing in public utility securities.

The general type of these pamphlets can best be indicated by reprinting in full the text matter of one of them as follows:

MR. AND MRS. SECURITIES HOLDERS:

As the owners of electric utilities securities you doubtless have been watching the bond and stock market, and perhaps you have been somewhat disturbed because of conditions reflected in the prices of the securities you hold.

Far from being perturbed, you should find encouragement in the present situation. No less an authority than the National City Bank of New York City recently stated that:

"The installation of electric power in factory operations has resulted in an enormous demand on the power companies to supply current. The large central stations have demonstrated their ability to produce and distribute power at such an economical unit cost that their position is permanently assured."

This can have but one meaning to holders of sound electrical securities: Your principal and interest are safe; your investment is secure.

In addition, your holdings have a certain speculative value, in the expectation of appreciation.

Have you studied conditions so that you understand how essential the electric light and power industry is to your community and your state and the nation as a whole; how basically sound the industry is; how certain is the growth of this industry, with resultant increased business and income and consequently increased value of its securities?

You should. Your local investment banker will aid you.

As the owner of electric light and power utilities securities you should realize just what this industry means to the prosperity of your community and how its growth must keep pace with the growth of the community.

Have you ever considered the extent to which the business of your community is dependent upon the electric light and power utility serving it?

Have you ever given a thought to how many of the necessities, comforts and luxuries enjoyed by yourself and your neighbors are made possible by the use of electricity?

Are you in a train, an automobile, a street-car; in your home, your office, your club? Electricity plays an important part in all these.

This being so, the future of an industry so closely allied to *all* modern activities must be apparent.

At present the demand for electric light and power is almost one-third greater than its available supply. The demand is growing by leaps and bounds while the available supply is being increased but slowly owing to the lack of money with which to meet the immense cost of constructing additions to existing plants and systems.

If the law of supply and demand holds good in this as in all other things, all indications are for a brilliant future for electric light and power utilities.

The holder of such securities who purchases additional electric utilities securities at the present market price is taking advantage of existing financial conditions to secure a larger rate of return upon his investment than holders of these securities ever before have enjoyed. He is also helping to build up the value of the securities he already holds by making it possible for the utility to increase its plant capacity or extend its distribution system to meet the demands for service and thus increase its business and consequently its revenues.

The individual with surplus money at present, whether it be a small sum or a large amount, has an enviable opportunity to lay the foundation for an immediate and continuing income by the purchase of stable, attractive securities at prices to yield from 7 per cent to 8 per cent.

Money is playing a Dr. Jekyll and Mr. Hyde rôle at present. Spent for necessities of life or luxuries, it has little more than one-half its 1914 purchasing power; invested in good electric light and power industry securities, it purchases nearly one-third more face value of stocks and bonds, with an assured income from one to one and one-half times greater than the pre-war return from the same investment.

Conditions are unusual, and the wide gap between the purchasing power of money when applied to commodities and its purchasing power when applied to securities and interest upon itself must gradually lessen until they again are approximately level. The trend in that direction is already apparent, and when it is realized new issues of securities will be at higher prices and lower interest rates.

When that occurs, the holder of sound electric light and power securities purchased under present conditions still will be enjoying an income based upon present conditions.

Ask your local investment banker to explain how you can benefit by the present low-priced and high-rate-of-return electric light and power company securities.

Being regulated by state and municipal authorities—who are *your* representatives—your investment is safeguarded by you yourself and your personal representatives on the governing bodies.

You can build no better for the future than by putting your money in this growing business you control.

Samuel Insull Offers Prizes for Constructive Suggestions

THERE is a popular and overworked pastime which consists in telling the other fellow how to run his job, but Samuel Insull, president of the Commonwealth Edison Company, Chicago, seems to think it is much more profitable for all concerned when employees try to improve the efficiency of their own work and of their own department.

It is Mr. Insull's practice each year to give a number of prizes for the best papers on a given subject, and in order to encourage the employees to make their own work and department more efficient he has made this the subject of the competition next year. In concluding the announcement Mr. Insull said: "If every employee will think of the problems encountered in his work, analyze the conditions and make concrete and constructive suggestions, it will be a great help to the management of the company in the conduct of its affairs and will give the employees a chance to present their plans to the management."

Accidents Due to Electrical Causes Show Marked Decrease

A STUDY of accidents to employees of the Consumers' Power Company for the first eight months of this year shows a total of 380. The company operates thirty-two steam and hydro-electric plants and seven gas stations, serving through an extensive transmission system eighty-nine municipalities in Michigan. This figure takes in all departments of the company—construction, distribution and sales, production and transmission and the gas department—and includes such accidents as slight cuts and burns as well as those of a more serious nature.

Of the 380 cases, forty-five were serious enough for compensation and involved lost time to employees. With one exception, the serious accidents—those involving compensation—in the production and transmission department occurred in the steam plants. None of these accidents occurred in the substations or hydro-electric plants.

There were no accidents in any of the steam plants, hydro-electric plants or substations due to electric shock that were serious enough for compensation. Only one serious case of electric shock occurred, and in this instance the victim was promptly restored to consciousness by the application of the prone-pressure method of resuscitation.

Virtually all of the serious accidents in the construction and the distribution and sales departments were due to electric shock. The serious injuries in the stations and substations were due to cuts, bruises, burns and falls.

An analysis of the accidents to employees of the production and transmission department made some years ago showed that 40 per cent of the total were caused by electricity. A later analysis shows that 4 per cent of the accidents were due to electric flashes and burns. Owing to effective application of the prone-pressure method of resuscitation the last analysis, covering a period from Jan. 1 to Sept. 1, 1920, shows that electrical accidents which have proved serious in the generating stations and substations have been reduced to a minimum.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Lamps and Lighting

A New Form of Portable Light Meter.—DAVIS TUCK.—This paper describes the construction of a small portable light meter capable of making measurements of the same order of accuracy as the larger portable illuminometers. The assertion is made that it is possible to measure candlepower, millilamberts and foot-candles to a reasonable degree of accuracy with this instrument, which is said to be small enough to be put in a brief case or traveling bag.—Paper presented before Illuminating Engineering Society's Convention, Oct. 18, 1920.

Measurement of Diffuse Reflection Factors and a New Absolute Reflectometer.—A. H. TAYLOR.—The complete theory of the reflectometer was described by the author briefly in the ELECTRICAL WORLD for Sept. 4, 1920, on page 467.—*Scientific Paper No. 391, U. S. Bureau of Standards,* July 28, 1920.

Generation, Transmission and Distribution

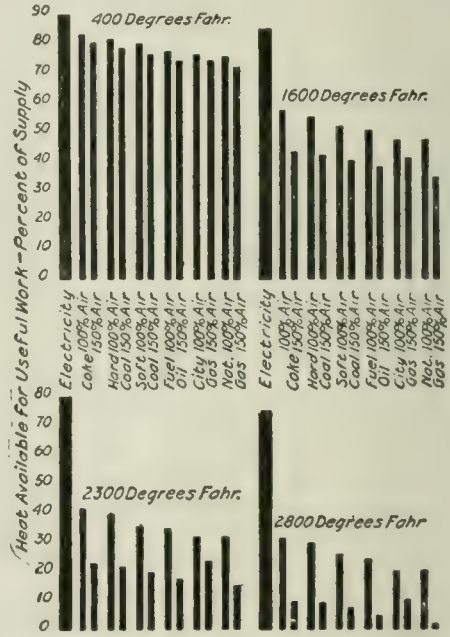
Characteristics of Lead-Covered Single-Conductor Cables.—CAPDEVILLE.—Single-phase cables usually are not steel-taped, but only lead-covered, since the presence of closed ferromagnetic circuits around the cable would give rise to hysteresis and eddy-current losses. Even the lead sheathing, however, will take up some magnetic flux, and secondary currents will be induced. The author shows that these secondary sheath currents may react quite appreciably upon the electrical characteristics of the cables, and he derives expressions for the apparent changes in inductance and resistance due to induced currents. The sheath currents, according to the author, often amount to as much as 100 amp. or 150 amp., and the voltage drop along the cable due to these currents may be 50 volts per kilometer (30 volts per mile). Actual measurements of the apparent inductance and resistance made by the author on lead-covered cables gave results which checked within 1 or 2 per cent with the theoretical values.—*Revue Générale de l'Electricité,* Aug. 7, 1920.

Graphical Determination of Voltage Distribution in Networks.—THOMALEN.—The author refers to a recent paper by Schwaiger on the same problem and presents a method for graphical determination (to the complete exclusion of intermediate numerical work) of the currents flowing from the points of supply in a network which is supposed to be loaded only at the knot points. The method represents a modification and completion of the Schwaiger method and, like that one, is based upon the principles originally suggested by Frick in his purely numerical network scheme for finding current and drops in closed networks.—*Elektrotechnische Zeitschrift,* Sept. 16, 1920.

The Dalmarnock Power Station.—This is a new power plant erected on the River Clyde not far from Glasgow. The ultimate capacity of this plant is placed at 150,000 hp. and the first 25,000-hp. unit has already been put on the load. While the generator voltage is 6,500, this is stepped up to 20,000 volts and transmitted to the substations over three-core split conductors and six-core type cables, using the Merz-Hunter system of protection.—London *Electrician,* Sept. 20, 1920.

Installations, Systems and Appliances

Relative Thermal Economy of Electric and Fuel-Fired Furnaces.—E. F. COLLINS.—The pronounced advantages of the electric furnace in providing easy and positive temperature control and uniform heat distribution are held to account for the large number of these furnaces that have been placed in service during the last few



EFFICIENCY OF VARIOUS KINDS OF FURNACES

years. It is said that nearly all the brass-melting furnaces now being installed are electric furnaces. The illustration shows in a striking manner the relative efficiency of the various fuels at four chosen temperatures. While in many cases the electric furnace was selected on the basis of performance rather than on cost of operation, the rising cost of fuel and even the cost of operation may be decidedly in its favor, as is shown by data on specific installations.—*General Electric Review,* September, 1920.

Electrophysics and Magnetism

The Condenser Machine, a New Electrostatic Generator.—WOMMELSDORF.—The Holtz-Wimshurt electrostatic machine is not adapted for technical needs as a generator of high-tension direct current because of its compact design, which makes it difficult to keep certain insulating surfaces clean and dry. The author in 1914 devised a modified electrostatic generator which subsequently was developed into a useful laboratory tool. The new design is called the "condenser machine" and is

said to be very easy to keep scrupulously clean owing to its open design. At the same time it is asserted that it gives considerably greater output than a Holtz machine of similar dimensions and the same number of disks. After a brief description of the new design, the author presents a table showing the output of different sizes of condenser machines. While a Holtz machine with two disks of 26 cm. (10 in.) diameter is said to give a maximum spark length of 10 cm. (3.95 in.), a machine of the new type with the same disk diameter but only one disk gives up to 19 cm. (7.5 in.) sparks. The maximum current is for the former machine 0.015 milliamp., but for the new type amounts to 0.4 milliamp. The largest Wommelsdorf machine mentioned in the table has seven disks of 55 cm. (21.7 in.) diameter, and gives up to 35 cm. (13.8 in.) sparks, and currents up to 4 milliamp., while it takes a 1-hp. motor to run it. The spark lengths above refer to 50-cm. (19.8-in.) spheres and thus correspond to pressures from 100,000 volts to 250,000 volts.—*Elektrotechnische Zeitschrift*, Sept. 16, 1920.

Electrochemistry and Batteries

Two Common Failures of the Clark Standard Cell.—E. C. MCKELVY and M. P. SHOEMAKER.—The causes and effects of the cracking of Clark cells at the amalgam terminal and the formation of gas in the amalgam limb are discussed. It is shown that the cracking of the cell can best be prevented by the very simple expedient of using a cell blank in which platinum wire previously subjected to the action of zinc amalgam is employed as the negative terminal; also that the effects of gas formation can be minimized through the employment of the smallest excess crystals required to insure saturation at the highest temperature at which the cell is to be used.—*Scientific Paper No. 390, U. S. Bureau of Standards*, July 21, 1920.

Units, Measurements and Instruments

Errors in Current Transformer Ratio and Phase Angle Due to Remanent Magnetism.—ENGELHART.—By means of a compensation method due to Schering and Alberti (see *Zeitschrift für Instrumentenkunde*, 1917, Vol. 37, page 98) the ratio and phase errors were determined for eight current transformers of different types, the transformers having previously had different magnetic treatments. After a magnetization of the core with 4 amp. direct current in the secondary winding (the normal meter current was in all cases 5 amp.) ratio errors of 0.1 to 0.3 per cent could be observed at full load, while the phase errors came out from 0 min. to 14 min. At one-tenth of full rated current the largest observed errors were 1.8 per cent in ratio and 1 deg. 25 min. of phase angle. The effect of the usual demagnetization process with alternating current was investigated and it was found that the polarization of the transformer core was completely destroyed by such a process, if the demagnetizing current was adjusted to 0.3 amp. and slowly diminished to 0.003 amp. The article contains a great amount of numerical material, covering the results of numerous different tests of similar type.—*Elektrotechnische Zeitschrift*, Aug. 19, 1920.

Measurement of Maximum Demand and Determination of Load Factor.—PERRY A. BORDEN.—Some conclusions resulting from the author's study of equitable methods of determining power charges may be stated as follows: (1) In the determination of demand it is not feasible to obtain a quantity which will fairly represent all the factors to be taken into consideration. It is probable that the most logical quantity will be found in the volt-amperes of the load. (2) Values of "sustained peak" as determined from the charts of graphic meters are frequently misleading and of little significance. (3) Values of averaged or integrated peaks are difficult to measure on graphic meter charts and are subject to a large personal error. (4) Readings of the Merz or "block interval" type of meters, though in themselves very erratic, will in the long run average more closely to the arithmetical average than the indications obtained by any other method. (5) Individual readings of the logarithmic meters are more consistent and usually closer to the true value of the arithmetical averages than are the individual readings of the Merz meters. (6) Since heating follows a logarithmic rather than an arithmetical law, it would seem where heating is being taken into consideration that the logarithmic average is quite as justifiable as the arithmetical for a basis-of-demand measurement.—*Journal A. I. E. E.*, October, 1920.

Telegraphy, Telephony and Signals

High-Frequency Multiplex Telephony and Telegraphy in Germany.—K. W. WAGNER.—Some of the earlier German experiments with carrier-wave multiplex telephony and telegraphy were dealt with in the Digest of the Feb. 7 and July 10, 1920, issues. The development work has proceeded so far that commercial multiplex service is now maintained over a number of trunk lines in Germany, and the matter has been made the subject for an extensive report by the author, who has been in charge of the preparatory research work. Three simultaneous telephone connections are now regularly given over a 300-km. (187-mile) line between Berlin and Hanover and over a 600-km. (374-mile) circuit between Berlin and Frankfort. On an ordinary telephone line between Berlin and Magdeburg two carrier-wave telegraphic connections, utilized for two sets of Hughes-apparatus, are duplexed. One Berlin-Frankfort line serves simultaneously six Siemens instruments for rapid printing telegraphy, and at the same time the line is used for the ordinary telephone service. The six Siemens printers work at an average speed of 4,000 words a minute, and during an eight-hour day, assuming 50 per cent utilization, there may be handled over this one line no fewer than 16,000 telegrams of ten words each with an average of six letters per word. The author describes old and new apparatus used for carrier-wave multiplex service and presents thirteen photographs of equipment for experimental and commercial use. The outfits are based on the use of vacuum tube oscillators and amplifiers, mostly using triodes or tubes with three electrodes, but in the receiving apparatus for printing telegraphy some large tetrodes are employed. These have two controlling grids.—*Elektrotechnische Zeitschrift*, Sept. 9, 1920.

Miscellaneous

On the Use of Bi-symbolic Equations in Electrical Engineering.—AUGUST HUND.—The author has developed a peculiar kind of analysis, based upon what he calls bi-symbolic equations. In the present article he uses this analysis for studying the effect of negative resistance in electric circuits, and extends the treatment to certain oscillation problems involving arcs and apparatus of the dynatron type.—*Elektrotechnik und Maschinenbau*, Aug. 22, 1920.

News in Brief

Summary of Market Conditions and of Recent and Approaching Happenings of Importance to the Industry

DESPITE the urgent representations of the National Committee on Gas and Electric Service that the Interstate Commerce Commission has failed to meet the requirements of the coal situation as it affects public utilities and that the assigned-car privilege should be restored, the commission maintains its plan of emergency service, and conditions as regards adequate storage for winter are growing worse.

A THREAT to recommend to the United States Senate that the federal goverment take over the control of the coal mines has been made by Senators Calder and Edge of the Senate reconstruction committee, who assert that this action will be taken by them unless there is a material reduction in price by Dec. 6.

SOFT-COAL prices will continue to drop, the National Coal Association says, as the result of an output of 12,000,000 tons a week.

PERMISSION to develop an additional 15,000 hp. of hydro-electric energy has been refused to the Toronto & Niagara Power Company by the Ontario government unless the company will accept a rate to be fixed by a government commission. Agitation for an embargo on the export of electricity from the province continues.

THE GOVERNMENT of Canada has reduced the amount of electrical energy that may be exported by the Niagara companies under their licenses from 110,000 kw. to 80,000 kw. This order does not lessen the amount at present being transmitted to the United States.

AN "EQUALIZING reserve," to be increased in good years and drawn upon in poor ones, was advocated by the Southern California Edison Company in rate hearings before the California Railroad Commission. The company desires also to establish an account providing "rewards for efficiency" of employees.

ISSUANCE of a permit to the Pit River Power Company of California has been authorized by the Federal Power Commission on legal advice that no rights of the United States would thus be impaired. Ten projects had been advertised up to Nov. 8 inclusive.

A SURVEY of the basin of the Tennessee River is being made by the Corps of Engineers, U. S. A. On account of the heavy fall of the river and its mountain tributaries the survey is of much interest in connection with water-power development.

GREATER sales effort is found necessary in order to move the electrical materials which are coming in from manufacturers, and jobbers' shelves are being rapidly filled. Buying continues at a curtailed rate. The South is the only section that shows any activity in the building market, and consequently the jobbers' recently acquired stocks of wiring material are not moving well. Considerable activity in alterations to buildings is, however, reported.

ELECTRICAL exports for the month of September reached a value of $7,307,068. For the first nine months of 1920 they were $68,329,414.

A DECISION dismissing the suit of the General Electric Company against the Ohio Brass Company, in which contributory infringement of patents concerning suspension insulators for use in the transmission of power was charged, has been handed down in the United States District Court of New Jersey.

THE REQUEST made by the Detroit Edison Company to its lighting customers to use as litle electricity as possible during factory hours has been withdrawn with the starting up of the new 45,000-kva. generator at its Delray plant.

ON NEXT Tuesday the Boston Edison rate case will be reopened by the Massachusetts Department of Public Utilities.

TWENTY-ONE engineering societies thus far have taken action qualifying them as charter members of the Federated American Engineering Societies.

THE INDICTMENTS charging the Brooklyn Edison Company with violation of the Lever act by conspiring to pay excessive prices for coal and by hoarding coal have been dismissed by the United States District Court.

A MOVE to abolish the Public Utilities Commission of Illinois has already been made by Chicago officials, who base their action largely on the result of the recent state election.

LEWIS NIXON has resigned as Public Service Commissioner for the First District of New York State, and the Governor has appointed Deputy Commissioner Alfred M. Barrett to succeed him.

A PROTEST by the Webster & Southbridge Gas & Electric Company against the sale of energy in bulk in its territory by the New England Power Company has been disregarded by the Massachusetts Department of Public Utilities.

AUTHORITY to enter the wholesale energy market in the territory of the Adams Gas Light Company has been granted to the New England Power Company.

FIGURES of electrical generation by public utilities for the month of August issued by the Geological Survey indicate a total of 3,705,184,000 kw.-hr., or 96,000,000 kw.-hr. more than for July. Hydro-electric generation was 1,500,000 kw.-hr. behind July.

INTEREST in power development and irrigation greatly exceeds any concern as to water transportation on the Snake and Columbia Rivers, on the Pacific Coast, according to the Board of Engineers for Rivers and Harbors.

REPRESENTATIVES of examining boards from six states met in Chicago this week and formed the National Council of State Boards of Engineering Examiners for the promotion of uniformity of practice and reciprocal relations.

LIABILITY insurance on rural transmission lines is being taken up with the insurance companies by a committee of the Iowa Section, N. E. L. A.

MEMORIAL exercises for the late Dr. Samuel Sheldon of the Brooklyn (N. Y.) Polytechnic Institute will be held in New York Nov. 17.

PLANS for the good-will advertising campaign of the N. E. L. A. manufacturers' advertising committee are progressing well, many manufacturers having pledged at least one-twelfth of their advertising space during the coming year.

DR. SAMUEL J. MELTZER, an active figure in bringing about the adoption of the prone-pressure method of resuscitation from electric shock, died in New York last Sunday.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Large Charter Membership for Engineering Federation

FINAL touches are being put upon the plans for the first meeting of the American Engineering Council of the Federated American Engineering Societies, to be held Thursday, Friday and Saturday of next week in Washington at the New Willard Hotel. Thus far twenty-one societies have signified their intention of becoming charter members of the federation and a number of others have signified that they will join at some time prior to the meeting. Those societies which have already joined represent more than 42,000 engineers.

It is not known at this writing just how many delegates will attend the meeting, but it has been learned that advance reservations for accommodations in Washington have been large. The twenty-one societies are:

Alabama Technical Association.
American Institute of Chemical Engineers.
American Institute of Electrical Engineers.
American Institute of Mining and Metallurgical Engineers.
American Society of Agricultural Engineers.
American Society of Mechanical Engineers.
Associated Engineering Societies of St. Louis.
Cleveland Engineering Society.
Detroit Engineering Society.
Engineers' Club of Baltimore.
Engineers' Club of Buffalo.
Engineering Association of Nashville.
Grand Rapids Engineering Society.
Kansas Engineering Society.
Louisiana Engineering Society.
Mohawk Valley Engineers' Club.
Society of Industrial Engineers.
Technical Club of Dallas.
Washington Society of Engineers.
York Engineering Society.
Engineers' Club of St. Louis.

Brooklyn Edison Company Freed from Coal-Hoarding Charge

INDICTMENTS against the Brooklyn Edison Company and the Adelphia Coal Company which charged these companies with conspiracy to pay excessive prices for coal and with hoarding coal in violation of the Lever law were dismissed on Nov. 10 by Federal Judge Mayer in the United States District Court.

Decision was reserved in the case against the B. J. Lynch Coal Company, which has to do with the alleged misuse of priority permits gained through the instance of the Brooklyn Edison Company. Decision was also reserved in the case against Walter F. Wells, vice-president of the Brooklyn Edison Company. Harry P. Wood, formerly in charge of all the company's coal transactions, pleaded guilty recently. Judge Mayer said in his decision on the Brooklyn Edison Company:

Passing on the constitutional questions raised, this indictment cannot stand unless defendant is one of those prohibited under Section 6 of the so-called Lever act from doing the acts there denounced. The defendant is not a wholesaler, retailer or other dealer in coal, nor is it a manufacturer within the meaning of Section 6. Defendant is a public utility corporation engaged in the manufacture, production and sale of electric light and power. It is a matter of common knowledge that the business of such corporations is subject to regulation by public service commissions or similar bodies. Such corporations are not in the same situation as uncontrolled private corporations or individuals. They owe a duty to the community to furnish light and power adequately and unceasingly, so far as practicable.

To perform this duty they need coal, and exigencies and contingencies must be foreseen. I am of the opinion that Congress never intended that this discretion should be controlled or interfered with by this act, particularly in view of the many regulatory statutes, national and state, which relate either to public utility corporations or carriers, interstate and intrastate.

Further, the phrase "public utility corporations" is well known both colloquially and technically. If Congress had intended to apply Section 6 to public utility corporations it could have so stated in simple language.

But there is an even broader reason why "manufacturer" does not refer to corporations like defendant. The furnishing of light and power was vital to the country during the war. No one could foresee what might happen or be needed. It was the duty of a light and power public utility corporation to prevent so far as possible the shutting down or suspension of the service of light and power. Congress undoubtedly realized that it would interfere with and possibly impair the usefulness of such corporations as defendant if they were left at the mercy of Section 6 instead of subject to the regulation of the appropriate regulatory bodies.

Service Order No. 21 Not Meeting Utility Emergency Requirements

THE coal situation as it affects the public utilities grew worse rapidly during the week ended Nov. 6. George W. Elliott, secretary of the National Committee on Gas and Electric Service, laid the facts in the case before Commissioner Aitchison of the Interstate Commerce Commission on Nov. 8, but with the same result as that attained a week earlier. It was insisted by the utilities' spokesman that they must have assigned cars to insure sufficient supplies of coal to enable them to continue in operation. The Interstate Commerce Commission, however, seems to be firmly of the opinion that utilities can get coal if they try hard enough. Mr. Elliott asked Mr. Aitchison if the utilities can be expected to go on all winter under the strain of operating on such a narrow margin of coal supply as to make it problematical whether service can be maintained on the following day. He said that only good luck and constant effort on the part of utility officials had prevented numerous shutdowns of gas and electric plants. He failed to get a satisfactory answer from Commissioner Aitchison when he asked why service order No. 21 was issued if it were not intended to use assigned cars in cases of emergency.

While Mr. Elliott does not admit it, apparently the

co-operative agreement for supplying public utility needs is not meeting with full success. When a utility emergency is reported to the committee which is handling these matters, the railroad member of the committee requests the carrier to be sure that the coal operator supplying the utility has sufficient cars for the purpose. The operators' representative on the committee requests the producer to supply the coal to meet the emergency. In many cases the plan works perfectly, but in some cases the operators are said to fail in their compliance with the request and in other cases they cannot comply owing to lack of cars.

As there is evidence that spot coal will continue to sell for some time at a higher figure than most contracts call for, it is feared that the tendency to sell on the open market, rather than comply with the terms of the contract, will continue. Should the East and the Middle West experience severe winter weather in the next few weeks it is feared that a large number of public utilities will be forced to suspend operation because they have no reserve stocks of coal.

Society for Electrical Development May Form Local Organizations

THE Society for Electrical Development is considering the formation of local organizations affiliated with the society to carry on the development work. At the semi-annual meeting of the directors of the society on Tuesday it was felt that this was a move in the right direction, and accordingly a special committee was formed to work out the plans therefor.

Reports were made on the newspaper publicity work and on what is being done by the society to discourage publicity which might react unfavorably on the industry.

Another phase of the work commented upon is the compilation of data in regard to electrical fires. The statistics so far compiled, covering the greater part of the United States, show that less than 3 per cent of the fires in this country are caused by electricity and that more than half the fires designated as electrical occur out of doors, on poles, trolley cars and other places, and do not properly come under the definition of electrical fires, thus showing only a trifle more than 1 per cent of the total fires to be electrical in their origin. The general manager reported that the society's electrical Christmas campaign is so well supported by the industry that already more money has been received for the display material, booklets, etc., than was received either during "America's Electrical Week" or "Electrical Prosperity Week."

Henry L. Doherty was appointed to the board as a representative at large, and George Weiderman was appointed to serve the unexpired term of Ernest McCleary.

Arkansas Utility Men Co-operate with University in Metermen's Course

IN CO-OPERATION with the Arkansas Utilities Association the University of Arkansas conducted on Oct. 11 to 15 a special metermen's course consisting of a study of the fundamentals of direct-current and single-phase alternating-current circuits and meters. The course was similar in many respects to one given a short while before at the University of Illinois and described on page 142 of the July 17 issue of the ELECTRICAL WORLD. Another course, on polyphase circuits and meters, to be given next year is contemplated. Prof. W. B. Stelzna, who was in charge of the course, writes that it was well attended and that already one utility has decided to start night classes for its men.

Sheldon Memorial Exercises to Be Held Next Week

MEMORIAL exercises for the late Dr. Samuel Sheldon, professor of physics and electrical engineering at the Polytechnic Institute of Brooklyn, will be held in the auditorium of the Engineering Societies Building in New York City on the evening of Nov. 17. Addresses will be made by Dr. Arthur E. Kennelly, professor of electrical engineering at Harvard University; Dr. William H. Nichols, chairman of the corporation of the Polytechnic Institute; T. Commerford Martin, Bancroft Gherardi, vice-president of the American Telephone & Telegraph Company, and William N. Dickinson, president of the New York Electrical Society. Arthur W. Berresford, president of the A. I. E. E., will preside.

Electrical Supply Jobbers to Discuss Merchandising

TWO addresses on electrical merchandising, one by J. A. Corcoran of the publicity department of the General Electric Company and the other by M. C. Turpin of the merchandising bureau of the Westinghouse Electric & Manufacturing Company, will be made at the Thursday afternoon session of the semi-annual meeting of the Electrical Supply Jobbers' Association at Cleveland, Ohio, on Nov. 17, 18 and 19. How to obtain capital to finance the electrical jobbing business properly will be discussed on Friday afternoon by F. H. Goff, president of the Cleveland Trust Company. The remainder of the three sessions will be devoted to committee reports and routine business matters.

Ontario Government Rejects Proposal of Toronto Company

THE government of Ontario has rejected a proposal made by the Toronto & Niagara Power Company as a result of the situation reported in the ELECTRICAL WORLD for Oct. 30 (page 893). The company offered, on condition that the government should authorize the diversion of sufficient water, to develop 15,000 additional horsepower and to sell the energy thus produced at current contract prices and on the usual conditions. The Premier of the province said that the specific value of the electrical energy in question had been fixed at $9 per horsepower-year by a commission of judges. Inasmuch as the Toronto company had not been represented before this commission, the Premier offered to reappoint the commission to determine on a fair price, provided that the company would agree to furnish the power immediately.

Delegates from Toronto, Hamilton and other municipalities directly interested in the power shortage met in Toronto on Nov. 5 and again urged the Dominion authorities to refuse to allow the export of electrical energy from Ontario except under contracts made previously to 1920. The resolutions adopted favored the generation by the Toronto & Niagara Power Company of an additional 25,000 hp. for the use of the Ontario Hydro-Electric Power Commission. Sir Adam Beck announced that in a few days the commission would have another 15,000 hp. available.

Dominion Government Reduces Amount of Licenses to Export Power

AN ORDER in Council has been passed by the Dominion government reducing the amount of the export licenses of the Niagara hydro-electric companies as follows: Ontario Hydro-Electric Power Commission (formerly Ontario Power Company) from 45,000 kw. to 40,000 kw.; Canadian Niagara Power Company (controlled by the Niagara Falls Power Company of United States) from 40,000 kw. to 25,000 kw.; Electrical Development Company (controlled by the Toronto & Niagara Power Company) from 25,000 kw. to 15,000 kw.

The action of the Dominion government does not reduce the power at present being exported, but prevents the quantity being increased by any of the companies without the cognizance of the federal authorities. Chief Engineer F. A. Gaby of the Hydro-Electric Power Commission said that the export of power by the commission up to the amount named—40,000 kw.—must continue because of contracts.

New 45,000-Kva. Generator Relieves Detroit Power Emergency

THE new 45,000-kva. generator at the Delray plant of the Detroit Edison Company was started last week, and as a result the company is advertising that it is now able to fill the demands for electric supply and the request to lighting customers to use as little electricity as possible during factory hours is withdrawn. It is expected that the work of rebuilding an older 45,000-kva. machine will be completed early in December, still further relieving the Detroit situation.

Iowa Discussing Rural-Line Liability Insurance

LIABILITY insurance for rural lines and transmission lines is being discussed with the insurance companies by a committee of the Iowa Section of the National Electric Light Association formed for that purpose. This is a new phase of the insurance problem and has so far been a puzzling factor in the rural line situation, but it is believed that the insurance companies carrying power-plant risks are in duty bound to care in like manner for transmission lines. The committee does not expect the formulation of a definite plan until after a meeting of the insurance companies.

Senators Calder and Edge Threaten Federal Control of Coal Mining

ANNOUNCEMENT that unless the price of coal to the consumer shall have been materially reduced before Dec. 6 next they will recommend to the United States Senate that the government take over control of the coal industry was made last week by Senator William M. Calder of New York and Senator Walter E. Edge of New Jersey as a result of testimony produced before the Senate reconstruction committee, of which Senator Calder is chairman.

"The plain fact is," the Senator said, "that coal has not been reduced in price despite promises. The price of coal is away beyond what it should be and has been admitted to be so by the men who control the industry. "We are both strongly opposed to any form of government control, but the practical admissions of prominent coal men show that there is guilt among the men somewhere who have the power to regulate the price of the commodity. Now it is up to the industry to put its finger on those guilty and eliminate the unfair and illegal practices. It is up to them to solve this problem for themselves, but if they fail to do so the Congress must."

Northwest Electric Service League Indorsed

FURTHER details concerning the formation and objects of the Northwest Electric Service League and the report of the advisory committee thereon were presented to the executive committee of the Northwest Electric Light and Power Association in Portland, Ore., Oct. 14. It was the unanimous opinion of the executive committee that the Northwest Electric Service League can be the medium for closer co-operation of all branches of the electrical industry in the Northwest and that such co-operation will result in better service to the public, greatly increased use of electricity and electrical equipment, and the adoption by all the elements making up the industry of sound, ethical and progressive business methods.

First Move to Abolish Illinois Commission Made Two Days After Election

WITH a demand from Special Corporation Counsel Cleveland to withhold activities in pending cases of the Chicago Elevated Railroads, the Chicago Surface Lines and the Chicago Telephone Company, the city of Chicago on Nov. 4 apparently opened its fight to abolish the Public Utilities Commission of Illinois. One of the grounds stated for Mr. Cleveland's demand was that the election for Governor of Illinois has indicated the desire of the people of the state to abolish the commission and that it must be anticipated this will be accomplished at the earliest opportunity; therefore the commission should take no action that would result in fixing its decisions on the public after its abolishment.

Manufacturers' Co-operative Good Will Advertising Plans Shaping Up

MEMBERS of the manufacturers' advertising committee of the National Electric Light Association had up for consideration on Nov. 9 replies from many manufacturers who have pledged themselves to publish good-will advertising in behalf of the entire electric light and power industry. Many of these manufacturers have pledged at least one-twelfth of their advertising space during the coming year. The outstanding feature of progress is the number of smaller manufacturers who have responded.

Work will be begun immediately, and facts, figures, statistics and general policy matter will be outlined for the use of these manufacturers. The campaign will be so formulated that one main subject will be handled each month during the year 1921, so that at the conclusion of the year the twelve major points and problems in the industry will have been presented.

Suspension Insulator Case Against Ohio Brass Company Dismissed

AFTER ten years of litigation virtually involving the use of suspension insulators for power transmission purposes, Judge Lynch in the United States District Court of New Jersey has dismissed the complaint of the General Electric Company against the Ohio Brass Company without taking into consideration the validity of the patent. Contributory infringement of the Buck and Hewlett patent, No. 925,561, relating to "suspension of high-tension lines," was alleged.

At the time when high-voltage lines were becoming more common, about fifteen years ago, Buck and Hewlett conceived a system of periodic dead-ending of lines to cross-arms using a special type of disk insulator and employing a freely suspended jumper. No infringement of the Hewlett insulator was claimed, but merely of the system of line suspension. The patent stated that the system was for high-tension lines of from 60,000 volts to 100,000 volts.

The claims in issue were:

Claim 1.—In a system of high-tension-line suspension, the combination of periodically dead-ended spans joined by jumper connections, and intervening spans freely suspended beneath cross-arms of the supporting towers.

Claim 2.—In a system of suspension for high-tension power circuits, the combination of conductor spans dead-ended at the cross-arms through two chains of insulators flexibly connected to each other and to the cross-arm and a jumper connection between the adjacent ends of the spans and hanging freely by gravity beneath the cross-arm.

Claim 3.—In a system of high-tension-line suspension, the combination of periodic spans dead-ended on opposite side of a cross-arm or support through series of insulators flexibly connected and electrically connected by depending jumper wires, and intervening spans freely suspended beneath cross-arms of the respective supporting towers.

Claim 4.—In a system of high-tension-line suspension, the combination of spans each dead-ended to its cross-arm; through series of flexibly connected insulators, each series of connected insulators having flexible connection with the supporting cross-arm.

Claim 6.—In a system of high-tension-line suspension, the combination of towers provided with cross-arms of conductor spans freely suspended beneath said cross-arms by series of flexibly connected disk insulators.

The particular instance of infringement relates to the Sanitary District of Chicago, where pin insulators were primarily used. This system was to be enlarged by an additional 40,000-volt circuit. There was no room for three additional insulator pins, and therefore two of the additional wires were suspended. The defendant manufactured and sold the suspension insulators used, and this contributory act the plaintiff urged amounted to infringement.

It was pointed out by the court that all parts of the patented combination, including insulators, wires, poles, etc., and the practice of dead-ending were well known in the prior art and that the only invention, if any, was in their arrangement.

The court found that, while the patent claims were for 60,000 volts to 100,000 volts, the Sanitary District system was operated at 40,000 volts, and that the change to suspended lines was made only because there was no room for pin insulators.

Secondly, the court held that the patent called for periodic dead-ending, but in the specific case at issue—namely, that in the Sanitary District—there was no periodic dead-ending. The only dead-ending was at railroad crossings, and this practice was shown to have existed prior to the application for the patent. It was further shown that to avoid conductor swaying the periodic dead-ending was called for in the patent.

The claim relating to a jumper "freely suspended by gravity" was not allowed in the Sanitary District test case because the jumpers were rigidly connected by three-way clamps.

Finally, the court held that the patent allowed for free lateral swaying, whereas the defendant's insulators were so made as to prevent lateral swaying. Furthermore, the patent claimed to "do away with the usual insulators and their pins and provide at certain of the supporting towers a vertical series of insulators flexibly connected to each other, etc." It was shown that the connections between the defendant's insulators were rigid and also that the defendant's insulators were different, being of the cap and pin type.

Other transmission systems employing defendant's insulators for line suspension were offered in evidence, but the court stated that it failed to find that they resembled the system contemplated by the plaintiff's patent.

The court, in summing up, said:

"Should the court hold that selling, or offering for sale, insulators for a 100,000-volt system in itself amounts to infringement of a patent which calls for a specified use of those insulators in conjunction with a specified use of the other elements of the combination? I do not think so. The invention relates to a mechanical arrangement of instrumentalities by the patent description and claims, yet the interpretation asked is that the patent should be construed to cover and necessarily include features not embodied therein. This I cannot agree to."

Water-Power Projects Advertised

THE complete list of water-power projects advertised by the Federal Power Commission up to and including Nov. 8 is as follows: Ford Motor Company, Troy dam, New York; Crown Williamette Company, project near Oregon City, Ore.; Washington Irrigation & Development Company, Columbia River at Priest Rapids, Washington and Oregon; Luther Hill, Sawmill Creek, California; Pit River Power Company, Pit River, California; State of Illinois, Des Plaines and Illinois Rivers, Illinois; Dixie Power Company, White River, Arkansas and Missouri; Columbia Valley Power Company, Deschutes River, Oregon; Edison Company (Los Angeles), Big Creek, California; A. Reed, Bingham, Perdido, Styx and Black Water Rivers, Alabama and Florida.

Soft-Coal Prices Will Continue to Drop, National Coal Association Says

ESTIMATING the average output of soft coal now running at more than 12,000,000 tons a week, the National Coal Association, through its director of publicity, asserts that the prices in the bituminous mine fields throughout the country are on the decline. Within the last month there has been a drop in price of more than 25 per cent in many of the fields. The immediate soft-coal wants of the whole nation have already been met, the association says, excepting in a few isolated places. The prediction is made that, with a supply of cars which will enable the operators to turn out 12,000,000 tons of coal a week for weeks to come, prices in the market will continue to drop.

Dr. S. J. Meltzer of Electric-Shock-Resuscitation Fame Died on Sunday

DR. SAMUEL JAMES MELTZER of the Rockefeller Institute for Medical Research, discoverer of a new method for inducing artificial respiration, died at his home in New York last Sunday. Dr. Meltzer was probably best known to the electrical industry for his activities in connection with the prone-pressure method of resuscitation from electric shock now so generally used. He represented the medical profession on the Commission on Resuscitation from Electric Shock, which was started at the suggestion of the late W. D. Weaver, then editor of the ELECTRICAL WORLD.

Dr. Meltzer was born in Russia sixty-nine years ago and came to this country in 1883. Since 1906 he had been at the head of the department of physiology and pharmacology at the Rockefeller Institute.

In commenting on the death of Dr. Meltzer, W. C. L. Eglin, chief engineer of the Philadelphia Electric Company, who was associated with him on the commission, said:

"We of the electrical industry feel very grateful to Dr. Meltzer for the work which he did while serving on the commission on resuscitation from electric shock, in which the late W. D. Weaver, editor of the ELECTRICAL WORLD, took a personal interest for so many years. All of the members of this commission served without any financial remuneration and gave of their time and experience without stint in this broad humanitarian work. From the inception of Dr. Meltzer's connection with this commission he continued his interest and activities, and he did much to increase knowledge of this subject."

Southern California Company Advocates an "Equalizing Reserve"

A NOVEL element has been brought into the hearings before the California Railroad Commission in connection with the application to establish regular rates for the Southern California Edison Company by the company's argument that its ability to carry out its building program should have a place in establishing a rate base alongside the customary historical value of past investments. The company contended that the completion of the Big Creek program on schedule time and to the best economic advantage demands a steady flow of new money into the enterprise and that this flow must not be interrupted by frequent rate changes which ordinarily would arise from emergency conditions.

For the purpose of avoiding such possible rate adjustments the company proposes a new item in its financial statement to be called an "equalizing reserve," which would be established in the first instance by a voluntary contribution from earnings. Once established, the fund would be increased in years of favorable operating conditions and would be drawn upon when the circumstances were reversed. The plan does not contemplate adjustments to meet general fluctuations in commodity prices, but merely the meeting of unusual and unforeseen conditions such as "dry" years, enhanced labor costs and serious accidents to plant.

In addition to the equalizing reserve it is proposed to establish a "reward for efficiency" account which would be in the nature of employees' participation in earnings. It is held that this fund would be readily maintained without cost and with profit to the consumer, as it would result in a degree of personal efficiency heretofore unknown in the public utility field.

This hearing, which was held at Los Angeles, was in resumption of a previous hearing (see ELECTRICAL WORLD for Oct. 9, page 748) at which Vice-President R. H. Ballard of the company advocated a new basis for rates based on necessary financial obligations.

Issue of Permits to Pit River Company Not Inimical to Nation's Interests

QUESTION as to whether the issuance to the Pit River Power Company of a permit or a license would diminish the right of the United States to the ownership of certain lands in dispute was settled by the Federal Power Commission on Nov. 8, when it agreed with the solicitor of the Department of the Interior that the application could take its usual course without affecting national interests. The commission also approved the ruling of its chief counsel to the effect that the head of a department who may have issued a preliminary permit prior to the passage of the water-power act has no right to extend the life of the permit. Extensions must come through the Federal Power Commission.

It was further determined that the extension of the period for the completion of the project authorized by a final permit issued under the act of Feb. 15, 1901, is within the jurisdiction of the head of the department which issued the permit. Unless the applicant applies for a license to the Federal Power Commission, that commission is without jurisdiction in the matter. Another ruling was made to the effect that there can be no transfer of a special-use permit. The would-be transferee must indicate whether or not he desires a permit under the water-power act.

The Commission decided that the nine Niagara and St. Lawrence River projects should be advertised, and the chief counsel was instructed to look into the jurisdiction of the International Joint Commission over developments involving the Niagara River.

Power Shortage Holds Back Development of Electric Heating Applications

ONE deterring influence in the development of electric heating applications is the shortage of power in industrial plants or the central stations supplying those plants. This point, as well as unanimity of opinion that electric heat-treating processes are very satisfactory, was brought out in the discussion of the subject at the Philadelphia Section meeting of the Association of Iron and Steel Electrical Engineers on Nov. 6.

All rivet heating for both the passenger-car and freight-car department of the American Car & Foundry Company at Berwick, Pa., is handled with electric rivet heaters, according to a statement by J. R. Bower, assistant master mechanic. A total of 102,000 rivets are heated daily, representing 45,739 lb. (20,746 kg.) of steel. The energy required is 6,370 kw.-hr., or 14 kw.-hr. per 100 lb. (45.3 kg.) of rivets. The saving shown over oil heating is from $1 to $2 per 100 lb. of rivets.

Electric heat treating was dealt with by George P. Mills, electrical engineer of the Electric Furnace Construction Company, while oil furnaces were covered for comparison purposes by James E. Wilson of the Treadwell Engineering Company.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Development of the Rhone River from Lake Geneva to the Sea.—Plans are under consideration for the development of the Rhone River from Lake Geneva—Lac Leman—at Geneva, Switzerland, to the sea. The proposed work includes water-power development, navigation and irrigation projects. The French Parliament, it is expected, will soon authorize the undertaking.

National Research Council Gets Site for New Building.—A site in Washington for the new building which is to serve as a home for the National Academy of Sciences and the National Research Council has recently been obtained. It comprises the entire block bounded by B and C Streets and Twenty-first and Twenty-second Streets, Northwest, and facing the Lincoln Memorial in Potomac Park.

Central-Station Co-operation in New England.—Visits to central stations will form an important part of the committee work of the New England Geographic Division, N. E. L. A., during the coming year. Besides holding meetings in various parts of New England for informal discussion of committee matters, individual calls will be made upon local companies to facilitate the interchange of data and better coordinate divisional affairs.

Electrical Engineering Students at Rensselaer Polytechnic Institute.—More entering students at the Rensselaer Institute, Troy, N. Y., have enrolled for the electrical engineering course than for any other course. During the war it was the chemical engineering course that proved the most attractive. The number of freshmen this year is 385, apportioned as follows: Civil engineering, 104; electrical engineering, 108; mechanical engineering, 89; chemical engineering, 74; special, 9; bachelor of science, 1.

Long-Distance Transmission in British Columbia.—The West Kootenay Power & Light Company of Rossland, British Columbia, has completed its transmission-line extension from Greenwood to Allenby, a distance of 100.1 miles. The line is one of the longest in western Canada, the total distance from the power house at Bonnington being 195 miles. The new extension has been constructed for 110,000-volt transmission, but for the present is connected with the old 50,000-volt system. The anticipated load at Allenby is about 3,000 kw., which will be used for mining and milling by the Canada Copper Corporation.

Proposal to Transmit Electricity Direct from Belgium to Italy.—Professor Guarini, an Italian engineer, has suggested that instead of sending coal from Belgium to Italy by railway it should be possible to utilize it to generate electricity for transmission direct to Italy. The distance, as the bird flies, between the Belgium mining centers and Lombardy, for instance, does not exceed 750 miles.

Electrification of State Railways in Austria.—The Water Power and Electricity Commission, a recently formed Austrian body, has decided to limit the equipment of the state railways for electrical operation for the present to some section of the western lines of what remains of Austria. The cost of the proposed work is estimated at 5,100,000,000 kronen. By the adoption of hydro-electric power it is hoped to save the state 434,150 tons of coal annually, out of a total of 3,500,000 tons available for the railways of the country.

Enlarging Prospect Plant of California-Oregon Power Company.—Extensive additions to its high-head plant at Prospect, Ore., on the upper Rogue River, are to be started before long by the California-Oregon Power Company. The plan calls for the construction of a concrete dam, 1½ miles of canal and a forebay with a surface area of about 10 acres. From this forebay water will be conducted through 3,000 ft. of high-pressure pipe to a new power house of reinforced concrete and steel which is to take the place of the present frame structure. The new plant is to develop 20,000 kw., the aggregate of four units.

Nearly 800 California Utilities File Reports.—There are 798 public utilities in California filing annual statements with the Railroad Commission, according to the annual report of the commission for the year ended June 30. Seventy electric companies, thirteen gas and electric companies, thirty-four electric railways and 106 telephone companies are included. The increase in the number of formal complaints filed over the number received in the preceding year was 63.7 per cent. In informal matters the number of complaints filed totaled 2,663, as against 2.342 the preceding year. The commission held 941 public hearings and rendered 1,349 decisions, 406 more than were handed down in 1918-19, and 257 more than were given in 1917-18, the record year up to the present.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Indiana State Electrical Contractors and Dealers' Association.—This association will hold its next meeting in South Bend, Ind., on Dec. 1 and 2.

A. I. E. E. and A. S. M. E.—A joint meeting of the New York Section, A. I. E. E., and the Metropolitan Section, A. S. M. E., will be held on Dec. 3, with Frederick Darlington in charge. topic, "The American Power Problem."

A. S. M. E. Organizes Materials-Handling Section. — Four hundred members of the American Society of Mechanical Engineers have organized themselves into a professional section on materials handling. This section will provide a common channel of intercourse between all the technical and industrial organizations co-operating in the solution of engineering problems connected with the handling and distribution of materials and products.

Ohio Electric Light Association.—The meter committee of this association met at Columbus on Nov. 11; the transmission and distribution committee will, it is announced, meet in Cleveland on Nov. 18, and the illumination committee and the new-business cooperations committee in Cleveland on Dec. 1, instead of Nov. 17, as at first intended. At the last-named meeting industrial lighting and sales methods will be discussed under the leadership of J. B. Wilson.

Iowa Electrical League.—A society with this name was formed with fifteen charter members at the recent semiannual convention of the Iowa Association of Electrical Contractors and Dealers at Waterloo by wholesale-house and manufacturers' representatives selling electrical supplies in the state. The membership is to include any person directly or indirectly interested in the electrical business in Iowa. Temporary officers were elected as follows: President, F. A. Rhode, Marshalltown; secretary, C. M. Knape, Cedar Rapids; treasurer, K. H. Bloodgood, Des Moines. H. E. Mason of Chicago is chairman of the "boosters'" committee.

Coming Meetings of Electrical and Other Technical Societies

Electric Power Club—Hot Springs, Va., Nov. 15-18.
Florida Ice and Public Utilities Association—Miami, Fla., Nov. 15 and 16.
National Electric Light Association—Southeastern Geographic Division, Miami, Fla., Nov. 17-19. (For program see issue of Oct. 23, page 845.)
Electrical Supply Jobbers' Association—Cleveland, Nov. 17-19.
American Engineering Council—Washington, Nov. 18-20. (For program see issue of Sept. 25, page 651.)
Jovian Order—St. Louis, Nov. 25 and 26.
American Physical Society—Cleveland, Nov. 27; annual meeting Chicago, Dec. 28-Jan. 1.
Indiana State Electrical Contractors and Dealers' Association—South Bend, Dec. 1 and 2.
A. I. E. E. (New York Section) and A. S. M. E. (Metropolitan Section)—Joint meeting, New York, Dec. 3.
Association of Iron and Steel Electrical Engineers—Philadelphia Section, Dec. 1; Cleveland Section, Dec. 13.
Rivers and Harbors Congress—Washington, Dec. 8-10.
Illinois State Electric Association—Chicago, Dec. 9. (For program see issue of Nov. 6, page 942.)

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Purchased Energy in Relation to Rates.—An electric company which purchases its energy will not be permitted by the Wisconsin Railroad Commission to increase its rates to its consumers upon the ground that its contract for purchasing electricity is terminable at will and that it will in the future be obliged to pay more for the energy purchased.

Solvency of Company No Reason for Operation at Loss.—The mere fact that the assets of a utility exceed its liabilities by a considerable sum is no reason, in the opinion of the Massachusetts Department of Public Utilities, why the utility should be required to operate at a loss for a substantial period of time, particularly where for twenty years the dividends upon the capital stock have averaged only 4.75 per cent.

Losses in One Department Must Not Be Recouped from Another.—The Georgia Railroad Commission in passing upon the application of the Georgia Railway & Power Company for increased rates reiterated its opinion, often expressed before, that losses, if any, or inadequate returns, if such, in one department of a public utility, as a street railway, should not be saddled upon the patrons of another department, as electric light or gas. Hence it made an effort to ascertain the fair value of the property used by the applicant in its railway department and the financial results of its operation without regard to the electric light and power and other departments of the company's business.

Right to Discontinue Service to Delinquent Customers.—The right of a public utility to discontinue service for non-payment of amounts justly claimed for service rendered is recognized by the New Jersey Board of Public Utility Commissioners, because it is in the interest of the public as well as the utility that the enterprise shall be conducted without unnecessary waste. This involves a minimum of loss through bad accounts. Material losses through failure to collect accounts or continual bringing of individual suits to enforce payment of numerous small accounts of delinquent debtors would in time be reflected in the rate charged for service. Nevertheless, the commission refused to sanction the action of a gas company in refusing service to one who had discontinued it sixteen years ago and, according to the company, still owed it money, suit for which, although the debtor was a property owner, had never been brought.

Classification of Service in Reference to Rates.—The United States Shipping Board Emergency Fleet Corporation having complained against a tariff supplement of the Delaware County Electric Company whereby in its schedule of rates an upper limit was placed upon the use of alternating current untransformed, the Public Service Commission of Pennsylvania found that the limitation placed upon the rate was a reasonable one, in view of changed operating conditions and changed load characteristics, but that the company should have provided an intermediate rate for demands in excess of the limitation so fixed.

Kansas Industrial Court on Its Relations to Capital and Labor.—In passing on a street railway wage case, the Kansas Court of Industrial Relations made these observations on its functions and obligations: "This court is very desirous to do nothing in this case that will unduly burden the respondent. However, it must be admitted that wages to labor should be considered before dividends to the investor and that a business which is unable to pay a fair rate of wage to its employees will eventually have to liquidate. The Kansas law imposes upon this court the obligation, so far as it has the power to do so, to assure to labor a fair wage and to capital a fair return. . . In order to insure skilled and faithful workers in these [essential] industries a fair wage must be paid and healthful and moral surroundings provided; otherwise workers of the highest skill and fidelity would seek employment in other industries. But it is also necessary that capital invested in such essential industries should be assured a fair return. Otherwise such industries would languish for want of capital and the public would suffer as a result."

Rates in Relation to New Capital Requirements.—In granting to the Georgia Railway & Power Company increased rates intended to bring a return of 8 per cent, out of which fixed charges must be met, the Georgia Railroad Commission said: "The record shows that there is a large demand on applicant for services, especially for industrial power, which it cannot meet without further development of unused water powers, and that large sums of new capital are necessary for such additional developments. Because of financial conditions now existing, it shows that it has been unable to secure needed capital from the sale of its bonds or from short-term loans except at very high rates of interest and only in limited amounts. New capital cannot be obtained by public utilities at all except where rates are such as will afford reasonable assurance, with efficient management, of earnings sufficient to care for legitimate fixed charge and establish for them a basis of credit. This does not mean that rates should be such as in themselves will supply new capital, but that they be such as to justify capital investments in competition with other business ventures."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Definition of "Proximate Cause."—The Court of Errors and Appeals of New Jersey has thus defined "proximate cause" in a damage suit (Kelson vs. Public Service Railway Company): "The 'proximate cause' is that cause which naturally and probably led to and which might have been expected to produce the result. It is the efficient cause, the one that necessarily sets the other causes in operation." (110 At. 919.)

A Broken or Fallen Charged Wire in Street Presumptive Evidence of Negligence.—In a suit to set aside damages granted for death resulting from contact with a broken wire charged with electricity (City of Thomaston vs. Atkinson), the Court of Appeals of Georgia held that it was for the jury to decide every disputed issue of fact, including that of whether the deceased was walking on a public path and whether he was guilty of contributory negligence. Upholding the original verdict, it declared that a broken or fallen wire in a street charged with a dangerous current of electricity affords a presumption of negligence on the part of the owner of the wire. (103 So. 876.)

Duty of Power Company to Servants of Telephone Company Using Same Street.—The Court of Appeals of Kentucky has denied a rehearing in Louisville Gas & Electric Company vs. Beaucond, thus affirming the verdict of the lower court awarding damages to Beaucond for injuries received while working for a telephone company whose wires were strung from poles erected nearly in line with those of the power company. The injured man claimed that his foot came in contact with the power company's lines and that the shock received forced him to lose his hold and to fall to the ground, 30 feet below. The Court of Appeals found that the power company had acquiesced in the proximity of the telephone wires to its own wires and that it therefore became the power company's duty to exercise every care to protect servants of the telephone company from the electric service wires. The cause of the man's fall was a question for the jury, as was that of contributory negligence, the case being one where ordinarily reasonable men might differ. The alleged concurring negligence of the telephone company did not affect the liability of the power company, the lineman being free to proceed against one or both of them or to settle with one and proceed against the other. (224 S. W. 179.)

Men of the Industry

Changes in Personnel and Position—Biographical Notes

L. W. Chubb, a well-known research engineer with the Westinghouse Electric & Manufacturing Company, has been appointed manager of that company's newly created radio engineering department. Mr. Chubb has been engaged in both theoretical and practical work with the Westinghouse company for fifteen years. He joined the company as a student engineer immediately after graduation from Ohio State University in 1905. During the past year Mr. Chubb has been conducting special studies in the material and process engineering department. Before that for more than ten years he was in charge of the electrical section of the research division of the engineering department. For many years Mr. Chubb has been an active member of



L. W. CHUBB

committees of the A. I. E. E., and at present he is a member of the meetings and papers committee, standards committee and electric physics committee of the Institute and of the United States national committee of the International Electrotechnical Commission. In the fall of 1919 and the spring of 1920 he was sent to London and Brussels respectively as one of the American delegates to the meetings of the I. E. C. He has received patents on nearly one hundred inventions in almost every phase of electrical engineering.

Major Howard S. Bennion of the Corps of Engineers has been assigned to the Federal Power Commission to act as office executive for the engineering section of the commission. Major Bennion was in charge of the camouflage service in France during the war.

G. R. Kenny, until recently statistician and valuation engineer for the San Joaquin Light & Power Corporation, has joined the engineering staff of Ford, Bacon & Davis in valuation, report and special investigation work. Mr. Kenny prior to his connection with the San Joaquin Light & Power Company was assistant engineer for the Railroad Commission of the State of California.

R. F. Hayward has resigned the post of general manager of the Western Canada Power Company, Ltd., Vancouver, B. C., to become manager of the Santiago Light, Tramway & Power Company, Santiago, Chile. Mr. Hayward, who has had a long experience in electrical work, came from England in 1894 and became general manager of the old Salt Lake & Ogden Gas & Electric Light Company, Salt Lake City, Utah. In 1897 he became chief engineer of the Utah Light & Railway Company, in which position, until 1905, he was active in the construction of many of the pioneer projects of that vicinity. From 1905 to 1909 he was general manager of the Mexican Light & Power Company, Mexico City. Since 1909 he has been chief engineer and general manager of the Western Canada Power Company, for which he designed and constructed the Stave Lake development. He is a fellow of the American Institute of Electrical Engineers and a member of the American Society of Civil Engineers.

A. R. Kelley has been appointed engineer of estimates and valuations of the Southern California Edison Company. This is a newly created department, and Mr. Kelley will report directly to the vice-president in charge of construction and operation. Mr. Kelley was born in Urbana, Ill., in 1878 and was graduated from Purdue University in 1903. He then spent two years in the apprentice course of the Western Electric Company, Chicago. Following this he was local manager with the Delaware & Madison Counties Telephone Company, Anderson, Ind., for one year; local manager of the Citizens' Telephone Company, Columbia City, Wash., for three years, and electrical engineer of the Seattle, Renton & Southern Railway, Seattle, for one year. He then spent two and one-half years in appraisal work in Seattle, during the latter part of this time being assistant engineer of the Public Service Commission of Washington. He then became electrical engineer of the Railroad Commission of California, specializing in rate investigations, valuations and condemnation proceedings. Since 1914 he has confined himself to a private consulting practice on rate cases and valuation proceedings, and he has numbered among his clients many of the California utility companies. During the war he was captain of engineers and assistant to Major-General Seever, Pacific Coast Power Administrator.

H. H. Barnes, Jr., district engineer of the General Electric Company in New York in charge of engineering and construction, has been appointed assistant district manager in addition to his other duties. Mr. Barnes was born in New York City Dec. 15, 1875, and was graduated in electrical engineering at the Polytechnicum in Stuttgart, Germany, in 1897. For a year and a half he was engaged in special testing for Siemens & Halske in Charlottenburg. He then went to Mexico City for that firm in 1899 as superintendent of the Compañia Mexicana de Electricidad. In 1902 he joined the staff of the Stanley Electrical Manufacturing Company, Pittsfield, Mass., and later became manager of its engineering department. Mr. Barnes left Pittsfield to



H. H. BARNES, JR.

act as consulting engineer for the General Electric Company in New York and one year later became district engineer. He is a member of the American Institute of Electrical Engineers, American Society of Mechanical Engineers and a number of other engineering societies, and for a number of years represented the A. I. E. E. on the board of trustees of the United Engineering Society.

R. S. Gereford has been appointed manager of the Hempstead (Tex.) Light & Power Company and assumed charge soon after Oct. 1.

George F. Brockman has been appointed superintendent of the municipal light and power plant at Albany, Tex., and will also be in charge of the construction of a new plant at Moran, Tex. During the war Mr. Brockman served in the United States Navy as electrician overseas. After his return in February, 1919, up to July, 1920, he served as chief electrician of the United States government's air service at Washington, D. C. Mr. Brockman, who also served in the Spanish-American War, is one of the oldest construction engineers in the country, having started with the General Electric Company in the year 1889.

Trade and Market Conditions

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

Schedule Material Manufacturers Busy

MANUFACTURERS of schedule material, while somewhat short of new business, are still actively engaged in production. Many back orders are being filled, especially along the line of specialties which were hard to manufacture earlier in the year on account of difficulties connected with raw material and transportation. One of the largest establishments has orders enough on its books to run its plant to Jan. 1, and while a good many requests from jobbers that shipments be postponed are coming in, cancellations have not as yet assumed serious magnitude. A few employees are being laid off in the switch and socket branch of the industry, and little additional help is being taken on. There is an evident disposition on the part of manufacturers to consider the jobber's situation from a co-operative standpoint, and some factory stocks of wiring devices, notably sockets of various types, are being built up pending a resumption of a more active demand for these products. Deliveries are therefore unusually prompt, except in a few lines, where for the reasons above mentioned special devices have not been produced on the normal scale.

Heating Appliance and Range Situation in San Francisco

PRICES of household heating appliances have remained steady in San Francisco for the past three months, but there are now daily expectations of serious changes. This feeling has been intensified by a recent telegram from the Westinghouse Electric & Manufacturing Company to those dealers who had placed protection orders for radiators with that company. This telegram stated that all prices on heating appliances and household material were withdrawn and were being replaced, but so far the new prices have not been announced. About ten days before this telegram was sent the same company addressed a letter to its radiator customers stating that it would prefer to fill their future orders immediately, because of the possibility of a serious price advance and the likelihood of there being no stock when the time of delivery came. Local electric iron stocks of all makes are excellent, and the opinion is that the high list prices are responsible for the present depression in iron sales. Other heating appliances, such as grills, toasters and small toaster stoves, are needed badly, as the stocks en route will certainly not suffice for the Christmas season. The percolator situation is a little better than previously, as there are plenty of the pot styles in stock, although there is still a shortage in certain makes of the urn models.

An exceedingly brisk heater season is expected. The recent power shortage extended only to street lighting, sign lighting and other special regulations, such as the skip-stop street railroad rules in San Francisco, and the various power companies state that they are prepared to accept radiator and even range business without fear.

Although no organized campaigns are being made on electric ranges by the power companies, a surprising amount of business has developed through the effort of scattered dealers. It may be safely said that the present high prices on ranges do not hurt sales, because customers seem to know plainly what types they want and are anxious to get them. Certain jobbers report that some styles are slow-moving, and it is found that it is hard to substitute when customers have once decided on a certain type. A great deal of government business is expected during the coming year, and resorts are now placing their orders for spring delivery, because of the long time required by the factory to complete such orders. Jobbers are ordering in carload lots.

The Pacific Gas & Electric Company has just issued a new range rate which reads as follows: First 180 kw.-hr. on separate meter for ranges and water heater, 3½ cents per kilowatt-hour; thereafter 2 cents per kilowatt-hour. As the irrigation load has now almost entirely dropped off the power companies' lines, owing to the winter rains having begun, the shortage of power is relieved. The companies will now turn to this class of business in anticipation of being prepared to carry it through next year as extensive additions to the generating plants are being made.

September Electrical Exports Holding Up Well

ELECTRICAL exports for the nine months ended September, 1920, total $68,329,414, the month of September furnishing $7,307,068, according to figures of the Bureau of Foreign and Domestic Commerce. This total is still slightly behind the figure of $68,414,360 for the same period in 1919, but well above the corresponding total of $43,737,320 for 1918. A significant feature of the present year's exports is that since June the total for each month has been larger than the corresponding month in 1919. This excess in July, August and September amounts to almost $2,000,000, so that if the present ratio is maintained, electrical exports for the year 1920 should exceed the figure of approximately $90,000,000 registered last year.

The small difference between the total exports for 1919 and 1920 to date is attested by the fact that this year has recorded a larger figure on ten items, while 1919 is ahead on nine. The largest excess thus far this year has been about $1,000,000 on motors, as well as approximately $750,-

	Sept., 1919	Sept., 1920	—Nine Months Ended— Sept., 1919	Sept., 1920
Batteries	$442,588	$607,936	4,606,695	$4,885,262
Carbons	72,816	119,233	1,107,227	1,085,851
Dynamos and Generators	525,040	461,673	4,145,933	4,655,057
Fans	49,708	70,489	1,240,808	930,990
Heating and cooking apparatus	91,881	95,986	1,187,296	1,260,863
Insulated wire and cables	501,315	635,641	7,269,804	5,298,293
Interior wiring supplies	146,729	241,042	1,730,509	2,334,168
Arc lamps	374	1,053	12,160	17,376
Carbon-filament lamps	10,861	4,402	138,343	70,955
Metal-filament lamps	358,396	244,047	3,774,211	2,756,484
Magnetos, spark plugs, etc.	226,843	271,177	2,341,437	2,664,864
Meters and measuring instruments	208,496	190,331	2,269,620	1,868,300
Motors	733,891	1,230,408	7,845,643	8,899,123
Rheostats and controllers	38,326	33,309	375,116	1,161,604
Switches and accessories	339,188	281,635	2,771,659	3,047,824
Telegraph apparatus	31,262	38,093	707,407	481,434
Telephones	199,936	246,841	2,691,137	2,594,939
Transformers	153,508	208,493	3,113,812	2,980,456
All others	2,188,370	2,325,279	21,085,543	21,335,611
Total	$6,119,588	$7,307,068	$68,414,360	$68,329,414

000 on rheostats, $500,000 on interior wiring supplies, $333,000 on magnetos and about $250,000 on switches. On the other hand, 1919 has up to date registered higher totals on insulated wire and cable by about $2,000,0000, on tungsten lamps by more than $1,000,000, and there was about $400,000 excess on meters.

The export total of $7,307,068 for September, 1920, is more than $1,000,000 ahead of the figures for September, 1919. It is about $500,000 behind the exports for the previous month this year, however, and falls slightly below

the year's average to date. No records were made in September, the exports of each of the nineteen different items having been exceeded by previous months this year. The increase of about $1,200,000 over the September, 1919, exports is largely accounted for by an excess of about $500,000 on motors, $333,000 on insulated wire and cable and about $166,000 on batteries.

Improvement Shown in British Electrical Labor Market

RECENT advices from the British Consulate-General in New York throw light on the condition of the labor market in the electrical trade in England. It seems that although at the time of writing labor unrest continues in certain sections of industry, there is undoubtedly a justifiable reason for some measure of optimism in view of the settlement of the electricans' dispute, which threatened not only to dislocate the electrical industry, but also to involve practically all branches of engineering.

The general position has shown a very marked improvement over the situation at the close of September. The home trade has naturally improved now that this particular threat of labor trouble is removed and demand reaches a fairly satisfactory volume.

Possibly the only really disappointing feature is the continued difficulty in securing export orders. One of the main hindrances to the development of a satisfactory volume of overseas trade, not only in the electrical but also in many other trades, has been the great difficulty in quoting firm prices. The instability of prices which has been so pronounced during the past two years and the consequent reservation by making quotations subject to subsequent advances in price have undoubtedly been responsible for the loss of many orders which would otherwise have been placed in England.

Considerable thought has been given by this industry to means for overcoming this difficulty, and the latest development in this direction is decidedly interesting. Efforts are now being made to have such contracts underwritten as regards the possibilities of increased costs of production subsequent to the quotation of prices. A solution along these lines would go far toward removing present difficulties and enabling exporters to quote firm prices.

Production of Conduit Still Six to Seven Months Behind Orders

CONTRARY to the general rule of increasing stocks and slackening demand in most lines at present, the market for rigid conduit, according to several large manufacturers, remains greatly undersupplied. In most cases demand is said to be holding up as strongly as ever, but in at least one instance the volume of orders has fallen off on the large sizes though the commonly used ¾-in. and 2-in. conduit is said to be scarce.

Manufacturers for the most part are far behind in filling orders. The chief reason advanced for this is a serious shortage of cars. This has not only impeded deliveries but in many instances has prevented manufacturers from obtaining pipe that is badly needed for the making of conduit. The pressing needs of coal transportation are held responsible for the inability to obtain cars. One manufacturer reports that as a result of shipping troubles his supply of pipe is only about 25 per cent of normal, and another at one time recently was able to get only one-tenth the number of cars needed.

In general producers are still struggling to catch up with back orders. Manufacturers' stocks are virtually nonexistent. Several large interests are accepting no new orders at present, and the average length of time for which production is completely booked up is probably about six or seven months. Deliveries are said to be very uncertain, and little relief is seen in that respect in the near future unless the transportation situation greatly improves. Some jobbers here and there report sizable stocks of conduit on hand, but these cases seem but instances of fortuitous arrival of shipments long ordered.

A few cancellations are reported, due to pyramiding of orders, but this practice has not been general in the conduit market. The consensus of opinion holds that prices in this line have reached their peak but that no fluctuation may be expected for some time to come. Lower prices of pipe by the leading steel interests might affect the finished product, one large producer says, but little likelihood of this is seen as yet. Labor conditions are, it is said, improved to the extent that more discrimination can be used in hiring men owing to a greater number of applicants.

Collections in Northwest Long

IN TRACING conditions of credits and collections in the electrical field in the Northwest it is shown that there is much room for improvement. Recent reports give lengthening terms of collections from the dealer trade, small dealers ranging from sixty to ninety days and in some cases going as long as 180 days. In several cases where their assets exceed their liabilities they are unable to realize on these assets because of slow collections. At the same time, collections in other branches of the trade are in much better condition, a good majority averaging less than sixty days. Some large industrial accounts are paying in thirty days but lumber companies are slow because of the slump in business.

Farmers are not buying because crops, from wheat to prunes, instead of being one-third greater than normal, as was expected, are reported less than normal. Heavy rains and hail have done much damage. With the price of wheat falling, the farmers hesitate to sell and are holding for better prices. Bankers are refusing to loan money on this wheat and the farmers have no cash. Consequently sales of lighting plants and appliances to this trade have suffered considerably and will fall far below the expected volume.

Metal Market Situation

A SLIGHTLY better tone prevails in the copper market. Large producers firmly hold to their 15-cent level for copper delivered over the rest of this year, and their position seems improved. A number of sales are reported at this price, and inquiries are also noticeably greater in the outside market, which is quoting on a level with producers. It is doubtful if any sales are being made under 15 cents by dealers, however, for offerings of second hands are not large. Many of the dealers are reported as entering the market as buyers rather than sellers, lending color to the belief expressed in some quarters that copper has reached its low limit. For shipment over the first quarter of next year, the price averages 15¼ cents delivered, but most of the present inquiries are for nearby shipment.

On the whole the non-ferrous metals market reveals a much steadier tone the past week than has been the case recently. Tin, however, developed weakness and declined slightly, as well as sheet zinc. Scrap-metals prices are firmer.

NEW YORK METAL MARKET PRICES

	—November 1—	—November 8—
Copper	£ s d	£ s d
London, standard spot	91 0 0	90 5 0
	Cents per Pound	Cents per Pound
Prime Lake	Nominal 15 50	Nominal 15 50
Electrolytic	15 00	15 00
Casting	14 50	14 50
Wirebase	17 50–18 00	17 50–18 00
Lead, trust price	7 25	7 25
Antimony	6 37½	6 25
Nickel, ingot	43 00	43 00
Sheet zinc, f o b smelter	12 50	11 50
Zinc, spot	7 40	7 40
Tin	40 00	37 62½
Aluminum, 98 to 99 per cent	32 90	32.90

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	12 00–13 00	12 00–13 50
Brass, heavy	6 50– 7 00	6 50– 7 00
Brass, light	5 00– 5 50	5 00– 5 50
Lead, heavy	5 25– 5 50	5 25– 5 50
Zinc, old scrap	4 00– 4 50	4 00– 4 50

THE WEEK
IN TRADE

ALMOST without exception buying in the jobbing field is continuing at a curtailed rate. More sales effort is being required to move the materials which are coming in from manufacturers at a rate that is filling up jobbers' shelves. Little activity is found in the building market except in the South, and consequently the demand for wiring supplies is not sufficient to move the stocks which jobbers have acquired in the last few weeks. On the other hand, the volume of alteration work is good and is keeping a good quantity of wiring material moving.

White conduit supply has not caught up. Stocks of black are building up in good shape and in general are found in pretty fair supply, the smaller sizes being hardest to get. Porcelain is back on the market in good quantity along with loom and flexible armored conductor. Wire is plentiful. While heating appliances as a whole are in pretty good supply, there are short stocks of hollow ware. There is little difficulty in filling orders for washers and cleaners.

In the Western States collections are showing more favorable reports than in the East and Northwest. At the same time it is necessary to devote much effort to improve conditions in this direction.

NEW YORK

A curious situation exists in that while many jobbers are finding business extremely slow and are saddled with large stocks some houses are very optimistic regarding their condition. The view is constantly heard that "we can't kick; sales have fallen off considerably but demand is still fairly good." In some of these cases it is admitted, however, that greater effort must be devoted to making sales. In spite of this, more than one jobber reports both a very encouraging volume of sales and a fairly low inventory level. Less talk is heard of price cutting. Cancellations, so far as can be learned, are not being received in an alarming degree. Collections, however, remain as bad as ever.

Building contracts for October in New York State and northern New Jersey, according to the Dodge reports, totaled $49,207,000, which represents a decline of $10,000,000 from the September figure. This decline is held partly to blame for the light demand in nearly all sorts of wiring material, though conduit, porcelain, radiant heaters and appliances are moving well.

Tape.—Demand is fairly good. Stocks are large but not excessive. Friction tape in 100-lb. lots is worth about 54 cents, with rubber ranging 2 cents per pound higher.

Metal Molding.—The three-wire and four-wire size is quoted at from $67 to $68.50 per 1,000 ft. by jobbers. Demand is reported light and stocks vary, in some cases being much too heavy.

Conduit.—Demand is maintained at a surprisingly strong level, and stocks continue badly broken, especially in galvanized conduit. Shipments are uncertain. The price of ½-in. black per 1,000 ft. ranges from $87 to $92 and for ¾-in. black from $115 to $121 in lots of 5,000 ft.

Sockets.—Sales are only fair. Pull sockets are overstocked, but the supply of other types is about normal. In standard package quantities pulls are quoted at 51 cents net, but keys vary from 28 cents to 33 cents and keyless sockets from about 25½ cents to 28 cents.

Dry Cells.—The supply is good, but demand is only fair. No. 6 in barrel lots is worth 36 cents.

Bells and Buzzers.—Considerable scarcity has been felt and demand, while not especially heavy, is reported still ahead of production. Raw-material troubles are given as a cause.

Hollow Ware.—Present indications point to a considerable shortage. Demand is good but shipments are poor.

Porcelain.—The situation is slightly better, though the market remains greatly undersupplied. Few tubes are in stock, but knobs are coming in better.

Heaters.—Jobbers are well pleased with the buying season thus far. Stocks, however, are spotty, and it is not unusual to find a house entirely cleaned out.

Washing Machines.—During the past month demand has fallen off to a considerable extent. Manufacturers are beginning to catch up on deliveries, but not all jobbers are fully stocked. The Universal machine has been reduced from a flat rate of $225 to $195 in the East and $210 in the West, effective Nov. 6.

CHICAGO

Inactivity continues to mark every phase of the electrical industry in this section. The vague feeling that things would be better after election still prevails, though no one seems to be able to advance any good economic reason. Some jobbers report more inquiries than usual during the past week, but actual orders placed do not amount to much.

Activity of collection departments and the strict terms which are being insisted on for new business doubtless have some effect in keeping down the volume of business. With stocks accumulating in dealers' and jobbers' hands it is for the good of the industry that buying be done in accordance with sound credit conditions.

Wire.—Prices mentioned last week are still in effect. Demand is fairly steady from central-station companies and municipalities, and jobbers are all in position to make immediate shipment in any reasonable amount.

Motors.—The larger manufacturers are still well filled up with work. Some small makers will either have to book more orders soon or curtail production. Demand for sizes under 15 hp. still exceeds supply, but ordinary types can be obtained in three months or less. On larger sizes stocks, still ragged, are steadily accumulating.

Control Apparatus.—This is still hard to get. With the increased output of motor makers last summer many motors were shipped with control apparatus to follow, and this is still necessary in many cases. Prices are firm and deliveries range from sixty days to four months.

Tape.—Stocks are well filled up, owing to the reduction in demand. It is probable that reductions in the price of cotton, rubber, etc., are causing the trade to look for lowered prices soon.

Rigid Conduit.—The ½-in. and ¾-in. sizes continue to be scarce, but no reports are heard of jobs delayed through lack of material. Shipments are coming through from factories in good shape, and stocks in all other sizes are as large as is desirable.

Schedule Material.—With demand from contractors at a low figure, stocks are accumulating and some jobbers are showing a disposition to shade prices to get business. Porcelain parts are still almost unobtainable.

Fixtures.—Demand for house-lighting fixtures has remained good all through the fall and but little reduction has been noted in the past few weeks. The great amount of alteration work that has been under way has kept this class of material at a premium. Industrial lighting fixtures have also had heavy distribution, but this demand has slacked materially recently.

Electric Ranges.—Retail demand has fallen off in recent weeks. Jobbers' faith in good business throughout the winter is proved by the volume of business still being placed with manufacturers. Rural districts which recently obtained power service are those in which the heaviest demand is felt.

Christmas Goods.—Retailers are ordering from jobbers in disappointing quantities. Stores are making early displays, and inquiry by the public seems to be lively. Indications point to a belated but heavy sale of this material.

Washing Machines.—Locally retail sales are improving slowly and the number of inquiries is heavy. A general holding off to watch prices is evident, but with several manufacturers guaranteeing prices and with dealers generally

educating their trade to the fact that prices cannot drop now a resumption of buying is about due. Sales campaigns in surrounding territory are proceeding successfully.

BOSTON

Business continues dull in comparison with the midsummer tide. Jobbers are engaged largely in filling back orders and are buying from hand to mouth on account of overstocks. Collections are uneven. Prices are fairly steady, although downward pressure in wiring supplies is being felt. Building operations have not picked up much as yet, but a better feeling is apparent in the commercial world now that the election is over. Electrical manufacturers are still busy in this district on back orders. Large retail stocks remain to be disposed of before any general resumption of business is expected.

Wire.—No. 14 rubber-covered wire is quoted at $9.50 per 1,000 ft. in 5,000-ft. lots. Demand is slow and local stocks are of good size. Weatherproof base around Boston is 22¾ cents to 22½ cents.

Lamp Cord.—Quotations are slightly weaker. Twisted yellow and green cotton-covered cord sells for $30.59 per 1,000 ft. in 1,000-ft. lots. The supply is excellent for current needs, which are not very pressing.

Motors.—Cancellations on washing machine and cleaner-motor orders are enabling manufacturers to catch up somewhat on production, but the volume of back orders is so heavy that long deliveries are still being quoted. On 5-hp., three-phase induction motors thirty-eight weeks' delivery is quoted by a large manufacturing house. Prices are remarkably steady.

Flexible Armored Conductor.—No. 14 single-strip is selling for $85 per 1,000 ft. in 1,000-ft. lots. No large quantities appear to be moving, and some manufacturers are reported to be offering this material at $80 to the jobbing trade.

Non-metallic Flexible Conduit.—Prices hold firm as yet, but little of this material is moving. Local stocks are quite satisfactory. For ⅜-in. conduit, in 5,000-ft. lots, $33.50 per 1,000 ft. is asked, and for ½-in. $36.50.

Radiators.—A steady demand is apparent and manufacturers are very busy. In one plant at least overtime evening work is being handled. Jobbers are quoting list less 25 per cent on lots of six or less. Production has increased so much that excellent deliveries can be had.

Washers and Cleaners.—The demand has fallen off a good deal, but prices are being held at recent levels.

Appliances.—Retail trade is spotty. Stocks in most lines are easily maintained, but in some quarters a shortage of immersion heaters and waffle irons is reported. Irons and toasters are moving well, and a fair demand for electric tableware in general exists.

ATLANTA

Despite the continued easing off in the volume of business there is now little or no pessimism expressed regarding the future outlook for business conditions. The general opinion seems to be that the slacking up is a healthy sign rather than otherwise. The wild buying of a few months back is noticeable by its absence, both jobbers and retailers placing orders only for their immediate needs. Jobbers have satisfactory stocks of nearly all standard lines and report an excess of some classes of material, specifically irons and loom. The latter article has been offered recently at prices a shade below the market quotations in an effort to move supplies. The retail trade is awakening to the expected demand for holiday goods and orders are beginning to arrive in fair volume.

Building activities in Atlanta continue to hold up very well, October permits reaching close to the million-dollar mark, a gain over October, 1919, of approximately $100,000. Local contractors report they have all the work on hand they can handle well, despite an easing labor market. Credits continue to be scanned closely and collections are not holding up well, especially from any lines connected with the automobile trade.

Meters.—The recent shortage in popular sizes continues, and it seems impossible to obtain 5-amp. and 10-amp., two-wire and three-wire types in sufficient volume. Customers' services have been held up as a result.

Distributing Transformers.—Two carloads of standard apparatus were received this week, serving to ease the situation materially. Back orders, however, will prevent the accumulation of any stocks.

Cable.—Difficulty in obtaining prompt shipments of lead-covered cable in 600-volt and 2,300-volt types is reported by jobbers. The demand continues to hold up satisfactorily owing, it is thought, in a measure to outstanding back orders.

Rigid Conduit.—Improvement in transportation has served to increase materially holdings of black pipe, nearly all sizes being at hand in sufficient quantity. Galvanized, however, is still short in popular sizes. Prices remain unchanged.

Safety Switches.—The demand is holding up remarkably well, showing less slump than any other line. Stocks and shipments continue quite good in all sizes. Prices on types without end plates, small quantities, two-pole, 30-amp., $2.04; two-pole, 60-amp., $10.40; three-pole, 30-amp., $7; three-pole, 60-amp., $14.40.

Lamps.—The heavy seasonal demand has depleted stocks of 40, 100, 150 and 200-watt sizes, and considerable difficulty is being experienced in meeting the requirements of the trade. The shortage is most pronounced in the 40-watt size.

Heaters.—The movement of beam-type heaters, which was brisk the latter part of October, has slowed up because of the warm weather. Dealers, however, predict a very satisfactory year beginning with the real winter weather. Stocks are quite satisfactory.

Portable Lamps.—Respectable stocks have been accumulated in anticipation of holiday demand. Sales are already on the increase and a satisfactory turnover is expected.

ST. LOUIS

Jobbers, manufacturers and retail dealers have spent a quiet week, owing in part to election activities, but in the main to the general dullness the market here has been feeling for some time. The demand for many items has dropped off considerably, and the market has become a buyers' market, with the exception of a few lines.

Stocks are becoming larger continually, and there is every indication that shortages will be few and far between by the first of the year. Deliveries on items which have been short for months are getting better, and in some cases this is working to the disadvantage of the jobber who pyramided his orders six months ago. Some cancellations are resulting. Jobbers also are receiving cancellations, but they are being encouraged by the number of "hold" orders they are receiving at the same time.

Production is being cut in a number of industrial plants, among them several electrical plants, and as a consequence labor has become much more tractable. Manufacturers report production per man increasing noticeably. Wages have not been lowered but many workers have been laid off.

One most encouraging factor is that collections have receded from a maximum of seventy days to about sixty days. This improvement is laid to the fact that customers are ordering less and thereby catching up on their bills.

Wire.—There are large stocks of rubber-covered and weatherproof on hand, but with the demand as low as it is jobbers are finding it hard to reduce them appreciably.

Rigid Conduit.—The shortage which had been existent here for some time has at length been relieved by large shipments from manufacturers, and jobbers' stocks of all sizes from ¼-in. up to 4-in. black are much improved. Galvanized is not quite so plentiful, but stocks are fair. Prices are holding.

Bare Copper Wire.—Jobbers are quoting direct shipment from manufacturers and the market is very unstable. Current quotation is 18 cents base with little demand.

Farm-Lighting Plants.—Stocks are large and demand has been quiet, but several jobbers are planning to put on sales campaigns during November and expect business to become more active. Jobbers report that their volume of business on 32-volt accessories is almost as large as on the plants themselves. In several cases prices are being guaranteed until June 1, 1921.

Knobs, Tubes and Cleats.—There are large stocks of these items and demand is slow. Three-inch ⅜ tubes are quoted at $9.90 in lots of 1,000. The 5½ new code "Nail-it" knobs are quoted at $32 per 1,000. The maximum discount on cleats is 45 per cent.

Christmas-Tree Lighting Outfits.—Some jobbers report that, judging by the orders booked and those coming in at present dealers will do almost as large a volume of business as last year. Practically all the outfits sold here are the series type. Christmas-tree lamps are short, but jobbers expect to be able to get enough by the holiday season to take care of all their orders.

Magnet Wire.—This is becoming slightly easier, and it is quoted on a 23-cent base. Until a month ago no specific deliveries were being promised. At present jobbers can give delivery in from three to four months of both the enameled and silk-covered wire.

Heaters.—Stocks are spotty. It is reported that jobbers will have difficulty in getting deliveries from the factory until the first of the year, but there are enough in stock here to take care of a normal demand.

SAN FRANCISCO

By almost imperceptible degrees conditions have so changed that a buyers' market is unmistakably present. Stocks are beginning to pile up which require special sales effort to move them. There are still certain kinds of roughing-in material, such as boxes and flexible metallic conduit, that are eagerly sought among available sources, but in general it may be safely said that jobbers are figuring very closely because of quickened factory output.

The railroads are increasing their electrical purchases and are rapidly resuming their pre-war volume of buying. Moreover, their plans seem to promise within the next year or so an almost unprecedented increase in business.

Shipyard business has decreased, and several of the war yards have closed. Government yards, on the contrary, have never been so busy. This is because of the enlarged Pacific fleet.

Credit men report collections fair to middling, averaging about fifty days. They are proportioning quantity orders from dealers, especially for household appliances, strictly in accordance with a conservative rate of turnover.

Schedule Material.—Stocks of sockets, switches, cutoffs and similar articles are good, although some sizes of fuses are hard to get in packages. Eastern factories are making steady progress in unfilled orders.

Motors.—Once again dealers are able to solicit new business, particularly in industrial fields hitherto untouched. The motor demand is still, however, far in excess of supply.

Household Appliances.—The California co-operative campaign is mapping out an intensive advertising campaign for the Christmas season. A limiting factor is lack of stock. There is an excess of flatirons, but hardware stocks will melt long before the peak of the holiday demand is reached. The call for the larger household appliances has slackened in spite of strenuous efforts to increase sales.

SEATTLE—PORTLAND

The election has not so far stimulated business in Puget Sound territory. If anything, the past week's sales volume was lighter than ever. Aside from domestic appliances electrical merchandise is moving very slowly. Movement of schedule materials, conduit and similar articles used in building construction is showing a daily decrease. Motors and heavy power-apparatus sales are negligible and the call for pole-line equipment and street-lighting facilities is at a minimum. Optimistic authorities believe the new year will usher in a change for the better, while others hold that nothing much of consequence will transpire until early spring. Stocks, with the exception of conduit, are in good shape, and replacements in most cases are easy to obtain. There is a surplus of labor, both skilled and unskilled, and lumber mills, logging camps and larger industrial plants are cutting down forces. In the case of mills and camps many plants in both Oregon and Washington have closed down altogether. A cut in wages of lumber workers is imminent; in fact, several mills have announced wage cuts approximating 50 cents a day.

The general situation in Portland seems to be that many dealers are in a very precarious situation. Their assets exceed their liabilities, but inability to realize on these assets because of slow collections has brought about a rather serious condition. Many cancellations of orders have already been made, and in most cases buying is from hand to mouth. Portland jobbers report business good at the present time—in fact, somewhat better than was expected a few weeks ago. Stocks are improving very materially, with the exception of porcelain. Conduit stock is good now. At the present rate jobbers will be able to catch up on back orders within the next thirty or forty days. Line-construction tools, "Economy" fuses and lamp guards show a slight advance. Conduit in small quantities shows a 10 per cent increase, but in large quantities there has been no change. Single-braid rubber-covered No. 14 wire has dropped from $13.75 per 1,000 ft. to $13.10.

Lamp Cord.—Cotton-covered No. 18 has dropped from $33.30 per 1,000 ft. to $31.40.

Domestic Appliances.—In Seattle and Puget Sound cities washing machines, ironers, vacuum cleaners, flatirons and percolators are moving well. In the smaller towns and rural communities campaigns, including house-to-house solicitation, window demonstrations and newspaper advertising, are producing good results.

SALT LAKE CITY—DENVER

Although no tangible effects of the national election are discernible yet there is a decided feeling of relief and a looking forward to improved business among electrical jobbers and dealers. Actual trade conditions are not much improved over the past week. In many agricultural sections farmers are holding their wheat and potatoes for higher prices. As a result money continues scarce and buying by consumers is at a low ebb. One large retail concern with more than twenty branches in Utah and Colorado reports that the month is not coming up to expectations based on crop forecasts. Crops are bountiful, but marketing is proceeding slowly.

There is hesitancy on the part of electrical dealers to yield to the impulse of price cutting as they believe that the electrical trade will remain stable for several months to come so far as price schedules are concerned. There is little building under way. Contractors report that they are employing not more than one-fourth of their normal building force. Revived building activity is looked for in the early spring, but it is expected that the coming winter will be very quiet.

The credit situation is said to be steadily improving, although there are still long delays in collections. Special advertising campaigns are being put over by offering liberal arrangement of time payments. "Edison Day" was observed recently by the leading contractors, dealers and jobbers of Idaho. Discussion and special demonstrations of merchandising were a feature of the convention, while care and display of stocks was another topic taken up. A "fill your socket" campaign is to be carried vigorously to every part of the state. As a special inducement to the trade power companies are filling sockets and allowing the charge to be made on the monthly bill for service.

Porcelain.—Stocks have been very short for months, but contractors report that they are now able to get their orders filled at a satisfactory rate.

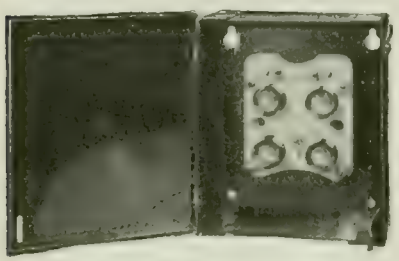
Christmas Tree Outfits.—An unusual effort is being made by jobbers to put this seasonal commodity on the market. Safety and attractiveness of a Christmas-tree adornment are the selling points being urged.

New Apparatus & Appliances

A Record of Latest Developments
and Improvements in Manufacturers' Products
Used in the Electrical Field

Inclosed Cut-Out

An inclosed cut-out to be used in conjunction with safety service switches has been developed by the Square D Company, Detroit, Mich. This cut-out No. 35,211 matches the Square D inclosed switches. It is designed for three-wire service with two-wire distribution or two-wire service with two-wire distribution. The ends are open to take any standard class "A" end plate. It is provided with two ½-in. and two ¾-in. knockouts on each side and two ½-in. and one ¾-in. knockout at top and bottom in the back of the box. It is designed for 30-amp., 125-volt plug fuses. The depth is 3⅛ in. and the weight 4 lb.



SAFETY INCLOSED CUT-OUT

Battery Charging from Alternating-Current Line

Apparatus for continually charging storage batteries while in service from an alternating-current line has been developed by the Valley Electric Company, 3157 South Kings Highway, St. Louis, Mo. With this system the battery is continuously given a small charge from an alternating-current line through a rectifier. This vibrating-type rectifier is made for any commercial frequency and voltage, has only one moving element and operates in any position automatically.

Loom for Weaving Tire Fabrics

A machine designed to weave a rubber-saturated yarn and bead into a fabric securely cemented between each ply, automatically completing the construction of the carcass in one operation, has been developed by the Automatic Tire Machine Corporation, 23 Falls Street, Niagara Falls, N. Y. The machine is entirely electrically operated, the bobbin being moved from one side to the other by magnetic action and the pickers being actuated by solenoids. The yarn going into the fabric is saturated with rubber before being woven. The fabric for one tire is woven in a continuous length, thus avoiding the necessity for laps and joints.

Thirty-two-Volt Generating Plant

The engine of the 32-volt farm-lighting plant made by Carlton, Young & Catlin, Inc., Grand Central Palace, New York City, follows as nearly as possible standard automobile practice. A number of parts are interchangeable with those of the Ford automobile engine, including piston, connecting rod, time gears, valves, valve-spring seats, etc. The specifications include a 1½-kw., 37½-volt, direct-current, 1,200-r.p.m. generator, directly connected to a single-cylinder engine. The switchboard is mounted on the generator frame. The engine is designed to run on kerosene, gasoline or alcohol.

Toggle Switch for Household Appliances

A toggle switch for mounting on electrical household appliances has been developed by the Bryant Electric Company, Bridgeport, Conn. The base is of porcelain, the covers are polished nickel-plated brass. The manufacturer identifies this device by catalog No. 2902.



FOR MOUNTING ON APPLIANCES

Four-Heat Disk Stove

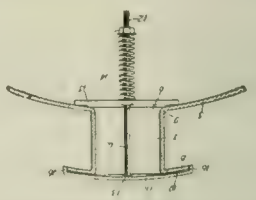
A disk stove equipped with a regulating plug for obtaining four degrees of heat has been developed by the Waage Electric Company, 6 Reade Street, New York City. An aluminium disk is used, as this metal, the maker declares, throws off heat quickly as it is a good heat conductor. The stove is built on a metal deck with fiber rests to avoid marring the table.

Cylinder-Type Clothes Washer

A cylinder-type clothes washer with all moving parts inclosed in a gray enameled cabinet has been developed by Landers, Frary & Clark, New Britain, Conn. The cylinder weighs 19 lb., is removable and when not operating locks automatically with the opening at the top. The washer has a capacity of six sheets, occupies a floor space 24 in. x 30 in. and weighs 285 lb.

Automatic Safety Valve for Oil-Filled Transformers

A safety valve to relieve abnormal pressure in oil-filled transformers has been developed by the Pittsburgh Transformer Company, Pittsburgh, Pa. An adjustable spring holds a plate from the inside, closing an outlet. It is claimed that the valve is automatic and that after it has relieved the pressure it will immediately reset and thus prevent rain or snow from entering the transformer.



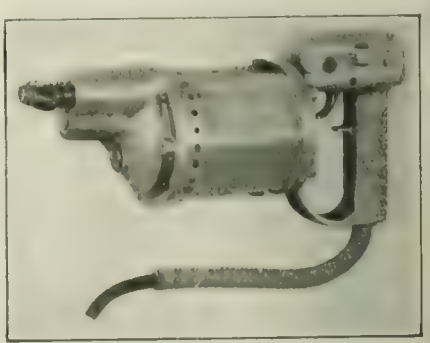
FOR RELIEVING PRESSURE INSIDE OIL-FILLED TRANSFORMER

Aerating Mixer for Kitchen Use

A mixer which aerates and mixes foods and liquids is being marketed under the name of "Whip-All" by the Air-O-Mix Corporation, 50 East Forty-second Street, New York City. The mixer is operated by a universal motor incased in a housing of brass casting nickel-plated. The device is 12 in. high and draws less current than a 50-watt lamp.

Two-Spindle Electrical Drill

A two-spindle drill for drilling two holes ⅞ in. apart has been designed by the Black & Decker Manufacturing Company, Towson Heights, Baltimore, Md. The handle of the drill is like that of an automatic pistol, and a pull on the trigger sets the two bits in motion. A second pull stops the drill. The operator can control the tool without changing the position of either hand. The two spindles have chucks to hold ⅜-in. drill bits.



DRILLS TWO HOLES AT ONCE

Machine to Test Permanence of Dyes

A "Color Fade-Ometer" to test the fastness to light of colors and dyestuffs has been developed by the Atlas Electric Devices Company, 360 West Superior Street, Chicago. It is said that this instrument tests dyes in a few hours as completely as a sunlight test requiring several weeks. Forty tests can be made at one time. The instrument operates automatically without an attendant. It is used for testing color in textile goods, paper, leather, paints, varnishes, inks, oil, etc.

Electric Immersion Heater

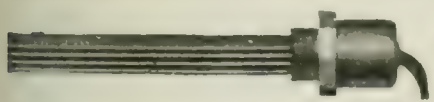
A new immersion water heater, the "Electro-Boil," the smallest model of which is said to bring cold water to the boiling point in three minutes, has been developed by the Milwaukee Manufacturing Company, 1316 Fond du Lac Avenue, Milwaukee, Wis. This device is composed of a metal cylinder with metal disks inside, perforated to admit a ready contact with water. For operation the heater is simply immersed in water and the current turned on. The four models range in size from 110 volts, 3 amp. (designed to boil one quart of water in seven minutes) to 110 volts, 30 amp. (to boil one gallon of water in one minute).

Automatic Switch for Battery Charging

An automatic switch designed to protect storage batteries while they are being charged by preventing a reverse flow of current from the batteries through the generator has recently been developed by the Hartman Electrical Manufacturing Company, Mansfield, Ohio. This switch is known as the "type L" automatic switch. When the alternating-current power fails a switch automatically disconnects the batteries, but when the power is restored the switch automatically closes again. It is rated at 30 amp. and can be used on either 110-volt or 220-volt circuits.

Water Heater Placed in Pipe Outlet of Container

A heater for application to water containers provided with pipe outlets has been recently designed by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. These heaters fit threaded pipes of 1¼ in. or 2 in. inside



HEATER SCREWED INTO HOLE IN TANK

diameter. They are inserted through the walls of the vessel below the minimum water level. These heaters are made in different capacities, from 500 watts to 4,500 watts, on standard commercial voltages. The larger sizes have three heats, selected by means of a switch on the heater cord.

Automatic Stoker for Household Use

An electrically operated automatic stoker for residences is now being placed on the market by the Domestic Stoker & Manufacturing Company of Salt Lake City, Utah. The device consists of a stoker, a thermostat, a clock and control apparatus. A small electric motor operates the stoker, the draft and the circuit-changing mechanism. A conveyor carries the fuel from a hopper containing 250 lb. of slack coal to an oscillating chute projecting into the furnace, whence it is dropped on the center of a conical grate. The rate of feed may be varied from 6 lb. to 60 lb. an hour. The thermostat is situated in any living room. To insure that the fuel bed shall be replenished periodically irrespective of temperature requirements, a clock is provided which causes the stoker to feed a certain amount of fuel to the furnace each hour.

Regenerative Receiver and Vacuum-Tube Unit

In the "type CR-3A" short-wave regenerative receiver and vacuum-tube unit offered by A. H. Grebe & Company, Inc., 70 Van Wyck Boulevard, Richmond Hill, N. Y., the usual variometer tuning elements are used, but a departure in



IMPROVED COUPLING ELIMINATES ONE ADJUSTMENT

coupling design has been effected which eliminates one tuning adjustment. In the position ordinarily occupied by the coupler dial a standard four-prong vacuum-tube receptacle and grid condenser have been placed. The wavelength range is from 150 m. to 375 m.

Notes on Recent Appliances

Plug and Receptacle

The Electrical Outlet Company, 119 West Fortieth Street, New York City, has developed a fixture hanger and plug combined.

Pressure Switch

The Penn Electric Machine Company, Des Moines, Iowa, is offering a pressure-controlled switch.

Dishwasher

A dishwasher has been placed on the market by the Fitzgerald Manufacturing Company, Torrington, Conn.

Christmas Tree Lamp

A Christmas tree lamp of new shape has been brought out by the Westinghouse Lamp Company, Bloomfield, N. J.

Washing Machine

An electric washer has been brought out by the Fosston-Carpenter Company, 473 Cleveland Avenue, St. Paul, Minn.

Flexible Light Holder

A flexible industrial light holder has been placed on the market by the Sterling Company, Sterling, Ill.

Branding Iron

An electrically heated branding iron has been placed on the market by the Detroit Electrical Branding Iron Company, 710 Farwell Building, Detroit, Mich.

Battery Bell

Bells and buzzers with self-contained dry batteries have been brought out by the Electric Signal Manufacturing Company, Inc., 31 Tremont Avenue, Orange, N. J.

Fractional-Horsepower Motor

Fractional-horsepower motors have been placed on the market by the A-C Electrical Manufacturing Company, Dayton, Ohio.

Hair Waving Machine

Hair wavers, both electrically heated and heated by electric stoves are being offered by Le Bijou Company, 186 North La Salle Street, Chicago.

Household Radiator

A radiator in sizes from 600 watts to 10,000 watts is being offered by the Electric Heating & Manufacturing Company. Westlake and Republican Streets, Seattle, Wash.

Volt Reader for Testing Batteries

In describing a volt reader for battery testing made by the Service Station Supply Company, 30 East Larned Street, Detroit, Mich., the wrong address was given in the ELECTRICAL WORLD of Oct. 2, 1920, p. 712. The correct address is that given above.

Semi-Indirect Lighting Unit

A semi-indirect lighting unit has been developed by H. G. McFaddin & Company, 38 Warren Street, New York City.

Washing Machine

The Hogan-Spencer-Whitley Company, Erie, Pa., has placed on the market a washing machine.

Machinery Blowing Outfit

The Black & Decker Manufacturing Company, Towson Heights, Baltimore, Md., is now making a No. 46 portable electric compressor equipped with reducing valve, hose and blow gun.

MANUFACTURERS' ACTIVITIES

Record of Changes Affecting Sales and Distribution Together with Trade Personals and Notes on Foreign Trade, Jobbers' News and New Trade Literature

THE DOUGLAS-RUDD MANUFACTURING COMPANY, Bronson, Mich., manufacturer of electric battery products, connections, etc., has filed notice of an increase in capital stock from $30,000 to $236,000.

THE WESTERN APPLIANCE MANUFACTURING COMPANY, Seattle, Wash., is planning to build a one-story plant at 5623 Duwamish Avenue, to cost about $25,000 exclusive of equipment. The plant will be used to manufacture a newly designed electrical ironing machine.

THE WESTINGHOUSE LAMP COMPANY, 165 Broadway, New York City, has filed plans for the erection of a four-story building, 80 ft. x 400 ft., on East Michigan Avenue, Indianapolis, Ind. The cost is estimated at about $500,000

THE UNITED ELECTRIC COMPANY, Canton, Ohio, has filed notice of increase in capital stock from $500,000 to $1,000,000. The company manufactures suction sweepers.

THE INDUSTRIAL IGNITION COMPANY, Flint, Mich., is planning to build a new power house, to cost about $60,000.

THE REFRIGERATING MACHINE & HEATING COMPANY, Detroit, Mich., has filed notice of change in name to the Refrigerating Machinery Company.

THE SUNSHINE SAFETY LAMP COMPANY, 1005 McGee Street, Kansas City, Mo., is considering plans for the erection of a one-story-and-basement building, 50 ft. x 115 ft., on Walnut Street. The company manufactures electric lamps.

THE IDEAL GAS & ELECTRIC FIXTURE COMPANY, 433 Broadway, New York City, manufacturer of brass and other metal electric and gas fixtures, has filed notice of increase in capital stock from $10,000 to $70,000.

THE EASTERN ELECTRICAL SUPPLY COMPANY, 798 Broad Street, Newark, N. J., has taken over the three-story-and-basement building, 47 ft. x 90 ft., at 88-90 Academy Street, for its proposed new works.

THE ELECTRIC STORAGE BATTERY COMPANY, Nineteenth and Allegheny Streets, Philadelphia, has awarded contract for another factory building, to cost about $100,000, at its new plant on Rising Sun Avenue

THE ELECTRO-REFRACTORIES CORPORATION, Buffalo, N. Y., has filed notice of increase in capital stock fom $200,000 to $550,000.

THE UNION ELECTRIC & MACHINE COMPANY, Charleston, W. Va., has filed notice of increase in capital stock to $50,000.

THE BERG CLARK ELECTRIC COMPANY, 10207 Euclid Avenue, Cleveland, Ohio, is planning to erect a factory and warehouse at St. Clair Avenue and East Fourteenth Street, Cleveland, to cost about $50,000.

THE DIAMOND CARBON COMPANY, Wardville, La., contemplates additions to its plant, including the installation of machinery, to cost about $250,000

THE R. D. NUTTALL COMPANY, Pittsburgh, Pa., has established permanent quarters at 129 Title and Trust Building Philadelphia, in charge of R. F. Fiske to handle direct all business other than electric railroad and mine haulage supplies and equipment.

LANDERS, FRARY & CLARK New Britain, Conn., are considering increasing their capital stock by $1,000,000, the new shares to be sold to stockholders at $25 each. The proceeds will be used in part for new construction.

THE GREENFIELD (MASS.) TAP & DIE CORPORATION is offering for public subscription $2,225,000 8 per cent cumulative preferred stock (par $100), a part of an issue of $5,000,000. The company has an authorized capital stock of $11,500,000, of which $6,755,000 is outstanding at the present time.

THE ROLLER-SMITH COMPANY, 23 Broadway, New York City, announces the appointment of L. Brandenburger, 59 West Broadway, Salt Lake City, Utah, as its representative in Utah and parts of Idaho, Wyoming and Montana. Mr. Brandenburger will handle the company's entire line of instruments, meters and circuit breakers in that territory in addition to representing the Wagner Electric Manufacturing Company, the Delta-Star Electric Company, the American Insulated Wire & Cable Company, and the Esterline Company. Mr. Brandenburger was formerly with the Telluride Power Company, and later with its successor, the Utah Power & Light Company. Since 1916 he has been in Salt Lake City as a manufacturer's agent, specializing in electrical apparatus.

THE CUTLER-HAMMER MANUFACTURING COMPANY has again increased the space of its New York City office at 50 Church Street. This is the fourth increase since the company has occupied space in the Hudson Terminal Building, the latest addition being on the ground floor, where the new offices are half as large as those on the nineteenth floor.

THE GENERAL ELECTRIC COMPANY, Schnectady, N. Y., has recently awarded the contract for the erection of an addition to its plant at Lynn, Mass., 180 ft. x 250 ft., with three ells, 40 ft. x 40 ft., 15 ft. x 40 ft. and 12 ft. x 20 ft., to cost about $150,000. The company, it is stated, will hold in abeyance plans for its proposed five-story plant at Springfield, Mass., and will ask for bids in 1921. The building will be 75 ft. x 800 ft. and cost about $500,000.

FRED E. RUSSELL, contracting engineer, who recently invented an insulated stove which heats an oven on all six sides, has moved his works and general offices to Langhorne, Pa. He also maintains an office in the Otis Building, Sixteenth and Sansom Streets, Philadelphia.

THE R. H. BEAUMONT COMPANY, 319 Arch Street, Philadelphia, has recently established an office at 230 Fifth Avenue, Pittsburgh, Pa. Thomas Widdop is in charge.

THE HURON STEEL COMPANY, Cleveland, Ohio, announces that it has made arrangements with the W. H. Gilbert Sales Company, with offices in Los Angeles, San Francisco, Cal., and Seattle, Wash., as Pacific Coast agent to handle its products and those of its subsidiary, the Ohio Steel Products Company, which include boiler tubes, lap and butt weld pipe, acetylene welded tubing, rigid and flexible conduit and metal molding.

THE PEERLESS INSULATED WIRE & CABLE COMPANY, Pennington, N. J., has made arrangements for the construction of an addition to its works for the manufacture of weatherproof wire products, to cost about $50,000.

THE CROUSE-HINDS COMPANY, Syracuse, N. Y., manufacturer of condulets and other electrical products, has removed its Philadelphia office from the Franklin Trust Building to the Otis Building, where it has much larger quarters

THE GASSER MANUFACTURING COMPANY, Trenton, N. J., recently incorporated with a capital stock of $500,000, is planning to erect a new factory, 100 ft. x 100 ft., for the manufacture of special electrical equipment. The cost of the building is estimated at about $85,000. The company has established temporary offices at 402 Greenwood Avenue.

THE HEULE ELECTRIC HEATER COMPANY, Cleveland, Ohio, has made arrangements with the Chamber of Commerce of Massillon, Ohio, to locate in that city. It will establish a plant there to manufacture electric heating equipment for residences

Supply Jobbers' Notes

THE GENERAL ELECTRIC COMPANY has purchased a large site in Atlanta, Ga., and has begun construction on what will be one of the largest electrical warehouses in the South. The preliminary construction will provide for warehousing space amounting to approximately 100,000 sq.ft., with plans for extensions as requirements demand. The new location was chosen with a particular view of providing freight and express terminal facilities, and it is expected that the building will be ready for occupancy by April 1, 1921.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A commercial agency in India (No. 33,926) desires to import various American products, including electrical goods, etc.

A firm in Sweden (No. 33,929) desires direct communication with American manufacturers of copper wire, cables, bars and sheets, brass wire, bars and sheets, and aluminum sheets.

Foreign Trade Notes

AMALGAMATION IN JAPAN.—In the hope of stabilizing the elecrical industry in Japan, the government there is reported as intending to amalgamate all the electrical interests. It is thought that such a combination would make the development of water power easier and more economical and simplify the raising of capital.

THE INTERNATIONAL WESTERN ELECTRIC COMPANY, New York, is planning the opening of a new branch at Singapore in the Malay Peninsula. The new office will handle the trade of the Straits Settlements, the Federated Malay States, Borneo, Siam, Ceylon, Burma and the Dutch East Indies.

GREAT INCREASE IN USE OF ELECTRICITY IN SWEDEN.—Owing to the scarcity and the high cost of coal in Sweden the development of water power to supply electricity for railway, mining and industrial purposes is increasing rapidly. The existing hydro-electric plants, it is stated, are capable of generating 1,150,000 hp., while works under construction will soon add another 250,000 hp. The equipment of the plants, such as turbines, generators, transmission line, etc., is largely of Swedish manufacture, but some of the distributing apparatus, motors, etc., have been imported. Four large generating stations belong to the state and thirty-two (of more than 5,000 hp. capacity) to private companies. The railway from Kiruna to the Norwegian frontier was electrified some years ago. The Kiruna-Lulea, Stockholm-Gothenberg and Nordmark-Klaralfoen lines are now being equipped for electrical operation. At present 19,000 km. of electric transmission lines are owned by private companies. The government is empowered to grant loans to private companies for carrying out hydro-electric enterprises, while 14,000,000 crowns have been voted for completing the work of introducing electric traction on the state railways.

Trade Publications

INGOTS, BEARINGS AND CASTINGS.—The Ajax Metal Company, Philadelphia, Pa., is distributing a new catalog covering the Ajax metal products, including white metal alloys, bronze and brass ingots, bearings and castings. This catalog has been published in two editions, one in English and the other in Spanish

TRANSMISSION MACHINERY.—The A. & F. Brown Company, Elizabethport, N. J., has issued a new catalog entitled "Power Transmission Machinery," covering its line of power transmission apparatus and equipment

GENERATORS AND EXCITERS. — The General Electric Company, Schenectady, N. Y., has issued bulletin No. 40,017A, superseding No. 40,017, which describes its small direct-current generators and exciters, type M L.

INSULATED WIRE AND CABLE.—The Okonite Company, Passaic, N. J., has just published a 104-page illustrated handbook, covering insulated wire and cable.

SPLICING MATERIAL. — The Okonite Company, Passaic, N. J., has issued a folder entitled "Spliced for Life," on insulating tape, cement and Manson friction tape.

FANS.—The Robbins & Myers Company, Springfield, Ohio, has issued domestic catalog No. 1153, dated Nov. 1, on "Electric Fans for A.C. and D.C. Circuits."

GRAPHIC METERS. — The Esterline Company, Indianapolis, Ind., is sending out a circular entitled "What Shall It Profit a Man?"

COTTON-MILL DRIVE. — The Westinghouse Electric & Manufacturing Company has issued leaflet 1919, which describes and illustrates "Electric Drive for Cotton Openers and Pickers."

New Incorporations

THE ROSS ELECTRIC APPLIANCES, Ltd., Toronto, Ont., has been incorporated by Charles A Barron, 268 Sherbourne Street; John H. Ross, William N. Irwin and others. The company is capitalized at $40,000 and proposes to manufacture electrical supplies as well as appliances, motors, etc.

THE CALIFORNIA AUTOMATIC LIGHT COMPANY, 715 South Flower Street, Los Angeles, Cal., has been organized by F. P. Clarke and others to manufacture electric and other lighting equipment.

THE RURAL LIGHT & POWER COMPANY, Kimballton, Iowa, has been incorporated with a capital stock of $25,000. Olaf Hanson is president of the Rural company.

THE CONSOLIDATED ELECTRIC COMPANY, Muscatine, Iowa, has been incorporated with a capital stock of $10,000. The officers are F. C. Stroup, president, and R. R. Miller, secretary and treasurer.

THE CORWIN ELECTRIC COMPANY, Lafayette, Ind., has been incorporated by Elmer E. Corwin, S. M. Johnson and William Stone. The company is capitalized at $10,000 and proposes to manufacture telephone and electrical appliances.

THE LIVE WIRE ELECTRICAL APPLIANCE COMPANY, 181 Griffith Street, Jersey City, N. J., has been organized to manufacture electrical devices. Edward Mohlen is one of the incorporators.

THE LYONS ELECTRIC APPLIANCE COMPANY, Bridgeton, N. J., has been incorporated by John P. Lyons, R. Elmer Shoemaker and Frank R Bacon. The company is capitalized at $100,000 and proposes to manufacture electrical appliances and equipment

THE FERNANDO C. MESA COMPANY, Newark, N. J., has been chartered with a capital stock of $1,500,000 to manufacture electrical wiring devices and equipment. The company, it is understood, will be located in the plant on Chancellor Avenue in the Waverly section, for the manufacture of ammunition, now occupied by the above concern. The incorporators are F. C. Mesa, Roy J. Harding, James Manzo and Joseph Price.

THE GUARANTEE BATTERIES, LTD., Guelph, Ont., has been incorporated by Charles L. Dunbar, Leo W. Goetz, James Sutherland and others. The company is capitalized at $300,000 and proposes to manufacture tools, electrical equipment, etc.

THE COAST REFRIGERATING FACILITIES, INC., Atlantic City, N. J., has been incorporated by H. H. Jennings, George S. Brooks and William C. Marshall. The company is capitalized at $400,000 and proposes to manufacture refrigerating machinery and apparatus.

THE WEIDMAN & MOHR MACHINE COMPANY, Lancaster, Pa., has been chartered by James B. Weidman, Charles A Mohr and W. M. Murphy. The company is capitalized at $300,000 and proposes to manufacture machinery and tools including electrical apparatus.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

Middle Atlantic States

CONCORD, N. Y.—The Iroquois Utilities Inc., City Bank Building, Syracuse, has applied to the State Public Service Commission for permission to construct an extension of its system in Concord. B. H. Shepard is president.

FOWLER, N. Y.—The State Public Service Commission has granted the St. Lawrence Transmission Company, Potsdam, permission to construct an electric plant in Fowler (Gouverneur P. O.).

MASSENA, N. Y.—The Louisville Power Corporation, Walter G. Wilson president, contemplates the erection of a hydro-electric plant on the St. Lawrence River. H. L. Cooper & Company, 101 Park Avenue, New York City, is engineer.

NEW YORK, N. Y.—New bids will be received by the Board of Education, 500 Park Avenue, until Nov. 22 for the installation of electrical equipment to cost about $40,000, in Public School No. 62, Borough of The Bronx. C. B. J. Snyder, twenty-eighth floor, Municipal Building, is engineer.

NIAGARA FALLS, N. Y.—The Lower Niagara River Power & Water Supply, J. J. Albright president, Lewiston, contemplates the erection of a hydro-electric plant. H. L Cooper & Company, 101 Park Avenue, New York City, is engineer.

NEWARK, N. J. — A referendum was passed at the recent general election for the installation of an electric and gas light, heat and power plant. Commissioner Raymond is director of the Department of Streets and Public Improvements.

ALTOONA, PA.—The Logan Valley Electric Railway Company, Eleventh Street and Twelfth Avenue, contemplates the construction of about 3 miles of new line, connecting present system, at a cost of about $40,000. Francis Tingley is chief engineer.

ERIE, PA.—Extensions to the municipal fire-alarm system to cost about $86,000 are being planned by City Electrical Engineer Crane.

FREEMANSBURG, PA.—The New Jersey Zinc Company contemplates making changes in its power equipment, installing additional motors, rearrangment of drives, etc H A Baruch is superintendent.

ABERDEEN, MD.—Bids will be received by the Constructing Quartermaster, Aberdeen Proving Ground, until Nov. 18 for the erection of a generator house and other buildings. Plans and specification may be obtained at the above address.

BALTIMORE, MD.—The rebuilding of its power-plant building is contemplated by the Church Home & Infirmary, Rev. Dr. A. C. Powell, chairman, Stoney Run Lane. University Parkway. Wyatt, & Nolting, Keyser Building, are architects.

BALTIMORE, MD.—Plans for the installation of a 'phone and signal system as a guard against theft are under consideration by Col. E. Austin Baughman, automobile commissioner of Maryland. Plans include the installation of a switchboard to cost about $5,000.

CHARLESTON, W. VA.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., contemplates the installation of substation switchboards (Specifications 4308.)

North Central States

DETROIT, MICH.—Plans are under way by Louis Kamper, architect, 751 Book Building, for the erection of a meat products factory for the Orling Brothers, Heidelberg and Elmwood Avenues, to cost about $200,000. Electric light equipment and motors for machines will be installed.

DETROIT, MICH.—Bids will be received by Harry Brabyn, secretary of the Board of Fire Commissioners Wayne and Larned Streets until Nov 22 for the erection of a pumping station. Bids will also be received at a later date for two motor-generator sets for the operation of pumps and electrical generating equipment for lights Smith, Hinchman & Grylls, 710 Washington Arcade, are engineers.

DETROIT, MICH. — The Michigan Elevated Railway Company, 711 Dime Bank Building, has applied to the State Public Utilities Commission for permission to construct a first unit of an elevated railway system from Detroit to Royal Oak, to cost about $491,000 per mile. Plans include an electric transmission line.

MENOMINEE, MICH. — The Michigan Electro-Chemical Company contemplates improvements to its power plant including the installation of additional equipment Cahill & Douglas, 217 West Water Street Milwaukee, are engineers.

ASHTABULA, OHIO. — An issue of $1,000,000 in bonds for the erection of a new electric light and power plant was carried at a recent election

EASTON, OHIO. — The County Commissioners have granted W. T. McCabe a franchise to erect and maintain an electric transmission line in Preble County.

HURON, OHIO.—An issue of $42,000 in bonds for improvements to the electric light plant was recently voted on.

SPRINGFIELD, ILL.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 24, for conduit and wiring changes in the post office and court house

GREEN BAY, WIS.—The De Pere Light & Power Company contemplates improvements and extensions to cost about $150,000.

MARSHFIELD, WIS. — The Board of Public Works has plans under way for the erection of an addition to the power house to cost about $25,000. John Seubert is city clerk.

MILWAUKEE, WIS. — The Milwaukee Bridge Company, C. Trimbarn president, 1400 Thirty-fourth Street, contemplates improvements to its power plant. Cahill & Douglas, 217 West Water Street, are engineers.

NORWALK, WIS.—The Wisconsin River Power Company, Madison, is considering the extension of its lines to this place at a cost of about $14,000.

WAUSAU, WIS.—The Wisconsin Valley Electric Company, 206 Third Street, contemplates the erection of a 6,000-hp. electric and water-power plant and dam at this place to cost about $600,000. L. A. DeGuere, Grand Rapids, Mich., is engineer.

WEST BEND, WIS.—Bids are being received by the Miller Spouting Company, Inc. P. O. Box 425, for equipment to cost about $20,000 for new factory, including twelve 220-volt, 60 cycle, three-phase motors, switchboard, etc.

NEW PRAGUE, MINN.—A meeting of the City Council was held recently for the purpose of discussing the construction of an electric light plant. J. F. Bruzek is city clerk.

CALAMUS, IOWA.—The Iowa Electric Company, Cedar Rapids, contemplates the erection of a transmission line from this place to the Wapsisinicon River vicinity.

DAVENPORT, IOWA.—The city officials contemplate repairs to the street-lighting system. Hugo Moeller is city clerk.

Southern States

MACON, MISS.—An issue of $25,000 in bonds will be submitted to the voters on Nov. 15 for the purpose of improving and repairing the light and water plants.

COTTER, ARK.—The Dixie Power Company, W. V. Powell president, Title Guaranty Building, St. Louis, Mo., is having plans prepared for the erection of a hydro-electric dam on the White River. Col Henry A. Allen, 23 Metropolitan Block, Chicago, Ill., is engineer.

BIG HEART, OKLA. — The Big Heart Light & Power Company, recently incorporated, contemplates the installation of two units and will purchase transfomers, meters, etc F J Mimck is secretary

LOCUST GROVE, OKLA.—The city officials have appointed V. V. Long & Company, engineers, Colcord Building, Oklahoma City, to make survey for a transmission line and distribution system to cost about $15,000

FORT WORTH, TEX.—Thomas Holiday, Longview, has plans under way for the erection of an electrically operated sawmill at 800 North Houston Street, to cost about $250,000.

TERRELL, TEX.—The City Commission will receive new bids for furnishing and installing two 5-in. two-stage electrically driven centrifugal pumps, 500 to 800 gal. per minute against a 200-ft. head, direct-connected to a two-phase or three-phase, 60-cycle, 2,200-volt electric motor adequate to operate pumps at full capacity; installation to be made complete with all electric wiring, etc.; also, as a counter proposition, for two 5-in. three-stage centrifugal pumps, 500 to 800 gal. capacity, belted to two or three 75-hp. oil engines of high compression type. Former bids were rejected.

WAXAHACHIE, TEX.—The City Council has voted to hold an election soon for the purpose of submitting to the voters a proposition to issue $9,000 in bonds for the erection of a municipal electric lighting plant.

Pacific and Mountain States

ILWACO, WASH.—It is reported that the town officials are considering the purchase of the distribution system of the North Shore Light & Power Company and the installation of a 1,000-kw. generating plant. E. E. Wood is manager.

LA CENTER, WASH.—The installation of an electric lighting system at this place is contemplated.

SEATTLE, WASH.—The Pacific Coast Coal Company, L. C. Smith Building, has petitioned the King County Commissioners for permission to erect poles and wires for a 13,000-volt electric transmission line from its Hyde mines to its Black Diamond Mines.

VANCOUVER, WASH.—According to N. J. Blagen, the Blagen Sawmill will be erected below the city at a cost of about $140,000. Plans include the development of electrical energy to the extent of about 15,000 kw.

BANDON, ORE.—The Bandon Power Company, with the view of building a larger electric power plant at this place, a dam at Willow Grove and a 20-mile transmission line to Bandon, has offered its entire plant, system, etc., to the city for $35,000. Engineers estimate the probable cost of the new system at $105,000.

EL CENTRO, CAL.—The installation of an ornamental lighting system on Main Street and several other streets is contemplated.

FRESNO, CAL.—The San Joaquin Light & Power Corporation contemplates extensive water-power developments in Fresno County. The most costly projects are on the Kings River and on the North Fork of this river. On the main stream 35,795 hp. will be developed at a cost of about $4,850,000, and the two projects on the North Fork call for the development of 70,738 hp. and 85,568 hp., at a cost of $9,600,000 and $11,600,000 respectively. Other developments are planned at Bear Creek, where a dam will be erected for storage purposes; also the development of 8,409 hp., at a cost of $1,200,000, and at Deer Creek, 8,834 hp., costing $1,200,000.

HOLLYWOOD, CAL.—The Board of Trade has completed final details for plans to install street-lighting system to cover the entire section of Hollywood at a cost of about $1,500,000.

HUENEME, CAL.—The Board of Trade is contemplating the formation of a lighting district at this place.

REDLANDS, CAL.—It is understood that the Southern Sierras Power Company, Riverside, contemplates the erection of two power houses in Mill Creek Canyon for the generation of 2,500 hp.

Canada

ST. THOMAS, ONT.—The Ontario Hydro-Electric Commission, care of Mr. Gaby, chief engineer, University Avenue, Toronto, will have estimates and reports prepared regarding cost of constructing an electric railway from St. Thomas to Simcoe.

WESTMOUNT, QUE.—Bids will be received by the city engineer until Dec. 1 for 1,000 ft. of cable and a power-house switchboard.

Miscellaneous

PANAMA.—Bids will be received at the office of the General Purchasing Officer of the Panama Canal, Washington, D. C., until Nov. 26 for furnishing electric cable, electric switches and receptacles, transformer, etc. (Circular 1447).

Record of Electrical Patents

Notes on United States Patents

(Issued Aug. 17, 1920)

1,349,978. Convertible Plate for Electrical Plug Receptacles; Adolph C. Recker, Oakville, Conn. App. filed Sept. 20, 1919. For use with screw plug and push plug.

(Issued Aug. 24, 1920)

1,350,658. Open-Slot Conduit; Franklin P. Lawrence, University City, Mo. App. filed Dec. 23, 1918. Formed in baseboard or ceiling molding.

(Issued Nov. 2, 1920)

1,357,160. Electric Battery; Harry F. French, Fremont, Ohio. App. filed Feb. 17, 1916. No precipitation.

1,357,197. Electric Transformer; Herbert B. Brooks, Washington, D. C. App. filed Nov. 1, 1919. Instrument transformers.

1,357,199. Telegraphy; Charles E. Hay, Essex, England. App. filed Nov. 14, 1916. By constant-period impulses.

1,357,210. Electromagnetic-Wave Navigational System; James Robinson, Biggin Hill, England. App. filed Dec. 16, 1919. Direction indicator.

1,357,215. Section Insulator; Lemuel S. Boggs, Springfield, Mass. App. filed Feb. 4, 1916. For trolley lines.

1,357,223. Converting System; Lewis W. Chubb, Edgewood Park, Pa. App. filed May 7, 1917. By rectifiers.

1,357,227. Exciting System for Commutating Poles in Dynamo-Electric Machinery; David C. Davis, Wilkinsburg, Pa. App. filed Feb. 8, 1918. For satisfactory commutation over wide range of armature reaction.

1,357,229. System of Distribution; Chris. Le G. Fortescue, Pittsburgh, Pa. App. filed Feb. 7, 1916. To maintain constant voltages.

1,357,230. Branding Iron; Joseph C. Garner, Detroit, Mich. App. filed June 5, 1920. Electrically heated.

1,357,257. Switching Device; Joseph Slepian, Wilkinsburg, Pa. App. filed Sept. 16, 1918. For preventing arcing.

1,357,264. Magnetic Modulator; Karl S. Van Dyke, Chicago, Ill. App. filed Sept. 27, 1919. For modulating carrier currents.

1,357,283. Battery Cover; John W. Fitzgerald, Detroit, Mich. App. filed April 1, 1920. Quickly attached.

1,357,287. Electric Heater Faucet; George H. Hart, Hartford, Conn. App. filed Feb. 18, 1919. Switch controls current and water.

1,357,290. Method of Manufacturing Graphite Articles; Frank R. Kemmer, Niagara Falls, N. Y. App. filed Dec. 18, 1919. In electric furnace.

1,357,296. Substation Circuits; William H. Martin, New York, N. Y. App. filed Dec. 19, 1918. Anti-side-tone type.

1,357,297. Solder; Bird E. Newell, Watson, Minn. App. filed Nov. 8, 1919. New formula.

1,357,303. Revleting-Test Circuit for Telephone Systems; Michael B. Stazak, Chicago, Ill. App. filed April 27, 1911. Busy signal.

1,357,332. Wire Connector; Charles P. McDonald, Kansas City, Mo. App. filed Feb. 14, 1920. Keeps slack out of trolley wire.

1,357,378. Storage-Battery Separator and Process of Producing the Same; Harry L. Bovee, Trenton, N. J. App. filed Feb. 6, 1919. Strong insulating ribs.

1,357,379. Process of Making Storage-Battery Separators; Harry L. Bovee, Trenton, N. J. App. filed Feb. 27, 1919. Of compressed fibrous material.

1,357,381. Controller for Motor Driven Machines; William E. Date, Westfield, N. J. App. filed Dec. 6, 1917. For rubber mills.

1,357,391. Apparatus for Taking Serial Roentgenograms; Fernand Freytag, San Rafael, Cal. App. filed July 24, 1916. Moving X-ray pictures.

1,357,400. Electrolytic Cell; Omar H. Jewell, Chicago, Ill. App. filed March 4, 1920. Production of caustic soda and chlorine.

1,357,401. Electrolytic Cell and Method of Using the Same; William M. Jewell, Chicago, Ill. App. filed April 21, 1919. Manufacture of chlorine, caustic alkali and hydrogen.

1,357,454. Wire Splicer; Lloyd M. Hellyer, Holden, W. Va. App. filed April 30, 1920. Trolley.

1,357,484. Gear-Changing Device; Thorsten von Zweigbergk, Lancaster, England. App. filed July 1, 1918. Electric machine in combination with mechanical gearing.

1,357,495. Metallurgical Process; William E. Greenawalt, Denver, Col. App. filed June 10, 1918. Treatment of copper ores.

1,357,548. Electrical Accumulator Plate; Chaimsonovitz P. Elieson, London, England. App. filed Dec. 10, 1919. Plante.

1,357,580. Method of Treating Fibers; Herbert R. Moody and Lewis H. Friedburg, New York, N. Y. App. filed Jan. 13, 1917. In electrolyzed brine.

1,357,582. Generator and Cut-Out Switch Apparatus; William B. Moses, Watertown, Mass. App. filed Aug. 18, 1919. Attached on generator.

1,357,604. Electrotester for Testing Automobile Motors; Leland R. Willits, Atlantic City, N. J. App. filed March 15, 1918. For testing spark plugs.

1,357,606. Soldering Iron; Launce R. Barber and Joseph A. Baker, Sharon, Pa. App. filed Dec. 11, 1919. Heated by internal arc.

1,357,613. Electric Power Hammer; Ralph F. Cianfrone, West New York, N. J. App. filed May 16, 1918. Reciprocating.

1,357,622. Railway Telephone System; Nicola de Ritis, Binghamton, N. Y. App. filed July 9, 1919. To talk with moving car.

1,357,648. Electric Heating Iron; Nels A. Nelson, Bode, Ia. App. filed Sept. 9, 1918. Arc-heated.

1,357,657. Method of and Means for Generating Low-Frequency Electrical Oscillations; Edward O. Scriven, New York, N. Y. App. filed Sept. 21, 1918. Vacuum tube.

1,357,681. Time-Limit Relay; George A. Burnham, Saugus, Mass. App. filed May 26, 1917. Magnetic drag.

1,357,695. Switch Mechanism for Starting Electric Motors; John Eaton, Schenectady, N. Y. App. filed Jan. 15, 1920. For starting squirrel-cage motors.

1,357,710. Method of and Apparatus for Automatically Removing Gases; William K. Kearsely, Jr., Schenectady, N. Y. App. filed Nov. 29, 1918. For treating electrical discharge devices.

1,357,724. Electric Lamp for Projection Apparatus; John E. Randall, Cleveland, Ohio. App. filed Jan. 15, 1917. Filaments mounted in panel form.

1,357,746. Control System; John F. Tritle, Schenectady, N. Y. App. filed July 29, 1918. For electric transmission in automobiles.

1,357,773. Rheostat; Mary H. Greenewalt, Philadelphia, Pa. App. filed Dec. 10, 1919. To vary brightness of a lamp.

1,357,827. Method of Operating Electrodes for Searchlights; Elmer A. Sperry, Brooklyn, N. Y. App. filed Dec. 22, 1915. Flaming arc.

1,357,850. Water-Level Indicator; Thomas S. Derr, Brookline, Mass. App. filed July 2, 1919. For steam-propelled vehicles.

1,357,858. Battery; Joseph R. Fenwick, Hampton, New Brunswick, Canada. App. filed March 20, 1919. Not affected by overcharge.

1,357,875. Traffic-Signaling System; Alexander W. Kent, Los Angeles, Cal. App. filed March 5, 1917. Four signals at each corner.

1,357,891. Portable Instantaneous Water Heater; Henry S. Murray, Denver, Col. App. filed July 15, 1920. Heats thin sheet of water.

1,357,901. Electric Furnace; Robert R. Reed, Ithaca, N. Y. App. filed March 27, 1920. For protecting the resistors from oxidation.

1,357,926. Binding Post for Electric Wires; Allen T. Baldwin, Elizabeth, N. J. App. filed July 18, 1919. Spring grip.

1,357,933. Electric Regulator; William A. Turbayne, Buffalo, N. Y. App. filed May 3, 1911. For battery charging.

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Competitive Supply of Electrical Energy

THE advance of interconnection and the "invasion" of hydro-electric transmission have often quickened the competition between small central stations and larger plants or networks. In many districts, therefore, the economics of energy supply are in a state of flux, which is rendered anything but sluggish by the ups and downs of fuel cost. In the long run every community will seek the lowest cost of service consistent with reliable operation, and the fair cost of generation, transmission and distribution will be met by the consumers. The entrance of hydro-electric or super-steam power into a territory already served by a smaller plant and system need not upset the financial kettle if the various parties in interest can get together and make a fair trade for services rendered. Engineering and commercial analyses of present and potential markets for power and of existing and possible means of supply should point the way toward solutions of these problems that will be satisfactory to the public and to the companies affected.

Every Accident Should Be a Lesson

WHILE the recent tragedy at the substation in Tonawanda, N. Y., related on page 1023, was not due to any negligence on the part of the operating company or the manufacturer of the apparatus, so far as present evidence shows, the heavy toll of human life makes it imperative that other companies shall learn whatever lesson the deplorable accident can convey. It would be impracticable to ask for more automatic protection than is already afforded in strictly modern stations, and it would be exacting too much to expect any piece of apparatus never to break down. However, we do believe that every operating company should make it a strict rule that no high-tension room, especially one which has a great store of power back of it, shall be used as a passageway or be open to any except authorized persons. It should be kept locked, and any one unfastening the lock or seen in the room without a permit should be subjected to severe discipline. Furthermore, after repairs, modifications or change-overs have been made at any spot, no person should be allowed near while the apparatus is being re-energized or until after service has been restored a reasonable length of time. In addition, operating companies should decide immediately and definitely which policy is better—to interrupt service on a circuit the minute signs of trouble occur and then correct the trouble or to let the trouble develop and have the circuit open automatically. In neither case would the operator have to be near live equipment if remote control is used, since it is impracticable to repair any high-tension equipment when it is alive. Last, but most important, respect for electricity at any voltage must be drilled into employees, and especially where there is much power back of it. But this is not to detract from the heroic attempt at rescue made at Tonawanda.

Closer Supervision of Line Construction

A LARGE expenditure has been incurred during the past ten years in the preparation of safety rules and line construction specifications. It is natural to suppose that the electric light and power industry as an interested participant has profited very greatly from the discussion, but even the casual observer is startled sometimes by the lack of care that is too often evident in overhead-line construction. Transformer mountings and corner-pole erections so put up that men called upon to do maintenance work must risk serious injury are not uncommon. Provisions for proper working space and the elimination of hazards due to carelessly wired corners and transformer installations are easily possible at the expense of a little careful study over the drafting board. In most cases no increase in construction expense is involved, but on the contrary an actual saving by the elimination of useless material and lessened labor costs is possible because the line crew knows exactly what must be done before work is started. Added to this is the saving in operating expense that must come with easier and safer working conditions. Objectionable conditions for the most part are due to leaving so much line construction work to the whim of the lineman himself. The remedy is to insist on adequate planning and executive supervision. Not all companies are guilty of negligence of this kind but the number, small as it is, is altogether too large.

Meters Not in Same Category as Time Clocks

WITH good metering equipment in a steam power station no guesswork is necessary; the operation becomes an exact science and variations from a high standard result only from careless neglect by the employees or from trouble with the apparatus. As meters quickly indicate faults, they are of great aid in keeping plants in good condition, as pointed out by J. W. Andree in this issue. However, it is an unfortunate fact that sometimes plant employees consider meters to be in the same category as the time clock, that is, that they are only for the purpose of showing that the men are on duty. Of course this is erroneous, as metering equipment is intended to assist the men in performing their duties, and the intel-

ligent use of the meters provided will generally greatly reduce the labor required. One point emphasized in the article referred to is the relatively high returns that may come from a judiciously selected meter installation. The one case of fuel saving cited may be multiplied many times in a large plant operating at high load factors. Small percentage changes in flue-gas temperatures, in CO_2, in vacuum, in steam pressure or in superheat will make startlingly large annual differences in the plant economy. With rapidly increasing fuel costs the need of saving every possible pound of oil or coal will undoubtedly hasten the installation of more meters in many plants.

The Synchronous Induction Motor

TO THIS issue R. G. Warner and A. E. Knowlton have contributed an article on an interesting method of operating a three-phase Y-wound induction motor so as to convert it into a three-phase synchronous motor. The machine is started from rest in the ordinary way, as an induction motor, and then the secondary winding is excited by direct current through two of its branches in series. If a direct-current source is not available on the premises, the direct current may be furnished over the line from the generating station with the aid of a fourth or special wire.

One of the advantages claimed for the plan is the improvement rendered possible in power factor by substituting synchronous-motor characteristics for induction-motor characteristics after the machine has been brought up to speed. It has to be remembered, however, that the supply of exciting current from the central station must to some extent increase the cost of operation, to say nothing of the cost of the additional wire. It would be interesting to have the relative advantages and disadvantages of this method of operating motors carefully investigated. Many economic factors would have to be taken into account. The method ought to have distinct advantages under conditions where the power-factor is very low and where the direct-current excitation can be easily supplied.

Color-Toned Incandescent Lamps

THE new "candle-flame" lamp demonstrated at the recent convention of the Illuminating Engineering Society was so admirable in its effects that we are naturally led to reflections concerning the practical usefulness of this type of lamp in domestic lighting as well as in lighting of ballrooms and similar places. It is quite certain that a great many people, especially women, think that the ordinary metallic-filament lamp gives a light of somewhat too glaring whiteness. When, about two years ago, a committee of the National Electric Light Association was investigating the question of toning lamps for color it seemed to be the general judgment of those to whom samples were submitted that a light even somewhat more distant from white than that of the carbon incandescent lamp was desirable, something indeed approximating the kerosene flame of earlier days. The results of practical experience on a considerable scale in Chicago seem to confirm this judgment.

The candle-flame lamp now brought out meets the color requirement very beautifully, and moreover the coating given to the bulb is permanent in hue even when used on the gas-filled lamps, thus possessing a virtue which most of the earlier experimental lamps did not have in a reliable degree. The loss in efficiency by the color-toned diffusing coating is relatively small, the specific consumption being less than half that of a carbon lamp of anything near the same color. Indeed, the efficiency is equal to that of the earlier tungsten lamps. The eye is astonishingly sensitive to small changes of hue, so that the cutting out, even in small part, of a strongly colored component of the light changes the appearance very greatly for a comparatively slight absolute absorption. It would seem that the new lamp might make a rather important place for itself inasmuch as it accomplishes with small loss of light the same result that is now sought by the use of comparatively opaque colored shades.

Concentrated Versus Distributed Magnet Windings

WHAT is the strength of the magnetic field at a point at any given distance on the axis of a bar magnet? An answer to this question was demanded in several important war problems. Textbooks give a simple answer for a magnet with poles concentrated at its ends. But who has ever seen such a magnet? The law of the magnetic circuit is simple only when the circuit is completely closed with magnetic material. With the opening of the circuit and the passage of the flux through the air the calculation of ampere-turns is greatly complicated and often impossible. Some extremely interesting experimental observations on the relation between the magnetizing ampere-turns on a cylindrical magnet and the strength of magnetic field at a point at a distance were reported in the September number of the *Journal* of the American Institute of Electrical Engineers by Messrs. Hutchinson and Pender. The authors find that for the same number of exciting ampere-turns a uniform winding occupying only the central half of the core gives the same field as a uniform winding completely covering the core; that both the windings mentioned give greater values of field than a winding so arranged and excited as to give a uniform flux density throughout the length of the core, and that in the case of alternating-current excitation the maximum external field per volt-ampere of excitation is given by a uniform winding covering the entire length of the core.

It is well known that the strength of field at a distance is proportional to the moment of the magnet. The analysis given by the authors shows clearly that beyond a certain point the effort to increase the effective length of the magnet by piling up ampere-turns toward the ends is soon outweighed as the end is approached by the rapidly increasing demagnetizing force of the resulting poles concentrated at the ends. In the case of the alternating-current magnet, while the strength of field at a distance is about the same for the central and the uniform windings, in the former all of the turns are threaded by approximately the maximum flux, while in the latter the average flux per turn is the average flux in the core. Consequently, in the former case the reactance is higher, and so therefore are the volt-amperes for excitation, in the instance cited by about 40 per cent.

The conclusions may also be explained by noting the importance of the reluctance of the path of the magnetic

flux just after leaving the core. For poles concentrated at the ends the cross-section of the path in air just outside the pole is practically that of the core itself. Therefore the reluctance is very high and a large increase in ampere-turns is required. If, however, the winding is not brought all the way to the ends, the sides of the core as well as the ends become effective, increasing the section of air path and so reducing its reluctance. Thus with a very small decrease in the effective length of the magnet we have a very large decrease in the ampere-turns required for passage from core to air. This indicates the value of the use of pole pieces for bar electromagnets, a fact not emphasized in the paper mentioned. For example, while the field at a distance is the same with the central winding and the winding uniformly distributed over the length, nevertheless by the simple expedient of adding pole pieces one-quarter of the length to the core excited with uniform winding the same excitation would give an average flux density 12½ per cent greater, an increased effective length and correspondingly increased field strength.

A Community of Stockholders

WE HAVE not infrequently referred to the desirability of public utilities obtaining widespread financial support in the communities which they serve and the project has been carried out successfully in a considerable number of instances. In another column William H. Hodge gives a serious consideration to the methods to be adopted in selling securities to local customers. The main factor in a decision as to how the end shall be reached is the purpose to be fulfilled. If a company, wishing to place a new issue of bonds or stocks, needs the money promptly and organizes a drive for local sale in connection with other activities, the situation is very different from that found when a company not needing quick funds decides on a policy of stock selling with the deliberate intention of making the community participants in the prosperity of the utility. The local security market may or may not be a good one so far as floating a bond issue is concerned, but it is a valuable one to take into partnership. The latter operation requires time and a well-organized selling policy, including provision for deferred payments.

A locally managed utility with a considerable amount of its stock held by its consumers is morally in a strong position, much stronger than that occupied by a utility owned and operated in the interest of foreign capital. In these days of hesitation to invest freely in public service concerns that company which stands nearest to its community, in which its community has direct and widespread interest, holds an advantage of position that is not to be overestimated. There are cases when a local drive for a considerable amount of capital is well justified and will pay, while incidentally securing friendly co-operation. Such instances not infrequently arise when a new enterprise is on foot, an extension of a transmission system or from an electric road. The introduction of such improvements are of so great and direct value to the people of any community that many a town would be well justified in taking on part of the financial responsibility to secure the resultant benefits. Partnership with the people obtained in this way is not likely to be turned aside, and it is apt to come to pass rather frequently in the future development of electrical enterprise outside the large centers. To those undertaking such a task, or planning for increased facilities when already established, Mr. Hodge's paper contains much that is suggestive. It is, after all, a sheer matter of tactful selling, with the purpose of the campaign directing the particular local measures which are likely to prove effective.

Some Problems of Super-Power Systems

THAT interconnection viewed as a broad principle is advantageous admits of no dispute. It has proved its usefulness over and over again. There are certainly cases, too, in which a super-power system with additional great stations can meet the economic situation very successfully. Of such systems thus far suggested, that for the Atlantic seaboard seems the most promising, particularly if it shall be connected and extended so as to take in hydro-electric resources not yet available.

None the less, we feel it needful to call attention to some of the dubious factors in all propositions of this kind. As the area served grows in extent, and especially in ratio of width to length, the problem of distribution becomes immensely involved. There no longer exists the situation of a long main fed at various points along its length and itself feeding laterally over comparatively short distances. For this must be substituted a network, and one of the very serious questions which arise is how much of this great primary network can lie in easily fed territory. The charges against energy fed long distances over a super-power network become severe, and it is a question whether in many instances they are not likely to eat up all the profit arising from generation on a larger scale.

The distribution of power in its potential form as transported fuel, although much more expensive than it used to be, cannot be said to be out of competition unless the super-power plant and its connections can operate under very favorable conditions. For example, in the Southern territory which Capt. L. A. Whitsit considers in this issue of the ELECTRICAL WORLD the aggregate hydraulic resources are considerable, although the natural storage facilities are comparatively small. Hence the water is not cheaply utilizable to any large extent. Besides, the transmission distances are great and the local fuel supplies rather plentiful. Therefore we are inclined to think that any large project over so great a territory requires exceptionally careful study from an economic standpoint.

Steps toward interconnection will for a good while to come have to be taken locally rather than generally. There are great interconnected systems in the South already reaching from the Atlantic seaboard almost to the Mississippi, but these are merely interconnections of convenience, not involving the transmission of an appreciable amount of power between the two ends of the system. The logical course of development would seem to be the strengthening of existing interconnections where there is strong economic reason for so doing, adding power supply as it becomes necessary. The main objective in such development should be such standardization of voltages and methods of operation as will not cause inconvenience when larger plans develop. Both generating stations and lines can readily be so designed that they will build up, if and when the occasion requires, into a coherent system to be extended as the economic demand arises.



John Joseph Carty

Advocate of scientific research in industry, through whose engineering efforts and leadership the universality of telephone service has been made possible

FOUNDED on scientific research, the greatest of America's public utilities has reached its present high state of engineering development largely through the efforts of that distinguished group of engineers which was organized and directed by J. J. Carty. Ever since he left high school, at the age of eighteen, Mr. Carty has been engaged in the telephone business, starting near his birthplace, Cambridge, Mass., with the Telephone Dispatch Company of Boston. During these years he has devoted his efforts to improving the telephone and making it an instrument for universal communication. How well he has succeeded every one knows. In January, 1915, under his engineering supervision the first transcontinental telephone line was placed in service. A few months later he announced the successful achievement by the members of his staff of the wireless telephone. Not only has the development of the telephone art been due to his careful and encouraging engineering leadership, but it is attributable also in no small measure to his individual contributions, among which are fundamental contributions to the multiple switchboard, and the balanced metallic circuit, without which there could be no long-distance telephony.

Even when chief engineer of what is now the New York Telephone Company, and later when occupying the same position with the American Telephone & Telegraph Company, Mr. Carty established himself as a pioneer in the general field of industry by his constant advocacy of the application of scientific methods to industrial problems and the use of technically trained men in this work. Now, as vice-president of the American Telephone & Telegraph Company in charge of development and research, he is putting his theories into practice in a bigger and broader way. He believes and has stated publicly that to keep American industry abreast of that of the rest of the world manufacturing research departments must be formed and encouragement and help must be given to the promotion of pure scientific research in colleges and universities.

Mr. Carty's war record is too full to cite in detail, but his work in the army, in which he attained the rank of colonel and where he co-ordinated all systems of communication and perfected methods whereby cable communications could be sent safely as well as with rapidity, is one of the most interesting chapters of scientific achievement in the great struggle. In recognition thereof he received from General Pershing in France the Distinguished Service Medal.

Although a quiet and retiring man by nature, Mr. Carty has not hesitated to engage in activities devoted to the advancement of engineering. He is chairman of the section of engineering of the National Academy of Sciences, a member of the executive board of the National Research Council and a past-president of the American Institute of Electrical Engineers. His engineering work has received recognition both in this country and abroad in the receipt of the Edison medal from the American Institute of Electrical Engineers, the Edward Longstreth and Franklin medals from the Franklin Institute and the imperial Japanese orders of the Rising Sun and the Sacred Treasure.

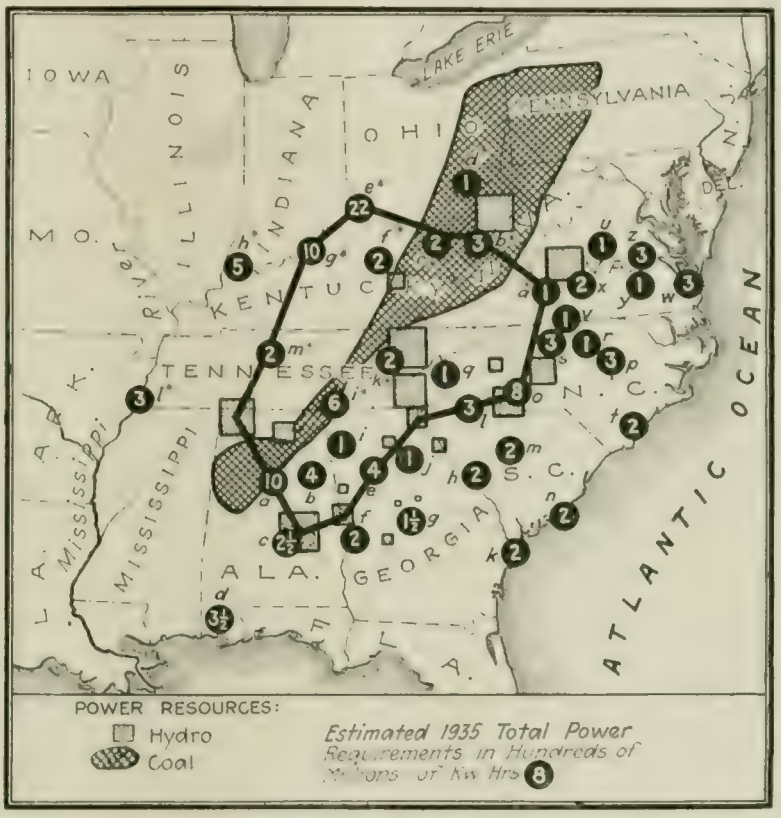
Proposed Power District in the South

Interconnection of Electrical Systems in Southern States Would Effect a Saving of 2,700,000,000 Kw.-Hr. Annually by 1935 and 250,000 Kw. of Generating Capacity Super-Power System Would Require 250,000 Kw. of Non-Income Earning Equipment per Year as Against 500,000 Kw. if Plants Are Operated Independently

By L. A. WHITSIT

Principal Assistant Engineer Division of Power and Transmission Boston-Washington Super-Power Survey

THE incorporation of the existing electric utilities south of the Ohio and Potomac Rivers and east of the Mississippi River into one super-power system and the development of the potential resources of water and steam power of the Southern States appears to be as logical a procedure as the similar incorporation and development of other systems now receiving attention. Perhaps it is even more logical. The district comprising the states of Virginia, West Virginia, Kentucky, Tennessee, North Carolina, South Carolina and Alabama, possibly Mississippi also, possesses natural advantages that make it possible to realize extensive economies by the establishment of a large interconnected and interoperated system for the transmission of power to meet the present and future industrial, domestic and railroad transportation needs. The investigation which the writer of this article has just recently completed on the power systems of the Southern States (ELECTRICAL WORLD, Oct. 16, page 769) and those in western Pennsylvania and eastern Ohio district (ELECTRICAL WORLD, Nov. 13), indicate the economic advantages of the interconnection of those central-station systems and focus attention to the greater economies that are possible in the self-contained power district described below.



ESTIMATED 1935 REQUIREMENTS

KEY TO CITIES

Alabama
a. Birmingham
b. Anniston
c. Montgomery
d. Mobile

Georgia
e. Atlanta
f. Columbus
g. Macon
h. Augusta
i. Rome
j. Athens
k. Savannah

South Carolina
l. Spartanburg
m. Columbus
n. Charleston.

North Carolina
o. Charlotte
p. Raleigh
q. Asheville
r. Durham
s. Queensboro
t. Wilmington

Virginia
u. Charlottesville
v. Danville
w. Norfolk and Newport News
x. Lynchburg
y. Petersburg
z. Roanoke
c° Roanoke

West Virginia
b° Charleston
c° Huntington
d° Parkesburg

Kentucky
e° Covington and Cincinnati
f° Lexington
g° Louisville
h° Evansville

Tennessee
i° Chattanooga
j° Knoxville
k° Memphis
l° Nashville

This district is 800 miles long by 500 miles wide (800 km. square). Its length is no greater than that of California, though its width is more than twice as great. On the other hand, its population is 16,000,000 as compared with California's 2,400,000. There are also vast coal fields, extending in an almost unbroken strip from the northeastern part of West Virginia to the Warrior coal fields of Alabama. In these coal fields are suitable locations for large super-power steam plants with ample water for condensing purposes and with short-haul distances for coal. A still more valuable characteristic of the district is the large water resources, which in a like manner occupy a central position and extend over a length corresponding to that occupied by the coal fields. These power resources are made possible by high altitudes and heavy precipitation. The streams may be utilized for power between the ranges of elevation, 3,000 ft. to 300 ft. (900 m. to 90 m.) above sea level. The maximum average annual precipitation is 80 in. (200 cm.) for the upper drainage areas of the Tennessee, Hiawassee and Savannah Rivers, and the greater part of the area has an annual precipitation of 50 in. (125 cm.). California does not possess fuel resources equal to those of this district, nor does it contain such extensive industries. There are a large number of cotton mills in Alabama, Georgia and the Carolinas; general manufacturing exists in Virginia and Kentucky; large steel companies are established and in successful operation in Tennessee and Alabama, and coal mining is one of the main industries of West Virginia, Kentucky, Tennessee and Alabama. The lower cost of power and the existence of extensive transmission systems will force the early electrification of railroads in the South. All of these operations require power in large blocks, and their load characteristics are of sufficient diversity to make the load factor on an interconnected power system relatively high.

Although reference to the illustration indicates that power-load requirements and the water-power resources

are evenly distributed, still a comprehensive transmission-line system is warranted in order to realize the advantages of an interoperated power system. A thorough interconnection of the load centers and generating stations as they exist at present, or as they will be extended and constructed to meet future load demands, will assure: (1) Reliability of operation; (2) economies due to the diversity of stream flow between different drainage areas (this power district would draw upon the water power of drainage areas on the opposite sides and ends of the Appalachian Range); (3) reduction in the total reserve generating capacity which would be required for the interconnected system as compared with the aggregated amount that would be required with the systems operated independently, and also a better utilization of such a capacity; (4) economies due to the greater diversity of loads in a large system as compared with a small one; (5) reduction in the amount of steam power that would be required for the combined system below the aggregate amount that would be required if the systems were operated independently, and, vice versa, a greater utilization of the power in the mountain streams; (6) the operation of only the efficient plants for the majority of the time, both as regards their economy of coal consumption and the coal transportation required; (7) the adoption of a construction program whereby additional plants would serve the growing requirements of a number of systems, as a result of which new plants would be put under load as soon as completed and be made to earn the maximum possible income; (8) the building of steam plants at coal-producing centers and points accessible to condensing water; (9) the possibility of accumulating the otherwise wasted secondary power of different systems into one block of power for its utilization for such industrial operations as extend over only a part of the year.

A super-power bus line for this district, as suggested by the accompanying illustration, would extend from Florence, Ala., where the government is building a large hydro-electric development on the Tennessee River. This, together with another possible development on the Tenessee River above the back water of the Muscle Shoals development, will generate 2,800,000,000 kw.-hr. a year, power which may be made primary power by the steam and reservoir resources elsewhere in the district. The line should extend from this plant to Birmingham by way of the Warrior steam plant, thence to the potential developments of the Coosa and Tallapoosa Rivers, thence easterly to the existing and potential developments on the Chattahoochee River, from there northerly through Atlanta, a load center, through existing and potential developments on the upper Savannah River, through Spartanburg, a load center, and thence through the system of the Southern Power Company to some point in Virginia. From here the line would extend northwesterly through Charleston, parallel to the mountain grades of the railroads, which should and doubtless will be electrified before long, and through excellent locations for super-power steam plants to the load centers of Huntington, Cincinnati and Louisville.

From here the line which is proposed might extend southerly through the load center of Nashville to a connection again with Muscle Shoals development. The water-power resources would be collected in large groups and tied by such lines and substations as would transmit the power in the general direction of the main load centers. The illustration shows the load and generating centers and the coal resources.

The total available coal of the district is in excess of the following estimated amounts in millions of short tons:

Alabama	30,000
Tennessee	15,000
Kentucky	40,000
West Virginia	70,000
Virginia	10,000
Total	165,000

The actual coal production in these states in 1917 and 1918 was respectively as follows:

	Millions of Short Tons	
	1917	1918
Alabama	20.0	19.0
Tennessee	6.2	6.8
Kentucky	17.5	20.7
West Virginia	86.5	89.9
Virginia	10.0	10.3
Total	140.2	146.7

The coal resources are therefore so very large as to justify a construction program of steam plants whose time length of operation may extend over hundreds of years. The establishment of efficient steam plants and an extensive transmission-line system will, because of the higher economy obtained, extend the life of that coal which is used or reserved for power purposes over what is possible in independent operation.

Water-Power Resources

An estimate of the hydro-electric resources, existing and potential, is expressed below in terms of kilowatt-hours of power available in a year of average stream flow, it being the best measure of the power available in such a system, in which the large super-power steam plants together with the water-storage plants would be used to make primary power out of the run of river power of the other hydro-electric stations:

Virginia	1,900,000,000
West Virginia	2,500,000,000
Kentucky	500,000,000
Tennessee	3,000,000,000
North and South Carolina	4,300,000,000
Georgia	2,300,000,000
Alabama	5,300,000,000
Total	19,800,000,000

The present annual power requirements of the central-station systems are approximately as follows, in kilowatt-hours:

	Water Power	Power from Fuels	Total
Virginia	180,000,000	300,000,000	480,000,000
West Virginia	25,000,000	500,000,000	*525,000,000
Kentucky	.....	250,000,000	250,000,000
Tennessee	600,000,000	150,000,000	750,000,000
North Carolina	600,000,000	120,000,000	720,000,000
South Carolina	670,000,000	80,000,000	750,000,000
Georgia	450,000,000	120,000,000	570,000,000
Alabama	450,000,000	150,000,000	600,000,000
Total	2,975,000,000	1,670,000,000	4,645,000,000

*This amount is an approximate estimate of the power generation in that part of the State of West Virginia which would logically form a part of the system here considered. The northern part of the state is properly a part of the Pittsburgh district.

The above figures are a measure of the power requirements of the district that are, with one exception, being supplied by central stations and do not include a very large amount of power that is at present being generated in isolated steam plants.

It is estimated that in fifteen years the power requirements of the central-station systems and one large interconnected system as here suggested would be as follows:

	Kw.-Hr.
Virginia	1,750,000,000
West Virginia	1,600,000,000
Kentucky and vicinity	4,650,000,000
Tennessee	1,850,000,000
North Carolina	2,350,000,000
South Carolina	1,100,000,000
Georgia	2,100,000,000
Alabama	2,600,000,000
Total	18,000,000,000

The larger industrial cities have been estimated separately, and these estimates will be found on page 1009. In addition, there has been included an amount to represent the general requirements of the state as a whole which would come from smaller cities which may be economically supplied by such a system. The general requirements of the state as a whole, in addition to the industrial needs of the larger cities, is on the basis of 1 kw. of capacity per ten inhabitants (1910 census) and 2,000 kw.-hr. per kilowatt of capacity. Another item has been added to represent requirements of railroad electrification of the main railroad systems of each of the states. It is based on the gross ton miles moved in 1918. The probable industrial load requirements are allocated on the map to show the general relation between load centers and generating centers. A portion of the load requirements for Cincinnati has also been estimated and included, as it is not at all improbable that the immense water-power resources of the developments on the Tennessee River near Muscle Shoals will be used to meet load requirements as far north as Cincinnnati.

It will be noted that the estimated load demands and the hydro-electric resources are about equal. Many of the hydro-electric potential resources are not economical when compared with the present cost of steam power. It is therefore proper to assume that super-power steam stations should form a part of the early construction program. In addition to this, some of the large amounts of the hydro-electric power are now and will be used for electro-chemical purposes and will not be available for general industrial and public utility loads.

Value of Joint Operation of Hydro and Steam Systems

In the comparison of hydro-electric developments and modern steam-power plants the relatively large proportion of the total cost of steam power that consists of the fuel and labor charges has an important influence. This amounts to 56 per cent for a 55 per cent annual load factor with coal at $3. In hydro-electric power the cost of power is nearly all made up of fixed expenses—that is, interest, taxes and replacement charges—and the expense of operation of the plants amounts to only a small percentage. In a comparative study a hydro-electric development may be favorable as long as it is operating under full load and there is a sale for all of its primary power, but in case of a slump in the power market the fixed charges continue, whereas in the steam plant the fuel and labor charges may be curtailed to the extent of the decrease in fuel and labor required under reduced power-market conditions. In addition, this fixed charge on the hydro-electric development, even if when distributed over the total primary power available it is a reasonable amount, yet when distributed over the decreased amount of power actually sold may bring the cost of such power up to an exorbitant cost per kilowatt-hour. It is therefore desirable that a hydro-electric plant, when built, be operated in conjunction with a steam-power system of appreciable capacity; for during a slump in the power market or a falling off in the power demand a saving may be effected in the operation of the system as a whole by an amount proportional to the value of the coal and labor that would have been expended in the steam plants had the demand kept up. The hydro-electric plants, on the other hand, whose annual cost remain unchanged during fluctuations in power output, are kept loaded up to full amount of the natural resources, which otherwise would be wasted.

A second value of combined operation is the freer and more complete use of the water storage permitted by the insurance which the steam capacity furnishes. When it is known that there is no steam capacity to fall back upon, a more reserved use of the water-storage capacity is necessary during the approach of extreme low-water conditions, and a less complete use of the water results. The supplemental steam capacity is therefore a guarantee of reliability of supply and of economical operation during conditions of quite opposite character —those characterized by a normal or even excess supply of available water power accompanied by a reduced power demand and those due to a low supply of water power accompanied by a maximum power demand. There is still another advantage in combined operation.

The water power furnishes the peak portion of the load and by so doing permits the operation of the steam capacity under a greater load factor. By increasing the load factor on the steam plants of the system the cost of steam power may be decreased by a greater amount per kilowatt-hour than the corresponding increase in cost of the hydro-electric power that results from over-installation of equipment in the hydro-electric system in order to allow it to take the peak portion of the load. This requires only a small additional expenditure, comparatively, as the greater part of the investment is in the fixed structures, whose costs are not increased by the over-installation. The increase of the load factor on a steam system from 50 to 75 per cent may decrease the generating unit cost of power by 20 per cent for two-thirds of the total power, whereas in the same case the accompanying increase in the generating unit costs of the hydro-electric power is only 13 per cent for one-third of the power. The hydro-electric developments possess a much greater value when operated in combination with steam than when operated alone as a separate system.

An example of the partial attainment of this exists in the interoperation of the Warrior steam plant and the Lock 12 hydro plant. A greater realization could be effected if the system contained also hydro storage power. During high water the steam plant carries the peak load; during low water the hydro plant carries it. These plants are 30 and 50 miles respectively from their main load center and fortunately are located on opposite sides of the local center. Transmission losses are thus reduced; better regulation and higher reliability are ob-

tained. Illustrations of these two generating stations, with their striking comparative operating forces, are given in the article of Oct. 16, ELECTRICAL WORLD.

Super-power steam stations should be built in the Warrior coal fields of Alabama, at Charleston, W. Va., and possibly at Evansville, Ind. The immense load centers of Cincinnati and Louisville come fortunately between the hydro-electric resources of the Tennessee River developments and the steam power of West Virginia. Steam-generated power would also be transmitted to the East and Southeast during periods of low water.

POSSIBLE ECONOMIES

In order to express in financial terms the advantages of an interconnected power system it is estimated that the diversity of stream flow between the drainage areas which possess different climatological characteristics will effect an economy of 5 to 10 per cent of the kilowatt-hours of hydro-electric power available. The interconnection of the systems and the use of the total storage facilities and steam reserves to the best advantage for the entire system would effect an economy of 10 per cent of this power, which otherwise would be lost in individually operated systems as fugitive power, inasmuch as the individual systems could not contract for a load which would use this fugitive power and because of their inability to furnish such load continuously. In addition, the diversity of peak loads in the different systems would make possible a saving of 5 per cent on the total kilowatt capacity required for the given load conditions.

The first two economies would at the end of fifteen years amount to 2,700,000,000 kw.-hr. annually. But, on the basis of only 2,000,000.000 kw.-hr. and at a value of only 6 mills per kilowatt-hour at the power plants, the saving should amount to $12,000,000 a year. The economy in capacity due to diversity of peak loads would amount to 250,000 kw., which, at an investment cost of $125 per kilowatt at an annual cost of 12¾ per cent per year, would effect a saving of $4,000,000 a year.

The following table gives actual or equivalent coal consumption of the public utility stations during January, February, March and April of this year, the corresponding output in kilowatt-hours, and the resulting consumption of coal per kilowatt hour:

	Output, Kw.-Hr.	Equivalent Short Tons of Coal
Virginia	98,400,000	146,000
West Virginia	†164,600,000	263,500
Kentucky	90,000,000	164,000
Tennessee	43,000,000	94,500
North Carolina	39,000,000	80,000
South Carolina	20,000,000	42,000
Georgia	37,000,000	72,000
Alabama	43,000,000	87,000
Total	535,000,000	‡949,000

†Only that part of West Virginia is included that logically forms a part of the power district here considered.
‡Equivalent to 3.55 lb. per kilowatt-hour.

In the operation of a super-power system inefficient steam plants would be shut down and the consumption of coal for unified system should not be in excess of an average of 2 lb. (0.9 kg.) per kilowatt-hour. The super-power system would therefore effect an economy of at least 1.5 lb. (0.68 kg.) for a total annual generation of 1,500,000,000 kw.-hr., or after provision for the increased power loss in the extra transmission line distance, a total of 1,000,000 tons, which at a cost of $5 would effect an economy of $5,000,000. These possible savings total $21,000,000 a year.

In addition to the above is the annual saving on a reduction of the non-income-earning capacity required to meet new loads and on the capacity to maintain an emergency reserve. The new capacity required annually to meet increased power demands on the central stations of the district amounts to 250,000 kw. per year. In a super-power system this would be placed under load immediately upon completion and from then on would earn an income. If the plants were operated independently, however, the construction program would aggregate at least 500,000 kw. of new capacity annually. Some equipment would not, of course, be purchased or installed until load conditions required it, but the construction and investment for the facilities required later to accommodate 250,000 kw. would, on the other hand, be idle continuously and bear no income. The idle investment on 250,000 kw. at an average cost of $125 per kilowatt, decreased by $40 per kilowatt for the cost of such equipment as would not be installed until there was a load for it, amounts to $21,000,000. Again, the total aggregate reserve capacity which should be provided in independently operated systems for emergency purposes would at the end of a fifteen-year period total 1,000,000 kw., which would be decreased to at least half of this amount, thereby reducing the inoperative and non-income-earning investment on 500,000 kw., or on $65,000,000.

The total saving of non-income-earning investment would be $90,000,000 in round figures. The interest and depreciation charges on this amount equal more than $10,000,000, which, added to the saving above noted, would effect a total annual saving of $30,000,000.

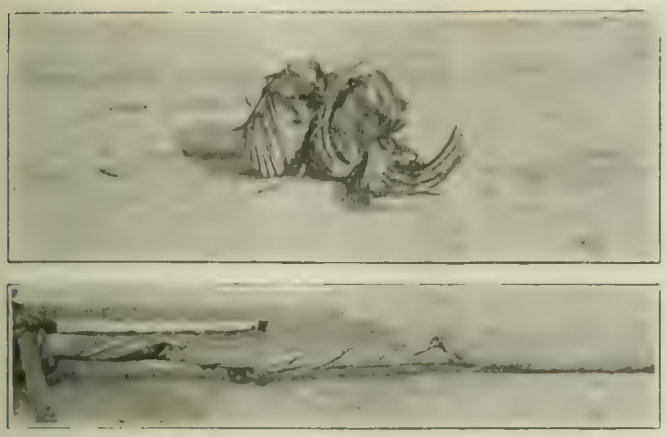
Submarine Cable Is Dried Out and Replaced

Following Severe Damage to Its Submarine Cables in San Francisco Bay the Great Western Power Company Successfully Removes and Repairs a 2,110 Ft. Section

AS A RESULT of accidents to shipping in San Francisco Bay in the month of November, 1917, the transbay power cables of the Great Western Power Company were twice fouled by dragging anchors. Two of the three cables were so damaged that sections had to be taken out and replaced before the cables could be put back into service. In one case a 2,000-ft. (600-m.) length of the section where damage was suffered was taken ashore and dried out by a vacuum-heating process. The repair of the cables was rendered much more difficult by the fact that the damage occurred where the depth of water was over 100 ft. (30 m.) and tidal currents amounted to 4 or 5 miles (6 or 8 km.) per hour.

The first accident occurred in November, when a Japanese steamer loading coal from a barge dragged her anchor across the cables, causing a short circuit in both cable No. 1 and cable No. 2. The No. 1 line is designed to carry 3,500 kw. and the No. 2 4,500 kw., both operating at 11,000 volts. An investigation immediately after the accident showed that cable No. 2 could probably be more speedily repaired and attention was given to it first. After much difficulty in dis-

entangling it from the twisted and kinked No. 1 line a 2,000-ft. section was taken out and the work of relaying a new section in its place was begun. While this was under way two vessels collided in the fog and a dragging anchor again fouled the cable. Although damaged the cable was still left fit for emergency use, and the work of relaying it was completed as rapidly as possible and the cable put in service temporarily.



DAMAGED CABLE RAISED FROM BAY

Attention was then devoted to cable No. 1. Launches were used to drag for the several ends. When these were picked up and that section which had been kinked and dragged out of place had been pulled up for inspection and test it was found that considerable lengths of it had been ruined by the kinks, and it was evident that water had been drawn by capillary attraction along the strands of the conductors. A process of cut and try was then employed for finding how much of the cable was wet. A section of it was cut off and tests were made between the new end and the power house. By repeating this process it was finally found that after taking out about 2,100 ft. (640 m.) of the damaged cable the remaining shore ends were still fit for service.

DRYING OUT THE CABLES

When the damaged sections of the cable came in from the barges it was found that there was one 1,100-ft. (335-m.) piece and 2,000 ft. (600-m.) of short lengths between 150 ft. and 500 ft. (45 m. and 150 m.) from which the water would have to be extracted before they could be put in service. To accomplish this the cables were taken to the company's Oakland steam auxiliary station, where a 29-in. (736-mm.) vacuum was available. The vacuum pipe was attached to one end of the 1,100-ft. cable just as it stood on the reel, and after making the joint airtight the full suction was applied. A coil of steam pipes was also placed under the reel, and by use of a double thickness of heavy canvas a housing was made over the reel under which a temperature of 200 deg. Fahr. (93 deg. C.) was maintained for thirty-six hours. Tests then showed the cable to be in suitable condition for use.

Experience with the several sections showed that the shorter lengths could be heated up thoroughly in about twelve hours, and that within twenty-four hours the treatment had removed a sufficient quantity of moisture to render them again fit for service. The plan of heating the cables by current in the conductors was tried at first, but it was not used because with the cable coiled on the reels it was impossible to secure uniform heating, while the outer end had better opportunity to radiate heat than the end near the center. Some of the short sections of cable, however, were stretched out on the ground and heated by electricity running through the conductors. Where this was done a current of 250 amp. was applied for about twenty-four to thirty-six hours, the same vacuum being used as in the case of the steam treatment. The same tests were applied to cables dried by steam and by electricity. They were considered suitable for replacement in service when the megger readings were satisfactory, depending on length and temperature; also when the jute filling could be burned without sputtering or dropped in hot ozite without showing morslive.

In replacing the cable cut out this 2,000-ft. gap was first spanned by a 1-in. (2.5-cm.) steel messenger cable made fast to one of the ends and laid thence to the other end, to which it was also attached. Sections of the original cable which had meantime been dried out were then spliced in, beginning at one end of the gap. As the work progressed the messenger cable was underrun by the barge containing the reels until the far end of the gap was reached and the final splice made. During this process it was occasionally necessary to drop the end of the cable. When this was done the end was temporarily sealed with a lead sleeve and a buoy used to mark the line.

METHOD OF SPLICING

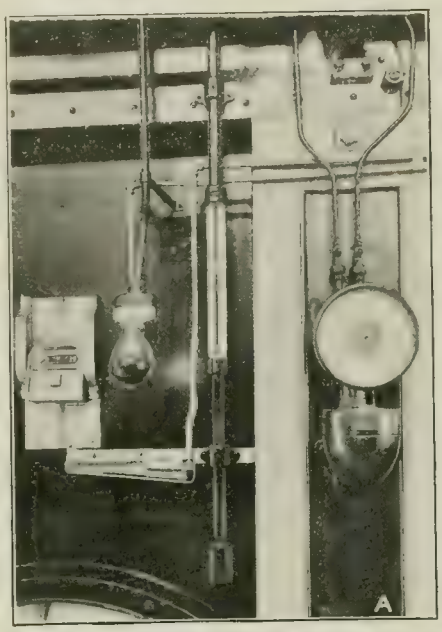
Because of the short lengths of cable which had to be put back in line No. 1 many splices had to be made, and special care was taken to see that these splices were strong and tight. The method used was first to slip a 2-ft. (0.6-m.) section of 4-in. (10-cm.) pipe over each of the two ends to be spliced. The outer ends of these pipe sections were threaded in opposite directions so that a coupling engaging both threads could be made to draw the two ends together. These pipe sections were kept on the cables, back out of the way, while the splicing and insulation of conductors was done in the ordinary manner. When the splice proper was completed as usual a layer of asbestos was put on by way of final covering. Over this the two pipe sections were slipped up toward each other until separated only by the width of the coupling. The armor wires were then welded to the outer ends of both pipes. Finally, the coupling was turned until the two pipe sections were drawn up together, thus taking the strain in the armor.

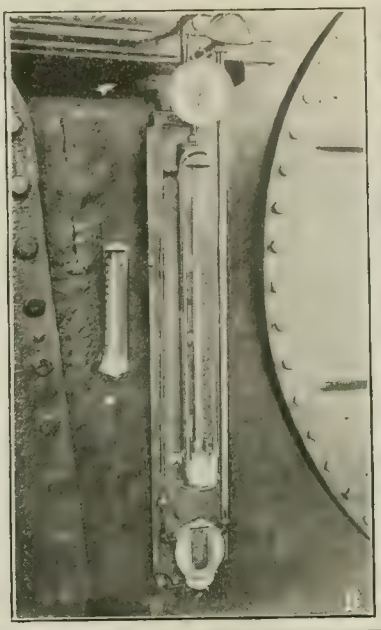


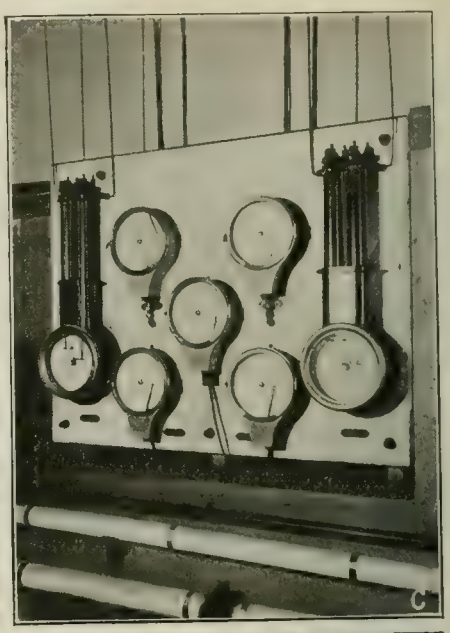
CABLE IN PROCESS OF BEING DRIED BY APPLICATION OF HEAT AND VACUUM

The drying out of the cables was done under the direction of J. M. Barry, engineer of distribution, and E. W. Beardsley, general superintendent.

Some Steam Metering Apparatus Which the Southern California Edison Company Has Considered Necessary to Plant Economy









A—On the front of the boilers at a convenient height above the floor where they can readily be seen by the fireman when adjusting fires are CO_2 indicators, gages and steam flow meters.

B—Atmospheric temperature thermometer, Aneroid barometer, and mercury column conveniently located on condenser near engineer's station.

C—CO_2 flue-gas temperature, draft and boiler feed-water temperature recorders are located at the rear of the boilers and are so mounted as to be easily accessible for changing charts and repairs.

D—Long Beach steam station of Southern California Company, where oil is used for fuel, has a very extensive meter equipment.

Selection of Steam Plant Meters

Metering Apparatus May Be Divided Into Classes Necessary for Safe Operation, for Good Operation and for Checking Results—Proper Use of Correct Meters Will Greatly Improve Economy

By J. W. ANDREE
Assistant Superintendent of Generation Southern California Edison Company

FOR the efficient and safe operation of steam power-plant meters, gages and thermometers are indispensable. As the cost of such metering equipment is so small in comparison with the total cost of the plant and the savings which may be effected by their proper use it is surprising that there are so many large plants in which metering equipment has been considered of little importance. The plant with too many meters is rare. However, improper selection is often found, due to confusion as to the logical functions of the many kinds of meters available or to lack of appreciation of the results to be gained through their proper use.

Metering equipment may be divided into three groups: (1) Meters necessary for safe operation; (2) meters necessary for obtaining good operation; (3) meters used for checking and for records of operation. Each of these groups may contain meters of three general classes: (1) Indicating meters, which indicate a condition existing at any time; (2) integrating meters, which measure a quantity during a period of time; (3) recording meters, which make a continuous record of conditions over a period of time. Sometimes two or more of these classes are combined into one instrument. The metering equipment of a plant will depend upon its kind and size. Table I gives the metering equipment of a 47,000-kw. vertical steam turbine plant using oil fuel. In this table the meters are divided into groups and classes, arranged from top to bottom according to their relative importance.

Uses of Metering Equipment

The value to be derived from metering equipment depends upon the use to which it is put and the care given it. Meters which are out of order are worse than no meters. If meters are allowed to remain out of order for any length of time the employees using them soon lose confidence in them, which is very detrimental to the operation of the plant. In a plant of the size under consideration an instrument man should be employed whose duty it is to keep all instruments in good working order, and he will be kept busy if the meters are rightly maintained.

The meters in group No. 1 need but little attention; an occasional checking and adjusting is all that is necessary. The use of meters in this group needs no discussion; they must be used by the station force in order successfully to operate the plant. Group No. 2 contains the meters of real importance with respect to the efficient operation of the plant; at the head of this list is flue-gas analysis apparatus or CO_2 meters. These are considered the most important of this group because improper combustion is the greatest preventable source of loss in the power house and continuous analysis of flue gases is the only reliable method for determining the condition of combustion. Vacuum gages are second in importance in this group and, from an economical standpoint, they are the most important meters in the engine room, as the economical operation of a steam turbine depends very largely upon the

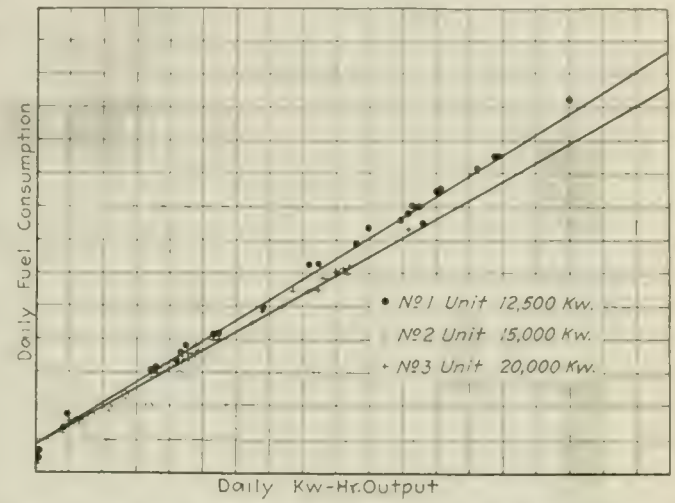


FIG. 1—POINTS REPRESENTING THE KILOWATT-HOUR OUTPUT AND FUEL CONSUMPTION, PLOTTED DAILY, WILL FALL NEAR THE AVERAGE LINE IF CONDITIONS ARE NORMAL

TABLE I—METERING EQUIPMENT OF 50,000-KW. OIL-BURNING PLANT

GROUP 1. NECESSARY FOR SAFE OPERATION	GROUP 2. NECESSARY FOR OBTAINING GOOD OPERATION	GROUP 3. FOR CHECKING AND RECORD OF OPERATION
1. Steam pressure gage on each boiler.*	1. CO_2 meters on each boiler.*	1. Watt-hour meters on each generator.‡
2. Water gage on each boiler.*	2. Vacuum gages on each turbine.*	2. Quantity gages for fuel used.‡ †
3. Lubricating oil pressure gages on each turbine.*	3. Steam temperature on each boiler and at turbines.†	3. Auxiliary power meters.‡
4. Voltmeter on each generator.*	4. Draft gages on each boiler.*	4. Quantity of boiler feed water.‡
5. Ammeter on each generator.*	5. Steam pressure at turbines.*	5. CO_2 meters on each boiler.†
6. Water pressure gages at feed pumps.*	6. Feed water temperature thermometer.†	6. Vacuum meters on each turbine.†
7. Steam pressure at turbines.*	7. Steam flow meters on each boiler.†	7. Steam temperature at each turbine.†
8. Wattmeter on each generator.*	8. Flue gas thermometer on each boiler.†	8. Steam pressure at each turbine.†
9. Temperature indicator on each generator.*	9. Circulating water to condensers temperature.†	9. Mercury vacuum column.*
10. Synchroscope.*	10. Circulating water from condensers temperature.†	10. Aneroid barometer.*
11. Ammeter on each circuit.*	11. Quantity of circulating water.†	11. Temperature of engine room atmosphere.*
12. Oil pressure gages on each fuel oil pump.*°	12. Quantity of feed water at pumps.*	12. Temperature of boiler room atmosphere.*
13. Lubricating oil pressure gages at the pumps.*	13. Quantity of make-up water.*	13. Steam flow to turbines.‡
14. Bearing oil thermometers.*	14. Condensate water temperature.†	14. Lubricating oil temp. entering filter.*
15. Steam pressure at each stage of turbines.*	15. Temperature of water entering heaters.†	15. Lubricating oil temp. leaving filter.*
16. Feed water level in each heater.*	16. Steam pressure on burner line.†°	16. Pressure of oil leaving return oil pumps.*
17. Fuel oil supply gages.*°	17. Steam pressure to burners.*°	17. Circulating water pressure at pumps.*
18. Feed water supply gages.*	18. Fuel oil pressure on burner line.†°	18. Portable flue gas analysis apparatus.*
19. Frequency meters.*	19. Fuel oil pressure to burners.*°	19. Portable thermometers, gages, gage testers, etc.; test apparatus.*
20. Wattmeters on outgoing lines.*	20. Fuel oil temperature from heater.*°	
21. Ground meters on generators.*	21. Feed water leaving economizers.†	
22. Temperature indicators on generators.*	22. Vacuum seal gages.*	

* Indicating instruments. † Recording instruments. ‡ Integrating instruments. ° For oil-burning plants only. ‡ Scales used in coal-burning plants.

vacuum maintained in the condensers. Proper interpretation of the readings of the vacuum gages will show the condition of the turbine blading, condensers, seals, air leaks, quantity and quality of circulating water and other conditions of the turbine unit. Assuming the firemen will keep the steam pressure up by observing the gages on each boiler, then steam temperature thermometers are next in importance on account of the effect of the steam temperature on the economy of the turbine. Recording thermometers are preferable because priming boilers can be immediately located and the conditions remedied, and the soot condition and method of firing can also be determined by these. The steam temperature at the turbines is also important because priming of boilers will be noticed sooner here, and the readings of these meters are used in the calculation of turbine efficiency.

Draft gages on each boiler assist the firemen in adjusting fires. Some prefer recording draft gages, but this is a refinement, as draft gages are secondary in importance and the CO_2 meters record the combustion. Furthermore, indicating draft gages are much more reliable and do not require the attention that recording types require. Economical operation of the turbines is dependent upon the pressure maintained at the throttle, hence steam-pressure gages at the turbine are important. Indicating gages check the recording gages and are more reliable. Where economizers are used, the temperature of the feed water entering them must be such as to prevent condensation on the tubes with resultant corrosion. Records from these thermometers are used for calculating boiler-room economies.

Steam flow meter on each boiler assist the fireman in uniformly loading the boilers and aid in determining the proper rate of feeding water into the boilers. Indicating meters are sufficient, but the recording attachment costs but little more and is a great convenience in checking up the firemen's work. Flue-gas thermometers determine the necessity of blowing the soot off the tubes, aid in keeping the temperature of the flue gases within the proper limits and show the condition of the boiler baffles. Temperature and quantity of circulating water to the condensers are of importance as the vacuum obtainable depends upon these. Recording meters are preferred because the conditions indicated are often made use of later to determine the condition of the turbine and condensers.

The meters of group No. 3 are used for checking other meters and conditions and furnish records from which plant economies are calculated. The records from these meters are carefully examined by the station executives after each day's operation and the plant efficiencies calculated. The records and results are then examined by the superintendent to make sure that the instruments are in proper order and that they are properly used, after which they are returned to the plant and filed away for future reference.

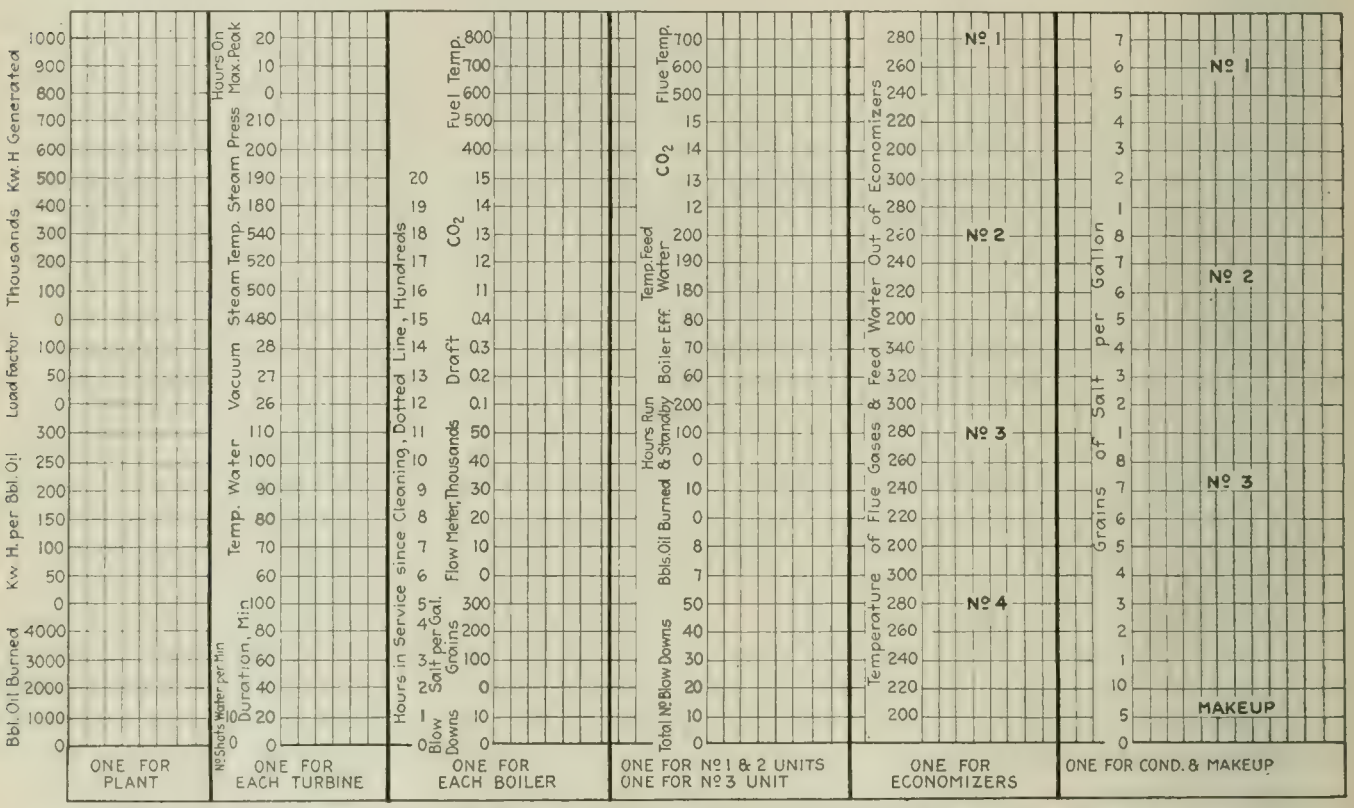


FIG. 2—SUCH RECORDS AS THESE CONSTITUTE IN EFFECT A CONTINUOUS TEST OF THE ENTIRE PLANT

These reports are compiled each day by the station men and are divided into two periods, one covering the entire day and the other 6 a.m. to midnight, during which time the plant operates under the best load conditions.

Summaries of Readings Tell the Story

In the plant noted the net results of operation are plotted each morning for the preceding day, as shown in Fig. 1, the net energy generated and the fuel burned being used as co-ordinates. These points will fall on a straight line provided the operation of the plant has been normal, and if a point falls off the line immediate investigation of the cause is made. The condition causing abnormal operation will probably already be known to the station operating men and in many cases may have been corrected before the day has passed. Points are plotted for each unit, hence abnor-

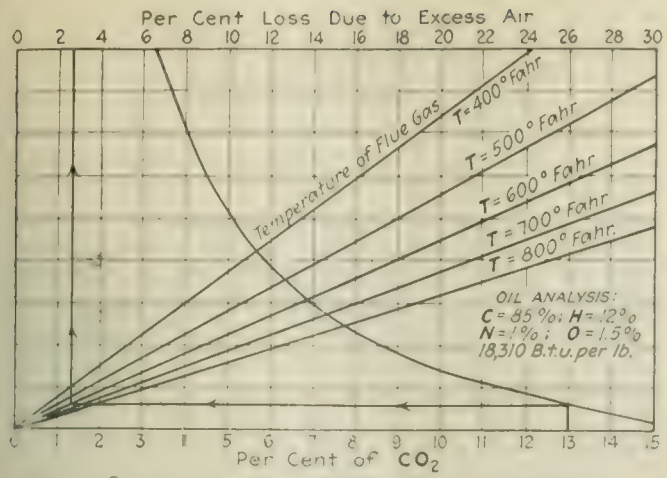


FIG. 3—STACK LOSSES MAY EASILY BE DECREASED BY INCREASING PERCENTAGE OF CO_2 IN FLUE GASES

mal operation may be readily traced to the offending unit. These sheets cover a period of one month each; the straight line is drawn through the average of the preceding month. A similar series is plotted showing monthly averages and this offers means for study of effect of wear of turbine blades, etc.

METHOD OF KEEPING ANNUAL RECORDS

Table II shows the method used for keeping a continuous annual record. Results of each day's operation are plotted on these charts by the instrument man and form a complete graphical record of performance of each piece of apparatus effecting economy in the plant, offering an easy method of continuous comparison of results of operation. These curves show conditions which tend to reduce the operating economy and show results of any changes made in apparatus which tend


SOUTHERN CALIFORNIA EDISON COMPANY
DAILY ECONOMY REPORT
LONG BEACH STEAM PLANT

DAILY ECONOMY REPORT

to change existing conditions. In this table the heading "hours of service since last cleaning" does not include stand-by hours, but only time of actual production. "Blowdowns" are the number of times the boilers are blown down in each day and "salt per gal." is the salinity of the water in the boilers. In all cases the records are average readings during the hours of actual production.

SPECIAL CHARTS GENERALLY SAVE TIME

Convenient and easy methods for determining the effects of operation of apparatus under various conditions are essential. The average station operator or

TABLE II KNOWN AND [illegible] CHARTS USED

Title of Charts	Range of Curves	No. Used
Barrels of oil burned	0-5,000	One each for each plant
Kilowatt-hours per barrel of oil	0-350	One of each for plant
Load factor per cent	0-100	One of each for plant
Thousands of kilowatt-hour generated	0-1,000	One of each for plant
Number of shots of water over	0-10	One of each for each turbine
Total time of shots—minutes	0-100	One of each for each turbine
Temperature of water, deg. Fahr	50-110	One of each for each turbine
Vacuum in inches	25-29	One of each for each turbine
Steam temperature, deg. Fahr	460-560	One of each for each turbine
Steam pressure, pound	170-220	One of each for each turbine
Hours on maximum peak	0-24	One of each for each turbine
Hours service since cleaning	0-2,000	One each for each boiler
Number of blowdowns	0-10	One each for each boiler
Grains salt per gallon	0-300	One each for each boiler
Flow meter, thousand pounds	0-50	One each for each boiler
Draft in inches	0.1-0.4	One each for each boiler
Per cent CO_2	12-15	One each for each boiler
Temperature flue gases, deg. Fahr	400-800	One each for each boiler
Total number blowdowns	0-50	One each for Units Nos. 1 2 and 3
Barrels of oil per boiler-hour	6-10	One each for Units Nos. 1, 2 and 3
Hours run and standby	0-200	One each for Units Nos. 1, 2 and 3
Boiler efficiency, per cent	60-90	One each for Units Nos. 1, 2 and 3
Feed water temperature, deg. Fahr	180-210	One each for Units Nos. 1, 2 and 3
Per cent CO_2	12-15	One each for Units Nos. 1, 2 and 3
Temperature flue gases, deg. Fahr	400-800	One each for Units Nos. 1, 2 and 3
Temperature flue gases and feed water out of economizers, deg. Fahr	200-300	One for each
Grains salt per gallon [illegible] water	0-10	One for each
Grains salt per gallon [illegible] economizers	0-9	One for each

The heading "shots of water over" is the number and duration of the time boilers have primed sufficiently to effect the temperature of the steam to the units. "Temperature of water" refers to temperature of circulating water both in and out of condensers, condensate or return to heaters, and feed water to the boilers or economizers.

engineer knows that if the vacuum on the turbine is low it will reduce the economy of the turbine, and the boiler room men know that if the boilers are dirty inside or out, the flue-gas temperature high or the feed-water temperature low the boiler economy is affected. By the use of the chart shown in Fig. 3 the loss due to admitting excess air into the furnace may readily be determined provided the temperature and the amount of carbon dioxide in the flue gases are known. Proper corrections can then be intelligently made.

Assuming combustion resulting in 13 per cent CO_2 and flue-gas temperature of 600 deg. Fahr. the preventable loss to the stack of 2.65 per cent is found as indicated. With this same temperature of flue gas, but a reduction CO_2 to 10 per cent a preventable loss of 6.20 per cent is found. In a plant burning $5,000 worth of fuel each day the saving in operating the plant at 13 per cent CO_2 rather than 10 per cent is $177.50 per day, due to the difference of 3.55 per cent in stack losses, and would be large earnings on the required investment in adequate meters to determine such conditions and the cost of attendance for same.

Customer Ownership of Securities

Better Understanding of Utility Problems Created—Progressive and Efficient Management, Good Service and a Safe Security Essential to Success of the Policy—Must Be of Real Benefit to Purchasers

By WILLIAM H. HODGE

CUSTOMER ownership is of more vital significance to public utility management than any other new principle that has been developed during the last ten years. The far-reaching and evolutionary character of this innovation as yet is only vaguely realized. All electric and gas supply companies, traction companies and communication systems will adopt it eventually or many will be taken over by the municipalities. The railroads and other industries serving the people as a mass will come to it in all probability. It will gradually grow its own crop of problems, but for many years and possibly generations it will be an economic factor of great service to society.

Early in 1919 not more than a hundred public utility organizations in the United States had sought to secure a wide distribution of their securities—or ownership—among their service customers. During the past eighteen months this number has easily quadrupled. The par value of the securities thus marketed has grown from about $50,000,000 to an estimate of $100,000,000. In five years not far short of 150,000 citizens have become financially interested in the service companies operating in their localities.

There is scarcely today a progressive utility manager who is not either selling the securities of his company direct to the public or studying plans for doing so with the idea of starting at the first favorable opportunity.

The position of investment bankers toward the practicability and wisdom of customer-ownership has been completely revised. From an attitude frankly skeptical of its success and a disbelief in the value of results, the views of the bankers have changed to commendation and the desire that all utility organizations build up a strong home ownership among the people. Thus we find an officer of one of the largest banks in the country saying:

"Essential," Says Banker

"It is in many cases essential that there be on the part of a community served a sufficiently large good-faith investment in its stock and debt to assure outside investors that the company will receive the same consideration as the other home industries in the territory which it serves. The investor will ask to be assured of such consideration for his property. It is the least to which he is entitled. It is more important than the renewal of a franchise or the winning of a rate case. It can be not only the salvation of the industry but also the cornerstone of the development of many communities."

This movement on the part of electric light and power and other utilities is, of course, in line with the general trend of steadily increased ownership of large corporations by an ever-growing number of people. The stock lists of nearly all well-known corporations show a remarkable gain in shareholders during the past few years. The government's war financing multiplied the number of bondholders in this country at least forty times, and even though many have sold their Liberty bonds, a vast number have retained them and all have received some education in the subject of investment.

There is, however, a great difference between the growth of shareholders of the steel corporation, for example, and the definite action of a central-station company to induce its customers to become profit-sharing partners in the industry. Every one in some way or other uses steel, but few are customers of the steel corporation and the latter requires no franchise to operate. Every one, however, who uses electricity is a direct patron of the central-station company and in daily, almost hourly contact with the latter. You can buy steel products from many sources, but usually you can purchase electrical energy from only one. The steel company can earn a sufficiently large surplus to expand its plant and business; the central station company cannot and, if it grows, must always be in the market for new capital.

Adjunct to Public Relations

The two foremost problems of public utility operation are public relations and financing. They go hand in hand.

If a company cannot finance its requirements so as adequately to serve its market, it is bound to incur public displeasure. If the company is the subject of public ill will, it finds the raising of new capital difficult if not impossible. The greater the difficulty of securing money the higher becomes the rate necessary to pay for the capital obtainable; and the cost of capital has a pronounced effect upon the service rates, while frequently the service rates are the controlling factor in the barometer of public sentiment.

The prevailing demand for capital for construction purposes far in excess of the supply and other effects of the World War merely accentuate some of the inevitable problems of utility operation. Were capital abundant and interest rates low in the summer of 1920, the desirability of customer-ownership as a solvent of the utilities' problems would exist almost as forcefully as it does under the contemporary circumstances. The necessity of good public relations and favorable public sentiment is fundamental, and it was perhaps harder to maintain them before the war than it has been since.

The apparent advantages to utility companies from a wide distribution of their securities among the local public have been frequently outlined. When a company invites the people to become profit-sharing investors it surrounds itself with a new and more attractive and engaging atmosphere. It does something that usually strikes a responsive public chord and immediately places itself on a more intimate and favorable footing with the people. Once a considerable number of home shareholders has been developed every office holder and politician takes cognizance of the fact and finds some other issue than attacking the utility company.

The home shareholders see the problems and conduct of the company in a more comprehensive and enlightened way and in turn educate many other people to the merit of the company's endeavors and the solid values of its work.

In brief, a considerable number of home shareholders so modify public opinion that the utility company is assured of just treatment and a fair chance to be prosperous and by being prosperous to discharge properly its duties to its community.

Before anything at all can be of lasting advantage to a utility company, however, it must be of genuine value to society. Many things which utility organizations have done or proposed have met this test and yet have also met with public criticism and disfavor. Often the general welfare has been well served but the company has been deprived of approval or reward. Nevertheless, the rule cited is certain to hold good over any extended period. How does customer-ownership measure up to this test?

In the first place it provides a safe investment regularly paying a good rate of return, encourages thrift, educates in the subject of investment, deprives many a hazardous or fraudulent enterprise of hard-earned savings, and keeps in the community the interest or dividend paid on the invested capital. Second, it places a salutary check on destructive politics and unfair legislation and taxation. Third, it cultivates a habit of public appreciation, which in turn stimulates the utility management to greater exertion toward better service and leaves the management free to devote its best energies toward this end rather than to defending itself against unjust attack. Fourth, it greatly assists the management in securing such capital as it may be necessary to obtain from outside sources in ample quantities and on the best possible terms. Fifth, it serves to make the company doubly careful to maintain financial success, since the failure to pay returns to its home investors would be calamitous.

What Customer Ownership Secures

The simplest and easiest way for a utility company to secure public good will is to offer sound securities to the people it serves. The simplest and easiest way for a citizen to obtain adequate utility service at just rates is to invest money in the utility company. On the one hand, the company secures peace and appreciation; on the other, the citizen secures a faithful and responsive public servant.

The success of customer-ownership naturally is based on certain elemental conditions. It must be predicated on progressive and efficient management, good service, sound finances and the ability to offer a safe security. If these are not present, very little of real benefit can be accomplished and preliminary to customer-ownership other and more drastic steps must be taken. Once they are taken and the people are sure of it they will invest in the company's securities.

Doing the obvious and most direct thing often seems to hold imaginary terrors. The next-to-hopeless snarls into which many utility organizations have been drawn can be unraveled, some of the most appealing arguments of the municipal ownership enthusiasts most effectively demolished and insufficient earnings increased to an adequate basis by merely selling utility securities directly to the interested public.

If there is any lesson that the public utility companies of the United States should have thoroughly learned during the past twenty years, it is that controversy gets them nowhere. The ultimate victory in a utilities quarrel goes to the demagogic politicians. The only way the politicians can be checkmated is by getting a sufficient number of people lined up with the utility company to insure that company a square deal at the polls. This can be done most easily simply by identifying the direct financial interest of a considerable number of voters with the company. Then, if the case of the utility is a just one, it need fear nothing. In fact it will seldom have an issue brought up for public decision.

Socialistic

The charge that customer-ownership is socialistic is correct. Every utility organization is inherently socialistic. It is based on service to society. It exists because it can render certain services more efficiently and economically by doing them collectively, and it touches practically every person in a community. As to the ownership of the property there are few actually effective arguments against collective or municipal ownership except impairment in efficiency and economy, and these are exceedingly grave objections.

When, however, customer-ownership starts with efficient management and the ownership of the property is fractional among individuals, there is no likelihood of dispossession of the efficient management. The principle and the advantages to society of individual ownership and initiative are retained with the addition of wider distribution of these advantages. Were every customer of a utility company presented with a share of its dividend-bearing stock, carrying voting rights, within a short time a very large proportion of the customers would hold no stock, any more than they have held their Liberty bonds. Quite a large number of customers would become owners of five to five hundred shares of stock, but as long they received their regular dividends they would do nothing to dispossess efficient management. Even if some aggressive genius tried to organize them with a view to bringing about changes of control he could not possibly succeed against an alert manager sufficiently diplomatic and statesmanlike to make the right moves.

In other words, customer ownership is socialistic—probably as far as it is possible to carry socialism with safety and good results to humanity in the present day. It also is individualistic and capitalistic and the single practical public utility policy that seems to meet the approval of both socialists and capitalists. In this joint approval and in its appeal to people who are neither socialists nor capitalists lies its chief merit—something that works and keeps the peace while cities are being built up, children reared and mankind slowly advancing in well being.

Experimental Stage Passed

The experimental stage of customer-ownership was passed long ago by companies which had the good fortune to make a beginning before the United States became involved in the war. These companies found themselves able to raise a considerable amount of money much needed for extensions and additional capacity at a time when investment bankers would not undertake to sell their preferred stock and found difficulty in marketing short-term notes at high rates of interest. It is an odd commentary upon financing mechanism to record the fact that certain utility companies sold large amounts of preferred stock direct to the public at that time, when Liberty bonds were offered at short intervals and the bankers seemed helpless.

With the proceeds from these customer-ownership sales during the war the companies installed generating equipment and built lines to serve industries manufac-

turing war equipment and essential products. They were thus able greatly to increase their volume of business and their earnings and also to serve the country in a patriotic way. From the increased gross earnings they were able to derive sufficient additional net earning to finish the war period in substantially improved position despite enormously increased operating expenses and higher taxes.

The ability of companies to finance construction by direct sales of their securities to the public when the customary financing channels are closed is again evident in 1920, when capital is the scarcest and its cost the highest since the years immediately following the Civil War. The utilities which have customer-ownership firmly established are selling larger quantities of preferred stock this year than ever before. Not only are they doing this but it is being accomplished on an income-bearing basis as low as many short-term note issues, and even lower.

Examples

A good example of what has taken place in 1920 is found in a company that marketed $6,600,000 of its 7 per cent preferred stock direct to the public through 12,600 separate sales in the four and one-half years ended Dec. 31, 1919. During the first six months of 1920 this organization sold direct to the local public $2,200,000 of its preferred stock by means of 4,080 separate sales. In the month of June, when the investment security markets of the world were stagnant and sales on the New York Stock Exchange the smallest in years, this company disposed of more than $400,000 par value of its preferred stock.

Many other equally good securities paying a higher rate of return were available to the people who bought this stock. Their choice was based on the fact that they wanted this particular investment, and they wanted it because it had been advertised, sold and found favor with the public over a period of several years.

Another instance is found in a Western company which is compelled to make a million-dollar addition to a power plant this year. In 1917, 1918 and 1919 this company through its regular employees placed upward of $1,000,000 par value of its preferred stock among the public. Late in January of the present year the management started out to raise as much as possible of the funds for the power-plant addition by direct sales of the preferred stock at a price close to par. On June 15 the sales had gone well over $400,000. The full million dollars will no doubt be in hand by the time the station is completed—and this in a period when financing is the most difficult and expensive in half a century.

The partial payment plan is an essential part of any customer-ownership plan aimed toward really popular ownership, but in the two examples cited less than 10 per cent of the stock has been sold on deferred payments and less than 20 per cent of the sales were of this kind.

A very important phase of customer-ownership is being observed during the 1920 depression of security prices. There is no selling movement of consequence on the part of citizens who have bought the securities of their local utility companies. They invested their money on belief in the stability of the properties and business and the ability of the management and in the expectation of a regularly paid cash income. Current stock and bond quotations do not disturb them. They have bought their stock to keep it, and only dire misfortune or some other urgent need for realizing cash will suggest the idea of parting with the investment. They are desirable shareholders in more ways than one.

For quite a number of companies customer-ownership performed another extraordinary service. When in 1917 and 1918 it was necessary to advance service rates to meet the increased costs of coal, materials and labor they promptly took the necessary steps and with a few minor exceptions obtained substantial rate advances without serious controversy. In certain large cities no objections from any source were made to the higher rate schedules. In other places there was prompt acquiescence in the findings of municipal and state authorities. During the rate increases the sales of company securities continued and in a number of cases gained in volume over the sales of the preceding year.

Results such as have been described speak for themselves. They were possible not simply because these organizations had home shareholders owning a considerable quantity of stock, but because the public as a whole had confidence in the company, its statements and its desire to play fair. For every man or woman who had invested in its securities during the preceding two or three years there were scores who had read its investment advertising, its circular letters and investment literature and had reformed his or her ideas of this particular organization, its motives, methods and integrity, and—most important of all—its attitude toward the public at large.

The salesman forever seeks additional inducement for his wares. Just so the publicity or advertising man looks for the best material which will appeal to people in whatever subject he deals with. As far back as 1912 the possibilities of customer-ownership were discussed with detail and enthusiasm. The idea was talked of and outlined practically as it is in effect and force today. In 1914 a utility organization made the first overtures purely as a financing measure. In 1915 two other companies took up the innovation.

Still Ample Work for Investment Bankers

Customer-ownership for utility companies was inaugurated at a time when it matched with the trend of events. It has received its start during a period in which wealth has been broken up, transferred to new hands and more widely distributed, in which the manual worker has received a greater share than ever before and the vendor of investment securities has had to seek the wage earner, the farmer and the man of comparatively small means. In reaching them the investment banker has little or no advantage over the executive personnel of a modern industrial organization. The advantage is rather in favor of the latter. Thus we see utility companies, shoe-manufacturing concerns, automobile makers and big hotels undertaking direct stock-selling campaigns where the investment banking world seems unable or unwilling to venture forth. In the case of the utilities, however, there will be ample work for the investment banker, for the demand for new capital and for refunding maturing obligations will as a rule continue far greater than the proceeds of the customer-ownership endeavors can supply, except in very large cities and old-established, wealthy communities when there is a considerable surplus of investment capital.

A subsequent article will discuss selling plans and methods which have been successful.

Improving Power Factor Conditions with Induction Motors

Phase-Wound Motor Operates at Synchronous Speed by Applying Direct Current to the Winding Used Normally as a Secondary Makes Possible Extension of Synchronous Machines to Smaller Sizes

By R. G. WARNER and A. E. KNOWLTON
Department of Electrical Engineering, Yale University

IT IS not generally known that practically any industrial plant where wound-rotor induction motors are used has a ready means of improving its power factor. By supplying the induction motor rotor with direct-current excitation it becomes a "synchronous induction" motor and at overexcitation may be used for power factor correction. The characteristics, however, are not identical with those of a synchronous motor of the same rating, one difference being that the synchronously operated induction motor has the requisite stability only under leading power-factor conditions. A further difference lies in the tendency toward constant current per terminal with field current constant and varying load. A scheme has also been devised to obviate the necessity of having an exciter at the motor location.

The synchronous operation of a Y-wound-rotor induction motor appears thoroughly practicable. Further, this manner of operation of such a motor, in, say, industrial applications can be accomplished with changes only in external connections, none being necessary in the motor windings if the stator neutral point is accessible. With moderate voltage motors no separate exciter is required, as it has been demonstrated that the direct-current field can be supplied simultaneously with the alternating-current power over the usual three wires plus only one additional wire, which may already be available in the case of a four-wire, three-phase circuit.

The motor employed in the investigation was a 10-hp., 220-volt, 60-cycle, three-phase Y-connected induction motor, 1,140 r.p.m., the full-load amperes per stator terminal equaling 27.3, and per rotor terminal equaling 23.05. The alternating-current power was first applied to the rotor windings so that the windings of the stationary portion might be reconnected with greater facility in determining the relative values of the third leg in series or parallel with the two others and, finally, short-circuited for damping effect. The first tests were made with these connections and found to have no advantage in changing the connections of the field. Consequently the remainder of the tests were made with alternating-current power applied to the stator with attendant decrease in core loss. The arrangements for starting as an induction motor with line connections to the rotor and with resistance initially inserted in the stator circuit were as shown in Fig. 1. After the machine had reached the rated speed the connections were changed by throwing the double-throw switch to the running position, upon which the motor pulled into synchronism. Only two (in series) of the three stator windings were employed for the direct-current field, after it had been ascertained that there was little to be gained either by using the third in parallel with one of the others or by employing it short-circuited, amortisseur fashion, to prevent possible hunting. The efficiency and power-factor characteristics with these connections and varying direct-current excitation at several loads are exhibited in Figs. 2 and 3. The curves are extended over practically the entire region within which the motor would operate, the left-hand termini thus indicating the minimum field current which would permit the motor to carry a given load. The limit in the direction of higher field currents was imposed, of course, by the safe heating of the windings.

The familiar V-curves of the synchronous motor are shown in Fig. 3, each curve corresponding to a given external load. These curves also show the operating range with given load and varying field excitation. Analysis of these results indicates that a relatively large field current would be required for full-load operation and that power factors and efficiencies at lighter loads would not seriously be affected by such heavy excitation. The computed value of field current to give the same copper loss in the stator (using two windings for the direct-current excitation) as would result in the three windings with rated current for normal induction motor operation is approximately 33.5 amp. This value was adhered to in subsequent tests, and the characteristics with varying loads but with field excitation constant at 33.5 amp. were obtained. The corresponding characteristics exhibited under the logical method of operation—*i.e.*, alternating current to stator and direct-current field in rotor, were also derived.

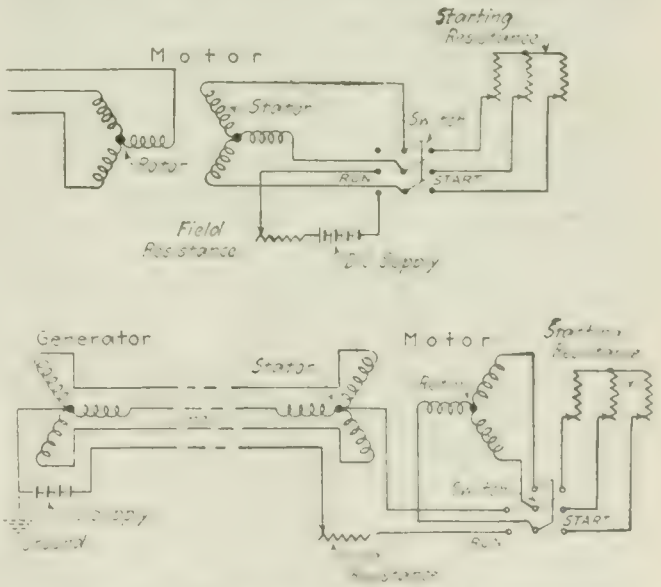
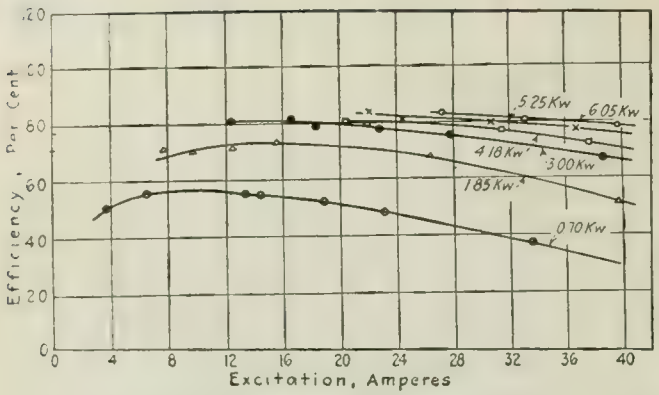
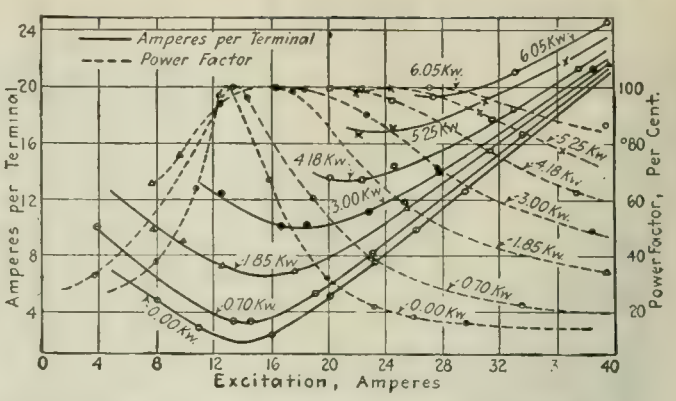


FIG. 1 STARTING CONNECTIONS FOR THE SYNCHRONOUS INDUCTION MOTOR

For facility of comparison of the two methods of synchronous operation and with induction motor opera-





FIGS. 2 AND 3—EFFICIENCY, POWER FACTOR AND PHASE CHARACTERISTICS OF SYNCHRONOUS INDUCTION MOTOR
For 10-hp., 220-volt, three-phase, 60-cycle wound rotor induction motor.

tion, the individual characteristics are grouped in Fig. 4. In Fig. 4A are shown the efficiencies under the three mentioned methods of operation, and the fourth curve exhibits the maximum efficiencies obtainable under synchronous operation by employing the most desirable value of field excitation for each load. Either method of synchronous operation shows consistently higher combined alternating-current and direct-current efficiency than the induction-motor operation; also Fig. 4C shows reduced line current for loads in excess of 50 per cent. Fig. 4D shows the amount of reactive current at various loads, leading in the case of synchronous operation and lagging when used as an induction motor. Not only is the amount of lagging current at a given load on the motor completely eliminated by synchronous operation, but furthermore there is provided a considerable leading current of value in offsetting lagging current required by inductive apparatus on the rest of the system. The amount available for such system power factor correction is shown by curve 5 in Fig. 4D.

The machine was started several times during the tests with brake loads applied in excess of 50 per cent of the normal rating, showing good pulling-in torque as synchronous motors go. Operation over the range shown in the curves was also free of hunting, all meter indications being notably steady.

There was next conceived the idea of supplying the motor with the three-phase alternating current and the direct current from the more or less remote switchboard by means of only four conductors, the three-phase line being Y-connected with both neutral points accessible. Investigation of this manner of connection, as exhibited in Fig. 1, demonstrated the complete practicability of it, the previous characteristics being duplicated. These results were obtained with either generator or storage battery source for the direct-current field. The rated amperes per terminal for induction-motor operation at full load are 27.3, and the corresponding watts per ohm of line wire are 745, or for all three wires (per ohm of each) 2,235 watts. Full load was carried under synchronous operation with 22.5 amp. (alternating-current) per terminal, each of the three alternating-current line wires carrying in addition one-third of 33.5, or 11.2 direct-current amp. Observing the difference in frequencies (60 and 0) the total copper loss per ohm of each of the three line wires in this case is $(22.5)^2 + (11.2)^2 = 630$ watts. The additional direct current loss in the fourth wire is $(33.5)^2 = 1{,}120$ watts per ohm. The total loss per ohm of each of four wires is $(3 \times 630) + 1{,}120 = 3{,}010$ watts, as against $(3 \times 506) + (2 \times 1{,}120) = 3{,}758$ watts loss resulting from the independent transmission of the alternating-current and

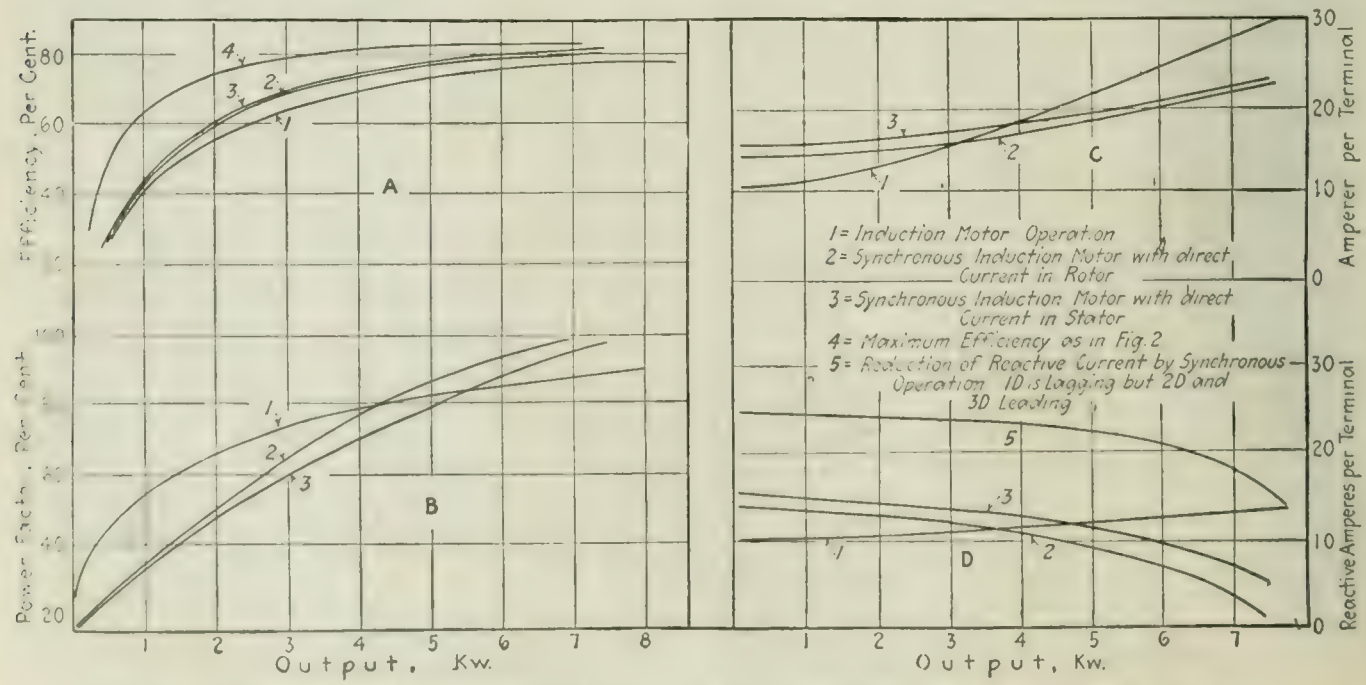


FIG. 4—CHARACTERISTICS OF SYNCHRONOUS INDUCTION MOTOR COMPARED TO NORMAL INDUCTION MOTOR

direct-current supplies to the synchronous motor. The saving by reduced copper loss is thus 20 per cent, and this method of connection in addition eliminates the exciter otherwise necessary in a position adjacent to the motor and one of the two wires normally employed to supply direct-current field from a more or less remote source.

The advantages to be derived from the transformation of the phase-wound-rotor type of induction motor to a synchronous motor, with field current derived from an adjacent exciter, are as follows:

1. No sacrifice in original rated capacity of the motor. The use of increased field current would, of course, permit a certain amount of overload, as has been pointed out.
2. A combination of good starting torque of the induction motor with the constant-speed characteristics of the synchronous motor.
3. Adequate stability of operation with change of load.
4. Improved system power factor, with motor in question having inherent leading-power-factor characteristics.

The further advantages to be derived from transmission over four conductors of both alternating-current and direct-current supply from a moderately distant source are as follows:

1. No separate exciter needed at the location of the motor.
2. Only one additional conductor is required above the three previously feeding the induction motor. In the case of four-wire, three-phase circuits this conductor is already available.

Readers' Views and Comments

Authoritative Report on Tonawanda (N. Y.) Accident

[The inaccurate newspaper reports of the cause of the catastrophe at the substation of the Tonawanda (N. Y.) Power Company not only misled the public but have doubtless spread apprehension among the employees of other central-station companies, or may even have struck terror to the hearts of the more timid and less informed. The ELECTRICAL WORLD has therefore obtained the following authoritative report of the accident and of its causes so far as they are yet known.—EDITOR.]

To the Editor of the ELECTRICAL WORLD:

SIR: We are in receipt of your letter of Nov. 1 in regard to the frightful accident that happened at Tonawanda on the morning of Oct. 31.

Directly beside the Tonawanda Power Company's substation the Niagara Falls Power Company has a switching tower, consisting of a brick building about 24 ft. square and two stories high. Through the upper story of this building pass our transmission lines, from which are made at this place taps to disconnecting switches, through which the Tonawanda Power Company could connect up to the several lines. This tower contained no switching apparatus which was operated under load, and required no operator, the Tonawanda Power Company's operator in the adjoining substation making such changes in the disconnecting switches as, at intervals of several months, might become necessary on account of line repair.

Recent increases of power used by the Tonawanda Power Company required current transformers of an added capacity for measuring its power. The transmission lines at this place are 22,000-volt, three-phase, 25-cycle. Two new current transformers, insulated for 45,000 volts, were purchased, and a shutdown of the Tonawanda Power Company's supply was made for the purpose of connecting up these current transformer as well as making some additional connections for the substation enlargement of the Tonawanda Power Company. Picked men were sent to do this work in as short a time as possible in order to occasion the least possible interruption of the Tonawanda power supply.

The work had been completed and the men were ready to go home. The Tonawanda station operator had cut in the disconnecting switches, making alive the new installation of current transformers and other connections, when a snapping of static discharge was heard somewhere in the tower, and very soon thereafter an explosion or short circuit occurred which involved the whole switching tower, including the new transformer installation and connections. This short circuit took place in approximately three minutes after the disconnecting switches had been closed.

There were thirteen men involved in this accident, nine of them being Niagara Falls Power Company men and four Tonawanda Power Company men. Of these, four were killed at the time of the accident and the remaining nine have died since—eight of them within the first twenty-four hours of the accident and one five days later. These thirteen men were all who were in or around the substation and tower and constituted all of the eyewitnesses of the catastrophe. The concentration and force of the short circuit destroyed the wiring in the tower, making it difficult at this time to give a statement of the actual cause and of the sequence of events.

It is, however, evident that only a part of the men were killed by the explosion, and that the others, showing the greatest self-sacrifice and heroism, rushed at once to the assistance of their comrades and in doing so received the burns which afterward proved fatal. Several of them died within a few hours in the hospital, from pneumonia.

The only oil in the building was that contained in the small cases of the four current transformers and two potential transformers. Both of the cases of the new current transformers were found broken after the fire was extinguished. Other transformers of this type had been installed and operated by these men and had been in service for years without trouble.

With what evidence remains, every effort will be made to search out the actual cause of this terrible calamity, which, in the loss of life resulting, must take its place beside such occurrences as strokes of lightning on buildings where people are congregated, boiler explosions in the midst of workmen and other similar instances.

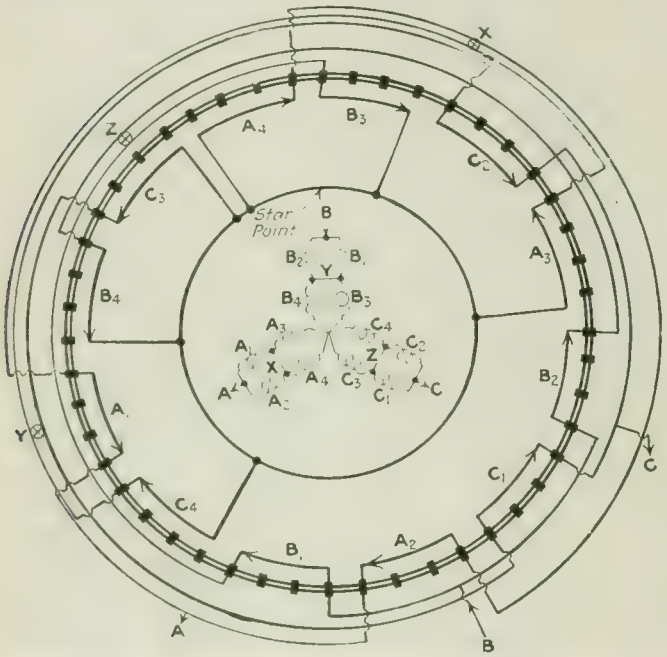
JOHN L. HARPER,
Vice-president and Chief Engineer.
The Niagara Falls Power Company,
Niagara Falls, N. Y.

Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Unbalanced Magnetic Effect Overcome by Change of Connections

TROUBLE in an alternating-current generator caused by unbalanced field strengths was overcome in an Eastern shop by making the distribution of the coils of each stator circuit uniform and adding cross-connections to the winding. The machine is a 250-kw., three-phase, 1,800-r.p.m., four-pole generator driven by



PERFECTLY BALANCED CONNECTION FOR TWO-PARALLEL STAR WINDING ON FOUR-POLE MACHINE

a Terry turbine. The winding has two circuits in parallel per phase, and the coils of each circuit were not uniformly distributed around the stator.

In mechanically balancing the rotor in the shop the ends of the four screws in one rotor pole were cut off so they were shorter than the screws in the other poles. This left a considerable air gap in the magnetic circuit and this pole was somewhat weaker than the other three. The machine consequently vibrated objectionably when running, due to unequal voltages being generated in the parallel sections of the windings and causing heavy cross currents.

To overcome this trouble the stator winding was reconnected so that each circuit of each phase was symmetrically distributed around the stator with respect to the rotor. To make extra sure of balance the two circuits of each phase were connected together between the two groups of coils as shown at X, Y and Z in the drawing.

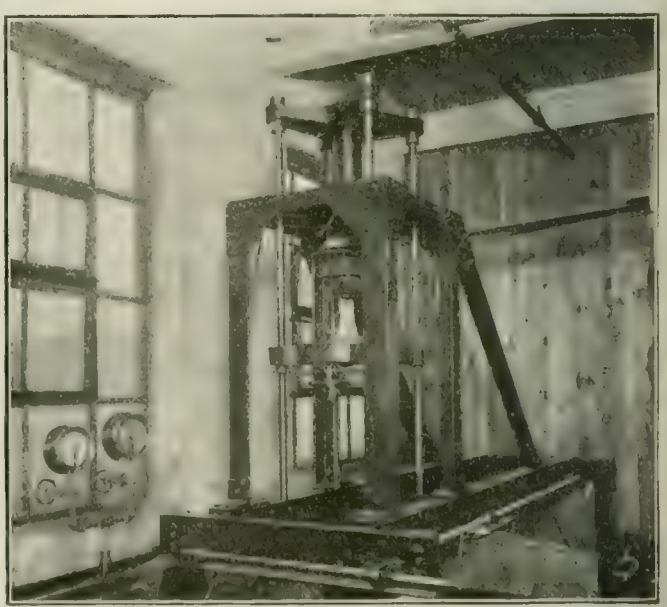
This connection results in a perfectly balanced winding and should be used on all machines having four poles and two parallel circuits. On eight-pole machines a similar method can be used, but the advantage gained is not great. The more poles the machine has the less will be the trouble with unbalancing, and the less will be the need of distributing the coils symmetrically with respect to the rotor.

JAMES DIXON.
Reliance Electric & Engineering Company,
Cleveland, Ohio.

Machine for Testing Insulators and Bus Supports

CENTRAL-STATION companies which would like to have their insulators tested mechanically before being placed in service may be interested in a testing machine which the Delta-Star Electric Company, Chicago, has built and installed in its laboratory for handling such tests on heavy bus supports, disconnecting switches, line insulators and outdoor switching apparatus. This machine is so designed that both single insulators and completely assembled switches can be mounted exactly as they will be installed for service, and test loads duplicating service strains applied. Samples can be tested in compression, tension, cantilever, torsion and combined cantilever and torsion. Loads can be applied symmetrically or eccentrically as required to parallel service conditions. By means of a universal joint in the pulling mechanism cantilever strains can be applied at the exact angle that is taken by the wire of a transmission-line span.

The drawhead, the four pulling rods and the yoke to



66,000-VOLT INSULATOR UNDER COMPRESSION TEST

which they are rigidly connected form a unit which rests on top of the hydraulic ram through which the measured force for tests is applied. The connection between this pulling unit and the hydraulic ram is a form of

universal joint consisting of a bearing plate with a hollow spherical surface which rests on the spherical top of the hydraulic ram. This construction allows strains to be applied at any desired angle and in tension tests provides a self-aligning member that prevents any side strain being applied to the test sample. The lower anchorage used in tension tests is also provided with a universal joint. Pressure is applied to the hydraulic ram by means of a manually operated pump provided with two pressure gages—one for forces up to 10,000 lb. (700 kg. per sq.cm.) and the other for the full capacity of 40,000 lb. (2,800 kg.). This arrangement insures accurate readings over the full range of the machine. A valve is provided to shut off the low-reading gage when it is not in use.

Insulators 20 in. (50 cm.) in diameter and 26 in. (65 cm.) high and a built-up stack 20 in. in diameter by 72 in. (180 cm.) high can be tested.

Delta-Star Electric Company, Chicago, Ill.

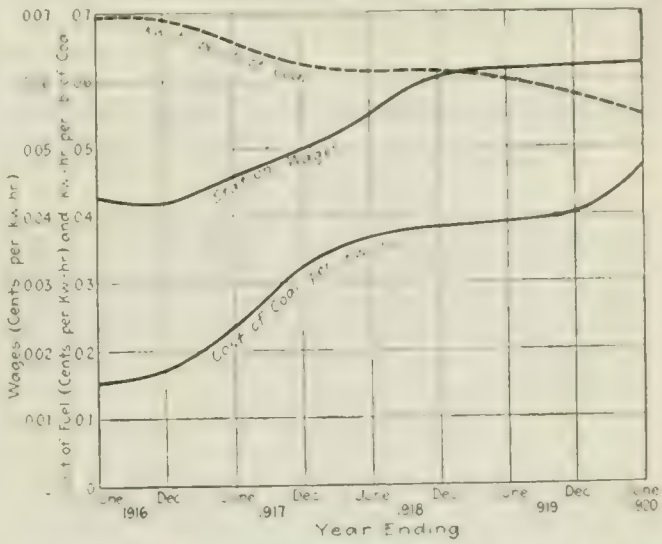
ALLEN RAMSEY, Designing Engineer.

Production Costs of Detroit Company at Connors Creek Station

PRODUCTION costs per kilowatt-hour of output for the Connors Creek station of the Detroit Edison Company are shown in the accompanying tables. These costs are compiled on the basis of the twelve-month periods ended June and December of the years 1916 to 1920. It must be remembered that the station has been greatly increased in size since 1916 and that new equipment has been installed. Moreover, during the last twelve months three out of four of the turbines have been running in a badly crippled condition because, as in many other plants, they could not be shut down for the necessary overhauling and repairs. Therefore, and on account of having to burn lower grades of coal than in former years, the generating efficiencies may not appear so favorable as might otherwise be expected.

The operating difficulties at the Connors Creek plant due to the crippled condition of equipment came to a maximum in July and August of this year. Since that time the receipt and installation of new turbines, which had been greatly delayed, have given the long-desired opportunity to repair the older machinery, and efficiencies are consequently improving. The figures for the twelve months ending Dec. 31, 1920, will necessarily be bad, but later schedules will show betterment.

The most notable increase in costs since June, 1916, is in the price of fuel, which has risen almost 200 per cent, 40 of the 200 per cent increase having occurred since December, 1919 (see curves). Fuel alone now costs 90 per cent more than the total operating expenses in 1916. In addition, the poorer quality of coal is in a



INCREASED COST OF COAL AND OPERATING WAGES SINCE 1916 AT DETROIT

large measure responsible for the 90 per cent increase in the cost of maintaining steam equipment. Station wages have increased 44 per cent since 1916, while the cost of "station supplies and expense" has almost doubled in the last two years. These figures from a station which contains the most advanced equipment operated under efficient supervision show conclusively the greatly increased costs of production which central-station companies have been forced to bear without any material increase in their returns since the beginning of the abnormal conditions arising from the war.

TABLE I PRODUCTION COSTS FOR TWELVE MONTHS ENDED JUNE 30, 1920

	Total Expense	Cents per Kw.-Hr.
Operation		
Superintendence	$48,482 78	0 010
Wages	302,310 21	0 062
Fuel	2,300,147 97	0 471
Water		
Lubricants	7 120 13	0 001
Station supplies and expense	53,222 25	0 011
Maintenance		
Station buildings	50,189 80	0 010
Steam equipment	174,702 70	0 036
Electrical equipment	6,262 98	0 001
Total	$2,942,439 82	0 602

TABLE II PRODUCTION EXPENSES PER KILOWATT-HOUR OUTPUT AT CONNORS CREEK POWER HOUSE—CENTS

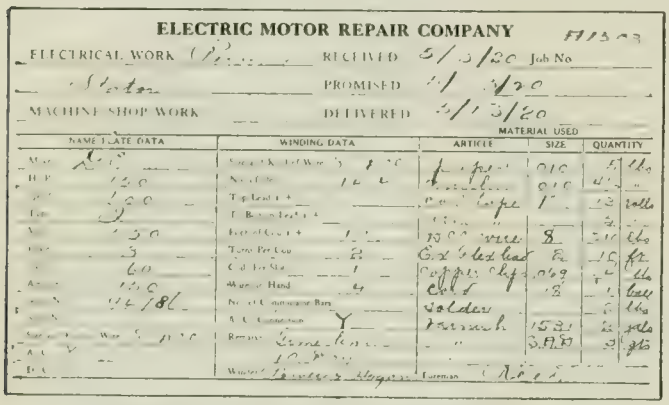
	For Twelve-Month Periods Ended —								
	June 30, 1916	Dec. 31, 1916	June 30, 1917	Dec. 31, 1917	June 30, 1918	Dec. 31, 1918	June 30, 1919	Dec. 31, 1919	June 30, 1920
Operation									
Superintendence	0 013	0 013	0 010	0 010	0 009	0 009	0 010	0 010	0 010
Wages	0 043	0 042	0 047	0 050	0 055	0 061	0 062	0 068	0 062
Fuel	0 158	0 174	0 240	0 325	0 368	0 382	0 394	0 407	0 471
Water									
Lubricants	0 001	0 001	0 001	0 001	0 001	0 001	0 002	0 002	0 001
Station supplies and expense	0 005	0 006	0 005	0 005	0 006	0 009	0 010	0 007	0 011
Maintenance									
Station buildings	0 006	0 007	0 011	0 010	0 008	0 007	0 008	0 011	0 010
Steam equipment	0 019	0 016	0 019	0 024	0 025	0 023	0 024	0 029	0 035
Electrical equipment	0 003	0 003	0 001	0 001	0 002	0 001	0 001	0 001	0 001
Total	0 248	0 262	0 334	0 426	0 474	0 493	0 511	0 527	0 602
Kw.-hr. output	125,158,800	162,117,600	210,039,700	249,192,200	280,814,700	327,020,500	383,252,000	445,535,500	488,060,600
Maximum demand (thirty minutes) Kw.	35,000	36,000	50,000	58,000	59,000	80,000	82,000	104,000	104,000
Average load, kw.	14,300	18,500	23,900	28,400	32,100	37,300	43,700	50,800	55,600
Load factor	0 409	0 514	0 478	0 489	0 544	0 466	0 533	0 488	0 534
Coal per kw.-hr., lb.	1 44	1 45	1 52	1 61	1 63	1 63	1 67	1 73	1 83
B.t.u. per kw.-hr.	19,700	19,800	20,040	20,470	20,930	20,900	21,200	21,800	22,800

Industrial Applications

The Economical Utilization of Electrical Energy
in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

Work-Order Records for Motor Repair Shop

COST records which make for accuracy, low running expenses and satisfaction to customers are used in the establishment with which the writer is connected. As soon as an order is received it is entered in an order book and a job number is given to it. The job


ELECTRIC MOTOR REPAIR COMPANY

ELECTRICAL WORK — RECEIVED — Job No.

PROMISED

MACHINE SHOP WORK — DELIVERED

MATERIAL USED

NAME PLATE DATA	WINDING DATA	ARTICLE	SIZE	QUANTITY

FOREMAN'S CARD FOR A MOTOR REPAIR JOB

is then turned over to a workman with a card on which are instructions and all the data that are necessary for him to proceed with the work assigned to him. The foreman has similar data on another card, shown here, which he keeps until the job is completed. On the back of his card the workman keeps a record of the material he uses on the job, and the total amount of material is entered on the foreman's card on completion, after which the foreman turns his data sheet into the office. Whenever it is necessary the back of this card is used for sketches, etc. The material used on the job and the amount of time spent in each operation are then posted in a cost sheet. On this sheet are posted the itemized costs of material and labor, and after overhead expenses and a profit have been added the customer is billed accordingly. J. B. TUFTS.

Electric Motor Repair Company,
Springfield, Mass.

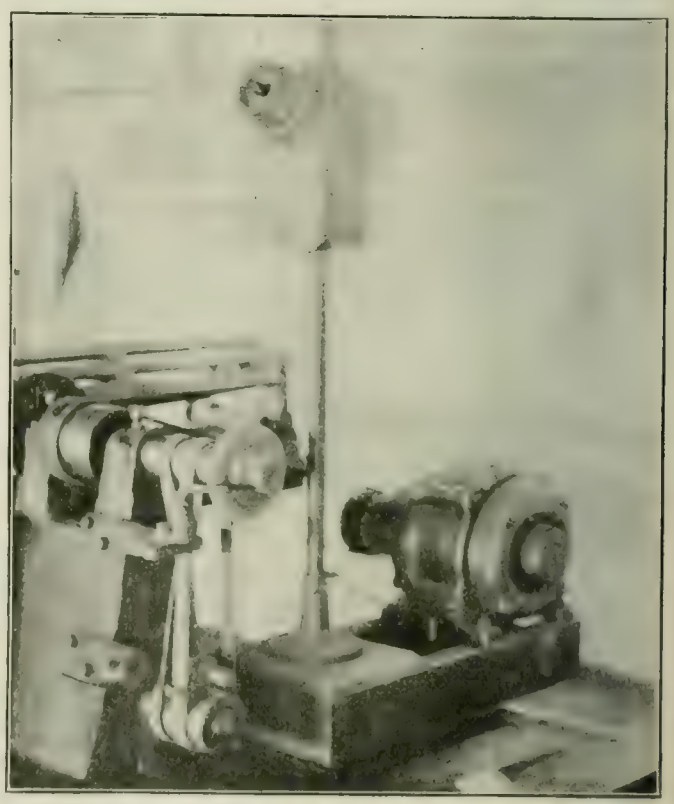
Electric Tractor Saves 50 per Cent at Unloading Pier

MORE than 50 per cent of the cost of unloading at a pier in the North River, New York City, was saved by using an electric tractor and five trailers in place of hand trucks. At this pier about 120 tons of freight are now handled every day at a cost of 0.264 cent per ton, while the former cost of moving by hand trucks was 0.56 cent per ton. A saving of 0.296 cent a ton was thus made in spite of the fact that only five trailers were in service, which is only about one-tenth the proper number. These trailers have platforms on the level with the tailboards of the street trucks which haul freight. It is noticed that when such trailers are used the driver of the street truck places boxes or packages on the trailer, while when hand trucks were used he would place the articles on the tailboard of his vehicle and wait for the freight handlers to unload them onto their hand trucks. Use of the tractors thus leaves at least one freight handler free for other work.

New York City. FREDERICK B. FINK.

Motor, Control and Grinder in Compact Arrangement

AMOUNTING where motor, control switch and fuses and grinder are easily within the reach of the workman, as shown by the accompanying illustration, is used in the Naumkeag Steam Cotton Company, Salem, Mass. The motor is mounted on a stout wooden frame just behind the grinder, to which it is connected by a short belt drive. The control is in the form of a snap switch and cut-out box combined, which is mounted directly behind and above the grinder on the conduit through which the feed wires run. In this installation



SWITCH IS VERY HANDY TO OPERATOR

the belt drive is so short that no power is lost. The motor does not obstruct working space or passageways, and at the same time it is off the floor where it could accumulate dust, and the snap switch is within easy reach of the operator.

Device to Detect Short Circuits in Armature Coils

TO TEST for short circuits in motor coils outside the motor, a quick, reliable and at the same time inexpensive outfit was made by the writer from an old pole piece of a synchronous motor. This pole piece measures about 7 in. long 4 in. wide and 6 in. high (18 cm. x 10 cm. x 15 cm.). A piece of fiber in the shape of the coil is attached to the yoke end of the pole to hold the winding, which consists of five layers of No. 11 double-cotton-covered wire. Flexible leads are soldered to the ends of the winding. Current is taken from the 110-volt alternating-current circuit.

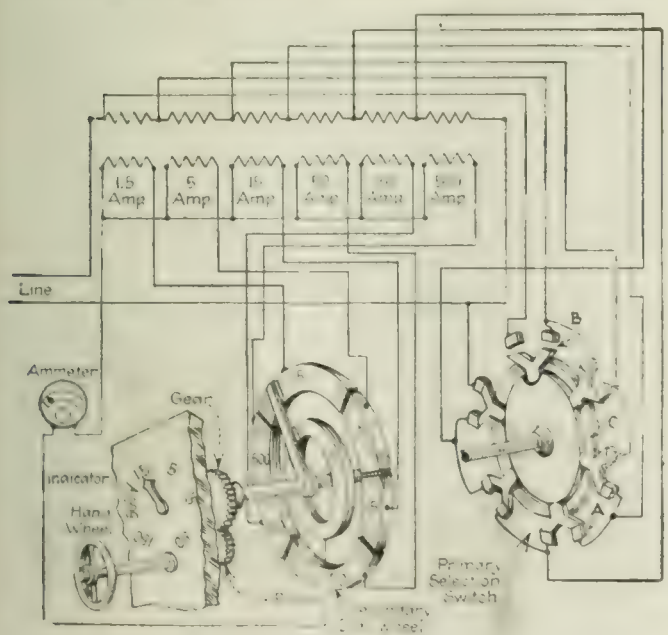
In testing a coil it is placed over the pole piece. Any short circuit in the coil is detected first by a force trying to throw the coil off the core and second by the heat developed in the short-circuited turns. This outfit is very handy and many other uses may be found for it in the winding shop.

A. MUNOZ.

Claymont, Del.

Current-Transformer Connection Board

TO FACILITATE the connection of current transformers in the circuit when testing electric motors in a large New York industrial plant which uses several sizes of motors the device illustrated was devised. Six current transformers, having ratings from 1.5 : 5 amp. to 500 : 5 amp., were connected so that all except one of the primary windings would be short-circuited at one time. The secondary windings were connected to a dial switch so that the secondary of the one transformer having current flowing in its primary would be connected in an ammeter circuit. Rotation of the hand wheel will shift the secondary dial switch to any one of the current transformers and, at the same time, open



SWITCHING DEVICE PERMITS OF QUICK CONNECTION OF CURRENT TRANSFORMERS AND USE OF ONLY ONE AMMETER

the short-circuiting shunt across the primary winding of that current transformer.

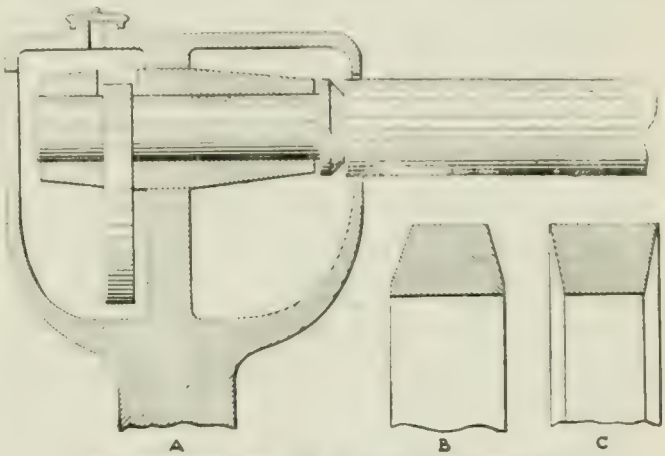
The contacts *A* are made of copper 2 x 2 x 1½ in. (5 x 5 x 3.7 cm.) with ¾-in. (1.8-cm.) studs projecting through the slate base for back connection. Brushes *B* are made of hard-drawn brush copper and are forced solidly against the contacts by the notched cam. This cam is made of a round iron plate 1 ft. (30.5 cm.) in diameter, ⅜ in. (1 cm.) thick, and is securely fastened to the shaft. The secondary dial switch is made of a piece of fiber 10 x 10 x ¾ in. (25 x 25 x 2 cm.) on which are mounted six contact segments and a contact ring. A pointer is placed on the end of the shaft to indicate which transformer is in the circuit.

A. R. MCDONALD.

Amsterdam, N. Y.

Beveling of Oil Rings Prevents Sluggish Action

SLUGGISH action of oil rings leading to improper lubrication of motor bearings was cured by beveling the sides of the rings of motors made in a large New Jersey factory after considerable searching for the



OIL RINGS BEVELED AS IN B OR C DO NOT STICK

reason for the trouble. On testing these motors it was noticed that the ring would creep along at a very slow speed, two or three revolutions a minute on a machine of several horsepower, instead of the regular speed of about thirty to fifty revolutions. Though all journals and rings were made in large numbers and as nearly alike as possible, this trouble appeared on only about one machine out of ten and disappeared nearly every time a new ring of the same size and shape was put in. Sometimes, of course, it was due to the ring rubbing against some projection on the casting, but more often no apparent cause was found by the assembling department. At that time the oil rings were cut from a rather heavy brass tube with straight sides (see *A* in the drawing), making the cross-section rectangular in shape while the journals had a straight slot about twenty to twenty five miles wider than the ring.

It was finally discovered that under certain conditions the ring would start with the machine and perhaps come up to normal speed but soon work itself toward one side of the slot and slow down, hugging closer and closer until there was only a very thin film of oil between the ring and the flat part of the journal.

Therefore, in an attempt to prevent sticking, three rings were removed and their sides were slightly beveled as in *B*, when the trouble entirely disappeared. Since that time all oil rings are beveled either from the outside or from the inside, *C*, and there has been no sticking.

PHILIP G. BERNHOLZ.

East Orange, N. J.

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

Public Ownership and Operation Criticised by Commissioners

PUBLIC ownership and public operation of public utilities has never been successful, according to the National Association of Railway and Utilities Commissioners committee on public ownership and operation. In its report, made last week at the Washington convention, the committee recommends the continuation of regulated private ownership. The report is given here in full for the benefit of those utility executives who have to face the music of municipal ownership:

The question of private ownership with regulation as against public ownership without regulation should no longer be considered by intelligent investigators as an open question.

We think it may be admitted as a general proposition that public ownership and operation has failed wherever it has been properly tested. We recognize the fact that in some special locations public ownership and operation may appear to be successful, but we hold that if the real facts be ascertained and the same test applied to the publicly owned and operated utility as is applied by regulatory bodies to the privately owned and operated utility the general result will apply in all instances.

We need no better illustration of the result of the attempt of the public to operate utilities than the recent operation of the railroads by the United States government. These roads were taken over pursuant to the war power of the government and operated by the Director General with such autocratic power and independent irresponsibility that the financial and other business interests of the country wondered what, if any, limitations really existed and in what forum conflicting claims of right might be adjusted, if indeed there was any forum of appeal from the will of the supreme operating authority. In fact, or at least in practice, there was no limitation on the power of the Director General and he operated these utilities as a unified system with full power and authority to make and change all rules and regulations to accomplish the most beneficial results. The rate of wages and the rates to be paid by the shippers and the rate of return to the owners of the property were arbitrarily fixed by the national government and a full and free opportunity was given to test the competency of public operation in the interest of the public and the efficiency of the service so rendered.

Failure of Governmental Operation of Railroads

The result is common knowledge. As the necessity which gave rise to the assumption of federal control and operation approached a conclusion the question of returning the roads to their owners and the manner and method of turning them back became such a complicated question that the situation became similar to that of the man who had hold of the bear—he was unable to hold on and feared to let go. They came back to their owners in a broken and disorganized condition, and it was necessary for the national government to create a fund which might be loaned to the railroads for the purpose of rehabilitating them and restoring them somewhat to their condition before government operation.

In addition to which, since they have been returned to their owners there have been increases in freight and passenger rates until the public is today paying the highest rate of freight and passenger transportation in interstate traffic that was ever charged by the railroads and more than the most optimistic railroad president dreamed would ever be their lot within as late a period as five years ago. Is there any reasonable and thinking man who has paid the slightest attention to the subject matter who can be heard to maintain that governmental operation, not to speak of governmental ownership, was a success?

In the field covered by the other utilities, street cars, electric light and power, telephone and telegraph, gas and water, there has not been the same opportunity to make the character of test as was made with the railroads. These latter utilities came upon the field at different times through process of invention, and, being a new enterprise and a new business, each in its turn was obliged to create the demand for the product it sold or service it rendered. In the early years the public was not interested in either.

With such utilities as required municipal permits or franchises the matter was conducted by the officers of the utility representing the demands or necessities of the utility company on the one hand and the municipal bodies controlling the use of streets and public avenues and representing the public at large on the other. Each party was dealing with the other to secure the best advantage possible for the interest which it represented. There was no independent, disinterested and honest effort to ascertain what should be a just and reasonable rate to which the utility should be entitled, and at the same time protect the public, until the advent of the regulatory commissions.

Agitators Complicate Commissions' Work

When the commissions took hold of the situation the result in many instances was a lowering of rates and the commissions were correspondingly popular. Since the outbreak of the war, with the enormous increase in the cost of labor and all materials entering into the construction and operation of utilities, the commissions have been confronted with the necessity of meeting these advanced costs in order to permit the utilities to function, and in different sections of the country there has originated a demand for municipal ownership and public operation on the part of those who think or believe that the commissions should compel or seek to compel the utilities to operate at the rates which were prevalent prior to the outbreak of the war.

It seems remarkable that any sane man with a knowledge of the increase in all costs of living should think or expect that utility corporations might be an exception to the general rule. No reasonable man has thought so. The operation of these general laws has again produced the political agitator who has sought and is seeking to make political capital out of present necessities. We all know him and we all understand his motives. It is remarkable that the public at large should not also recognize the impossibility of doing business today at the cost of doing business prior to the war. It is remarkable that men honest and reasonable in the conduct of their own business affairs will accept as gospel truth the perverted, even dishonest statements of the demagogue who seeks to climb into power and prestige by denouncing the increased rates allowed to utility corporations by the state and national regulatory commissions. It is remarkable that the public has not sufficient appreciation of the constitutional limitations and the constitutional restrictions placed upon the attempted confiscation of private property for public use.

It is possible that in some communities, indeed in some

states, the laws creating the regulatory commissions may be repealed by reason of the weakness of the legislative power to withstand the demands of the demagogue, but in those communities and in those states we believe the state and federal courts will protect the rights of those who have invested their money in the securities of the utility corporations, and compel the authorities to permit the collection of just and reasonable rates.

It is most natural in this condition of affairs that the demagogue and the dreamer should invoke the doctrine of public ownership and public operation. We have seen it made the issue and apparently honestly urged by men reasonable and sane in all other matters, but who hope by some process of legerdemain to continue to pay high constructive costs, high wages and other advanced costs of operation and yet continue to operate the utilities at the same price for the product or service rendered as was in vogue prior to the world war. Some are honest we are forced to believe and others are not.

The argument is generally advanced that in the early construction days of the railroad and other utilities the public was defrauded by wildcat financing, and as a result thereof public opinion is prejudiced against utility corporations in general. These charges may or may not be true, and it is not necessary, for the consideration of this question to review them. We know that under the present system of public regulation these abuses can no longer exist. We know that as a result of the depreciation in all values resulting from the great war any "water" which might have existed in these properties has been squeezed out and cannot get back in.

We have noted many changes in the functions of the government during those later years and many enterprises and duties have been assumed by the state and national governments which were not dreamed of by the founders of our system, and it may be necessary to continue the experiments even to the extent of taking over the utility corporations in order to convince the public at large that such is not the proper method and manner of operating them.

PUBLIC OPERATION INHERENTLY INEFFICIENT

It stands to reason that no business enterprise dependent upon the varying changes of political thought can be operated by the public in as efficient, methodical and careful a manner as can a similar business enterprise managed by a body of men who have their capital invested therein or who represent those who have invested their fortunes.

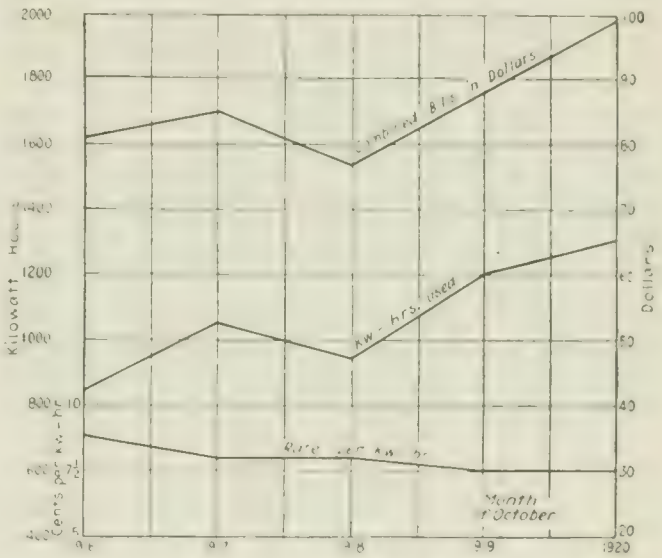
It may be necessary in order further to demonstrate this fact that the public shall demand a further extension of the experiment of municipal ownership or municipal operation. It is being tested in some of the European countries today; it is demanded in this country by those who would destroy our governmental system and substitute some system similar to that which is said to operate in Russia. There are two classes of people opposed to private ownership with governmental regulation. One is made up of the classes of the communist, the anarchist and all others who follow the divers and various governmental vagaries with which they seek to supplant our constitutional government. The other general class is the dreamer, the visionary, the professor who deals in ideals but not facts, and who is opposed to private ownership and governmental regulation. They both feel that should this process fail nothing will remain but public ownership and public operation, and we believe they are correct in that view.

Destroy private ownership with public regulation and the next step is government ownership and government operation. When that time comes, if it does, our system of government will have changed to meet it. We will not be living under the system of constitutional government which we now enjoy, because these properties cannot be taken over and honestly paid for, through any series of bond issues or otherwise, and operated as efficiently and economically as they are now operated in the hands of their owners. In order to take them over and operate them at a less cost than their owners can operate them it will be necessary to confiscate all or a large portion of the actual value of these properties, and if that can be accomplished it will be notice to the world that our constitution has changed and that our courts are no longer able or capable of protecting private property from public confiscation. It is no less immoral to take private property for public use without making just compensation therefor than it is to take private property for private use under the same or similar circumstances.

We believe that the system of private ownership and private operation with public regulation that is now the custom in this country is the proper, logical and indeed the only just and honest manner of conducting the public utility business of this country.

Growth of Residential Consumption in Four Years

FIFTY residential customers in Worcester, Mass. whose use of electric service was analyzed recently, showed a 50 per cent increase in energy consumption with only a 22 per cent increase in the amount of their bills during the past four years. The Worcester Electric Light Company serves a highly diversified community, and the fifty customers were selected at random from different localities in the city. The total energy



COMBINED BILLS AND CONSUMPTION OF FIFTY CUSTOMERS

consumption and bills are compared for the months of October, 1916, to October, 1920, inclusive.

Thirty-four customers' individual bills increased and forty customers' energy consumptions were larger in October, 1920, than in October, 1916. The combined bills of the fifty customers increased from $81.45 to $99.26, and the combined energy consumption from 868 kw.-hr. to 1,307 kw.-hr. Variations from year to year are shown in the accompanying curves. During the period the rate for this class of service was reduced from 9 cents to 7.5 cents per kilowatt-hour.

Continuity of Service Is Paramount

"CONTINUITY of service" is a slogan which most central station companies adopt and all endeavor to maintain to the fullest possible degree. The Southern California Edison Company has built its reputation largely around this idea, and at all times the paramount aim kept before its staff is to satisfy the consumer. In these days, the company holds, continuous production is more important than ever.

Recently the California-Oregon Paper Mills plant.

in Vernon, Cal., which is a customer of the Southern California Edison Company, was forced to drop part of its load owing to the failure of one of the machines in a closed delta bank of three 250-kw. transformers. This failure occurred at 9:29 o'clock in the morning. The manager of the paper mills immediately called the Southern California Edison Company's district manager and the "Edison service" machine began to move. Within twenty-nine minutes from the time the transformer failed the mills were back on the line with part of their load on the remaining two transformers.

Full service at the earliest possible moment was essential and as no extra transformers similar to the one that had failed were available for quick service, the next expedient had to be carried out. The rating of the transformer that failed was 2,200-460 volts. The alternative was to install 15,000-460-volt transformers. The Edison company decided at once upon this arrangement, and within fifty-one hours from the first interruption the mills were again operating at full capacity, although they had seemed to be confronted with a reduction of operation to two-thirds normal for an indefinite time.

Convenient Tabular Analysis for Executives

TO FACILITATE comparisons between central stations from the executive standpoint the table printed below is used by the United Electric Light Company, Springfield, Mass. The major financial and physical plant items are reduced to a unit basis after being drawn from the report of the Massachusetts Department of Public Utilities. At Springfield a separate report is made out after the tabulation has been completed, setting forth the reasons why the local company differs in one particular or another from the others. Walter L. Mulligan, treasurer of the United Electric Light Company, furnished the tabulation.

Merchandising Policy Should Fill Load-Curve Valleys

THE degree of certain profit to those who have hazarded their savings in the central-station industry has become largely a matter of load factor, according to A. S. Nichols of the Paducah (Ky.) Electric Company at a recent convention of Stone & Webster commercial managers at Boston, Mass. Good management is required to sell the extra productive capacity of the plant. The market for the product of the central station is almost unlimited, the speaker said, and the saturation point of the average central station is almost indiscernible, so great is its distance. The ills from which the world is suffering can find relief only in increased production, and necessity summons to service that form of energy that requires the least space for its translation and works most efficiently. Because of this the volume of industrial power which a central station obtains depends upon the quality of sales effort which is applied to the growth of the output.

Until recently, Mr. Nichols said, methods of marketing and retailing electric appliances have been crude, and even today they are manifestly inadequate to meet the demand. The industry as a whole has failed to apply the principles of modern business to the sales and distribution of appliances which would popularize the use of its product and build the load where it is most needed. The speaker favored the merchandising of appliances by central stations in the average town on account of the lack of capital and initiative possessed by the electrical contractor, and because the central station is concerned, from the service standpoint, with the quality of appliances connected to its lines. A proper conception of its duty to the public requires that the people be kept informed of improvements in the art and acquainted with the usage of the many labor-saving devices. Efficiency at the power plant avails little if the gain is not realized at the socket.

COMPARISON OF MASSACHUSETTS LIGHTING COMPANIES ON A UNIT BASIS*

	City and Population Served, 1919†											
	Cambridge, 108,822	Boston, 1,165,012	Brockton, 102,942	Fall River, 133,988	Lawrence, 118,914	Lowell, 129,503	Lynn, 114,761	Malden, 134,014	New Bedford, 136,506	Salem, 37,200	Springfield, 116,092	Worcester, 166,019
Capital stock per capita (dollars)	9 20	19 30	14 30	15 70	10 15	9 10	6.75	7.70	12 10	26 90	20.60	9 65
Assets per capita (dollars)	22 00	54 00	33 80	33 10	17 85	23 80	26.60	19.50	42.30	65 60	58.30	26.90
Peak load (thousands of kw.)	7 8	95 7	10 1	12 3	5 4	8 8	5.3	5.2	23.8	12 3	23.2	23
Capacity per capita (kw.)	0 127	0 123	0 226	0 07	0 131	0 10	0.103	0.025	0.478	0 57	0.326	0.263
Kw.-hr. per capita generated and bought	232	266	337	279	88	217	146	123	574	999	514	440
Connected load per capita (kw.)	0 168	0 324	0 218	0 210		0 189	0.164	0.161	0.240	0.45	0.407	0 246
Street-light watts per capita	2 8		2 42	3 9	3 0	4 2	2.96	2.47	3.08	3.6	7.67	5.9
Feet of wire per capita	48 40	59 20	74 00	45 00	55 50	46 40	74.00	64 00	46 50	58.00	77.50	83 00
Feet of street lines per capita	1 2	3 15	2 0	0 9	0 50	0 51	1.54	1 03	0 79	2.42	8 6	3 3
Poles per capita	0.035	0 063	0 13	0 066	0 084	0 06	0 126	0 08	0 09	0 087	0 08	0 089
Underground wires per capita (feet)	5 10	16 70	1 58	12 30	1 55	3 22	11.20	9.00	5 30	15.70	44 70	34.20
Feet street with overhead per capita	3 14	6 23		6 70	7 95	9 0	12 00	10 00	6 30	7 50	5.70	4.47
Boiler capacity per kw. peak (hp.)	0 41	0 45	0 45	0 41	1 74	0 96	0 73	0 48	0 35	0 36	0.48	0 406
Boiler capacity per kw. generator capacity (hp.)	0 27	0 231	0 237	0 349	0 599	0 391	0 427	0.810	0 16	0 25	0 34	0.24
Generator capacity per kw. peak (kw.)	1 53	1 97	1 88	1 24	2 9	1 27	1 70	0 60	2 18	1 46	1.45	1.67
Kw.-hr. generated per kw. generator capacity	2,100	1,600	1,830	2,100	2,950	2,500	1,840	1,300	1,500	2,150	1,170	1,840
Generator capacity, per cent of connected load	0.65	0.50	0 85	0 53		0 46	0 48	0 15	1 55	1 08	0 715	0.94
Sold to other companies, per cent	2.95	2.5	17 0	1 45	0 0		0 0			31 5	14 3	18.7
Bought of other companies, per cent	0 03	1 5	0 0	14 0	0 0		0 0	75 0			14 3	2 8
Coal per kw.-hr. generated (lb.)	2 45	1 96	1 94	2 35	6 65	2.34	.....	3 84	1.957	1 92	2 4	2 46
Fuel cost per kw.-hr. generated (cents)	1 064	0 703	0 881	0 895	2 945	1 14	1.297	1 519	0.710	0 878	0.760	0.777
Assets per kw. capacity (dollars)	200	334	182	290		274	.....	840	....	114	100	116
Capital stock per kw. capacity (dollars)	84	120	78	138	..	104	.....	347	....	58	72	415
Ratio of assets to capital stock per kw. capacity	2 38	1 76	2 34	2 16		2.6	.....	2.4	....	2 42	2.78	2.80
Steam plant cost per kw. (dollars)	51 0	37 7	32.7	50 0	86 0	55.0	41.0	78 0	52.50	26 4	29.8	19.5
Electric plant cost per kw. (dollars)	16 0	44 0	30 6	24 6	18 6	30 0	35.0	53 0	52.50	10 7	20 5	9 30
Operating expense per kw. generated and bought (cents)	3 23	3 03	2 32	1 99	4.25	3 23	4 49	4.02	1 40	1 63	2 07	2.01
Ratio of total assets to total assets and depreciation since 1909, or ten years	0 86	0 93	0 92	0 90	0 999	0 91	0 916	0.89	0.83	0 87	0 87	0.71

* These companies generate part of load by water-wheels. † Includes suburban towns and outlying districts.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Standardization in German Electrical Industry.—A review of the standardization work of the Verein Deutscher Ingenieure was given by Adler at a meeting in Vienna. The standardization program was outlined and progress up to date described. The lecture is reprinted in abbreviated form in *Elektrotechnik und Maschinenbau*, Oct. 3, 1920.

On the Use of Induction Generators.—ZEDERBOHM.—An article containing abstracts from a number of papers dealing with the use of induction generators for utilization of small energy sources. This idea was developed by Steinmetz in an address before the A. I. E. E. in 1919 and excited much interest among German and Austrian engineers. Similar ideas were expressed in a paper by Adler (*Elektrotechnik und Maschinenbau*, 1919, vol. 37, page 221), and the same author in another article (same volume, page 425) discusses the operating conditions when of two interconnected power plants one is provided with synchronous generators and the other with induction generators. In the latter article a chart is presented which shows what the rating of each machine must be for given maximum load and load power factor. Several other papers are referred to, some dealing with practical points in connection with induction-generator operation, others describing American and European induction-generator plants. A number of plants of this kind are said to be in operation in Europe, most of them, however, having a very limited output. Paschen has described (*Elektrotechnische Zeitschrift*, 1907, page 1005-1035) a development at the Binnenkanal, in the Rhine Valley, where a synchronous main station of 3 × 250 kva. is co-operating with two induction-generator plants, each plant having 2 × 250 kva. capacity.—*Elektrotechnische Zeitschrift*, Aug. 26, 1920.

Lamps and Lighting

Distinctive Features of White "Mazda" Lamps.—That the softness of light from this type of lamp results in illumination without glare is maintained. The special white glass used assures permanent coloring, evenness of distribution and low brightness of light source.—*Electrical Review*, Oct. 9, 1920.

Generation, Transmission and Distribution

Design of the New Canadian Niagara Power Project.—A water-power development which will utilize nearly the full drop between Lake Erie and Lake Ontario and require for maximum capacity practically all the flow now permitted Canada under the international agreement is under construction by the Hydro-Electric Power Commission of Ontario and is known as the Queenston-Chippawa hydraulic development. The present scheme contemplates the development of 500,000 hp. and 305-ft. (93-m.) head, using ten 50,000-hp. turbines, five of which have already been ordered. This article gives the fundamentals which govern the design of the hydraulic installation.—*Engineering News-Record*, Oct. 14, 1920.

Electric Propulsion of Ships.—CHARLES RETTIE.—The author deals with the advantages of electric propulsion and makes references to American experience with the electrically driven warship New Mexico.—London *Electrician*, Sept. 3, 1920.

Traction

Methods of Protecting Electrical Equipments.—LYNN G. RILEY.—Adequate protection of the electrical equipment on cars and locomotives is discussed under the following headings: (1) Normal overloads, due to careless operation or incorrect functioning of apparatus; (2) excessive overloads, due to grounded apparatus or cables; (3) momentary interruption of the power supply, due to bouncing of the trolley or to gaps in the third rail, causing current surges and possible flashing of motors; (4) violent surges in the line voltage, due to sudden changes in load, particularly at the end of long transmission lines; (5) grounds occurring between the current collector and the main fuse which are not sufficiently severe to open the substation or feeder breakers; (6) failure to concentrate the normal arcing in that part of the apparatus especially designed for such duty; (7) excessive burning of contacts, with accumulation of gases, resulting from "inching" the car in congested traffic. Methods of meeting these difficulties are given in detail by the author.—*Electric Journal*, October, 1920.

Multiple-Unit Train Operation.—S. B. SCHENCK.—The field of usefulness of multiple-unit control is first discussed, followed by a treatment of the important features of this method in various kinds of service.—*Electric Journal*, October, 1920.

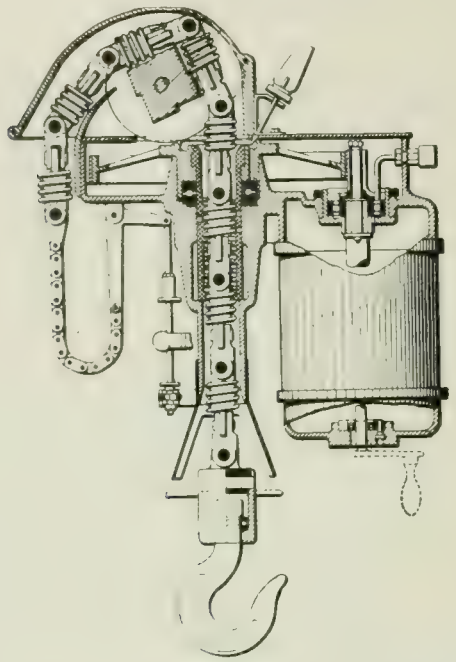
Installations, Systems and Appliances

Electric Arc Welding.—L. MILLER.—A discussion of what goes on in the arc stream and various methods of providing power for the arc.—*Beama*, October, 1920.

Electrical Signaling Method for Guiding Aërial and Marine Craft.—ROBERT H. MARRIOTT.—Inability to guide vessels accurately has resulted in such large losses of life and property that the perfection of a method by which they can be steered with exactness will have immense value. A signal-carrying conductor along the course of a vessel and a means capable of indicating the proximity and direction of the signal conductor are described and discussed, including various forms and combinations. Oceangoing vessels entering harbors are chiefly considered, but the same principle is applicable to other craft and channels, to airships, and so on. Experimental tests of the system are described in detail with numerical data, and suggestions are made as to how it may be further developed and applied.—*Proceedings Institute of Radio Engineers*, October, 1920.

A New Electric Tackle.—The Stahl factories in Stuttgart have on the market a novel type of portable electric

tackle, as shown in the illustration. The tackle chain is made up of short cylindrical threaded pieces interconnected by double joints. These threaded pieces fit into a nut, which may be revolved by an electric motor, or



AN ELECTRIC TACKLE WITH SCREW DRIVE

in an emergency by a crank. The screw is self-locking, so that no extra braking is needed. When the hook reaches its highest and its lowest position the motor is automatically disconnected. The tackle is made in different sizes from 100 kg. (220 lb.) to 5 tons (11,000 lb.) lifting capacity.—*Elektroteknisk Tidskrift* (Norway), Sept. 25, 1920.

Electrophysics and Magnetism

A Tentative Mathematical Theory of Ferro-Magnetism.—Kelen.—It is not the author's intention to present a physically acceptable magnetic theory. Certain analytic expressions for magnetization curves and hysteresis loops are derived, but these are said to be of a formal nature, although they are based upon fundamental physical assumptions, and seem to give a rather good representation of experimental facts. Without entering upon a discussion of the nature of molecular magnets or Ampère currents, the author assumes that some intermolecular systems exist in a ferromagnetic body, which have an orientation governed by the frequency function known from the theory of probability, and on this basis he builds up a set of magnetic equations.—*Elektrotechnik und Maschinenbau*, Oct. 3, 1920.

Units, Measurements and Instruments

A Current Transformer for 10,000 to 40,000 Amp.—Keinajh.—The common type of current transformer can hardly be built for ranges above 1,000 amp. or 1,500 amp. since for higher current values the losses rapidly mount to hundreds of watts. Siemens & Halske now have developed a new type of current transformer, working on the same principles as the Riogowski "magnetic potential meter." The new transformer is made up of a number of sections which are magnetically and electrically series-connected. The primary conductor passes once through the transformer ring. The sections are built in two types, a larger type for 2,000 amp. per section of 220 mm. (8.70 in.) core length, 400 turns and 15 sq.cm. (2.32 sq.in.) iron section with a copper loss of 15 watts, and a smaller type for 1,000 amp. per section of 100 mm. (3.96 in.) core length, 200 turns, and 6 sq.cm. (0.93 sq.in.) iron section, with 4.8 watts copper loss per section. A 40,000-amp. transformer has twenty sections of the bigger type, corresponding to a 4.40-m. (173-in.) path for the magnetic flux. The limiting capacity of this type of section is estimated to 80,000 amp. A 20,000-amp. transformer with twenty smaller sections in series showed an error of 0.3 to 0.5 per cent from one-fifth to full load, and the corresponding phase deviation was from —3 min. to +7 min. The accuracy was found to be very little affected by unsymmetry in the arrangement of the primary conductor. The new current transformer is used in connection with electric furnaces for direct measurement of the input current.—*Elektrotechnische Zeitschrift*, Oct. 7, 1920.

Color and Special Composition of Certain High-Intensity Searchlight Arcs.—Irwin G. Priest, W. F. Meggers, K. S. Gibson, E. P. T. Tyndall and H. J. McNicholas.—Quantitative data on the color and spectral distribution of energy of some modern searchlight arcs, together with spectroscopic analysis of the carbons, are given in this paper as well as the methods of measurements.—*Technologic Paper 168, U. S. Bureau of Standards*, Aug. 12, 1920.

Telegraphy, Telephony and Signals

Electrostatically Coupled Circuits.—Louis Cohen.—The expressions for the secondary frequencies, secondary current and secondary resonance current of electrostatically coupled circuits are derived theoretically. The system is shown to be practically monofrequent even for fairly close coupling between primary and secondary circuits. The results obtained are compared with the corresponding expressions for inductive coupling. In a practical numerical example it is found that the secondary resonance currents in the two cases are of the same order of magnitude but that the electrostatic coupling yields superior sharpness of resonance.—*Proceedings Institute of Radio Engineers*, October, 1920.

Miscellaneous

Better Fuel Economy by Utilizing Exhaust Steam.—Gercke.—A combination of steam heating and steam-driven prime movers always is highly economical, the author says. This is so (1) because the high-pressure steam may be produced with relatively small additional fuel consumption and is much more important in producing useful energy than low-pressure steam, and (2) because exhaust steam even in high-efficiency plants contains from four to seven times as much energy in the form of heat as it contains mechanically utilizable energy. It is therefore better to use a high-pressure turbine, utilizing the exhaust steam for useful heating instead of conducting it to a condenser. In following up this idea the author describes a number of turbine designs and other equipment for combinations of this kind. He also discusses the use of steam accumulators as equalizers interposed between the high-pressure turbine and the low-pressure steam consumer, and finally states certain rules which apply to a desirable future development toward better fuel economy in large steam generating plants.—*Sparsame Wärmewirtschaft*, No. 2 I, 1920; abstracted in *Elektrotechnik und Maschinenbau*, Sept. 26, 1920.

Scientific and Industrial Research

(PRINTED IN THE THIRD ISSUE OF EACH MONTH)

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available, and Suggestions for Co-operative Work.

Conducted by PROF. VLADIMIR KARAPETOFF
Cornell University, Ithaca, N. Y.

Research in Progress and Completed

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

BEARING MATERIAL, SELF-LUBRICATING.

A new self-lubricating bearing material has been developed for use where lubrication from outside sources is difficult, uncertain or objectionable. The material is a synthetic bronze with finely divided graphite incorporated intimately in the body of the material. It may be run hot without binding or rapid deterioration and may be used in an ordinary lubricated bearing or without lubrication on light service. *Research Laboratories of the General Electric Company, Schenectady, N. Y.*

CELL, PHOTO-ELECTRIC, THALOFIDE.

A new photo-electric cell has been developed which is composed of thallium, oxygen and sulphur. This cell shows maximum sensitiveness to light at about 10,000 Angstrom units of wave length and is much more sensitive than the familiar selenium cell. Some of the best cells lower their dark resistance by 50 per cent when the intensity of illumination is 0.06 foot-candle and when the source is a tungsten filament. The cell is valuable in the measurement of stellar radiation and in other light measurements. It has been used in experiments in light telephony over a distance of about 6 miles (10 km.). In order to transform sound waves into light waves, a special talking jet was constructed which consisted of a small central jet for acetylene and two opposing, slightly elevated oxygen jets which converged on the central acetylene jet. The acetylene is lighted and a flame about 3 in. (7.6 cm.) high secured, then the oxygen jets are turned on. This reduces the acetylene flame to an intense bead of light which is placed in the focus of a sending mirror. In the acetylene line there is a gas chamber with one side made of stretched skin diaphragm which may be made to vibrate and fluctuate the acetylene flame by the sound waves of the voice. At the receiving end a concentrator and a two-step vacuum amplifier are used with the photo-electric cell. *J. W. Case, Auburn, N. Y.*

METER, ELECTROLYTIC, AMPERE-HOUR, DIRECT-CURRENT.

A simple and inexpensive device has been developed which will automatically open a direct-current lighting circuit and terminate service to a consumer as soon as he has completely used a specified amount of energy for which he has paid in advance. A solid cylinder of copper which serves as the anode in a copper-sulphate solution is placed in the main circuit, and the electrolytic cell itself is shunted across a low resistance in the main circuit similar to an ammeter shunt. The cathode is a copper can which holds the solution. A small part of the total current flows through the cell and gradually consumes the copper anode. The ratio between the shunt current and the weight of the anode is such that the anode is completely consumed when a specified amount of electricity has been used by the consumer. The final disappearance of the anode opens the main circuit and forces the main current through the solution. The resistance of the solution being high, enough heat is developed to melt 60-deg. solder. Another copper cylinder is placed just above the copper anode in the device and held in the main circuit by a 60-deg. soldered connection. When this solder is melted the cylinder falls and completely opens the main circuit. This instrument is designed to replace expensive meters for a small consumption of electricity, as in residences, apartments and single rooms. Since the energy must be paid for in advance, it does away with the necessity of monthly meter readings, computations, and bill collecting. It will not cost so much to manufacture and install as other types of meters, nor will it consume as much energy as ordinary meters. Thus it will reduce expenses of the power supply company and enable it to get returns from small consumers now classed as unprofitable. *E. O. Schweitzer, Chicago, Ill.*

METER, ELECTROLYTIC AMPERE-HOUR, ALTERNATING-CURRENT.

Referring to my electrolytic direct-current meter, described on this page, experiments are in progress on a meter similar in principle for use in alternating-current circuits. Where the power factor of the load is practically equal to unity an ampere-hour meter may be permissible for small consumers. In this instrument a graphite cylinder with hard-rubber caps replaces the copper container for the copper sulphate in the direct-current meter; otherwise the design is practically the same. Extensive experiments show that the copper anode is positively reduced under the action of the alternating current and that this reduction in weight is a function of the ampere-hours that passed through the circuit. As in the direct-current meter, this instrument is intended to make the use of energy by small consumers profitable to the operating company and less expensive to the consumer.—*E. O. Schweitzer, Chicago, Ill.*

PORCELAIN, POROSITY TEST OF.

In the production of insulators a method has been developed that is very valuable in production control testing. A solution of fuchsine dye in wood alcohol is used and unglazed pieces are placed in it under pressure. The slightest degree of porosity of the open-pore type is indicated by a deep penetration of the dye into the body of the test piece. It is so penetrating that the microscope has shown it forced into the cleavage cracks of minute quartz crystals. If test pieces of the same shape and volume as the insulators being fired are properly distributed in the kiln, the fuchsine test on these pieces will furnish a very reliable indication of the condition of neighboring pieces as to porosity. *W. D. L. Porcelain Heat Control Committee, A. I. E. E. Journal, 1920, p. 1114.*

WAVE FORM, DETERMINATION OF.

Attention is called to the considerable [illegible] of the Rosa Curve Tracer in plotting the wave form of current and voltage. The instrument is semi-automatic and is capable of giving results of high precision. Frequencies as high as 3,000 can be recorded easily and accurately. Recently we had occasion to determine the damped discharge current from the secondary of an induction coil, the circuit having a double natural frequency. This was accurately done. The Rosa curve tracer should prove valuable in recording many electrical phenomena that can be made recurring, such as the behavior of automobile ignition systems etc. *Leeds & Northrup Company, Philadelphia, Pa.*

Suggestions for Research

LAMP, FLASHING, FOR DANGER SIGNALS.

It is desired to develop for use at points of danger an automatic flashing lamp, which will not require an expensive flashing arrangement, such as electric switches in power stations which must not be closed or opened without proper precautions. Such a flashing light will receive more attention from the person whom it is intended to warn than an ordinary red light. The thermostat method of flashing which is the simplest now available is too flimsy for continued use.—*Editorial Suggestion.*

METERS, WATT-HOUR, EFFECT OF WAVE FORM ON.

No serious error in the indication of an induction-type watt-hour meter is introduced, owing to an irregular form of the current, but if the current wave is unsymmetrical with respect to the zero line—i.e., has even harmonics—considerable error may occur. One case in which the latter condition may take place is that of the current between the electrodes of an electric furnace due to considerable rectification in the arc. A further study of this subject is recommended. *N. E. L. A. Committee on Meters.*

ROTARY CONVERTER, FLASH GUARDS FOR.

Flash guards or barriers have been experimented on which consisted of two continuous end rings, one at the back of the commutator, next to the commutator necks, and one at the front of the commutator, with barriers between the arms extending down to within approximately 0.8 mm. of the commutator. These guards were made of asbestos lumber, a composition of asbestos and asphalt. These tests have been described in the *A. I. E. E. Journal*, April, 1920, page 355. Considerable trouble was experienced on account of the carbonization of the material of the flash guards by the electric arc. No suitable material for the purpose which will not carbonize has been found so far, and further research on the shape, position and material of flash guards would be very useful. *Marion W. Smith, Pittsburgh, Pa.*

TELEPHONY, SUBMARINE, WITH HIGH-FREQUENCY CARRIER WAVES.

The most promising hope of improving the line construction for ocean cables is believed to be to abandon the present method of design and construction and to start with the simple case of bare wires in water, using high-frequency currents and studying the necessary changes to produce optimum transmission. The use of a high-frequency "carrier" has the inherent advantage that the distortion phenomena accompanying present methods of long-distance transmission are eliminated, and we are principally concerned with the problem of reducing attenuation. The most suitable voltage may be employed and present multiplex methods may be utilized. The electron tube is available for both the generation and the reception of the waves. *G. O. Squier, War Department, Washington, D. C.*

TRANSFORMERS, POTENTIAL, ERRORS IN.

Voltage transformers for high voltages should be smaller and less expensive and means for obviating or allowing for electrostatic effects on ratio and phase angle should be found.—*H. B. Brooks, Bureau of Standards, Washington, D. C.*

VECTOR ANALYSIS, APPLICATION OF, TO ALTERNATING CURRENTS.

In the usual vector diagrams of alternating-current machinery and circuits use is made only of addition and subtraction of vectors, the other relationships, especially the equations of loci, being derived from similar triangles and other such elementary and tedious means. It may be of advantage to apply the concepts of scalar and vector product and other methods of vector analysis to these problems, in order to simplify certain deductions and to obtain results in a shorter form. The circle-diagram of the induction motor offers a fruitful field, to be followed by a similar study of alternating-current commutator [illegible] *Journal of Mathematics.*

TRANSFORMERS, RESISTANCE OF WINDINGS.

Reliable theoretical and practical information is desired on the resistance of transformer windings to alternating currents of standard frequencies, taking into account an unequal distribution of the current through the cross-section of the conductor. Some work has been done on parallel wires, busbars, solenoids, etc., but none of it seems to [illegible] with an iron core.—*Montreal Meeting, Committee [illegible]*

SPEAKING before the meeting of state commissioners at Washington, members of the Interstate Commerce Commission defended their action on coal supply for utilities, asserting that the priority privilege had been abused. The representative of the National Committee on Gas and Electric Service declared, on the other hand, that the service order now in force had never functioned and was dormant.

DECLARING that prices for bituminous coal at the mines are steadily declining owing to increased output, the National Coal Association maintains that there is no reason for consumers to pay unreasonable prices and also that there are no immediate shortages reported anywhere in the country.

AN OFFER at par of between $27,000,000 and $28,000,000 new stock to supply working capital is to be made by the General Electric Company to its stockholders.

OPPOSITION to government ownership of utilities and a general belief that rates must be increased were clearly evidenced at the Washington meeting of the National Association of Railway and Utility Commissioners.

A CENTRAL radio station under construction near Port Jefferson, L. I., described by Dr. E. F. W. Alexanderson before electrical men, follows closely the design of central stations for light and power purposes, it having been established that the principles of alternating-current-power technique can be applied almost without change to radio transmission.

A PERMANENT injunction against the enforcement by the Missouri Public Service Commission of street-railway fares predicated on a valuation of the property of the St. Joseph Light & Power Company which was based on the "original-cost" method has been issued by a United States district judge in Kansas City. Unless this decision is upset by the United States Supreme Court, it will revolutionize the rate-fixing practice of the commission.

PHOTOGRAPHS can, it is asserted, be reproduced by wire at any distance by the process of Edouard Belin of Paris, who has just conducted a successful demonstration of his invention, sending pictures between New York and St. Louis.

ELECTRICAL production in Moscow has fallen to 8,000,000 kw.-hr. a month and in Petrograd to 6,800,000 kw.-hr. a month under the nationalization policy of the soviet government.

DULLNESS in the general supply lines continues in most parts of the country, although a slight improvement is reported in New York and the district served by it. Christmas activity, however, is beginning in all sections. Stocks are being built up in anticipation of a good spring demand. Labor conditions are easier. Railroad and other lay-offs are thought likely to exert an influence toward increased individual output in manufacturing plants.

News in Brief

Summary of Market Conditions and of Recent and Approaching Happenings of Importance to the Industry

A POWER plant to cost about $20,000,000 and with a rating of 120,000 kw. is under consideration by the Northern Ohio Traction & Light Company, to be erected on a site near Coshocton.

AN ELECTRICAL co-operative league for Utah, Idaho and parts of Wyoming and Nevada has been organized at Salt Lake City.

AUTHORIZATION of the purchase by the Pennsylvania-Ohio Power & Light Company of part of the properties of the Pennsylvania-Ohio Electric Company of Youngstown has been given, with the object of segregating subsidiary railway companies from subsidiary power and light companies.

NEGOTIATIONS for the purchase of the four subsidiary companies of the Toronto Power Company by the Ontario Hydro-Electric Power Commission are under way.

AN AGREEMENT to supply the Ontario Hydro-Electric Power Commission with an additional 15,000 hp. has been made by the Toronto & Niagara Power Company, the price to be fixed by a prominent Canadian engineer.

AWARD of a distinguished-service medal to Thomas A. Edison by the Navy Department is announced, the award being for his services as president of the Naval Consulting Board during the war.

A CROSS-INDEX of the electrical fire and safety codes is to be prepared by the Bureau of Standards with the view of aiding in the discussions on consolidation of the two sets of rules.

READJUSTMENT of rates was declared essential in the interest of the public itself by the president of the Southeastern Section, N. E. L. A., at its Miami convention, which opened on Wednesday.

AN ANALYSIS of jobbers' costs prepared by a committee of the Electrical Supply Jobbers' Association was a feature of its Cleveland convention.

A TENTATIVE draft of a uniform accounting system for electric and gas companies was adopted by the Washington convention of public utility commissioners.

A CELEBRATION of the centenary of Ampère's first contributions to electromagnetism is to be held at the Crocker-Wheeler Company's works at Ampere, N. J., on Dec. 4.

AN EMPHATIC assertion that there had been no profiteering in the public utility business in California was made by Commissioner Edgerton in a speech before the League of California Municipalities, in which he dwelt on the vast importance of utility development to the state.

GOVERNOR-ELECT PARKHURST of Maine has declared for private ownership of the water powers of that state under strict public regulation. He opposes exportation of Maine power to other states.

LIGHTNING protection methods were discussed by the A. I. E. E. at a joint meeting with the Western Society of Engineers at Chicago last week, much interesting information being brought out.

THE MARKET for flexible armored cable is reported to be glutted, although it is only two or three months since an acute shortage was reported. The lifting of embargoes and the slump in building are among the chief causes assigned for the change.

AN EFFORT to standardize service voltage at 110, 115 and 120 volts is being made by lamp manufacturers, who hope thus to reduce the list of stock items and the consequent heavy inventories.

UNCERTAINTY prevails concerning the prospects for electric heater sales during the coming winter, fuel shortage weighing in their favor and mild weather thus far combining with tight money to operate adversely.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

G. E. Company Offers $27,000,000 New Stock to Supply Working Capital

DIRECTORS of the General Electric Company have voted to offer between $27,000,000 and $28,000,000 new stock for subscription at par in the ratio of one new share for each five outstanding on Dec. 8. The purpose of the issue is to supply new working capital. The company announces that this is only the second time since 1912 that it has called on its stockholders to supply new capital. It is needed now to finance the heavy growth in the company's business. It is expected that sales billed for the company for the year 1920 will approximate $270,000,000, approximately $40,000,000 ahead of the record of last year.

Northern Ohio May Build 120,000-Kw. Plant to Satisfy Industrial Demand

THE Northern Ohio Traction & Light Company contemplates building a power plant costing $18,000,000 to $20,000,000 to supply the demand for industrial power in northern Ohio. Construction of the plant, however, is held up for the present because certain industries in Akron are undergoing important readjustments, and until these are completed the Northern Ohio Traction & Light Company will not have signed up all the contracts necessary for the starting of this construction. An option has been obtained upon a site for the plant, which, according to present plans, will have an initial capacity of 120,000 kw. and form part of a loop of power plants serving northern Ohio industries. The site of the plant is on the Muskingum River, near Coshocton, Ohio, and was selected because of the proximity of coal and water supplies.

Coal Association Asserts that Soft-Coal Prices Are Steadily Declining

ACCORDING to an official statement of the National Coal Association, there has been a decline of from 25 to 50 per cent in the price that prevailed for bituminous coal at the mines six or seven weeks ago. This tendency is said to persist in all parts of the country and to be due to increased output, which in the last two months has averaged 12,000,000 tons a week, enabling operators to make up deficiencies in immediate supply and to start the country well on the way toward storing coal for winter's use. "No longer are there any immediate shortages reported anywhere through the country," the association's spokesman says. "Great manufacturing plants in dire need of soft coal early in the fall now have an ample supply on hand. Public utilities everywhere have had their immediate wants filled, while many of them have been able to provide themselves with stocks for the winter. With adequate railroad transportation, which the railroad officials promise, so that the bituminous output may be maintained at approximately 12,000,000 tons a week, prices in coal at the mines will undergo a further decline until the bottom is reached. The fact is," the statement continues, "that there is no occasion for coal consumers at this time to be paying unreasonable prices for soft coal."

Utilities Abused Coal-Car Priority Privilege, Says I. C. C.

CHAIRMAN CLARK and Commissioner Aitchison of the Interstate Commerce Commission, in defending before the meeting of state utility commissioners in Washington last week the change from general to emergency coal priorities for utilities, made the statement that it had been brought about largely on account of the abuse of the assigned-car privilege. Commissioner Aitchison said that this privilege had been granted for obtaining contract coal for current use, but that many utilities not only tried to pile up reserves through the exercise of this privilege but even went to the extent of reassigning shipments to their advantage. He said that data presented to the commission proved that in three districts alone the coal ordered by consigned cars was equal to the total average consumption of all the utilities in the United States.

Typical cases, involving the filling of approximately one-third of the public utility coal requirements, show that order No. 21 of the I. C. C. is not effective in securing coal delivery, declared George W. Elliott, secretary of the National Committee on Gas and Electric Service, who denied that the utilities wished to have order No. 21 used to enforce contract coal delivery. They simply wished to make possible delivery of contract coal which mine operators are ready and willing to supply if cars are available. The committee, Mr. Elliott stated, has declined to ask for assigned cars for movement of spot coal unless this coal has actually been purchased. The I. C. C. has been notified of approximately fifty plain cases of emergency, according to Mr. Elliott, but has declined to regard any of them as sufficiently important to invoke the assigned-car privileges of order No. 21. Therefore, he said, this order "never did function and is dormant."

Edison Gets Distinguished-Service Medal

THE only civilian to be awarded a distinguished-service medal by the Navy Department, it has just been announced, was Thomas A. Edison, who was president of the Naval Consulting Board during the war. The citation in the case of Mr. Edison, made public by Secretary Daniels, is as follows:

"For exceptionally meritorious and distinguished service in a position of great responsibility as president of the Naval Consulting Board."

W. D'A. Ryan Talks on Achievements in Lighting

W. D'A. RYAN, director of the illuminating engineering laboratory of the General Electric Company, gave a most entertaining illustrated lecture Tuesday evening at the Mohawk Country Club, Schenectady, on the development of artificial lighting from centuries before Christ to the present time. Mr. Ryan said that a mistaken impression prevails that incandescent lamps are supplanting arc lamps for street lighting. He declared that only the older types of arc lamps are being displaced and that luminous-arc lamps have many advantages that make them far from a dead issue. Incandescent lamps and arc lamps each have their place. Elaborate street-lighting installations are costing $75,000 to $100,000 a mile, while smaller and less pretentious ones are costing about $40,000 a mile.

Touching on searchlamp development, Mr. Ryan called attention to the fact that the efficiencies of navy-type searchlamps and small army searchlamps have been increased to almost 90 per cent, and the beam candlepower increased by 450 per cent, through the modification of mirror curvature, mirror support and electrode operation.

Co-operative Idea Spreads to Mountain States

FOR the purpose of conducting an educational campaign to encourage co-operation between the several branches of the electrical industry, to further the practice of ethical business methods and to give the consumer better value for the money he spends for electrical service, the Rocky Mountain Electrical Co-operative League has been organized at Salt Lake City, Utah. The activities of the league will extend to Utah and Idaho and that portion of Wyoming and Nevada served by Salt Lake City as a distributing center.

An advisory committee, which will be the governing body, has been appointed, consisting of representatives of the manufacturer, the jobber, the contractor-dealer and the central station, the four branches of the electrical industry. J. A. Kahn, vice-president and general manager Capital Electric Company, is chairman. TThe campaign will be conducted along somewhat similar lines to those followed by the California Co-operative Campaign.

Missouri Commission Enjoined from Enforcing Rate Based on Original Cost

A DECISION was handed down by Judge Arba Van Valkenburgh of the United States District Court in Kansas City, Mo., on Nov. 12 which, if upheld by the United States Supreme Court, will revolutionize the policy of the Missouri Public Service Commission in rate making for public utilities. The decision was rendered in the case of the St. Joseph Light & Power Company, which sought to enjoin the Public Service Commission from enforcing a 7-cent street-car fare on the ground that the commission's valuation of its property on an original-cost basis was in violation of the Fourteenth Amendment of the Constitution.

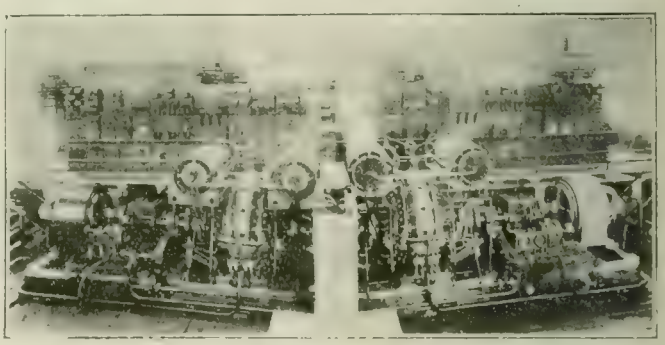
The commission valued the property at $5,784,883.07. The valuation was based on an original-cost plan using the average cost of labor and materials during the five-year period immediately preceding the war. The company contended that the valuation should have been $11,521,639, based on the present cost of labor and materials. The items in the valuation of the company and of the commission were identical, and the only issue involved was the proper formula for fixing the rate-making valuation. The 7-cent fare order of the commission was based on its valuation. The company asked for an injunction on the ground that the commission's order would not yield a return on the true valuation and therefore was confiscatory.

Judge Van Valkenburgh in permanently enjoining the commission from enforcing its order attacked the formula of the commission, pointing out that with the present price of money and expense of doing business it is more expensive to operate a public utility and the inherent hazards of the business are much greater than was formerly the case.

The commission has appealed the case to the United States Supreme Court.

Central Station for Radio Power Supply

THE fact that the well-established principles of alternating-current-power technique had been applied to radio transmission almost without change was affirmed by Dr. E. F. W. Alexanderson, chief engineer of the Radio Corporation of America and consulting engineer of the General Electric Company, in addressing a joint meeting of the Institute of Radio Engineers and the New York Electrical Society on Nov. 10. He showed that the New York central radio station being



CENTRAL RADIO STATION ON LONG ISLAND FOLLOWS POWER-STATION DESIGN CLOSELY

constructed near Port Jefferson, Long Island, follows very closely the design of central stations for light and power purposes, from the Alexanderson high-frequency alternators to the conventional switchboard for their control. The general plan for the station was given in the ELECTRICAL WORLD of July 17, page 143.

Following the paper there was a lively discussion, led by J. V. L. Hogan and W. N. Dickinson, who presided jointly for the two societies. The members showed particular interest in the multiple antenna scheme, credit for which is given to Dr. Alexanderson, and in the nature of the waves transmitted by powerful radio stations which are said to have already encompassed the earth.

The Liebman memorial prize, consisting of the annual income from $10,000, was awarded to Roy A. Weagant, chief engineer of the Marconi Telegraph Company, for the work he has done toward the elimination of static disturbances in radio communication. A report of his work may be found in the ELECTRICAL WORLD, March 15, 1919, page 539.

Memorial Exercises for the Late Dr. Samuel Sheldon

APPROPRIATE memorial exercises for Dr. Samuel Sheldon, noted educator, engineer and author, who died at Middlebury, Vt., Sept. 5, were held at the Engineering Societies Building, New York City, on Nov. 17. High tribute to Dr. Sheldon as a man and to his accomplishments in the electrical art was paid by the following speakers who had been his intimate friends and professional associates: Arthur W. Berresford, Dr. Arthur E. Kennelly, William N. Dickinson, Dr. William H. Nichols, T. Commerford Martin and Dr. C. O. Mailloux.

At the conclusion of the exercises, in response to the numerous suggestions that had been received, Mr. Martin, chairman of the Sheldon memorial committee, consented to continue the committee with the view of determining a suitable way in which to perpetuate the memory of Dr. Sheldon.

Sending Photographs 1,000 Miles by Wire

PHOTOGRAPHS were sent between New York and St. Louis, Mo., by electric wire in a recent demonstration of the "tellestereograph" made by its inventor, Edouard Belin of Paris. The transmission is accomplished by revolving a cylinder holding a bas-relief photograph against a stylus connected to a microphone. The microphone current varies according to the height of any point on the bas relief. At the receiving end this current actuates a mirror galvanometer, which reflects light from a lamp through a small screen which varies from transparency at one end to opacity at the other. The varying beam of light is caught by lenses and focused on one spot on a second revolving cylinder holding sensitized paper. This cylinder is kept synchronized with the sending cylinder. The photograph is received as a long spiral as the cylinder revolves and moves slowly lengthwise.

Draft of Uniform Accounting System for Utilities Approved

A TENTATIVE draft of a uniform system of accounts for electrical corporations has received approval in fundamental outlines from the National Electric Light Association. The draft was proposed by the committee on statistics and accounts of public utilities, National Association of Railway and Utilities Commissioners, and at a meeting held in Washington on Nov. 9 was approved in its main issues by the sub-committee of this national association, the committee of the N. E. L. A. and the American Gas Association. It will now be submitted to each state regulatory commission for adoption.

It has long been felt that a uniform classification of accounts was absolutely necessary for the proper conduct of the electrical industry throughout the country. Companies operating properties in more than one state found difficulties because of the differences in accounting systems required by the several commissions under which those properties were regulated. Since October, 1919, the three associations mentioned above have been working together on a scheme of accounting for gas and electric utilities—a scheme, it is hoped, simple enough and clear enough to meet the needs of both utilities and commissions. The plan still contains, however, some notes which in themselves are regulatory provisions, but which are inserted to permit of adoption by states whose regulations contain certain points not found in the regulations of other states.

Electrical Manufacturers' Council Confers with A. E. S. Committee on Dual Code

FOR the purpose of bringing up differences of opinion and clarifying points at issue in connection with the possible combination of the fire and safety codes, the Electrical Manufacturers' Council met with the electrical committee of the National Fire Protection Association and representatives of the Bureau of Standards at New York on Nov. 12. Arguments were presented both for and against the code, and it was finally decided that the Bureau of Standards would prepare a cross-index of the two codes to show how similar subjects were dealt with in the two sets of rules. This index will be studied at a future conference to bring out more clearly the practicability of the proposed combination and how such a dual code could be made or arranged.

The electrical committee of the National Fire Protection Association and the Bureau of Standards are representing the American Engineering Standards Committee in a study of this proposal. Dana Pierce, chairman of the electrical committee of the N. F. P. A., presided at the conference.

Rate Readjustment Is Essential, Declares President of Southeastern N. E. L. A.

PRESIDENT P. R. TILLERY in his address at the eighth annual convention of the Southeastern Section of the National Electric Light Association, held at Miami, Fla., Nov. 16 to 19, after reviewing the growth of the electrical industry since its beginning, dwelt on present-day economic conditions. He said that in the Southeast many electrical companies have scarcely a kilowatt of power for sale and no plants under construction. Utilities have fallen more than two years behind in their construction program. Thousands of horsepower in available industrial business which would have meant much to the industry has been turned away, but the loss means far more to the communities served than to the companies themselves, and it is an irretrievable loss. The remedy, Mr. Tillery continued, is in a readjustment of rates to meet prevailing costs of service, including a fair return on the property used in that service. "When we have convinced the public and their representatives," he said, "that regardless of our best efforts we cannot provide service at less than cost, and that such a requirement is now being made of us, then perhaps there will be a move for relief to the utilities in present service and to provide for the future."

In an able address on the regulation of public utilities, A. J. Maxwell of the North Carolina Corporation Commission outlined the basis of tax valuations which was made a law at the last election and which distributes the taxes on all property on an equitable present-value basis. In the relations between utilities and the regulating commissions he urged a co-operation that would take into consideration the viewpoint of the commission and that of the public. When executing a decision or

ruling he urged that the same details that are given to the commission should be given to the public, rather than to convey the impression simply that an order of the commission was being carried out. Courtesy in the handling of complaints Mr. Maxwell also considered most essential to good public relations.

J. J. Gibson, manager of the supply department of the Westinghouse Electric & Manufacturing Company, in a paper entitled "The Industry We Are In," gave a comprehensive survey of the growth of the electrical industry accompanied by figures comparing it with other large industries. He estimated that the sales of all equipment and supplies for the past year would be around $2,850,000,000, made up as follows: Generating apparatus, $150,000,000; distribution apparatus, $150,000,000; transportation, $200,000,000; industrial apparatus, $350,000,000, and all electrical devices, supplies and accessories, $2,000,000,000 more.

The report of the merchandising committee, presented by G. B. Buck of the Durham Traction Company as chairman, covered the following topics: Purchasing stocks, cost-accounting records, merchandising, sales, financing, advertising, co-operation, public relations and general conditions. This report contains recommendations which the incoming merchandising committee will study in detail and report on at the next annual meeting. The committee has found that most Southern companies have allowed terms of from six to twelve months on appliances and that the majority require only one-quarter cash payment. About $1,200 is the average amount spent for advertising, and this has been found to produce good results in the average Southern town. Better co-operation between all branches of the industry in the Southeast now exists than ever before.

One of the most interesting and profitable sessions of the Miami convention was that devoted to a discussion of public utility rates in a comprehensive paper by L. R. Nash, of Stone & Webster. The subject was reviewed from a broad economic standpoint, supplemented by findings of commissions and courts. The discussion brought out the need for a more thorough understanding of reserves for depreciation and betterments on the part of utilities, the commissions and the public. President Tillery emphasized the need of maintaining operating efficiencies at a high figure and the setting up of a reserve for depreciation such that replacements can be made as needed and an adequate rate of return paid on the capital invested at the same time.

An engineering session took up plant operation, and a general session dealt with accounting and other subjects. At the technical session three papers were presented—one on steam-plant operation by C. A. Greenidge, chief engineer J. G. White Management Corporation; another on automatic substations and generating stations by T. F. Barton, General Electric Company, and a third on design and construction of distribution systems by T. H. Rice of the H. L. Doherty Company.

At the general session a paper on accounting was presented by F. B. Culley, assistant treasurer Augusta-Aiken Railway & Electric Company; another on safety work by W. R. Lloyd, manager casualty department Alabama Car Company, and a third on labor and employment methods by J. T. Trazzare, manager employment and public relations Georgia Railway & Power Company.

M. H. Aylesworth, on behalf of the National Electric Light Association, explained in detail the publicity plans of the national body in matters of public policy and financing and pointed out how this work can be applied locally by members of the different sections. W. L. Goodwin of the General Electric Company, the well-known advocate of better organization within the industry, and S. A. Chase of the Westinghouse company gave interesting talks on co-operation and showed what has already been accomplished together with the practical benefits to all branches of the industry in the establishing of economic methods for the merchandising of electrical goods.

In an executive session the Southeastern Section adopted changes in the constitution to make its membership groups correspond with those of the national body and to extend the same office-holding and voting privileges to manufacturers and contractor-dealers that have been established by the national association.

The convention was still in session when the Electrical World went to press. The results of election of officers and other details will be published next week.

Analysis of Jobbers' Costs Feature of Cleveland Convention

DETAILED cost figures showing the expense of handling each of twelve principal lines of goods distributed by electrical jobbers were presented before the Cleveland convention of the Electrical Supply Jobbers' Association at its opening session on Wednesday morning by H. F. Thomas of St. Paul, Minn., chairman of the committee on costs. The figures were based upon an analysis of the business during one month (April, 1920) of four representative jobbing houses in different parts of the country. The four houses studied did together $1,400,000 of sales business during that month, with a total expense of $162,000, indicating the average ratio of total expense to total sales to be about 11.6 per cent. The twelve lines reported on constituted about one-half of the total sales.

Percentages of total cost to total sales for each of the twelve lines reported were: Schedule material, 17.07; rubber-covered wire and lamp cord, 7.67; rigid conduit elbows and bushings, 12.25; porcelain knobs, cleats and tubes, 27.15; weatherproof wire, 4.93; condulets and similar fittings, 24.93; flashlamps and flashlamp batteries, 28.71; house goods, bells, pushes, 37.93; dry batteries, 16.33; heating devices, 16.44; commercial lighting fixtures, 19.48; pole-line hardware, poles, insulators, 19.79. In computing the figures neither interest on investment nor income or excess profits tax was included. The ratios of the separate elements of cost making up the total expense for each line were also analyzed, and figures were shown giving the percentages of financial expense (accounting, billing, collection and credit expense), warehouse expense and sales expense for each line studied.

Hearty appreciation of the scientific cost studies made by Mr. Thomas' committee was evident on the part of the jobbers present, and an additional fund of $10,000 was voted the committee to extend the studies to cover all lines handled by six different jobbing houses, the study to extend over six months.

At the Wednesday afternoon session reports of committee chairmen were heard. Approval was voiced of the plan to adopt the triple-standard basis of 110, 115 and 120 volts and of the tendency by manufacturers to adopt net prices in place of discount schedules.

Governor-Elect of Maine Favors Private Development of Water Power



FREDERIC H. PARKHURST
Governor-Elect of Maine

DECLARING that water power is the greatest natural competitive asset of Maine, Governor-elect Frederic H. Parkhurst told a representative of the ELECTRICAL WORLD last week that he favors the policy of private ownership and operation under strict public regulation. He advocates the private development of water-power resources, whether in the form of storage reservoirs or other hydraulic and electric facilities. The incoming Governor believes that in the industrial growth of Maine the water power of the State constitutes an asset comparable to the coal deposits of Pennsylvania and the trunk-line location of Massachusetts. Mr. Parkhurst has given much thought to the problem of attracting industries to the state and has become more and more impressed with the economic value of hydro-electric power, especially to industries like pulp and paper manufacturing, which employ a relatively small number of persons per unit of power required. The Governor-elect stands firmly upon the platform of Maine water power for Maine industries and is not in favor of its exportation to other states.

Power Shortage Situation in Ontario Relieved

AFTER two weeks of negotiation between the Ontario government, the Hydro-Electric Power Commission and the Toronto & Niagara Power Company the Toronto company agreed to supply to the Ontario Hydro-Electric Commission 15,000 additional horsepower which it is able to develop at the plant of the Electrical Development Company at Niagara Falls. The power was turned on and furnished to the commission on Sunday night, Nov. 14. The price is left to the determination of a single arbitrator, Brig.-Gen. C. H. Mitchell, a well-known engineer of Toronto.

Chief Engineer F. A. Gaby of the commission stated that the distribution of the additional power would be made with a view to giving the greatest measure of relief to those municipalities where the power situation is most acute.

Crocker-Wheeler Company to Hold Celebration of Ampère Centenary

THE one hundredth anniversary of the first great contributions made by André Marie Ampère to the development of electromagnetism, of which science he has been called the father, is to be celebrated at Ampere, N. J., on Dec. 4 by the Crocker-Wheeler Company, and invitations will be sent to leading electrical scientists, inventors and engineers to be present. A special train will leave Hoboken, N. J., at 2:30 p.m., by the Delaware, Lackawanna & Western Railroad to carry the guests. Dr. Schuyler S. Wheeler, president of the company, will make a speech of welcome, with special reference to the expected presence of Ambassador Jules J. Jusserand and other official and non-official compatriots of Ampère. Ambassador Jusserand will peak on "Ampère—a Great Frenchman"; Dr. M. I. Pupin will dwell on the appreciation felt for "Ampère, the man and the genius," in technological circles everywhere, and particularly in America, and Dr. C. O. Mailloux will deal with the fundamental principles given to the world by Ampère, upon which are based millions of useful devices in service in all civilized countries.

Utilities Commissioners Oppose Government Ownership, Favor Higher Rates

THAT utilities commissioners throughout the country have come to recognize that public service corporations are entitled to more sympathetic consideration of their problems became very evident during the sessions of the annual convention of the National Association of Railway and Utility Commissioners, which was held in Washington last week. It seemed to be very generally agreed among the commissioners in attendance that it is to the public interest that utility rates generally be revised upward. A flat-footed declaration against government ownership of railroads by P. J. Lucey of the Illinois commission brought forth many expressions of approval.

Officers for the coming year were elected as follows: President, James A. Perry of the Georgia commission; first vice-president, Carl D. Jackson of the Wisconsin commission; second vice-president, Dwight N. Lewis of the Iowa commission. James B. Walker of the New York Commission, First District, was re-elected secretary of the association.

Abundant commendation of the increased attention being given public relations by public utilities was forthcoming. Some of the commissioners, however, notably Clyde M. Reed of Kansas, took the position that further expansion of this program is desirable, special emphasis being laid upon the necessity of careful selection of those employees who come in direct contact with the public. Consideration must be taken of the fact that customers are sometimes unreasonable, Mr. Reed said, and every effort should be made to convert them.

M. H. Aylesworth, executive manager of the National Electric Light Association, explained how some lighting companies are placing in the envelope with each customer's bill a slip telling pertinent facts affecting public utility operation.

Commissioner Lewis of the Indiana commission gave it as his experience that in a town where the public utility strives earnestly to please the public a two-hour hearing is all that is necessary when it becomes advisable to revise rates upward.

S. F. Mitchell of the Electric Bond & Share Company pleaded for more elasticity in franchises and other regulations. The economies of interconnection, he asserted, are very frequently made impossible of attainment because of the inflexibility of the franchise or because of the legal situation.

The committee on government ownership and operation declared in favor of regulated private ownership and operation. It was the opinion of the committee on public utility rates that regulating commissions are under the same obligation to make suitable allowances for increased cost of money as for the increased cost of coal, wire, labor, etc.

August's Production of Electrical Energy 100,000,000 Kw.-Hr. Ahead of July's

FIGURES of electrical generation by public utilities for the month of August have just been issued by the United States Geological Survey. They show a total of 3,705,184,000 kw.-hr. as compared with 3,608,804,000 kw.-hr. for July. Hydro-electric generation, however, was 1,500,000 kw.-hr. behind July, the August figure being 1,410,831,000 kw.-hr. Unlike the central-station statistics published monthly by the ELECTRICAL WORLD, the figures of the Geological Survey include electric railways.

Average daily production of electricity in kilowatt-hours by public utility plants for the first eight months of the year was as follows: January, 124,700,000; February, 119,800,000; March, 120,700,000; April, 119,200,000; May, 115,700,000; June, 118,900,000; July, 116,400,000, and August, 119,500,000. The total output for the eight-month period from January to August, 1920, was 29,114,000,000 kw.-hr., an increase of 17 per cent over 1919. The August, 1920, output involved the consumption of more than 3,000,000 tons of coal, more than 1,000,000 barrels of fuel oil and 2,704,000,000 cu.ft. of gas.

Christmas Selling Campaign in Full Swing

THE Christmas selling slogan, "Say 'Merry Christmas' electrically," has jumped into popularity almost overnight. This is the slogan being spread broadcast by central stations and electrical merchants taking part in the holiday campaign of the Society for Electrical Development.

The society has conducted many campaigns in the past, but from present indications the 1920 Christmas drive promises to eclipse all similar selling movements in the trade. As in previous campaigns, the society supplies a certain amount of advertising material free to its members. Non-members, however, are required to pay the actual cost of producing and distributing the material which they may want to use. On Monday of this week the society reported that it had already received more cash in payment for campaign advertising material than it received either during "Electrical Prosperity Week" or "America's Electrical Week."

Ontario Hydro-Electric Commission Seeks to Buy MacKenzie Interests

NEGOTIATIONS for the purchase by the Ontario Hydro-Electric Power Commission of the four subsidiary companies of the Toronto Power Company, now controlled by Sir William MacKenzie, are under way, and alternative propositions are to be submitted to the bondholders of the Toronto companies—one to discount their holdings and sell out for cash and the other to allow the commission to assume all outstanding obligations. The price mentioned, about $35,000,000, represents securities sold.

The four companies control of which is sought are the Electrical Development Company of Ontario, which owns a generating plant at Niagara Falls; the Toronto & Niagara Power Company, which owns transmission lines from the Falls to Toronto; the Toronto Electric Light Company, which distributes energy for light and power, and the Toronto & York Radial Railway Company, which owns and operates street railways.

Lightning Protection Records Are Discussed by A. I. E. E.

A LARGE number of engineers from the East and Middle West gathered in Chicago on Friday of last week to attend the three hundred and sixty-fifth meeting of the American Institute of Electrical Engineers, participated in by the Western Institute of Engineers and under the joint auspices of the Chicago Section and the protective devices committee of the Institute. A reception and dinner preceded the technical session, which was given over to a discussion of lightning protection.

Experiences with different types and densities of lightning arresters on a 4,000-volt primary network were given by D. W. Roper of the Commonwealth Edison Company in a paper (see ELECTRICAL WORLD, Nov. 13) which Dr. Charles P. Steinmetz said in his written discussion "was the most valuable contribution ever made to the study of lightning disturbances in primary distribution network as it contains the exact performance of nearly 90,000 lightning-arresting-years, comprising 529 apparatus failures." J. L. R. Hayden of Schenectady also sent a written discussion in which he stated that at low arrester density 1 per cent increase in arresters decreases the failures by 2 per cent, while at high arrester density the same increase in arrester density reduced the percentage of failures by only 1 per cent. Plotting not the percentage of failures but the total number of failures as a function of the number of transformers or arresters per square mile shows, he asserted, that for extremely high lightning-arrester densities the average failures approach a minimum of 0.92 transformer per square mile per year. For very low arrester densities the failures approach 7.7 transformers per square mile per year.

Harry B. Gear of the Commonwealth Edison Company said he had found the economic mean between a high lightning-arrester density and maintenance with the lower cost of transformer burn-outs to be about half way between 100 and 200 per mile, but the tendency is to work toward the higher figure in order to maintain better service.

V. E. Goodwin of the General Electric Company discussed the effect of switching electrostatic condensers on and off circuits containing inductance and resistance and described some of the more important applications of condensers. Elmer E. F. Creighton of Schenectady cited the case where a condenser with low resistance in series, used as a high-frequency absorber, successfully protected a submarine cable from lightning when other arresters had failed. An absorber was placed at each end of the cable and was adjusted for high frequency.

An experience paper on the life and performance test of oxide-film lightning arresters was presented by N. A. Lougee of the General Electric Company, giving additional data obtained since his paper on the subject before the Institute about three years ago.

Supplementing the paper read before the Institute in 1918 on the selective gaps for use with electrolytic arresters, Chester T. Allcutt of the Westinghouse Electric & Manufacturing Company read a paper giving the discharge characteristics of a commercial type of impulse gap under various conditions of service.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Electric Heating in Switzerland.—An official British report says that a new industry is growing up in Switzerland in the construction of electric stoves for the heating of private houses. The energy used for these stoves is generated at night, during which time the stoves are heated up. In the morning the electricity is cut off and the stoves remain warm during the whole of the day. In modern houses and hotels a large quantity of water is heated by electricity between midnight and 6 a.m. and provided at a cheaper rate.

Equalizing Power Rates in Tacoma.—The City Council of Tacoma, Wash., recently eliminated a provision of the franchise of the Tacoma Railway & Power Company which provided that the city should furnish lighting service to power patrons of the company at the same rate charged city power patrons. The ordinance resulted from the discovery that power patrons of the company were getting lighting service for from 1½ cents to 4 cents a kilowatt-hour, as compared with a general city charge of 5 cents. The company has no lighting franchise in Tacoma.

Rural Distribution in England.—The streets of Hereford, an English town of 22,000 people, are not electrically lighted, but, says the London *Electrician*, the municipal gas works are, and all the machinery therein is electrically driven. So is the machinery of the cider works, which are the town's chief industry, and of other manufactories, and transmission lines energized from the central station at Hereford carry energy for lighting and power to rural consumers. This is said to be the pioneer English transmission system supplying rural service on a scale sufficiently large to denote a forward step in the electrical world.

One Year's Growth of Utility Securities in California.—From July 1, 1919, to July 1, 1920, California utilities asked authority to issue securities totaling $142,654,526, according to the annual report of the Railroad Commission. The applications acted upon totaled $93,191,806. Applications totaling $447,046 were denied and applications totaling $1,706,275 dismissed. Authority to issue $91,038,485 of securities was granted by the commission, as against $84,572,599 in the twelve months ended June 30, 1919. In 1919 14.29 per cent of the amount of securities authorized was for reorganization purposes. The percentage in 1920 was 3.13. Of the securities applied for in 1919-20 40.52 per cent was represented by stocks, 43.97 per cent by bonds, 14.17 per cent by notes and 1.34 per cent by certificates of indebtedness.

Portland, Ore., Wants International Electric Exposition in 1925.—The Columbia Hydro-Electric League has adopted resolutions favoring an international electric exposition in Portland, Ore., in 1925, in celebration of the hundredth anniversary of the invention of the electric magnet. The board of directors of the Portland Chamber of Commerce has become interested in the proposition and has appointed a committee to make a thorough investigation of the scheme.

The Electrical Industry Under Soviet Rule.—The condition of the electrical industry in Russia is the subject of an article by N. O. Lifschitz which is abstracted by the London *Electrician* from the *Elektrotechnische Zeitschrift*. Like all other industries, it has been naturalized. A commission at Moscow presides over electrical affairs, and this is largely manned by committees which grew up during the war. The various factories are partly in the hands of the old directors, but are mainly under the control of men who have been elected by the workers and officials. There is no question of working at a profit, seeing that wages and salaries make this quite impossible; the various firms exist at the expense of the state bank. It is a fortunate circumstance that none of the leaders of the electrical industry in Russia has lost his life as the result of the revolutionary conditions. Some of them have, however, suffered imprisonment.

Rate Advances Are Still the Order of the Day.—On Dec. 1 the Hartford (Conn.) Electric Light Company will advance its maximum lighting rates from 8½ to 10 cents per kilowatt-hour and its maximum power rate from 5½ to 7 cents per kilowatt-hour. Residential flat-rate lighting will be increased from $1.10 to $1.30 per month for ten 10-cp. lamps, and additional lamps will be supplied at 15 cents each per month instead of 13 cents. Through action of the municipalities of Deadwood, Lead, Belle Fourche, Spearfish and Sturgis, S. D., the Consolidated Power & Light Company of South Dakota has been permitted to increase maximum rates from 10 cents to 12½ cents per kilowatt-hour, and the company has put into effect a schedule for lighting, heating and power that represents a 25 per cent increase over the previous rates. Increased heating and cooking rates have been granted to the Southern Illinois Light & Power Company of Hillsboro, which serves more than fifty communities, and increased commercial rates to the Southern Indiana Power Company of Bedford, Ind. Corning, Elmira, Geneseo, Jamestown and Plattsburg, N. Y.; Claypool and Bluffton, Ind.; Clarinda, Iowa, and Rockport, Mo., are among the numerous other places where revised rate schedules have gone into effect.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Iowa Section, N. E. L. A.—The next annual meeting of this section will be held at Okoboji during the third week of June.

Chicago Section, A. I. and S. E. E.—"Ore and Coal Handling Equipment" was to be discussed by C. S. Williamson, manager of the Western office of the Mead-Morrison Manufacturing Company, before this section of the Iron and Steel association on Nov. 19.

Electrical League of Canton.—Electrical men of Canton, Ohio, have formed the Electrical League of Canton along the same lines as the Electrical League of Cleveland. G. E. Nash is president, R. G. Vincent vice-president and F. A. Grohsmeyer secretary and treasurer.

Philadelphia Section, A. I. and S. E. E.—This section of the Iron and Steel association will meet on Saturday, Dec. 4, when H. C. Boynton and W. Voigtlander of the John A. Roebling's Sons Company, Trenton, N. J., are scheduled to discuss the care, use and inspection of flexible steel cables.

O. E. L. A. Committee Meeting.—At the Warren meeting of the station operating committee of the Ohio Electric Light Association, to be held on Dec. 8, the subjects listed for discussion are stokers, coal handling and disposal of ash, and the function of a chemical laboratory in power plant operation.

Pacific Coast Wireless Men to Convene.—The first Pacific Coast radio convention and show will be held in San Francisco Nov. 25, 26 and 27. The army, the navy, the Department of Commerce, the Shipping Board, radio manufacturers, radio clubs and associations and amateur radio operators will all be represented, and the San Francisco Radio Club expects that new standards will be set, development outlined and good will promoted.

Coming Meetings of Electrical and Other Technical Societies

Jovian Order—St Louis, Nov. 25 and 26

American Physical Society — Cleveland, Nov. 27; annual meeting Chicago Dec. 28-Jan. 1.

Indiana State Electrical Contractors and Dealers' Association—South Bend, Dec. 1 and 2

A. I. E. E. (New York Section) and A. S. M. E. (Metropolitan Section)—joint meeting, New York, Dec. 3.

Association of Iron and Steel Electrical Engineers—Philadelphia Section, Dec. 4; Cleveland Section, Dec. 13.

Rivers and Harbors Congress—Washington, Dec. 8-10

Illinois State Electric Association—Chicago, Dec. 9 (For program see page [illegible] Nov. 6, page 944.)

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Revenue and Prohibition.—The Illinois Public Utilities Commission recently turned a deaf ear to the plea that the revenue derived by an electric company from street lighting would be greatly decreased because of economies forced on municipal governing bodies by the loss of revenue from liquor licenses.

Abandonment of Service Without Appeal to Commission Forbidden.—Abondonment of electric service on the ground that operation involves a loss will not be permitted by the Public Utilities Commission of Illinois where it appears that no application for an increase in rates has been prosecuted before the commission.

Going Value and Cost of Obtaining Business.—Utility property in successful operation, the Missouri Public Service Commission asserts, possesses value over and above the "bare-bones" value of the physical property; none the less, costs of obtaining business when charged to operation may not be capitalized as going value.

Ability of Municipal Consumer to Pay.—The city of Point Pleasant, W. Va., having opposed an application by the local water and light company for increased rates, on the ground that it was financially unable to meet any increases in its expenses because it was already enforcing the maximum tax levy allowed by law, the West Virginia Public Service Commission found that the city could not by this plea escape liability for its reasonable share in the necessary increase in rates.

Abandoned Property as Stand-by Plant.—In fixing electric rates for the Spring Valley Utilities Company the Public Utilities Commission of Illinois refused, in valuing property, to make an allowance for a plant out of repair, unoperated for two years and incapable of being put into commission without the work of several men for at least three hours being first expended on it. The full cost of generating stations abandoned during construction and no longer the property of the utility cannot be allowed even though the consumers have reaped full benefit from the abandonment of the properties in the rates charged for service. Property abandonment on account of the construction of other units of property in substitution for the originals, and property obtained on account of changes in methods of operation to insure greater operating economy, should be charged to depreciation and are not a proper addition to the capital account of the utility.

Income of 11.4 per Cent for Return and Depreciation Approved.—In permitting the Maryville Electric Light & Power Company to file a new schedule of rates for commercial lighting in eight towns served by it, the Missouri Public Service Commission gave its approval to a return of approximately 11.4 per cent for profit and depreciation, established a differential of ½ cent per kilowatt-hour as between consumers within the municipality where the energy in generated and those served by transmission lines, and found a prior valuation of $350 per kilowatt of demand and $800 per mile of transmission line too low for an electric department constructed and maintained in first-class condition.

Cost of Service in Relation to Rates.—An increase in contract rates to a large individual consumer by an electric utility distributing energy generated at its own plant and purchased under contract from a supplying utility is not warranted, according to a decision of the Missouri Public Service Commission, where the net cost per kilowatt-hour of distributed energy has, owing to increased consumption, decreased during the life of the contract, unless the contract rates were unfair at their inception and resulted in recouping losses from other consumers. In prescribing electric rates for service to a large consumer of the Springfield Gas & Electric Company consideration was accorded to costs of generation, line and transmission losses, interest, depreciation and substation rental, resulting in a charge of 1.043 cent per kilowatt-hour, the consumer requiring 200,000 kw.-hr. a month. Transmission losses of 7.2 per cent over lines 5 miles in length were held conservative, and 10 per cent was allowed for depreciation and return.

Entrance of Competing Company Into Occupied Field Refused.—The controversy between the Northern Adirondack Power Company, supplying a portion of the unincorporated village of Ausable Forks, N. Y., with electric light, and the J. & J. Rogers Company, a manufacturing firm at that place, which has been before the New York Public Service Commission for the Second District, the courts and the Legislature for six years (see ELECTRICAL WORLD, May 22, page 1217), came up again for determination by the first-named body on a rehearing of the application of the Ausable Forks Electric Company for permission to build a plant at Jay and for approval of a municipal franchise owned by it and authority to sell stock. Pointing out again that there are already two lighting companies in this small community, the commission declared that there was no public necessity for a third company. If defective service was rendered it should be improved, but the rights of the existing company should not be forfeited or the value of securities issued by authority of the commission impaired. The application was therefore denied by the commission.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies

Rate Procedure in New York State.—The Supreme Court of New York, in City of New York vs. Richmond Light & Railroad Company, has declared that if a determination of the Public Service Commission concerning the rates to be charged by a public utility is not satisfactory to the city, the city must apply to the commission for a rehearing, and if the determination of the commission is not satisfactory, it may be reviewed by the court in a certiorari proceeding. The city cannot, without following this procedure, come into a court of equity for correction and review of a determination of the commission if the commission had jurisdiction to make an order in the matter. (183 N. Y. S. 922).*

Purchasers of Void Franchise May Discontinue Operation.—Purchasers from a municipality of a franchise to construct and operate an electric lighting plant, which franchise was void *in toto* because it exceeded the constitutional time limit of twenty years, had the right, according to the decision of the Court of Appeals of Kentucky, in Hamilton vs. Bastin Brothers, to abandon it at any time and were not under obligation to operate their plant throughout the period stated in the franchise. The fact that the excess period named, nine months and seven days, was granted for the construction and not for the operation of the plant did not prevent the franchise from being in violation of the state constitution. (224 S. W. 430.)

Defective Insulation as a Proximate Cause of Injury.—In Hollis vs Kansas City Light & Power Company damages were sought for the death of an operator of a steam shovel who backed the shovel into an overhead wire, breaking the wire, and was afterward killed by grasping with both hands the broken conductor, which was not properly insulated. On account of improper instructions to the jury in the lower court, which found for the plaintiff, the Kansas City Court of Appeals remanded the case for retrial, but in doing so it declared that the question of contributory negligence was one for the jury and also that the proximate cause of the fatality was the employer's original negligence in allowing defective insulation of the wire, the breaking of which by contact with a steam shovel was reasonably to be anticipated. (224 S. W. 158.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Robert W. Hoy has been appointed sales manager of the Pennsylvania Power & Light Company, Allentown, Pa., which operates gas and electric properties in Pennsylvania at Allentown, Bethlehem, Hazleton, Herwood, Shamokin, Danville, Williamsport and several smaller communities. Mr. Hoy was formerly associated with the Elmira (N. Y.) Water, Light & Railroad Company as commercial manager. Prior to 1915 he held the same position with the Harrisburg (Pa.) Light & Power Company. Mr. Hoy's career in the utility field has been interesting and varied. His first experience was as day and night operator with the telephone company. Later Mr. Hoy became associated with the Edison Electric Company, the Harrisburg central station, to whose lines at the



R. W. HOY

time were connected three wired houses and one motor, the motor being used to run a newspaper press. His duties as wireman later included arc trimming and he assisted in constructing the distribution system. As soon as the central stations learned that they must merchandise their service Mr. Hoy was made commercial manager, and he has ever since been identified with that department of the electric utility property.

Gordon Fox, formerly connected with the Fort Wayne works of the General Electric Company and later electrical engineer of the Mark plant of the Steel & Tube Company of America, has joined the engineering staff of Freyn, Brassert & Company, consulting engineers of Chicago, in the capacity of electrical engineer. Mr. Fox is chairman of the Chicago Section of the Association of Iron and Steel Electrical Engineers and is a member of the A. I. E. E.

Capt. Edward C. Bebb, a Reclamation Service engineer, has been assigned to the Federal Power Commission to act as specialist in the examining of plans. R. W. Davenport of the United States Geological Survey has also been transferred as a specialist in power reserve.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

F. J. Ginn has been added to the Washington staff of the National Committee on Gas and Electric Service. He will be in charge of traffic matters. To accept this post Mr. Ginn resigned as chairman of the car allotment commission of the Chesapeake & Ohio Railroad. His experience in mine rating and car distribution will be valuable in his new position.

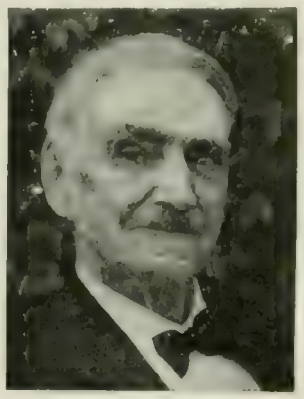
Lewis Nixon, Public Service Commissioner for the First District of New York State since May 3, 1919, has tendered his resignation to Governor Smith in order to devote his attention to his private business interests. Governor Smith has appointed Alfred M. Barrett, who has acted as deputy commissioner since Mr. Nixon's appointment, to succeed the latter as Commissioner. Commissioner Barrett is a former banker who was connected with several of the principal financial institutions of New York City and was at one time president of the Guardian Trust Company.

Arthur Warren, well known for his successful publicity work in the electrical and mechanical fields—notably that done for George Westinghouse—has just brought out through the Boston publishing house of Little, Brown & Company a charming book of reminiscences, entitled "London Days." It is based on his recollections and records of brilliant work done through many years as the correspondent of the Boston Herald in the British Metropolis in the "70-90" decades. Many great personalities are dealt with at close range, but by long odds the best chapter is that on Lord Kelvin, whom Mr. Warren knew intimately. It is a characterization or portraiture that will appeal to American readers as fine and true.

Edy Velander, who was lately secretary of the electrical engineering research division at the Massachusetts Institute of Technology and instructor in electrical engineering at Harvard University, has recently accepted a proposal to undertake hydro-electric work for the Swedish government, with headquarters in Stockholm. Mr. Velander has contributed important articles to the ELECTRICAL WORLD and several technical and scientific societies. Born in Sweden, he was graduated as civilingenjor, electrical engineering department of the Royal Institute of Technology, Stockholm, in 1916, and pursued graduate study under Professor Pleijel. In 1917 he entered Harvard University as fellow of the American Scandinavian Foundation with thesis work under Dr. Kennelly, receiving the degree A.M. in 1918.

Obituary

James W. Bell, vice-president of the Wagner Electric Manufacturing Company of St Louis and one of the pioneer capitalists of the electrical industry, died at his home in St. Louis, Nov. 4, at the age of ninety-four. Mr. Bell was associated with the late Samuel M. Dodd in the old Missouri Electric Light Company and was a director and large stockholder of the Wagner Electric Manufacturing Company. He was a member of the board of directors of



J. W. BELL

the Mercantile Trust Company up to his death and manager of the company's savings department until his ninetieth birthday. Mr. Bell was more interested in manufacturing than in any other branch of industry. To him is given credit for having introduced the first comprehensive cost system in the stove industry.

Percy B. Taylor, a well-known consulting engineer in electrical and mechanical work, died Oct. 21 at his residence in Newark, N. J. Born in Manchester, England, Mr. Taylor came to the United States at eight years of age. He entered the employ of Cyrus Currier & Sons, machinists, Newark, when a young man and was with this organization for a number of years. In 1897 Mr. Taylor opened an office as a consulting electrical and mechanical engineer. He made a specialty of power-plant installations. For a number of years he was employed by the Board of Education as consulting expert in the installation of heating and ventilating equipment and electrical apparatus in the local public schools. Numerous factory buildings were constructed from his design and under his supervision, his work embracing not only the electrical phase of installation but all features of the plant construction.

Trade and Market Conditions

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

Lamp Sales Expected to Reach 230,000,000 This Year

FROM estimates which have been made at this time it appears that total sales of large lamps, tungsten and carbon will amount to approximately 230,000,000 for the year 1920. Of this amount sales of carbons will account for about 15,000,000 lamps. This leaves 215,000,000 tungsten vacuum and gas-filled lamps of the large size, which, compared to sales for the year 1919, shows an increase of 38 per cent for the present year. Miniatures will probably total just over 100,000,000 lamps.

Lamp manufacturers are working to capacity to fill the demand which is existent, and their stocks are in such a condition that they are able to make quite satisfactory shipments. Even under these conditions some jobbers report difficulty in obtaining sufficient stocks of the household sizes of the tungsten vacuum type, while in other quarters there is difficulty in getting enough of the largest sizes of the gas-filled type, 750 watts and 1,000 watts.

Demand is keeping up at a very high rate, although it has dropped a little from the curve on which it set out early in the year. It is not quite on the curve of three months ago.

Porcelain Shortage Slightly Relieved

ALTHOUGH in general the market for porcelain still remains undersupplied the acute scarcity that has been existing for some months past has to a considerable extent been relieved. Manufacturers are at last beginning to catch up on back orders. Improved production conditions are largely responsible, though to some extent demand has fallen off too. Less building construction accounts for the latter, though on the whole the volume of business for knobs, tubes, cleats and wiring specialties employing porcelain holds up well. In the high-tension porcelain field the shortage is as acute as ever.

Two months or so ago the supply of clay was greatly restricted by freight embargoes. This condition is now relieved. Labor troubles and shortages also seem past and fuel costs have receded somewhat. As a result, orders on file with porcelain manufacturers as long as six and even eight months have now diminished to such an extent that wiring specialties can be obtained in from two to five weeks.

During the period of scarcity many new factories were opened and these can supply porcelain tubes in about forty-five days and knobs and cleats in thirty days. The long-established factories are still handicapped by back orders, however, and cannot ship so quickly. Porcelain high-tension insulators are in such great demand that production is barely able to keep pace with new orders. Hence deliveries are still ranging around the six to eight-month period. No cancellations on any porcelain material are reported. Manufacturers' stocks of porcelain are largely non-existent. Many jobbers, too, throughout the country report broken supplies in spite of better shipments. Of the rough material tubes are in the worst supply.

In line with the anticipated increase in building construction in 1921, it is expected that there will be a larger demand than ever before in the history of the business next spring. Little hope of lower prices is held out for the immediate future. No change in quotations has been made since an upward revision about three months ago. Of the principal factors involved in the manufacture of porcelain —namely, raw material, labor, fuel and freight charges— it is pointed out that a slight reduction in fuel costs has been the only break thus far that would tend to lower quotations.

Heavy Production of Heaters for 1920 Season

AN ANALYSIS of the prospects for heater sales during the season of 1920-21 reveals opposing factors. On the one hand, there is a very evident shortage of coal which should help demand. From sections of the country where natural gas is used as fuel reports are received of a scarcity of that too. Furthermore, a great deal of publicity and intensive selling work has been carried on in pushing heater sales since last winter's buying. At that time central-station lines in some parts of the country, notably the West, were greatly overloaded and the use of additional appliances was discouraged rather than encouraged. This condition has now largely been remedied by making the needed power expansions. From the foregoing considerations it would seem that heater sales should be good.

On the other hand, mild weather conditions this fall have thus far not been conducive to a large demand. Money is increasingly tight with jobbers and retailers, who, as a result, have ordered more conservatively than they otherwise might have done. This conservatism has in turn been passed on to the ultimate consumer, who is further induced to spend cautiously by price uncertainties in many lines. These are the factors to which attention is called by several of the largest manufacturers in this line.

Regarding the actual conditions of supply and demand developed thus far this season there is considerable variance. A reliable estimate of the total production of socket heaters for 1920 is placed at between 415,000 and 450,000, compared with a production of about 275,000 in 1919. Although a large producer whose estimated output for this year has numbered about 85,000 reports that never before have there been such large surplus stocks available at distributing points at this time of year several other important manufacturers report a low level of surplus stocks and in some cases back orders which are just now being overcome. Deliveries of new orders in these instances can not be made until the first of the year.

Manufacturers do not all agree as to the extent to which jobbers have bought heaters. The majority, though, state that orders and repeat orders have been heavy. Reports throughout the country at this writing indicate an encouraging sales volume to consumers. Demand last winter was excellent so that in general very small stocks were carried over last spring. This would seem to substantiate the hopes of producers for large repeat orders in the cases of jobbers who have ordered conservatively.

Production has been proceeding smoothly, with a good and more efficient supply of labor available. Raw-material shortages have been largely overcome, and though some complaint is still heard of such items as porcelain, steel, lamp cord and switches it is in less degree. Prices seem to be placed for the remainder of the year at least, and no change is contemplated so far as can be learned. Virtually no cancellations have been made on heaters, though a few requests for extensions have been made.

Promising Market for Lighting Fixtures in Cuba

CUBA is an important field for the sale of electric fixtures, according to the foreign trade bureau of the Guaranty Trust Company of New York. The use of electricity on the island is increasing, and the trade there up to the present has been comparatively undeveloped. The largest cities, including Havana, Cienfuegos, Santiago and Matanzas, are the best fields for the development of electrical trade. The trade in Havana has been most highly developed and this city is virtually the only one where both electrical fixtures and combination gas and electric fixtures are in demand. The other localities have no gas plants and therefore use fixtures designed only for electricity. The various sugar estates have their own electric power plants which furnish electricity for the sugar mills and also for the homes in their vicinities.

In the smaller cities the fixtures used in the illumination of houses and stores commonly consist of drop lights with reflectors. The fixtures should be suitable for high ceilings and for store use especially, and should be capable of lighting large spaces. In the larger localities some kind of chandelier is generally used. The most popular is that covered with glass or crystal. The two-arm or four-arm pendant is in common use, with the arms and ceiling rod covered with glass and often different sorts of glass ornaments.

The designs vary widely according to the purchasing power and taste of the buyers. Most are made of crystal or crystal and bronze. Ornate types are in great favor. American designs are said to be suitable to Cuban trade but must meet competition in price from the Spanish dealers. Supply houses in Havana are pushing the sale of American domes, indirect and semi-indirect fixtures, and table lamps. There are almost no manufacturers of electrical goods in Cuba, and only a few minor concerns there make chandeliers and drop lights. Fixtures for store use are very crude in most places, and the buildings are old-fashioned. Merchants on the whole have been conservative about the introduction of modern fixtures. The newer stores, however, are using well-designed fixtures. Show-window lighting has been slow to develop.

Street-lighting fixtures should find valuable markets in Cuba, as many cities there are installing electric street-lighting systems for the first time. Other cities are bringing their antiquated systems up to date. Havana should be an especially fertile field, for this municipality is providing electric lights on all streets. Five-hundred-watt gas-filled incandescent lamps have been substituted for the arc lamps previously used in some streets.

Sign lighting is scarcely known in Cuba outside of Havana and Santiago, but such of this equipment as is used is imported from the United States. The market is comparatively small, therefore, but fairly constant and should afford reasonable development.

Commerce Bureau Needs Funds to Carry On Improvements

THE electrical industries, along with practically all others, are relying more and more upon the statistics of imports and exports which are compiled by the Bureau of Foreign and Domestic Commerce. There is urgent need for a new classification of these figures, as well as for the consolidation of the statistics of the Bureau of Customs and those of the Bureau of Foreign and Domestic Commerce. A plan to put these reforms in effect has been agreed upon by all concerned, but unless Congress can be induced to provide the necessary funds before Jan. 1 it will be necessary for the improvement to be delayed for another year.

The new import classification shows 984 separate monthly classes of commodities against 700 classes in the present schedule, an increase of 40 per cent. The export classification has been extended from 700 in the present to 1,234 classes in the new schedule, an increase of 76 per cent. It had been planned to put the new schedules into effect on Jan. 1, 1921, but the tremendous growth of imports and exports since the close of the war has increased the current work of the statistical division of the bureau to such an extent that it will be impossible to handle the increased work which would be caused by the extended classification unless additional funds for statistical work are provided by Congress.

Apparatus Held in Middle West for Rising Market

GAMBLING on a rising market in transformers, motors and other similar electrical equipment seems almost an absurdity, but the business slump of the last few weeks has revealed unsuspected stocks in the Middle West of both distribution transformers and motors that had been stored away and purposely forgotten in the expectation that the shortage prevailing earlier in the year would become more acute and higher prices for quick delivery would prevail. While these stocks have been found in a number of cases, so far there have not been enough of them revealed to exert a noticeable influence on the market, though some representatives of the industry have been led to wonder whether there may not be more than has hitherto been believed possible

The Metal Market Situation

FOLLOWING a slightly firmer tone which developed in the copper market the past two weeks under the influence of a spasmodic increase in buying, the pendulum has now swung the other way. The depressed tone is reflected not only in a further slump in copper but in lower positions on most of the other non-ferrous metals as well. The drop in standard spot copper at London of £4 10s. to £85 15s., which is the lowest figure reached since the middle of June, probably had its effect on the domestic market. Copper for prompt delivery is generally held by producers at from 14.75 cents to 15 cents. Actual sales are reported at 14.50 cents delivered, however, the lowest level reached since 1915. Some producers still refuse to shade 15 cents even while admitting the absence of inquiries. For delivery over the first quarter of next year 15 cents is quoted, though some producers still ask an advance over that figure. The outside market is dull, with prices on a level with those of operators. As dealers do not hold large tonnages at present most inquiries are made direct to producers. One of the large interests has announced a 15 per cent decrease in wages and the laying off of a large number of employees in line with the reduction of output that is being carried out. Similar action from other operators is expected.

A weaker market has developed on tin, lead, zinc and antimony, resulting in lower quotations on all these metals this week. The tendency to resist the downward trend of prices which developed in the scrap metals market recently proves to have been but temporary as all quotations there show a further decline.

NEW YORK METAL MARKET PRICES

	—November 8—	—November 15—
Copper	£ s. d	£ s. d
London standard spot	90 5 0	85 15 0
	Cents per Pound	Cents per Pound
Prime Lake	Nominal 15 50	Nominal 15 00
Electrolytic	15 00	14 75–15 00
Casting	14 50	14 25
Wire bars	17 50 18 00	17 00–17 50
Lead, trust price	7 25	7 00
Antimony	6 25	6 00
Nickel, ingot	43 00	43 00
Sheet zinc f.o.b. smelter	11 50	11 50
Zinc, spot	7 40	6 85
Tin	37 62½	36 00
Aluminum, 98 to 99 per cent	32 90	32 90

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	12 00 13 00	12 00–12 50
Brass, heavy	6 50 7 00	6 00– 6 50
Brass, light	5 00 5 50	4 50– 5 00
Lead, heavy	5 25 5 50	5 00– 5 25
Zinc, old scrap	4 00 4 50	3 75– 4 00

THE WEEK
IN TRADE

EXCEPT in the metropolitan district in New York, where a slight betterment in buying has been reported by the jobbing trades, the dullness of the past few weeks is continuing in the general supply lines in most sections of the country. For the lines of goods generally expected to move for the Christmas trade, however, there is quite a bit of activity reported by all hands.

Of course stocks of the supply lines are being built up in a rather complete way, and jobbers will be in good shape when the spring demand for building opens up, a condition to which the trade is looking with much anticipation.

Throughout the country labor conditions are becoming much easier. The Pennsylvania Railroad and the New York Central Railroad have issued orders to lay off large blocks of shop and repair men, and two manufacturers in the electrical field are reported to have reduced the working hours in their plants. The special result to the electrical trade is expected to be a larger output per man with consequent lowering of unit cost of manufacture.

Credit conditions have suffered little change in the past week, and no improvement in general is seen.

NEW YORK

A slightly more optimistic tone is evident in the trade. The first break in the direction of improved sales is reported, though whether this is merely a flash in the pan it is too early to say. Many jobbers are moving their goods by dint of greater efforts toward increasing the number of orders to make up for their smaller size. Electrical contractors at this season are apparently not very busy, though a good volume of rewiring work is reported from some adjacent sections.

Collections have not improved materially, a great deal of complaint being heard both from jobbers and manufacturers of the length of time required for customers to pay bills.

Price cuts, so far as can be learned, are no longer being made in any appreciable degree. Many jobbers state that they prefer to sit tight on present supplies rather than attempt to liquidate stocks at cost or at a loss. It seems an open question in the trade which policy is more advisable. Seasonable goods such as lamps, heaters and Christmas specialties are moving well, but jobbing houses are about evenly divided as to whether the holiday trade this year will measure up to the standard of other seasons.

Fuses.—A plentiful supply with jobbers is moving fairly well. Non-renewable, N. E. C. standard, 250-volt, 3-amp. to 30-amp. fuses are quoted from 12½ to 14 cents each net in standard packages, and the plug type from about 5 cents to 5½ cents.

Lead-Covered Wire.—Stocks are large, but demand is light. No. 14 duplex is worth $60 to $66 per 1,000 ft. net in 5,000 ft. lots.

Wall Cabinet Boxes.—Several jobbers report good sales, but others are finding demand light. Stocks are spotty and raw material difficulties are affecting production.

Flexible Armored Conductor.—Little market exists in the metropolitan district, but in adjacent territory demand is good, owing to house-wiring work, and some jobbers are temporarily cleaned out. No. 14 two-wire ranges in price from $85 to $94 per 1,000 ft. in double-strip, in quantities of 1,000 ft. and over.

Lamps.—Stocks are moving well, especially since the exit of daylight saving. Reports on shipments and the condition of stocks vary from poor to good. Some complaint is heard of supplies of 40-watt and 25-watt type B and also 100-watt type B and C lamps.

Heating Appliances.—Supplies with many jobbers are not moving satisfactorily, but others report good sales. Hollowware is generally scarce, shipments being on an allotment basis. Hope is expressed of better demand soon.

Flush Switches.—Stocks are large, but demand is only fair, in some cases an oversupply being reported. Some cancellations have resulted. Manufacturers are still hampered by the item of porcelain.

Non-Metallic Flexible Conduit.—Sales outside of the city are good, a shortage of both large and small sizes being reported by different jobbers. The metropolitan market is weak, however, as low as $30 and $31 per 1,000 ft. being quoted on the ⅜-in. and ½-in. sizes respectively. Elsewhere as high as $40 for ⅜-in. and $45 for ½-in. per 1,000 ft. is asked.

CHICAGO

Trade in electrical lines seems to be above the average that is being maintained in other lines. No electrical jobber, dealer or manufacturer is very busy, but all have sufficient business to warrant their going ahead with production or stock purchases. There is some inclination to cut prices in those lines which happen to be well stocked, but in general prices are well maintained. Business as a whole in the Middle West, while very quiet, is not alarming. The construction industry continues at a low ebb, and strenuous efforts are being made by all concerned to stimulate it.

Waiting for this stabilization is what is occurring now. The process should be less painful to the electrical industry than to many others, for electrical goods are priced more reasonably, in relation to their cost, than are most other lines in the building field. Labor took a long step in the right direction last week. The building trades have agreed with the associated contractors that for a period of eighteen months there shall be no strikes; neither side shall make any effort to alter existing wages or working conditions, and all jurisdictional disputes shall be settled by an arbitration committee without the men being called off the job. Labor cost on erection jobs is reported as being materially lowered through increased efficiency, and this development is felt in manufacturing and other lines as well.

Collections continue difficult. Strenuous efforts are required to keep them up to the mark. This is not only true of jobbers and dealers in the electrical trade, but inquiry finds the same condition existing in all lines, installment furniture houses particularly saying that they collect just what they go after and no more. Sales of electrical goods seem to respond to increased effort.

Wire.—Lowered demand has permitted the building up of stocks to a point where any reasonable demand can be met with immediate shipment. Prices are unchanged, but some reports are heard of shading in certain items.

Motors.—Fractional sizes are easily obtained and some overstocks are reported. Stocks on large sizes are improving. Many resale lots are being put on the market, these being motors that small dealers were holding for higher prices. Little disposition is shown by the large jobbers to take these goods off the hands of the holders at any price.

Percolators, Etc.—Cessation of buying by the general public has extended to percolators, toasters, flatirons and various other items of that class. Most retailers have fair stocks and orders on jobbers and manufacturers are light. Pressure of Christmas demand is beginning to be felt and good business is expected from now on.

Heaters.—A week of real winter has stimulated retail demand, and the expectations of the trade for good business are apparently being met. Large stocks are the rule with both jobbers and dealers, and prices in Chicago are firm in spite of cuts reported from other cities.

Washing Machines.—Manufacturers have decided on a policy of intensive selling as apparently public consumption needs such stimulation. Sales are better than they were this time last month. The manufacturers believe that washing machines are not a fair-weather need, but that they may be sold in slack times as well as in boom times. Strong selling campaigns backed by widespread advertising are going to be used to prove the truth of the opinion.

BOSTON

Jobbers are largely occupied in filling back orders, and the volume of these makes the gross business booked of excellent proportions. Little new business is coming in, but a turn for the better is observed in the buying of appliances for the Christmas trade by dealers. Collections are slow. Stocks are filling up in wiring material lines, but are spotty in regard to many other products. Deliveries are coming through reasonably well, with the exception of motors and rigid conduit. Prices are showing little change either way this week. The severe fluctuations common to some industries do not seem likely to disturb the electrical trade to anything like so great an extent. A waiting policy in regard to purchases by jobbers is still being pursued. Labor conditions continue to improve in electrical manufacturing plants. Many New England industrial plants are running on part time or are temporarily closed, but a general belief prevails that as soon as existing retail stocks are cleaned out conditions will greatly improve.

Flexible Armored Conductor.—Stocks are ample and 5,000-ft. lots are selling for $85 per 1,000 ft. Demand is rather light.

Motors.—Odd sizes are coming into stock, and the manufacturing plants are pushing hard on back orders. A leading jobber reports few cancellations except in the case of one or two central stations that have stopped buying motors for stock purposes. Prices are firm and there is still a good demand for second-hand motors.

Rigid Conduit.—Certain sizes are reported scarce, and local stocks are most uneven. One of the largest houses has had no ¾-in. pipe for several weeks. Representative prices are: 1-in. black 18.95 cents per foot, and 1-in. galvanized 20 cents per foot.

Wire.—Rubber-covered wire No. 14 is easy at $9.50 per 1,000 ft. in 5,000-ft. lots. Plenty of this material can now be had. Bare copper wire is in light demand at 20 cents base, and weatherproof is in good supply at 23 cents.

Washing Machines.—The market appears to be overstocked, or nearly so. Prices are still steady, and the demand is a bit sluggish.

Radiant Heaters.—Last week's cold snap moved these radiators well. No complaint is heard as to stocks being depleted, and for the present no signs of a shortage are apparent. Retailers are pushing these devices very successfully.

Floor Lamps.—Considerable price cutting is evident with the object of moving old stocks.

Non-Metallic Flexible Conduit.—The market is quiet and prices hold steady. For ½-in. $33 per 1,000 ft. is charged in 5,000-ft. lots, and for ¾-in. $36.50. Ample stocks are understood to exist.

Appliances.—Improved deliveries and a quickening demand from retailers looking forward to a good holiday trade are beginning to be felt. It is believed that an excellent Christmas business will be done regardless of the present uneasy price situation.

Lamps.—Manufacturers are catching up well with deliveries, and leading jobbers report good stocks on hand as regards immediate needs.

ATLANTA

Sluggishness in nearly all lines continues, little or no change in underlying conditions being reported this week. Government reports on cotton ginning show the Southeast still far behind the figures of preceding seasons in amount of cotton ginned, Louisiana only showing an increase over 1919. Southern banking interests met in New Orleans Nov. 7 and formed the Federal Foreign Finance Corporation, a banking institution organized for the purpose of assisting producers in placing their products abroad, especial interest to be devoted to cotton, sugar, rice and lumber. Capitalized at $6,000,000, it is expected to have a financing power of approximately $60,000,000, which will go far toward stabilizing the market not only in the above lines but also in all other business lines as well.

Jobbers report receipt of orders as having fallen off considerably, dealer buying being of the hand-to-mouth variety, all lines making every effort to reduce inventories. There continues to be a shortage in some lines, however, such as outlet boxes, connectors and panelboards, while an oversupply of loom, irons and black pipe is generally reported.

Retailers seem to feel that their trade will begin to show improvement as the holiday season approaches and are making preparations accordingly.

Motors.—Spotty stocks and long deliveries up to thirty weeks are the rule with slip-ring motors, but stocks and shipments of the squirrel-cage types have shown marked improvement in the last few weeks. Industrial plants are still placing respectable orders for three-phase apparatus, while most of the single-phase orders are being received through the small amount of central-station trade. Good stocks of the latter type apparatus are available.

Printing-Press Apparatus.—Activity continues, the demand being such as to prevent the accumulation of any stocks. Slip-ring equipment is quoted at thirty weeks with squirrel-cage type at six to eight weeks.

Rigid Conduit.—Several jobbers report overstocks on black pipe, and a number report fair stocks of galvanized for the first time in several months. Demand continues fair with prices steady.

Flexible Metallic Conduit.—The steady demand has prevented the accumulation of any stocks, shipments being quoted at eight to ten weeks. Prices, lots of coil to 1,000 ft., ½-in., $12.22; ¾-in., $15.86; 1-in., $28.96, per 100 ft.

Exhaust Fans.—This specialty continues to move quite well, jobbers reporting the 24-in. to 36-in. sizes the most popular. Stocks are better than usual and shipments good.

Hoists and Cranes.—Shipments are quoted at eight to ten weeks, despite a very lifeless demand.

Armored Conductor.—Heavy receipts have wiped out all back orders, while the demand has slowed up very considerably. A number of firms find themselves heavily stocked as a result. Prices, lots of 1,000 ft. to 2,500 ft., two-wire, No. 14, $12.05 per 100 ft.

ST. LOUIS

There has been little change in the continuing dull market here. Jobbers are still moving their stocks, but more slowly, and supplies of various items are beginning to become too large. This applies particularly to those articles used in building. At present there are a number of large buildings being finished, but by the first of the year virtually all of these will have been completed with nothing new under way. As a result demand for supplies of this sort has dropped off sharply. There is a fairly good demand, however, for heating devices and small appliances, and jobbers expect to turn over their entire stock of these. The holiday trade also is shaping up better than some jobbers had expected.

There are numerous indications that money is getting easier. One of the smaller public utilities of Missouri reports that it had no trouble getting a loan of $40,000 from a St. Louis bank for the purpose of a line extension where three months ago the same bank refused the application for a smaller amount for the same purpose.

Curtailment in manufacturing circles has not spread during the past week. Plants which shut down several weeks ago are re-employing some of their men at smaller wages. A manufacturer of automotive electrical devices reports 40 per cent normal production with conditions promising improvement.

Wire.—In spite of the large stocks carried by jobbers no further price concessions have been made to buyers during the past week. Rubber-covered wire in the No. 14 size sold as low as $9.75 per 1,000 ft. in lots of 5,000 ft., with some sales as low as $9.50. Demand is light.

Transformers.—Within the last two months deliveries on power transformers have shortened from nine months to about four months. This has been caused by better deliveries of materials and by a number of cancellations. Delivery on 50 kva. to 100-kva. transformers can be had

in three months. Immediate delivery can be made on 1-kva. to 10-kva. transformers. Orders have dropped off considerably, but inquiries are good.

Rigid Conduit.—Practically all jobbers have good stocks of both the black iron and the galvanized conduit and are able to fill back orders which accumulated during the shortage. New business is reported fair, and prices are firm at $80 per 1,000 ft. of ½-in. black, in lots of 5,000 ft. or more.

Lightning Arresters.—There is a good demand, and lightning arresters of the distribution type are proving difficult to get.

Lamp Cord.—Stocks are decidedly spotty and there is a fair demand. Prices have weakened considerably, a representative quotation on No. 18 twisted pair being $21 per 1,000 ft. in lots of 5,000 ft. and more.

Fuse Plugs.—There is a good stock in jobbers' hands, but demand is lower than normal. Prices are firm, however, and range from $4.50 to $5 per 100 on the 30-amp. size.

Heaters.—Stocks are still equal to the demand, which has been brisk during the past week on account of the colder weather. Some jobbers report that they will not be able to get further deliveries from manufacturers until the first of the year and there may be a slight temporary shortage.

Motors.—The Emerson Electric Manufacturing Company has issued a new motor price book, No. 51, listing new discounts applying to bulletin list prices on all types of motors and motor applications, 2-hp. and smaller, including exhaust-fan motors but not including ventilating-fan motors. The new prices represent a reduction of 15 per cent from prices appearing in the firm's motor price book No. 50, and are said to equalize prices of other makers.

SAN FRANCISCO

Heavy rains have already placed the seasonal rainfall well over normal, and they promise a wet winter. Building permits for October, 1920, are as follows: San Francisco, $1,890,530; Oakland, $520,717; Los Angeles, $6,431,661; San Diego, $390,117; Fresno, $333,470. For October, 1919, the figures were: San Francisco, $2,014,706; Oakland, $586,096; Los Angeles, 4,125,696; San Diego, $170,030; Fresno, $377,287. It will be noted that southern California figures have increased and northern California figures have decreased.

Motors.—Dealers in second-hand motors are reporting many sales in 10-hp. sizes and larger.

Insulating Material.—Many large bids, especially for the United States government, are reported. Excellent stocks are carried locally and good business from motor-repairing shops is being received.

Batteries.—The higher prices on single batteries are increasing the sales of multiple sets. The billboard campaigns are acquainting consumers with the multiple sets, and better sales to dealers are the rule. These multiple sets are now to be stocked as standard single batteries.

Poles.—Through quieter labor conditions complete stocks are now to be found at the Northwestern yards, and as the car situation is also better, better Coast stocks may soon be expected.

Tape.—Local stocks are good. The present price on commercial grade friction tape in 100-lb. lots averages 33 cents.

Lamps.—Deliveries are good, and dealers' stocks are well maintained in all sizes. The demand seems to be regularly gravitating to larger units in the "C" style, 40-watt lamps still being the biggest sellers, but being gradually outstripped by the 75-watt and 100-watt "Mazda C" lamps, of which the 100-watt lamp now seems to be the favorite.

SEATTLE—PORTLAND

Generally speaking, the electrical trade reports little or no improvement in conditions over that of the past month. It is true that Christmas merchandise is moving exceptionally well, but this increase does no more than offset the decrease in sales volume of other lines.

Lumber mills in both Oregon and Washington are liquidating stocks by selling at less than cost. Portland manufacturers report that business is continuing about the same as for the past several weeks. A drop in bare wire of approximately 20 per cent recently occurred. Some lines of stocks are improving, but there is no immediate prospect of great improvement in apparatus such as motors, meters, transformers, etc. The credit situation is no better and collections are only fair. Portland contractors in some cases report that business is exceptionally good, while others are not finding it so active. Dealers in this section report that business is good, in some cases very materially ahead of a year ago.

Spokane jobbers report that general conditions are tending toward the dullness affecting other sections. Farmers are holding their wheat in anticipation of higher prices, and bankers are extending the farmers' paper, one bank now having $7,000,000 worth on hand. Sales of supplies are for repairs only with few extensions. Stocks are generally good in all lines with porcelain material and some lamps short.

Plentiful stocks of heating appliances and hollow-ware are on hand. January orders on hollow-ware are now being filled and orders placed after January are being canceled. The current rate of billings is nearly equal to the average of the past twelve months, but new orders are not coming in as the buying public lacks interest at present prices. Collections are running over sixty days.

Conduit.—Half-inch black is being sold at $101.70, and 1-in. at $200 per 1,000 ft., both less 5 per cent for cash.

Flexible Armored Conductor.—No. 14 brings $126, with large stocks and slow market.

Farm-Lighting Plants.—Jobbers are not selling over one-fourth of expected demand. The present cost of plant installed is about $1,000.

Wire.—A further decrease in price is noted. From $13.10 per 1,000 ft. in coil lots for No. 14, rubber-covered, the price has fallen to $10.85. Other prices have changed in proportion. Stocks are good, with demand ranging from fair to medium.

Heating Devices.—Difficulty is found in accumulating stocks for Christmas trade, which to a certain degree has already started. Stocks except irons are low and shipments are coming through unsatisfactorily.

SALT LAKE CITY—DENVER

The credit situation is bad, vexatious alike to jobbers and dealers. Sixty-day business is a pretty fair average. When concerns using credit get through liquidating with the banks they have not much left for their other creditors. As conditions develop in the Intermountain States it is found more and more that the lack of a market for wool is affecting all lines of commercial activity. It was hoped that the first payment to farmers for "bests" would stimulate better business, but the relief from this source has proved somewhat disappointing. Even those who have available money are holding it pending the outcome of the general decline in prices. Crops throughout the jobbing territory are good. Sluggish transportation is an obstacle to marketing. In some sections farmers are holding their wheat in the stacks till spring because high-priced labor makes threshing at present prohibitive.

Speculation is rife as to how the downward trend in the general market is going to affect the electrical trade. Many jobbers believe that a readjustment in the price schedule will have to come before long. Others think that there will be no material change before late spring at the earliest. Frequent turn-overs in stock are the rule, and it is being vigilantly followed. Dealers are wary about loading up with merchandise that is in any way doubtful and they are showing little tendency to stock specially for the holiday trade.

Christmas-Tree Outfits.—There is little response to the general appeal of jobbers to lay in a supply. Dealers are playing safe even on highly seasonable lines.

Motors.—The 10 per cent increase announced several months ago on motors has been ordered canceled.

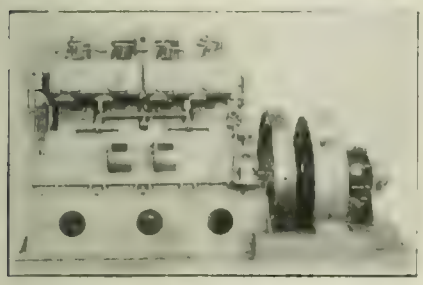
Washers.—Electric washers are moving satisfactorily; considering the average demand for the past six months; stocks are abundant.

NEW APPARATUS & APPLIANCES

A Record of Latest Developments
and Improvements in Manufacturers' Products
Used in the Electrical Field

Oil-Engine-Driven Generator Sets

Generating units driven by heavy-oil engines are being made by the Dodge Sales & Engineering Company, Mishawaka, Ind. The units, which are



RUNS ON HEAVY OIL

direct-connected or belted, and in all standard voltages, use Dodge heavy-oil engines and generators made by the Engberg Electrical & Mechanical Works, St. Joseph, Mich. The sizes manufactured at present range from 12½ hp. to 75 hp.

Material for Mending Heating Elements

A substance for repairing burned-out heating elements of electric ranges, flat irons, etc., is offered to the trade by the Carricite Company, 5436 Ferdinand Street, Chicago.

Rheostat for Charging Batteries from 32-Volt Line

A 6-in. rheostat for charging small batteries from 32-volt farm-lighting plants has just been developed by the



FOR CHARGING AUTOMOBILE BATTERIES FROM FARM-LIGHTING PLANTS

Cutler-Hammer Manufacturing Company, Milwaukee, Wis. The rheostat is connected in series with the battery to be charged. The operating handle may be set for three, six, nine or twelve cells. No ammeter is required to measure the charging current. The device is small and compact and readily mounted on any flat surface.

Standing Iron for Delicate Fabrics

An electric iron that stands on a fixed base while the clothes are passed over it, and which is designed especially for delicate fabrics, has just been developed by the Waage Electric Company, 6 Reade Street, New York City. The ironing head, supported on a rod 11 in. high, is of polished nickel and oval-shaped, measuring 6 in. x 3 in. A plug regulates the heat to four different degrees. The voltage is 110; wattages, 575, 350, 225, 150.

Asbestos-Covered Magnet Wire

An asbestos-insulated magnet wire which will be known as Salamander W. E. finish magnet wire has been announced by the Independent Lamp & Wire Company, 1737 Broadway, New York City. This wire, intended for armature coils, is said to have high dielectric qualities and to be proof against moisture, fire, acid and oil. The coating of asbestos is treated with compound in such a fashion that it resembles rawhide. It is claimed that the wire is practically immune to hammer blows and that the conductor can be deformed without damaging the insulation.

Machine for Winding Lamp Filaments

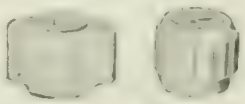
A machine for automatically winding or concentrating coils used in nitrogen, gas-filled and miniature lamps has been designed by Charles Eisler, 159 Clifton Avenue, Newark, N. J. This machine is designed to wind 15-watt to 1,000-watt coils of 25 to 900 turns per inch with a core from 0.003 in. to 0.035 in. The speed is from 500 to 3,000 r.p.m., depending on the size of wire. The wire can be heated electrically to a cherry red while being wound. It is possible to coil about 5,000 ft. of wire in one length, the amount varying with the size of wire.

New Line of Tapes

The General Electric Company, Schenectady, N. Y., will soon place on the market a complete line of tapes, including black or yellow varnished or oiled cloth, white cotton, asbestos, friction tape and splicing gum.

Snap-Switch Handle that Cannot Be Unscrewed

A handle for snap switches which is prevented from unscrewing by means of a ratchet built in it has been developed by the Bryant Electric Company, Bridgeport, Conn. The handle may be substituted for the ordinary handle. The ratchet escapement comes into play when the handle is turned in the reverse direction so that it cannot be loosened or removed. By using a small screwdriver on a screw which is well recessed in the center of the handle the ratchet is released. These handles may be used to prevent the removal of "dead-front" insulated covers of safety panel switches. This

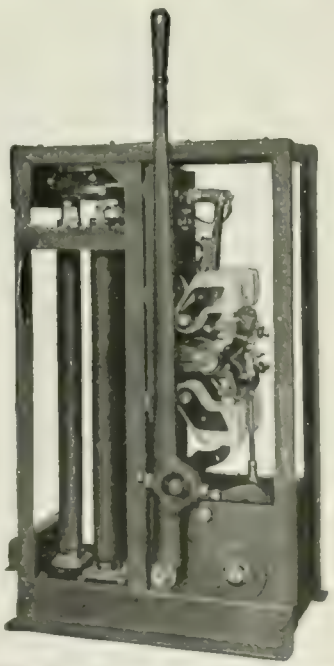


RATCHET PREVENTS THESE HANDLES BEING UNSCREWED

improved feature can be had in small round fluted handles and large and small flat handles in both porcelain and durable composition.

Clapper-Type Controller for Mills, Cranes and Hoists

The Allen-Bradley Company, Milwaukee, Wis., has developed a new line of mill, crane and hoist controllers to supplant its type Q, R and S controllers. The new controller is made in sizes ranging from 1 hp. to 150 hp. All switching and contact making is done with clapper contactors of copper-to-copper, rolling type. A graphite compression resistor is used instead of grids or wire-wound resistors and



CONTROLLER WITH CLAPPER SWITCHES AND COMPRESSION RESISTORS

step contacts. All speed control is obtained by pressure upon the resistor column applied by one control lever.

MANUFACTURERS' ACTIVITIES

Record of Changes Affecting Sales and Distribution
Together with Trade Personals and Notes on Foreign Trade,
Jobbers' News and New Trade Literature

THE ROBBINS & MYERS COMPANY, Springfield, Ohio, will start work immediately to remodel the foundry just vacated by James Leffel & Company.

AMERICAN DI-ELECTRICS, LTD, New York City, manufacturer and engineer in the field of electrical insulation, announces that James C. Barr, 84 State Street, Boston, Mass., has been appointed railway representative for the New England States, handling the company's line of insulating varnishes and compounds.

H. D. RANDALL, formerly manager of the Salt Lake City branch of the General Electric Company, on Oct. 1 became manager of the Denver district office with headquarters in Denver, Col. Robert Miller becomes manager of the Salt Lake City branch. Mr. Randall continues as president of the Capital Electric Company in Salt Lake City.

FAIRBANKS, MORSE & COMPANY, Chicago, have purchased the entire business, consisting of all stock on hand, good will and liabilities, of the Luster Machine Shop & Railway Equipment Company, 917 Arch Street, Philadelphia. The Fairbanks-Morse company has opened a new branch at this address under the management of D. W. Dunn and will sell its complete line of engines, motors, pumps, etc. The entire personnel of the Luster Machinery Company has been retained. E. J. Luster, former president ,will be manager of the machine tool division of the Fairbanks-Morse Philadelphia branch.

THE WESTINGHOUSE UNION BATTERY COMPANY, Swissvale, Pa., has appointed the Battery Service Company of New England, 711 Beacon Street, Boston, its distributer for New England. Charles A. Jackson is treasurer and general manager.

THE TECHNICAL PRODUCTS COMPANY, 501 Fifth Avenue, New York City, announces that the November issue of the *Technical Products Economist* will list many items of new and used machinery, embracing refrigeration, power, pulp and paper, tank and chemical apparatus.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY announces its sales billed during the six months' period from April 1 to Sept. 30, 1920, as $78,771,675. The sales billed during the previous fiscal year, ended March 31, 1920, totaled $136,052,092, so that the current year's business is in excess of that of last year. Earnings for the six-month period and the twelve-month period given above show gross income to be $8,164,875 and $16,801,164 respectively; interest charges, $751,852 and $1,594,823; net income available for dividends, etc., $7,413,023 and $15,206,341. Current assets on Sept. 30, 1920, were $128,630,880, which compare with $101,896,951 for March 31, 1920, while current liabilities for the same dates were approximately $31,000,000.

INDIANA ELECTRICAL MANUFACTURERS WANT OUTLET TO SEA.—Electrical men of Indiana are very much interested in the possibility of ports on the Great Lakes virtually becoming seaports through the proposed Great Lakes-Tidewater route for oceangoing vessels. The manufacturers particularly desire to see the route put through. During the last three years the manufacturers of Indiana, who do a large export business have been handicapped by the general transportation shortage and by high prices obtaining at the seaport cities. Last winter thousands of dollars' worth of shipments were tied up because of weather conditions at both New York and Boston. One electrical exporter in Indianapolis states that it costs him more to get his goods transferred from the warehouse in New York to the dock than to ship the goods from Indianapolis to New York.

THE REMY ELECTRIC COMPANY'S plant at Anderson, Ind., which has been closed for two weeks, will reopen some of its departments soon. It is said that all employees who were laid off will not be called back to work until there is an improvement in business in the automobile line.

THE F. V. L. SMITH BATTERY COMPANY, Atlanta, Ga., recently organized with a capital stock of $300,000, is planning to erect a plant for the manufacture of electric batteries, and also to establish a chain of general service stations.

THE MOLOCH COMPANY, Kaukauna, Wis., recently incorporated with a capital stock of $750,000 to take over the plant and holdings of the Moloch Automatic Stoker Company, has awarded contracts for the first unit of its machine shop and erecting floor 60 ft. x 120 ft. Considerable new equipment will be installed.

THE CAPITAL ELECTRIC COMPANY has just moved into its new building at 310-14 West Second South Street, Salt Lake City, Utah. The building, which is 55 ft. x 165 ft. and of four-story and basement construction, is fireproof and was especially planned and built to make it the last



NEW BUILDING OF CAPITAL ELECTRIC COMPANY

word in usefulness as an electrical supply jobbing house. In the rear of the main building is a large machine shop and factory for rewinding and repairing armatures, motors and other electrical machinery and for constructing switchboards and other apparatus. Railway side track is provided. J. A. Kahn is general manager and H. D. Randall, president.

THE UNITED STATES ELECTRIC COMPANY, New London, Conn., manufacturer of electric forges, hot-water heaters and other equipment, has taken over the local property of the J. N. La Pointe Company for about $50,000. The company recently filed notice of dissolution of its Connecticut charter to incorporate under the Delaware laws with a capital stock of $500,000.

THE UNION ELECTRIC & MACHINE COMPANY, Charleston, W. Va., manufacturer of electrical machinery, etc., has filed notice of increase in capital stock to $50,000.

THE AMERICAN BLOWER COMPANY, Detroit, Mich., contemplates extensions to its foundry at Cincinnati, Ohio, to cost about $90,000.

THE HAYES ELECTRIC COMPANY, Detroit, Mich., has filed notice of change in name to the Hayes Home Appliance Company.

THE RELIANCE ELEVATOR COMPANY, 212 West Austin Avenue, Chicago, has made arrangements for remodeling the plant of the Palmer Tire & Rubber Company, St. Joseph, Mich., recently acquired for its new branch works. The plant, it is expected, will be ready for installation of machinery by the end of the year.

EDWARDS & COMPANY, Exterior Avenue and 140th Street, New York City, manufacturers of electrical specialties, have filed notice of increase in capital stock to $75,000.

Supply Jobbers' Notes

THE ELECTRIC SUPPLY & EQUIPMENT COMPANY, electrical distributer at 220 West First Street, Charlotte, N. C., announces that it has recently acquired additional warehouse facilities in Charlotte, doubling the original warehouse room. The company has just issued to the trade in its territory its 1920 supply catalog.

THE MINE & SMELTER SUPPLY COMPANY, Denver, Col., is making over its office space to care for its increasing electrical supply business. Since September, 1917, the personnel handling electrical supplies has increased in number from fifteen to forty-seven at the present time. H. J. Gundlach has been made sales manager of the Denver branch and J. W. Ryall manager of the electrical department, vice Mr. Gundlach.

Foreign Trade Notes

THE CANADIAN WESTINGHOUSE COMPANY, Ltd., Hamilton, Ontario, Canada, has recently awarded contracts in connection with power house to cost about $10,000.

MARKET FOR AMERICAN ELECTRICAL PRODUCTS IN THE NETHERLANDS.—The United States Consul reports that there is an excellent opportunity for American electrical products, including lighting fixtures, copper wire and other electrical equipment, in the Netherlands, owing to Germany's inability to furnish them in sufficient quantities.

FRANCE REORGANIZES FOREIGN TRADE BUREAU.—The Office du Commerce Exterieur of France, although bearing the name of a bureau that has been in existence for some time, has recently been reorganized on a more ambitious scale. This department of overseas trade is a practical link between official France and the general public at home and abroad. It is now aided on the financial side by the new Foreign Commerce Bank. It controls the service of French commercial agents and is responsible for organizing trade exhibits in France and other countries. The department supplies trade information in the form of loose-leaf pamphlets, or in response to verbal and written inquiries, and at the same time welcomes the opportunity of helping foreign traders seeking information as to the French market. The department will soon begin the publication of a periodical similar to the British Board of Trade *Journal*.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An importing firm in Switzerland (No. 33,980) wishes to be placed in communication with manufacturers of porcelain electric fixtures, especially insulators, with a view of establishing trade relations.

The representative of a firm in Australia (No. 33,969) is in the United States and desires to receive an agency for the sale of electrical lighting, insulating, switchboard material, etc.

A merchant in Mexico (No. 34,019) desires to purchase one electric furnace for fusing limestone for the manufacture of calcium carbide.

A commercial agent in Australia (No. 34,029) desires to be placed in communication with manufacturers who desire representation throughout that country for the sale of electrical supplies of all kinds.

A mill owners' association in India (No 33,994) desires to secure an agency and purchase electrical plants for bungalows.

A commercial agent in France (No 33,998) wishes to purchase and secure an agency for the sale of resistance chrome-nickel wire and resistance molybdenum-chrome-nickel wire, round, square and in plates, for electric heating.

Trade Publications

OIL ENGINES.—The De La Vergne Machine Company, foot of East 138th Street, New York City, has recently issued bulletins Nos. 176, 177-5 M-5-19, 178 and 153-No. 40, describing and illustrating its different types of oil engines for power plants, etc.

LIGHT, HEAT AND POWER.—Dwight P. Robinson & Company, 125 East Forty-sixth Street, New York City, are distributing a pamphlet describing and illustrating different light, heat and power plants designed and constructed by the company.

INDUSTRIAL TRANSPORTATION.—The Lakewood Engineering Company, Cleveland, Ohio, is distributing a booklet calling attention to the lack of modern transportation facilities in industrial plants. It also describes and illustrates many devices and machines for improving transportation systems in manufacturing plants, marine and railway terminals.

DIRECT-CURRENT GENERATORS.—The General Electric Company, Schenectady, N. Y., has issued digest bulletin No. 40,017A, superseding No. 40,017, covering its small direct-current generators and exciters, type ML, standardized from 1 to 35 kw.

EXTENSION FRAMES.—S. W. Hull & Company, 3729 Prospect Avenue, Cleveland, Ohio, have issued a new data book on the use of pole-top extension frames, for adding new circuits on poles that are too short to give proper clearance for another cross-arm.

CONTROLLERS.—The Allen-Bradley Company, Milwaukee, Wis., has issued bulletin F-2250, supplementing bulletin B-15, describing its newly developed "clapper-type" controllers for mill, crane and hoist service.

BELTING.—The Graton & Knight Mfg. Company, Worcester, Mass., has issued a ninety-six page loose-leaf bulletin, No. 101, dealing with standardized leather belting for power transmission.

HEATERS.—The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has issued a "Dictionary of Uses" for its space heaters—a sixty-four-page booklet, No. 867; also a folder No. 863, four pages, on "Protecting the Sprinkler System Against Freezing."

BELTING, ETC.—The Boston Belting Company, Boston, is issuing a booklet covering its various rubber products—belting, hose, mats, etc.

New Incorporations

THE PINEORA (GA.) UTILITIES COMPANY has been incorporated by P. J. Ziegler, J. V. Norton and William L. Gignilliat. The company is capitalized at $50,000 and proposes to establish electric lighting, power, water and telephone plants.

THE ALFCO ELECTRIC COMPANY, Hagerstown, Md., has been chartered by F. A. and G. E. Vogelsang and Ambrose L. Foreman. The company is capitalized at $10,000 and proposes to manufacture electrical fixtures.

THE ELECTRICAL SUN COMPANY, Miami, Fla., has been incorporated with a capital stock of $220,000 to do an electrical advertising business. The officers are: Charles P. Winters, president; William J. Van Vlech, vice-president, and Karp R. Morgan, secretary and treasurer, all of Asbury Park, N. J.

THE MEEK-DENNISON MANUFACTURING COMPANY, Huntington, W. Va., has been chartered by E. C. Meek, R. C. Dennison and V. G. Bryan. The company is capitalized at $50,000 and proposes to manufacture electric signs and other electrical equipment.

THE LOYAL LAMP SHADE COMPANY, Brooklyn, N. Y., has been incorporated by M. and J. M. Reiss and A. J. Osborne, 662 Quincy Street, Brooklyn, N. Y. The company is capitalized at $5,000.

THE DIAMOND GRID BATTERY & ELECTRIC COMPANY, Ashland, Ky., has been organized by C. F. Higgins and J. H. Briant to manufacture electrical batteries and accessories.

THE ELECTRICAL EQUIPMENT COMPANY has filed articles of incorporation to do business in Kentucky. Capital stock amounts to $25,000. The corporation will manufacture electrical supplies and install lighting plants. The incorporators are I. T. Noe, Louisville, Ky.; B. C. Wilson, Frankfort, Ky.; H. Clay Anderson, Lexington, Ky.

THE HOME ELECTRIC APPLIANCE COMPANY has been chartered with a capital stock of $25,000 by J. C. Akers, W. H. Levine and H. Scott. The company proposes to manufacture electrical appliances.

THE RISING STAR (TEX.) LIGHT & POWER COMPANY has been incorporated with a capital stock of $15,000 by W. L. Felt, J. E. Lewis and J. R. Edison.

THE H. B. POLAK MANUFACTURING COMPANY, 279 Magnolia Avenue, Jersey City, N. J., has been organized to manufacture electrical equipment. Henry B. Polak is promoter of the company.

THE MAGNETOR GENERATOR & REPAIR SHOP, 69 William Street, Newark, N. J., has been organized to manufacture magnetos and parts and to operate a general machine shop. Irving N. Yadwin, 558 Grove Street, Irvington, is interested in the company.

THE ELECTRIC PARTS AND SERVICE COMPANY, Hartford, Conn., has been incorporated by C. H. Schray, 646 Windsor Avenue; J. H. Miller and E. G. Reinert. The company is capitalized at $50,000 and proposes to manufacture electrical equipment for automobile service.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

BOSTON, MASS.—Plans are under way by the A. T. Stearns Lumber Company, 99 Taylor Street, for improvements to its power plant to cost about $30,000. Monks & Johnson, 99 Chauncy Street, are architects.

FALL RIVER, MASS.—The city officials will soon award the contract for the erection of a pumping station and dam on Watuppa Pond to cost about $150,000. H. K. Barrows, 63 Beacon Street, Boston, is engineer.

FALL RIVER, MASS.—The Lincoln Manufacturing Company contemplates the erection of a switching station at its local textile mills, in connection with the proposed addition to Mill No. 2, to cost about $300,000.

HARTFORD, CONN.—A permit has been issued to the Hartford Electric Light Company for the construction of a steam-electric power station on Van Dyke and Wawarme Avenues to cost about $2,815,000.

Middle Atlantic States

BROOKLYN, N. Y.—Bids will be received by the Board of Education, 500 Park Avenue, New York City, until Nov. 23 for installing electrical equipment in the new Public School No. 181, on New York Avenue and East Thirty-fourth Street.

BUFFALO, N. Y.—The Niagara Falls Power Company contemplates the erection of a new transmission line from Buffalo to Niagara Falls, via Grand Island, for furnishing 100,000 hp. in addition to the present service. Plans include the furnishing of light and power for local distribution on Grand Island.

HORNELL, N. Y.—Permission has been granted by the Public Service Commission to the Hornell Electric Company for the construction of a power plant at Hornellsville for local service.

THIELLS, N. Y.—Bids will be received by Frank A. Vanderlip, president of the board of managers of Letchworth Village, 7 Wall Street, New York City, until Dec. 1 for underground electric service connections at Letchworth Village, Thiells.

JERSEY CITY, N. J.—According to a report submitted to the Boulevard Commissioners by Frank Radigan, county engineer, it will cost about $60,000 for improvements to the Laurel Hill power plant, including two new transformers to cost $36,000.

NEWARK, N. J.—Experts will be engaged by the City Commission to conduct an investigation for the purpose of establishing a municipal power plant at this place. According to Commissioner Thomas L. Raymond, two city-owned buildings, one in the meadows and the other on Clifton Avenue, may be used as unit plants.

HARRISBURG, PA.—Plans have been filed by the Harrisburg Light & Power Company for the erection of an addition to its electric substation on Cedar Street, near West Cameron Street.

PHILADELPHIA, PA.—The Glen Knitting Mills, Second and Westmoreland Streets, contemplate the erection of a power plant to cost about $52,000.

PHILADELPHIA, PA.—A proposition has been tendered to the city officials by the Philadelphia Electric Company for lighting the highways and streets at $1,355,868, including the installation of proposed new lights. The contract of the present year was placed at $1,317,289, and it is understood that the entire balance will be used for the new lighting units.

TYRONE, PA.—The borough officials are negotiating with the Public Service Commission for improvements and betterments to the local street-lighting system and service.

BALTIMORE, MD.—The General Chemical Company, Munsey Building, has plans under way for the erection of a 50-ft. x 59-ft. power house at its plant at Race and Winder Streets.

KINGWOOD, W. VA.—The Carleton Mining & Power Company has plans under consideration for the erection of an electric power house.

CLIFTON FORGE, VA.—The Chesapeake & Ohio Railroad, 61 Broadway, New York, N. Y., contemplates the erection of several buildings at this place, including a power house.

North Central States

DETROIT, MICH.—Plans are under way by T. A. Leisen, engineer, care of the Board of Water Commissioners, 232 East Jefferson Avenue, for a tunnel for water mains, including electric conduits, wires and cables.

DAYTON, OHIO.—The Dayton Power & Light Company, Fourth and Jefferson Streets, plans to issue $1,000,000 in bonds for the purchase of equipment, such as generators, turbines, transmission material, transformers, etc., for the purpose of increasing the capacity of the Miller's Ford plant.

SANDUSKY, OHIO.—The Sandusky Cement Company, Engineers' Building, Cleveland, contemplates the erection of an addition to its power house to cost about $25,000. W. B. Newberry, Engineers' Building, Cleveland, is engineer.

UHRICHSVILLE, OHIO.—It is reported that a recent fire damaged the power plant of the Unitile Company, Trenton Avenue, to the extent of $10,000.

WEST CARROLLTON, OHIO.—The installation of a new street-lighting system at this place is contemplated by the Dayton Power & Light Company.

WILLOUGHBY, OHIO.—The Thor Tire & Rubber Company, care of R. C. Gary, 802 Society for Savings Building, Cleveland, contemplates the erection of a factory and power plant to cost about $300,000.

BLOOMFIELD, KY.—Harry Peet, Jr., proprietor of the Bloomfield Utilities Company, has purchased the Bloomfield light plant and contemplates changing the present direct-current system to alternating current.

TAYLORVILLE, KY.—The city officials have had plans prepared for the erection of a municipal electric light plant.

WALTON, KY. An issue of $10,000 in bonds has been authorized for the erection of a municipal electric light plant on Main Street.

FRANKFORT, IND.—Upon completion of surveys for the proposed municipal electric light and power plant the city officials will appoint an engineer to prepare plans.

PEKIN, ILL.—A company will be organized with a capital stock of $15,000 for the purpose of supplying light and power to this town. Energy will be furnished by the Central Illinois Light Company.

LAKEVILLE, MINN.—The Northern States Power Company, Northfield, contemplates the extension of a transmission line from this place to Webster. Guy F. Harden is superintendent.

OWATONNA, MINN.—Plans are under way by Toltz, King & Day, consulting engineers, 1410 Pioneer Building, St. Paul, for the erection of a municipal light, power, heat and gas plant to cost about $475,000.

PETERSON, MINN.—The council plans a special election to submit to the voters the proposal to issue bonds for the installation of an electric lighting system. Carl Johnson is village clerk.

FULTON, MO.—The light and water committee has made a recommendation to the City Council that a new power plant be erected at a cost of about $75,000.

WELLINGTON, MO.—Plans are under way for the erection of a municipal electric plant to cost about $60,000. L. A. Walton is city clerk.

LINWOOD, NEB.—The village officials contemplate the issue of bonds for the erection of an electric distributing plant.

NORFOLK, NEB.—A movement has been started for the submission of an issue of $300,000 in bonds for the erection of a municipal electric light and gas plant.

BREWSTER, KAN.—The City Council has called a special election to vote on the issue of bonds for the erection of an electric light plant.

Southern States

LENOIR, N. C.—The Granite Falls Manufacturing Company, Granite Falls, has applied for preliminary permit for the construction of a power house, dam, etc., on Wilson Creek and a transmission line for service in Lenoir.

MORTIMER, N. C.—The United Mills Company, Hickory, contemplates the erection of power houses, dams, transmission lines, etc., for the operation of cotton mill and for public service in Mortimer. H. J. Holbrook is secretary.

GREER, S. C.—The Piedmont & Northern Railroad, Charlotte, N. C., contemplates the erection of a power-house substation.

GREER, S. C.—The city officials contemplate the erection of a 13-mile transmission line to Fair Forest to connect with Duncan, Wellford and Spartanburg, to cost about $50,000. John A. Law, Spartanburg, is engineer.

NASHVILLE, TENN.—The National Industrial Corporation, H. G. Hill, president, contemplates improvements to its power plant. C. B. Howard & Company, 118 Fourth Avenue, are engineers.

MONTGOMERY, ALA.—Application has been filed with the Federal Power Commission at Washington, D. C., by the Alabama Power Company, Birmingham, for permission to construct a dam and hydro-electric plant at Duncan's Riffle on the Coosa River.

TUSCALOOSA, ALA.—Plans are under way for the erection of a dormitory building and the first units of a laundry, power house, etc., for the Alabama Home for the Feeble-Minded. Total cost is estimated at about $2,000,000. D. O. Whilldin, Title Guaranty Building, Birmingham, is architect.

HOUSTON, TEX.—The Houston, Bay Shore & Texas City Traction Company plans to increase its capital stock from $300,000 to $1,000,000 to provide for the construction of an interurban electric railway from this place to Texas City, a distance of 15 miles. Edward Kennedy is president.

Pacific and Mountain States

VANCOUVER, WASH.—The Spirit Lake Railway has made application for permit to construct a power house, reservoir, etc., at Toutle River and Spirit Lake. Joseph Roome, 110 East Twelfth Street, is president.

EXCHEQUER, CAL.—Application has been made for preliminary permit by the Merced Irrigation District, Merced, for the erection of a dam at this place for irrigation and power purposes.

SAN FRANCISCO, CAL.—Application has been made by A. P. Seybold, 1213 Hobart Building, for perliminary permit for the development of a power project at Klamath River and Bluff Creek.

VICTORVILLE, CAL.—Surveys are being made by the Victor Valley Irrigation District for an irrigation system, including a hydro-electric plant, booster pumping plant etc., to cost about $7,000,000. F. C. Finkle 448-449 I. W. Hellman Building, Los Angeles, is consulting engineer.

SALT LAKE CITY, UTAH.—Bids are being received by S. Q. Cannon, city engineer, for extensions to the ornamental street-lighting system in the business section.

IDAHO FALLS, IDAHO.—The Howard Pulp & Paper Company has plans under way for the erection of a news-print paper factory to cost about $4,000,000. Plans also include a power plant to generate 18,000 hp. Thomas L. Tomlines, City Bank Building, Syracuse, N. Y., is engineer.

CASA GRANDE, ARIZ.—The City Council is considering improvements in the light and water departments, including the installation of a steam plant with generators, motors, boilers, etc.

CLYDEPARK, MONT.—The Montana Power Company, Livingston, contemplates the erection of a transmission line to supply light and power to Shields Valley near this place. J. R. Kaiserman is manager.

LO LO, MONT.—The Amazon Dixie Mining Company, Wallace, Idaho, has applied for a license for the construction of a transmission line over the Lo Lo National Forest for mining operations of the company.

Canada

LONDON, ONT.—Bids will be received by R. C. Desrochers, secretary of the Department of Public Works, Ottawa, until Dec. 1 for electric lighting of the grounds and additions to transmission lines at the Westminster Psychopathic Hospital, London.

TORONTO, ONT.—The Ontario Hydro-Electric Power Commission is considering the construction of a radial railway line to the border between the United States and Canada. F. A. Gaby is chief engineer.

Miscellaneous

JUNEAU, ALASKA.—The Alaska Endicott Mining & Milling Company, care of John B. Marshall, Juneau, has filed application for a power project, including the diversion of water from an unnamed stream and lake at the head of the William Henry Bay.

Record of Electrical Patents

Notes on United States Patents

(Issued Nov. 13, 1920)

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1,357,942. Rectifier for Alternating Currents; Edwin C. Ballman, St. Louis, Mo. App. filed June 25, 1917. Vibrating.

1,357,979. Transmission-Equalization Arrangement; Alfred U. Happel, Evanston, Ill. App. filed Oct. 2, 1919. Telephone.

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1,258,179. Method of Testing the Insulation of Generators in Service; Edmund O. Schweitzer, Chicago, Ill. App. filed May 24, 1917. Exploring conductor installed near working conductors.

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1,358,182. Trunk Circuit; Charles Sparks, Chicago, Ill. App. filed March 25, 1916. Telephone trunking systems.

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Rural Service Will Help Solve National Problems

ANY steps which encourage decentralization of the population by making rural districts better places in which to live ought to be encouraged by every available means. If electric light and power were generally available in the agricultural regions on which city dwellers must depend, there would be far more encouragement for local industries and better opportunities for building up again those country districts which have fallen upon evil days. General electrical distribution is a powerful factor in making the country attractive to live in and to work in. Rural California, for example, is almost in a class by itself as regards the general use of electricity. If distribution facilities in other parts of the country, more thickly populated and far more easily reached by transmission lines, were anything like so good as they are on the Pacific Coast, centrifugal forces would be set to work, bringing the population outward from the crowded centers to build up anew the prosperity of rural territory.

Are Flat Rates Desirable?

IN THE early stages of each water-power development companies usually offer flat rates for electric service, believing that electricity costs virtually nothing to generate after the fixed charges on investment have been wiped out. While the fixed charges still constitute the greater portion of the cost of generating hydroelectric energy, many companies which have been making flat rates for years now find themselves in the position of having to install more equipment than is warranted by the revenue, because the consumers have increased their load factor. Is it not time to discontinue flat rates, base charges on load factor or go into a straight maximum-demand and energy charge? Some of the water-power companies of the Northwest have chosen to limit the load factor when energy is supplied at a flat rate, hoping that the diversity factor will enable them to continue this form of charge.

Factory Educational Courses Have Definite Limits

FACTORY educational courses give men an understanding of the fundamentals of the specific work they are called on to do, create a greater interest and pride in the work and make for greater efficiency by developing knowledge and ability to think. The courses, however, cannot produce high-class technical men. Their limitations are due to the comparatively small amount of time that can be devoted to such work. If these facts were clearly realized, there would be fewer failures in such industrial courses. Such failures are often caused by attempts to go too far in theoretical subjects while too little in the line of teaching by practical demonstration is accomplished. Concentration on the development of men for the specific tasks they are called upon to perform, with only enough of the theoretical to give them an understanding of the why and wherefore of these tasks, will not only produce better results but will quickly indicate the men who should be assisted to greater development through the technical schools. The picking out of men for further technical education should be one of the aims of factory courses, and to that end industrial managers should co-operate with technical schools in the formation of their courses.

Customer Ownership of Securities

RENEWED interest is being displayed by central-station managers in customer ownership of utility securities. The present financial situation not only makes the plan attractive but its possibilities as a factor in the education of the consumer as to the real place of the utility in the community furnish an even more powerful argument for its employment. It must be realized, however, that the ordinary methods followed by banking houses in placing such securities will not avail. For the most part the users of electric service have little understanding of finance and must be enlightened. Another requisite is that the securities must be safe. A single failure may mean disaster. Moreover, in placing them a steady campaign is necessary. The buyer must be taught that the company has something to offer that is worth while, and his experience must be such that he will come back again and again.

Responsibilities of the Engineer and Construction Man

SO MUCH is heard about the friction existing in many places between construction departments and engineering departments that many have come to think that the situation cannot be changed. The signs of this friction between the construction man, or so-called practical man, and the engineer are lack of co-operation, duplication of work and the feeling of each that the other is intruding on his premises. The results show in waste of material and waste of labor. To deny the existence of this friction is impossible. On the other hand, to give up hope of eliminating it is to block progress in a vital place. Many reasons have been given to explain the existence of the trouble, and much emphasis has been laid on finding the causes, but little attention has been given to remedies. Would it not be well to point out to both sides that their respective rôles are widely different and that with an understanding of the purpose of each kind of work

there might be no reason for conflict? The engineer plans the work; the construction man does the work. No simpler or more complete distinction could be made and none could represent more accurately the conditions that should exist. There is no doubt, even at the present time, that the best results are obtained by such a division of responsibility. All enterprises where such relations and understanding obtain have shown the best efficiency, economy and engineering accomplishment. In other words, experience has shown that one department or one man cannot handle both the planning and the doing of the work as well as two co-operating departments or men can. Not only would absolute impartiality toward both activities be impossible to obtain, but also there would be the difficulty of insuring equal proficiency in both—something very seldom encountered.

It is hardly necessary to point out that many men would be able, with the necessary training, to handle either branch of the work with equal success, and that both branches require their quota of practical experience, engineering knowledge and executive ability. It is therefore in the main simply necessary to realize that either planning the work or doing the work is in itself a job of a scope sufficient to be worthy of undivided effort and promising unlimited accomplishments.

Modern Practice in Transmission-Line Insulation

NO SINGLE element in a complete transmission system surpasses in importance that of line insulation. As a consequence research engineers have in recent years given the closest study to line insulation, in order that the increasing demands of the high voltages of expanding transmission systems may be met. In this field America unquestionably has been the leader and she has contributed largely to knowledge on this important question. An excellent summary of that knowledge and of present American practice in line insulation which should be welcomed by transmission engineers is given in a series of articles by F. W. Peek, Jr., which begin in this issue. The series should prove especially valuable in connection with the plans of the International Electrotechnical Commission for standardization by giving engineers in foreign countries a good understanding of high-tension insulation practice in the United States.

The directions in which recent progress has been made are clearly indicated in the current issue, which also emphasizes how far we still remain from satisfactory and reliable solution. Perhaps the most striking advance lies in the recognition of the importance of the impulse ratio for air gaps and insulators. It is to be noted that this ratio does not have a constant value, but depends on the steepness of the voltage impulse. Nor is the law of variation with steepness of the wave front known. A further uncertainty is the range of steepness of wave which occurs in practice. Notwithstanding these things, great progress has been made in the study of line insulators, and it is now possible to lay down fairly definite principles of design to meet the different classes of disturbance.

Further indication of progress is given in the curve showing the relation between time and puncturing voltage for insulation. The shorter the time of application, the higher the value of puncturing voltage, the puncturing voltage for an indefinite time approaching a definite limiting value. It is shown that repeated applications of a voltage stress not of itself sufficient to cause puncture, but in excess of the minimum breakdown voltage corresponding to indefinite time, will ultimately cause the insulation to fail. These effects are probably due to a localized breakdown within the body of the insulation. This local breakdown is of the nature of ionization with its accompanying electrolytic or thermal decomposition. It results in progressive deterioration leading to ultimate complete breakdown. The same explanation can probably be made of the advantages from the standpoint of impulse ratio of a petticoated insulator over one with smooth surfaces.

Opportunity to Improve Furnace Conditions

THE boiler plant is the department in which the central station producing energy by steam-driven units can effect the greatest economies or suffer the largest losses. It is true that the company which can proceed with the construction of a new plant is in the best position to take full advantage of all the lessons that experience has taught the designer and operator in cutting down boiler-plant losses. This fact should not blind the operator to the fact that the ordinary course of maintenance work in a boiler plant offers numerous opportunities to correct defects in early designs revealed by later experience. One possibility of this sort is in the design of ignition arches. More and more intelligent study is being given to furnace conditions, and many operators are not hesitating, when the course of maintenance work offers opportunity, to change furnace arrangements in the effort to obtain better results in the use of fuel. Even though physical limitations should prevent full use of the knowledge that experience has given the maintenance supervisor would be culpable if he did not do everything possible toward this important end.

Central-Station Industry Cannot Be Accused of Profiteering

SOME features of the post-war situation of a group of central stations are reviewed in the ELECTRICAL WORLD this week on page 1067, with an analysis of the variations in costs, service and profits that have occurred in the last seven years, especially with reference to the period since the armistice. The plants considered are twelve good-sized stations in New England especially typical of the conditions which have come about through the changes in the costs of fuel and labor. The outstanding fact is that the combined rating of these plants has more than doubled since pre-war times, following quite closely an increase in the connected load. Interconnection somewhat bettered the conditions of distribution, and this, with the improvement in diversity factor and a threefold increase in the number of customers, has tended strongly to bring about a better load factor.

The striking increase in the cost of fuel, particularly during the last two years, in which it has doubled, is the principal factor in added expense. This has demanded closer attention to efficiency in the plants, and there has been on the average a decrease of between 15 and 20 per cent in the coal required per kilowatt-hour.

From the standpoint of general improvement the most conspicuous item is the great increase in the

number of customers, showing how year by year, in the stress of war and the even more difficult period following it, electric service has become more and more a vital part of community existence.

After the United States entered the war operating expenses took a sudden jump, and the production costs, as our chart shows, rose so fast that rate increases due to coal clauses and surcharges failed to keep up with their rapid upward shoot. It is very recently that more stable conditions have been reached, and even now it is perfectly clear that prices for electrical energy must still further increase to insure a reasonable return to the utilities. The fact is that the price of electric light and power has risen less since 1913 than any other important product of general use. The central-station industry is about the only one which has steadily played the game and refrained from taking advantage of war conditions to raise unduly the price of its product, and if fuel becomes even more expensive the central stations can come before the commissions with clean hands to ask a fair return upon their necessary capital investments.

Locating Faults on Underground Cables

THE ordinary method of attempting by electrical means to locate a fault in an underground distributing conductor is that of the Varley-loop test. This test, however, requires the use of an intact return conductor back to the testing station. Unfortunately a serious fault in a three-phase underground cable usually causes a rupture of continuity in all the conductors and so prevents the application of the Varley-loop method. In such a case an alternating current of the regular 60-cycle frequency is often applied to the faulty cable at the testing station, and search is then made along the cable for the point at which the inductive effect of this current undergoes sudden variation. Much then depends upon the resistance of the fault. If the fault has a high resistance, the potential at the fault will be almost as great as at the testing station, and the alternating-charging current in the section beyond the fault may be relatively so large as to give very reliable indications.

Another method, one which has long been in use, is to send a direct current into the faulty cable from the testing station, with interruptions of very low frequency, and then to make observations with a pocket compass along the cable for the point at which the direct-current magnetic field undergoes sudden variation by reason of the escape of current through the fault. An ingenious modification of this test is described in this number by W. R. Bullard. The testing instrument, instead of being a suspended magnetic needle, is a portable little dynamo-electric machine of such form and dimensions that the field magnet can be made to straddle the faulty cable. When the direct current flows through the cable this current magnetizes the little hand-driven dynamo and causes it to generate a detectable electric current, whereas when the cable current is interrupted the field excitation is lost and only residual magnetic effects are produced. If the direct current in the cable and consequently the indications fall below a certain value, owing to high resistance in the fault, the indications may be magnified above stray disturbances by a simple and ingenious expedient explained in the article.

Interior Wiring for Farm Buildings

HOW interior wiring on the farm, particularly for barns and buildings other than residences, should be done needs careful consideration. Recently the Industrial Commission of Wisconsin issued a bulletin calling attention to the advisability of all wiring in such buildings being placed in conduit, but an informal discussion of the bulletin has shown the existence of troubles that indicate the need of careful investigation as to the kind of installation it is advisable to make. In stables particularly, the fumes from animal wastes have had a detrimental effect on conduit. In winter weather some cases of serious condensation in conduit installed in a stable have been encountered, and in one case at least an inspector has raised the question whether open wiring, guarded from contact by individuals and from mechanical injury, is not preferable to conduit work. The use of brass in place of porcelain sockets and ordinary snap switches in place of weatherproof switches is a practice all too common. The fire hazards involved are unusual because of the presence of large quantities of loose hay and straw and the general use of timber construction. The subject should receive careful consideration with a view to modifying existing practices to meet such new conditions as may be discovered.

Installations Should Facilitate Future Repair

SOME extremely useful hints on the care and repair of hydraulic turbines are given this week in a paper by L. W. Wyss. Turbines used to be installed, apparently, on the theory that eternal life was theirs, and it was very unusual to find proper facilities for getting at the runners and other internal parts of the equipment with facility. Sometimes on account of the particular hydraulic situation existing it was not even easy to provide for a necessary shutdown. Few are aware how great the improvements in turbines have been within the last twenty years—improvements quite comparable with the gains that have been made in substituting steam turbines for reciprocating engines. The same changes for the better in a similar degree have come about in the installation, and it is now very rare to find more than two runners on the same shaft, or a collection of rattletrap gears in the main drive. Mr. Wyss lists the things which must be looked into when time comes for inspection or repairs of the turbine, laying particular stress on the need of cutting as short as possible the time required for the operation. This implies very complete preparation for every mechanical move that has to be made, in order that once the turbine is shut down it may be promptly opened up and the parts handled as necessary. The water turbine is, in fact, an extremely durable and reliable prime mover, but if anything does happen to it the results are likely to be serious and to put the unit out of service for some little time. Mr. Wyss' suggestions make it very evident that today in installing hydraulic turbines for power service the installation should be designed at the start so that repairs shall be easy instead of difficult or well-nigh impossible, and the whole plant should be arranged so as to cause the minimum disturbance to service by the shutdown of a single turbine for the brief period which should be all that is necessary thoroughly to overhaul it.



Gano Dunn

An engineer of the highest type who, besides excelling in invention, design and construction, is an executive with a broad conception of engineering social endeavor which has made him a dominant figure in the profession

STRAIGHT thinking combined with a sympathetic nature and a charming personality makes for leadership. Thus it is with Gano Dunn. As an engineer he has made many original contributions to electrical design and application. As an executive he has led great organizations with sympathy and resourcefulness through many important developments. But in addition he has unselfishly given freely of his time and effort to engineering association activities in order that greater progress could be made by the entire profession. Directly upon graduation from Columbia University in 1891 as an electrical engineer he became an apprentice in the Crocker-Wheeler shops. This company was then in its infancy, and Mr. Dunn grew up with it, being successively assistant engineer, chief engineer and later vice-president and director. With this organization he was engaged principally in the design of electrical apparatus, and later as an executive he had direct supervision over this phase of the company's work. For a long time he gave especial attention to the industrial application of electric power, the company being one of the pioneers in the application of the electric motor to machine tools and to industrial purposes generally.

Toward the end of 1911 Mr. Dunn left the manufacturing field to engage in consulting engineering practice as a director and vice-president in charge of engineering and construction of J. G. White & Company. In 1913 he became president of the J. G. White Engineering Corporation, in which work he is now engaged.

Because of his exercise of his inventive ability the industry has become the richer. Patents have been granted to him on the structural features of the generator, motor, rheostat and heavy-power switch and on systems of operation, control and speed regulation. Among the latter is a system for operating heavy-duty two-high reversing roll trains in steel mills whereby almost instantaneous reversals of full speed can be secured without imposing heavy peaks on the energy supply system.

It is in the field of engineering social endeavor, perhaps, that Mr. Dunn has been of broadest service to the profession. This is probably best indicated by a brief recital of some of the more important appointments he has held, namely: president American Institute of Electrical Engineers, 1911-12; president United Engineering Society, 1913-16; vice-chairman National Research Council, 1917; chairman Engineering Foundation, 1915-16; vice-president International Electrical Congress at Turin 1911; member War Department nitrate commission, 1916-18; member engineering committee of the Council of National Defence, and member American Committee of International Electrotechnical Commission. He also assisted in organizing the International Electrical Congress in St. Louis in 1904 and was secretary of the section on electric lighting and distribution.

Although Mr. Dunn has been prominently active in the industry for so long a time, it cannot be said of him that he has grown old in the service. It was only a month ago, on Oct. 28, that he celebrated his fiftieth birthday.

Locating Faults on Underground Cables

Direct Current Used for Tracing Instead of a Pulsating or Alternating Current—Effect of Capacity, Resistance of the Fault, and Stray Currents Eliminated—Method May Be Used on Live Circuits

By W. R. BULLARD

United Electric Light & Power Company, New York City

THERE are many schemes used for locating faults on underground cables, such as the bridge or loop method and the use of various tracing currents. All of these methods, however, have had certain limitations due to the effect of capacity, resistance of the fault, stray currents and other similar factors. Owing to these limitations on previous methods the United Electric Light & Power Company of New York City has developed a scheme for using direct current for tracing that has given accurate results for practically all conditions of faults found in underground cables.

Limitations of the Bridge Method

For the proper use of the bridge method it is required that the conductor on which the fault is located shall not be burned apart, and also that a clear conductor of the same length and of approximately the same size, running between the two points which constitute the ends of the conductor at fault, shall be available. This is not always the case. For instance, in the case of a three-conductor feeder, all three conductors may be short-circuited and grounded, or one or more of them may be burned apart, and no other feeder of the same length running between the same two points may be available at the proper time. Furthermore, the bridge method can never be used when the cable or circuit at fault is alive on high potential.

In cases where one or more conductors are burned apart but not grounded the fault can be approximately located by measuring the capacity of a conductor on either side of the fault. This method will not apply, however, if the two sections of the conductor are grounded.

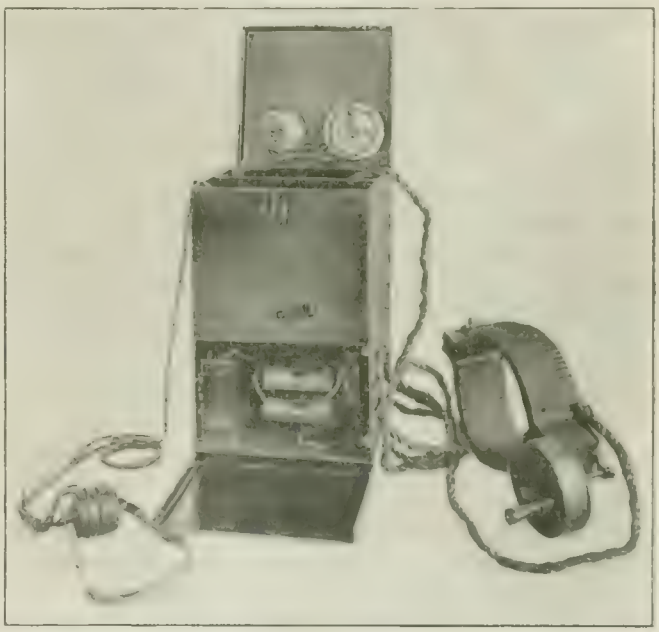
Effect of Pulsating Currents

Owing to the limitations of the resistance and capacity methods, various methods have been devised for locating faults by passing alternating or pulsating current through the conductor to the fault and then with an exploring coil and telephone receiver, or some similar form of detector, proceeding to test for the presence of the tracing current at various points along the cable. This is done until the fault is passed, when under the proper conditions the tracing current will disappear. This method is fairly satisfactory under all conditions involving a ground of very low resistance on one or more conductors or a short circuit of very low resistance between two or more conductors. But in cases involving high or moderate resistance of grounds or short circuits the method quite frequently fails. This is due to the fact that under conditions of moderate or high resistance a potential is set up at the fault by the tracing current, and this potential causes a current to flow beyond the fault, owing to the capacity between conductor and ground or between two conductors.

In practice this defect has proved to be so serious that the method in itself has come to be regarded as almost entirely non-dependable. Gross errors in indicating the location of faults have come to be regarded as the rule rather than the exception. For instance, in one particular case involving a three-conductor feeder approximately 1½ miles (2.4 km.) in length a fault occurred in the section immediately outside of the station, at one end of the feeder. Interrupted direct current was applied from the station and indications were obtained at points along the feeder almost to the opposite end, thus giving an indication almost 100 per cent incorrect.

The Direct-Current Method

The ideal form of current for use as tracing current is that involving no changes of value, or, in other words, direct current. But for this form of tracing current it is obvious that some method of detection other than the ordinary exploring coil must be used. A method of detection for use on direct current has been developed. The elements of this method are shown in Fig. 1.



DETECTOR SET DEVELOPED BY UNITED ELECTRIC LIGHT & POWER COMPANY FOR LOCATING CABLE FAULTS WITH DIRECT CURRENT

Direct current is applied from one end of the feeder in a manner similar to that used in the case of alternating current. An interrupter is used, but the period of interruption is very slow, being in the neighborhood of two seconds for each complete cycle. That is, the cycle consists of a period of one second on and one second off. It has been found that with this period of interruption the capacity effect of the cable is entirely negligible, and no matter how high the resistance of the fault may be, no current in the conductor beyond the fault can be detected by ordinary methods, except perhaps a click in the telephones at the instant of making or breaking the circuit.

The principal element of this system is found in the detecting instrument shown in the upper right-hand part of the illustration. Basically, this is a generator, either alternating current or direct current, having a field which consists of two halves of soft iron. This field is arranged to clamp around the cable. The armature is revolved by means of a crank and gears, and the resulting emf. is impressed upon a telephone receiver. The field is excited by the direct current pass-

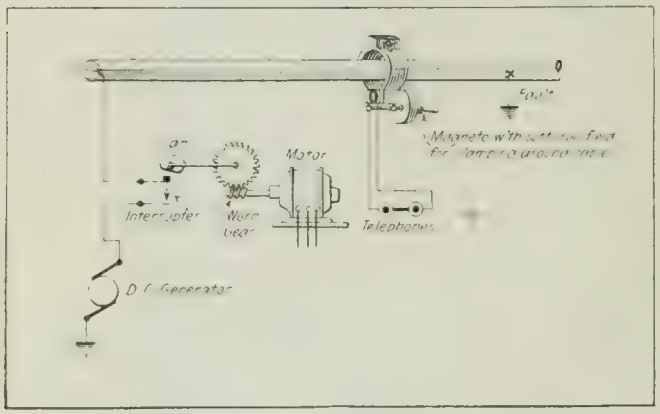


FIG. 1—DIRECT CURRENT IN THIS METHOD OF LOCATING FAULTS PRODUCES THE EXCITATION FOR THE MAGNETO FIELD

The circuit is periodically interrupted to enable the observer to distinguish the difference between the sound produced by the fault current and any stray currents that may be present.

ing through the grounded conductor of the cable. The object of the periodic interruption of this current is to enable the observer to distinguish between the effects of residual magnetism in the field pieces of the instrument (or stray fields in the vicinity) and the field produced by the current through the grounded conductor. Thus, though the observer may hear a sound constantly in the telephones due to residual magnetism or stray fields, still he is able to detect the periodic variations of this sound due to the current through the conductor.

Detecting Apparatus for the Direct-Current Method

The simple apparatus, shown in Fig. 1, will give comparatively good results in cases where direct current of 6 amp. or 8 amp. through the fault can be obtained. However, it is frequently impossible to obtain a current of this magnitude at ordinary voltages, owing to the fact that the resistance of the fault is quite often comparatively high. In order to detect currents of smaller magnitude than this, it has been found necessary to make certain additions to the detecting apparatus. A diagram of the complete apparatus, using a telephone receiver as the indicator, is given in Fig. 2.

The generator has a comparatively low speed and if slip rings were used would give an alternating current of about 15 cycles when the crank is turned at a moderate rate. Instead of slip rings a two-segment commutator is used, which gives a unidirectional emf. with a corresponding frequency of pulsation. The peaks of this emf. are smoothed out by means of a condenser. Since the frequency of 15 cycles or thirty pulsations is too low for good audibility, an interrupter in the form of a buzzer operated by a small battery has been added to make and break the telephone circuit. In addition to this a coil for neutralizing residual magnetism or stray fields due to direct current flowing through the sheath of the cable has been added.

This coil is excited from a battery similar to the one which operates the buzzer, and the current is adjusted by means of the rheostat shown in the lower part of Fig. 2. By means of the coil and this rheostat a flux passing through the field pieces of the instrument in either direction can be neutralized if constant. The procedure is the first to clamp the instrument around the cable and then to revolve the armature and listen for constant sound in the telephones. The rheostat is then adjusted for minimum constant sound. As soon as this is done the periodic rise and fall of sound due to the tracing current can be heard. It will be noted that the same switch which is used to open the buzzer circuit also opens the neutralizing coil circuit. This provides against leaving the neutralizing circuit closed and thereby exhausting the battery, for the buzzer will give a warning sound until the circuit is opened.

The first outfit of this type was placed in service in June, 1920, and the complete apparatus is shown in the photograph. The complete outfit is contained in a sheet-metal case, which also provides mounting for the switch, rheostat, batteries and buzzer.

The inside diameter of the field pieces when closed is approximately 6 in. (15 cm.), which permits the apparatus to be clamped around three-conductor cable having a protective covering of cement. The gears are inclosed in a protective case of sheet brass. The buzzer is mounted on leather straps in the lower part of the case to reduce noise. With an outfit of this type it is practicable to detect tracing current of the order of 2 amp. or 3 amp. The telephone receiver as an indicator has the advantage of simplicity, ruggedness and sensitivity. However, its use involves several objectionable features, as enumerated below:

1. It is practically impossible to reduce the constant sound in the receivers to zero. This is due to the fact that while it is possible to reduce the average value of unidirectional current to zero, still, owing to local magnetic circuits in pole faces and residual magnetism in the armature itself, a certain amount of fluctuating

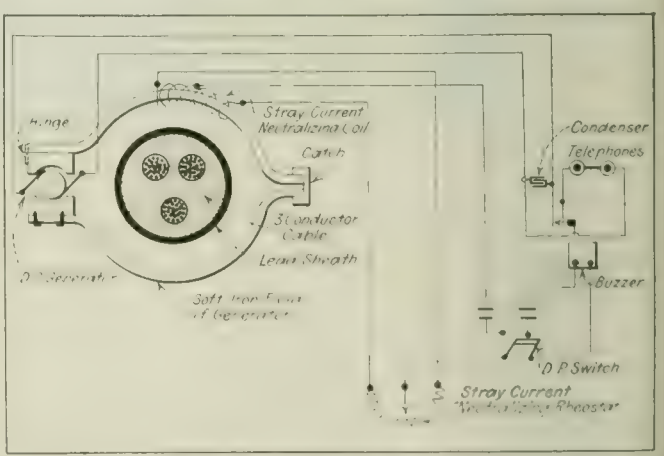


FIG. 2—DETECTING APPARATUS USED WHERE FAULT CURRENT IS OF LOW VALUE

current will remain in the telephone circuit, regardless of the position of the neutralizing rheostat.

2. The use of telephone receivers does not provide an exact measurement of the amount of tracing current. It is important to obtain such measurement because of the presence of tracing current flowing along the sheath of the cable, as will be shown further on.

3. When telephone receivers are used the stray current neutralizing coil does not provide for neutralizing

stray alternating current in the sheath of the cable or stray alternating fields. This is taken care of to some extent by the condenser shunted across the armature terminals. But it is impossible entirely to neutralize stray alternating current of a certain character without the use of condensers of large size, which would make the apparatus cumbersome. These difficulties are overcome by the use of a direct current millivoltmeter as an indicator, as shown in Fig. 3.

Since the moving element of the millivoltmeter cannot follow the fluctuations of induced alternating current of the usual frequencies or the fluctuations produced by the revolving armature of the instrument, a true indication of the average unidirectional current is given, and disturbances produced by stray alternating fields, or stray alternating current in the sheath of the cable, are entirely eliminated. Furthermore, the swings of the needle, due to the periodic application of tracing current, give a fairly accurate indication of the amount of tracing which is flowing through the cable. Of course, the amount of indication varies somewhat with the speed at which the crank of the instrument is turned, but it is not necessary to time this speed accurately in order to obtain the degree of accuracy which is required for practical purposes.

In order to use the detector set with a millivoltmeter, the instrument is clamped around the cable, the armature then being revolved and the neutralizing rheostat adjusted until the average indication of the needle is in the neighborhood of zero. The instrument used is one which has the zero point in the center of the scale. After the rheostat is adjusted the observer continues to turn the crank, and if he should be between the point of application of tracing current and the fault, the needle of the millivoltmeter will periodically swing first to one side of zero and then the other, following the periodic application and removal of the tracing current made by the motor driven interrupter.

Variability of Stray Current and Stray Fields Causes Trouble

The instrument shown in Fig. 3 can without difficulty be constructed for almost any degree of sensitivity. In fact, it can be constructed to detect direct current of the order of a small fraction of an ampere. The sensitivity is only a question of size and material of pole pieces, winding of the armature, speed of armature and sensitivity of the millivoltmeter. In practice the limiting factor has been found to be the effect of stray fields and stray direct current in the sheath of the cable. A stray field, if constant, can be neutralized in practically any amount by means of the stray-current neutralizing coil. However, under conditions encountered ordinarily there are always fluctuations in stray fields and stray current. This is due to changes in load on circuits carrying direct current, changes in stray ground currents due to passing trolley cars, and other such causes as these.

Under conditions encountered in the business districts of New York City it has been found that fluctuations of stray current will be encountered of such magnitude as to render the indication of tracing current somewhat uncertain, if the value of tracing current is reduced to less than approximately 1 amp. However, in certain cases current as low as 0.5 amp. has been used. In the majority of cases it is not difficult to obtain 1 amp. or more through the fault at 120 volts direct current. If the resistance of the fault is of such value as to limit the current to less than 1 amp., it is usually possible to decrease the resistance of the fault by applying high potential for a short length of time and thereby burning the fault to a lower resistance.

If the interrupter shown in Fig. 1 be replaced by a reversing switch, and if the current be reversed at each operation of the switch, instead of interrupted, the effect on the millivoltmeter of Fig. 3 will be doubled, reducing the amount of tracing current required for positive operation to 0.5 amp. instead of 1 amp.

Pendulum Method of Eliminating Fluctuations Due to Stray Current

Occasionally faults are encountered where the resistance is so high as to limit the tracing current to a small fraction of an ampere at ordinary voltages of direct current and where it is practically impossible to reduce the resistance of the fault by burning with high potential. In cases of this kind it is usually impossible to locate the fault by means of the apparatus described above without certain modifications, for in such cases the fluctuations due to stray current are of sufficient magnitude to drown out the fluctuations due to tracing current. However, the effects of stray current can be considerably reduced by "tuning" the millivoltmeter to correspond with the period of the applied tracing current. The fluctuations caused by stray current will then remain constant, while those caused by the tracing current can be multiplied many times. The details of the tuned method are as follows:

The millivoltmeter must be devoid of all damping so that the moving element will swing freely with a natural period in the neighborhood of one or two seconds. A meter of this type can be very easily constructed from an ordinary D'Arsonval type of millivoltmeter by rewinding the moving element on a frame of non-metallic material.

Some provision must be made for adjusting the period of the instrument by changing the length of the spring or by moving adjustable weights toward or from the pivot of the moving element, or by some other similar means. The interrupter must have an absolutely constant period, which need not, however, be adjustable. In cases where alternating-current supply of very close frequency regulation is available, this can be accomplished by using a synchronous motor to drive the interrupter.

Another alternative is the use of a pendulum contact. This method is under development at the present time, and it is not known to what limits it may be carried under practical conditions. However, it has been possible during laboratory experiments to multiply the indication of an instrument by 80 or 90 by the application of current periodically, with a frequency corresponding to the natural period of the instrument. It is believed that after this method is fully developed, it will be possible to detect a periodic tracing current of the order of a very small fraction of an ampere under the conditions of stray current interference which are usually encountered.

In all cases of faults on transmission feeders where one clear conductor of the same feeder or a similar conductor of the same length running between the same two points is available the bridge method of testing should be used to approximately locate faults.

A test of this kind, however, should be depended on only for an approximate location. For instance, in the case of a transmission feeder of 8 miles or 10 miles (13 km. or 16 km.) length, a bridge test should locate the fault within 1,500 ft. (450 m.) or 2,000 ft. (600 m.), if conditions are favorable. This test should then be supplemented by the direct-current tracing-current method, and the indicator described above should be used in the vicinity of the location indicated by the bridge method to determine definitely the section of cable in which the fault is located.

In case two or more conductors are burned apart and grounded, or in cases where all three conductors of a three-conductor feeder are short-circuited or grounded, it will usually be impossible to use the bridge method of location. In such cases, if one or more conductors are grounded at the fault, it is possible to locate the fault accurately by means of the direct-current tracing-current method.

TRACING GROUNDS ON LIVE CIRCUITS

In the case of ungrounded high-tension circuits where single-conductor cable is used, quite frequently one conductor may become grounded without affecting the other conductors, and in such cases (on distribution circuits for instance) it may be desirable to keep the

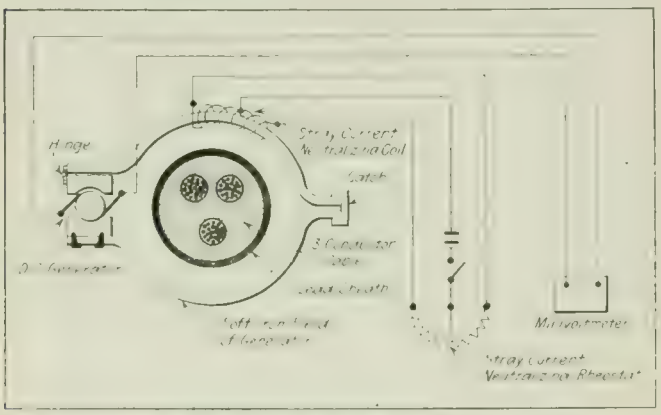


FIG. 3—A MILLIVOLTMETER GIVES BETTER RESULTS AS AN INDICATOR THAN THE TELEPHONE RECEIVERS

circuit in service while locating the fault. The direct-current tracing-current method of fault location offers a very suitable means for locating a fault of this kind.

If the connections in Fig. 3 are used, the indication is not affected by the alternating-current fields, and hence the load current flowing in cable will not interfere with the work of locating the fault. However, in cases of this kind it is necessary to clamp the instrument around all three conductors of a three-phase circuit in order to avoid error due to tracing current passing through the transformers or other apparatus which may be connected to the circuit.

The above method of locating faults depends upon obtaining a ground on one or more conductors at the fault. In a case where short circuit occurs between two conductors with no ground, the system is not well suited to hunting the trouble, for the tracing current returning from the fault over the other conductor almost or entirely neutralizes the effect of the conductor current from the point of application to the fault.

In other words, in case of a short circuit between two or more conductors without a ground the application of very high values of tracing current is necessary to give an indication. However, owing to the physical characteristics of the cable, almost any type of fault will in the majority of cases cause a ground on one or more conductors, and in most cases where a ground is not formed a ground on one or more conductors at the fault can be obtained by applying high potential between the conductors and ground and thereby burning the insulation, which in all probability is already partially charred.

The proper operation of the direct-current tracing-current method, therefore, depends upon conditions which will cause the tracing current to pass away from the cable into the ground at a point very near the fault. This is usually the case in systems where iron ducts are used, but in systems using tile duct cases are quite frequently encountered where a large portion of the tracing current passes into the lead sheath of the cable and continues along the sheath for a considerable distance in either direction or both directions from the fault.

In duct systems where cases of this kind are likely to occur it is necessary to use some method of detecting the sheath current and distinguishing it from the tracing current flowing through the conductor. Heavy copper clamps are placed around the conductor at points as widely separated as possible (in a manhole this will, of course, be at opposite duct edges), and these clamps are connected together by a heavy copper shunt.

Owing to contact resistance of the copper clamp it is usually impossible to reduce the sheath current to a negligible value in case it is present in any large amount. However, a noticeable reduction is obtained, and by opening and closing a switch in the shunt the comparative amount of sheath current can be determined. If the indication of the millivoltmeter is reduced when the switch is closed, this indicates that the instrument is indicating sheath current only, and hence the location at which the reading is being taken is beyond the fault. If when the switch is closed the indication of the millivoltmeter is increased, this indicates that the instrument is reading both conductor current and sheath current, and that the location at which the reading is being taken is between the point of application and the fault.

As a final and accurate check on sheath current, the effect of this current can be entirely eliminated by cutting a ring out of the sheath at a point on each side of the place where the fault is suspected to be. In case the fault is not found to be at the suspected location, the lead can usually be replaced without disturbing the insulation or making a new joint. If the fault is at the suspected location, no cable except that at the faulty section will be involved and it will not be necessary to replace the lead.

The direct-current method never fails to locate a fault surely and accurately if a sufficient indication can be obtained to overcome stray-current fluctuations and if sheath current is properly taken into account. Furthermore, direct comparison between the use of direct current and alternating current or pulsating current has repeatedly shown the former method to be far superior to the latter in the matter of accuracy.

As an example might be given the case mentioned in the first part of this article where the pulsating current method gave an indication nearly 100 per cent incorrect. In this case direct-current tracing current was applied to check the results obtained, and the fault was at once located at the opposite end of the feeder.

Transmission-Line Insulation in America

A Full Discussion of the Factors Affecting Spark-over and Puncture Voltages of Insulators and Bushings—Experience with Porcelain Insulators and Tests for Predicting Their Performance

By F. W. PEEK, JR.
Consulting Engineer General Electric Company

TO ASCERTAIN if there are sound theoretical, practical and economic reasons for the line-insulation standards which have grown up in America, the writer has made a thorough study and presents his findings here. In making this survey it was borne in mind that theory and practice agree if theory contains all of the variables of practice. It is not always possible to anticipate all of the variables of practice in laboratory work. Laboratory and theoretical work, however, admit of a logical start in any new field and, coupled with practical observation and experience, result in the best conclusions.

Modern standards require uninterrupted service. Line insulation must be selected accordingly. In this connection it is very important to have certain standard steps in voltage. These should be as few as possible and preferably in multiples of a given voltage. The object is, of course, the possibility of good insulation at a minimum of cost and minimum time of replacement in case of trouble.

The factors determining the spark-over and puncture voltages of insulators and bushings will first be discussed as it is necessary to bear these in mind while drawing conclusions regarding the desirability of any standard routine or design tests.* This information, coupled later with a consideration of the results of practical operation, will make it possible better to decide the value of standard tests as a criterion in anticipating the suitability of insulators for a given duty.

The main insulation of any transmission line is the air in which the conductors are immersed. It seems appropriate, therefore, to discuss the subject of corona in the final section.

Effect of Lightning on Insulators

Insulators of different designs may have equal normal frequency spark-over voltages but greatly different impulse or lightning spark-over voltages.† This is because a definite but very small time is required for a spark to form which depends upon the design and upon the rapidity at which the voltage is applied. Higher voltages are required in the case of lightning, where the voltages are applied very rapidly and the time is, therefore, limited. Such rapidly applied voltages are said to have steep wave front. Spark-over does not occur when the normal frequency spark-over voltage is reached by the rapidly increasing impulse voltage, but some time later when this voltage has reached a higher value.

Referring to Fig. 1, the spark-over voltage of a given insulator is e_1, and always practically constant, if the time of application is not limited. Spark-over may take place after the continuously applied voltage e_1 has been on for some time t_1. If a voltage increasing at a rapid rate as represented by A, in Fig. 1, is applied, spark-over will not take place when the continuously applied spark-over voltage e_1 is reached, as the time t_1 is required at this voltage. The spark will begin to form when the voltage reaches the value e_3, however. The voltage will, therefore, rise above e_1, and spark-over will take place after the time t_2 has elapsed and the voltage has risen to e_2. When the voltage is applied at a more rapid rate along wave B, the spark, as before, will begin to form when voltage e_3 is reached. The voltage will continue to rise and reach the value e_2 during the time t_3 before spark-over occurs. Thus, on account of the time lag, when voltage is applied at a very rapid rate, as by an impulse, spark-over does not occur when the continuously applied breakdown voltage is reached. The voltage "overshoots" this value during the time that rupture is taking place. The excess in voltage is greater and the time lag less the greater the rate of application. The time lag for any given gap or insulation has thus not a fixed value but depends on the wave shape of the impulse or rate of application of the voltage. In making a study of such phenomena it is necessary to use certain definite wave shapes. The ratio between the impulse spark-over voltage and the normal frequency spark-over voltage has been termed the impulse ratio.

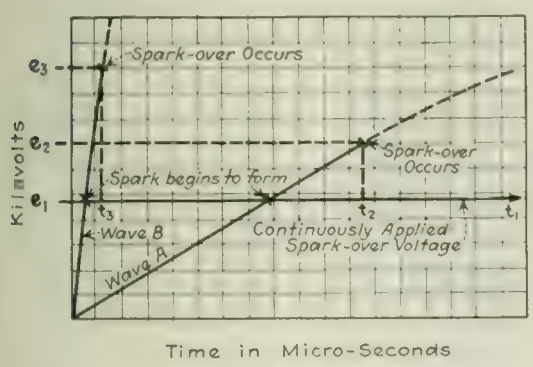


Fig. 1

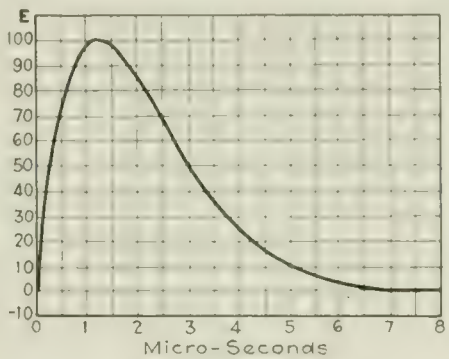


Fig. 2

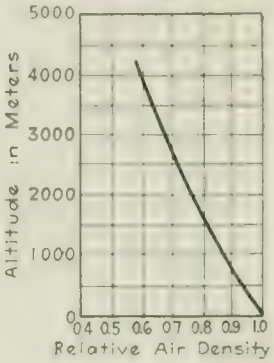


Fig. 3

FIG. 1—IMPULSE SPARK-OVER VOLTAGE IS HIGHER THAN FOR NORMAL FREQUENCY. FIG. 2—200-KILOCYCLE IMPULSE WAVE. FIG. 3—VARIATION OF AIR DENSITY WITH ALTITUDE

*Spark-over—an arc, or spark, over the insulator surface through the air; puncture—electrical breakdown of the solid insulation.

†Normal frequency—any low operating frequency as, for instance, 60 cycle; lightning voltages—time of application in the order of a millionth of a second or micro-second.

TABLE I—IMPULSE SPARK-OVER OF INSULATORS

No.	Type	Spark-Over Kv., 60-Cycle Dry	Spark-Over Kv., 60-Cycle Wet	Impulse Spark-Over Kv. (Single Half-Cycle, 200 Kilocycles Sine Wave) Dry	Impulse Spark-Over Kv. (Single Half-Cycle, 200 Kilocycles Sine Wave) Wet	Impulse Ratio
1	Petticoat	100	67	142	140	1.42
2	Smooth	100	50	105	105	1.05

The impulse ratio is very high for steep wave fronts and approaches unity for "low-frequency" surges. For a given impulse the impulse ratio is lower for smooth insulators than for insulators with properly designed petticoats or corrugations. An example of the variation of the impulse ratio for two different insulator designs is given in Table I.

It will be noted that although both insulators have the same 60-cycle or normal frequency spark-over voltage, the "lightning" spark-over voltage of insulator No. 1 is about 40 per cent higher than the "lightning" spark-over voltage of insulator No. 2. The impulse used was a single half-cycle of a 200-kilocycle wave as shown in Fig. 2. With a steeper impulse the difference

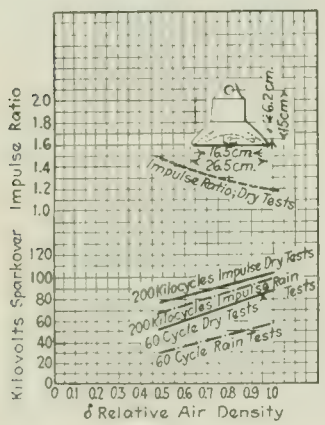


Fig. 4

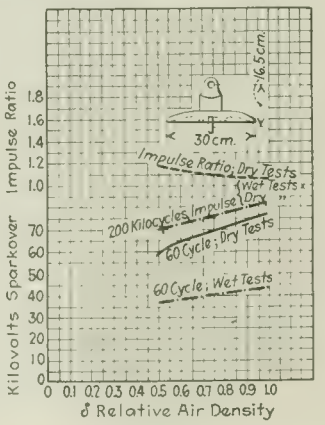


Fig. 5

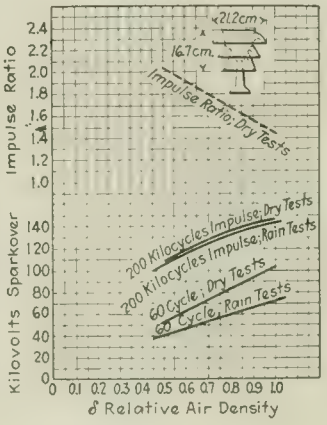


Fig. 6

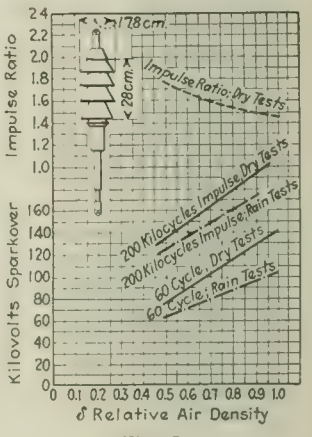


Fig. 7

FIGS. 4 AND 5 - SIXTY-CYCLE AND IMPULSE SPARK-OVER CURVES FOR SUSPENSION INSULATORS. FIGS. 6 AND 7—SIXTY-CYCLE AND IMPULSE SPARK-OVER CURVES FOR PIN INSULATOR AND TRANSFORMER BUSHING

would be greater. Lightning would be less likely to cause spark-over of insulator No. 1. Rain does not greatly decrease the lightning spark-over voltage. Because of this the probability of failure due to steep-wave-front disturbances is greatly decreased. For "low-frequency" surges the wet spark-over voltage approaches the 60-cycle wet spark-over voltage. The effect of steepness of wave front may be seen by reference to Table II.

In practice the lightning-arrester gap should have a low impulse ratio, the line insulators and bushings a high impulse ratio. In fact, the author's attention was first called to this phenomenon on an operating line. A bushing was "protected" by a horn gap set at about half the 60-cycle or normal-frequency spark-over voltage of the bushing. Lightning always caused the bushing to spark over. It was found that the lightning spark-over of that particular design of bushing was less than the lightning spark-over voltage of the horn set at half the 60-cycle spark-over voltage of the bushing.

Effect of Altitude on Spark-over Voltages

The spark-over voltage of an insulator or bushing decreases with the air density, or pressure and temperature. At high altitudes where the barometric pressure is low the spark-over voltage is much lower than at sea level. Generally the spark-over voltage decreases approximately as the air density. A curve of variation of air density with altitude is given in Fig. 3. The values of δ, or correction factor, are in terms of unity at 76-cm. barometer (30-in.) and 25 deg. C. Thus, from this curve the approximate spark-over voltage at 5,000 ft. (1,500 m.) altitude would be 82 per cent of the spark-over voltage at sea level (25 deg. C.).

The correction factor is calculated as follows:

$$\delta = (3.92b) \div (273 + t),$$

where

b = barometric pressure in centimeters,

t = temperature in deg. C.

If e is the spark-over voltage at sea-level at 25 deg. C., the spark-over voltage at some other value of δ is

$$e_1 = \delta e$$

Rain greatly lowers the 60-cycle spark-over voltage of insulators but has very little effect on the impulse spark-over voltage for steep wave fronts.

Figs. 4, 5, 6 and 7 give the wet and dry 60-cycle and impulse spark-over voltages for typical designs at various air densities. The voltages are in terms of root-mean-square or effective values. Altitudes corresponding to δ may be found from Fig. 3. These tests show that the ratio between the 60-cycle dry and rain spark-over voltages remains approximately constant for different values of δ.

Figs. 4, 5, 6 and 7 show also that the steep wave front impulse spark-over voltage is not greatly lowered by rain. The impulse ratio increases with decreasing δ.

Dust and Salt Lower Spark-over Voltage

Insulators and bushings are occasionally placed where they become coated with dust, salt, etc. When the coating becomes moist the spark-over voltage is very low. This is especially bad when the moisture is due to fog or condensation as the whole surface of the insulator becomes coated and conducting. The break-down voltage is then quite low. Condensation of moisture on a

TABLE II—IMPULSE SPARK-OVER OF SUSPENSION INSULATORS

	60-Cycle Spark-Over Kv. Dry	60-Cycle Spark-Over Kv. Wet	100-Kilocycle Impulse Spark-Over Dry	100-Kilocycle Impulse Spark-Over Wet	500-Kilocycle Impulse Spark-Over Dry	500-Kilocycle Impulse Spark-Over Wet
A Two-piece suspension with petticoats	112	72	118	114	165	162
B Two-piece suspension with petticoats	116	70	128	125	172	168

clean insulator generally does not seriously lower its strength.

In making rain tests the spark-over voltage varies considerably with the resistance of the water. It is generally desirable to use water with a specific resistance of about 10,000 ohms per centimeter cube or higher.

Causes for Deterioration of Porcelain

The apparent deterioration of porcelain is generally due to one of the following causes:

1. Gradual mechanical cracking due to expansion of cement or tight-fitting metal parts, or to internal firing strains or brittle porcelain.
2. Gradual absorption of moisture due to porosity.

The greater part of the trouble has been due to cracking under stresses caused by expansion of cement or of tight-fitting or cemented-in metal parts. Cracking may also be caused by uneven expansion in very thick porcelain parts of different shapes.

Mechanically, porcelain would never be selected as a line support. It is unreliable in tension, subject to cracking, and if made in large pieces subject to porosity. The greatest care is necessary in manufacture to secure a uniform, tough, non-brittle material, free from porosity. Unfortunately it is the only material known at the present time that will withstand the weather without the carbonization and deterioration of organic compounds under the electrical stress.

Often after three to five years of more or less successful operation insulators selected by the most careful electrical tests begin to fail.

The foregoing causes of deterioration are well verified in practice because the type of insulator in which the porcelain units are strung together by loose-fitting metal parts or cables shows no deterioration after ten years or more of service. This was found to be true even in some of the earlier units made of poor material. The absorption of moisture seems to be due to a considerable extent to breathing. The presence of a damp sponge of cement is thus also undesirable from this standpoint as it keeps moist the air breathed by the porcelain.

The solution of the deterioration problem seems to be to start with a design as free as possible from expansion troubles and the selection of a tough, non-porous porcelain. Years of service have been the best criterion of design. Regarding the selection of material, no present practical electrical test will anticipate future cracking due to internal strains or brittle porcelain or will indicate porosity in dry porcelain. The desired results can probably best be attained by testing a small percentage of the product to destruction from day to day after the usual electrical and inspection tests have been made, the object being to determine if the product is up to the standard and of uniform quality. This idea is not new but is used in the manufacture of lamps and in other industries. Electrical, mechanical and porosity uniformity tests are necessary. Extremely accurate tests are not necessary, but it is necessary to have tests that can be quickly made so that any fault can be at once detected and remedied.

In our investigations we made first the electrical tests, followed by mechanical impact tests to destruction. Samples were then taken from the head and thick parts of the units and subjected to a porosity test. In this test the samples were placed in a dye solution under pressure, after which the depth of penetration was noted. The porcelain was placed in three arbitrary mechanical and porosity grades and a graphical chart made indicating the percentage in each.

Mechanical Strength and Porosity Are Important

It is evident that the mechanical and porosity characteristics are as important as the electrical. An insulator with high initial electrical strength is of little value if it eventually cracks or becomes conducting owing to porosity.

Combined electrical and mechanical tests are sometimes made. For instance, a suspension insulator is put in tension and voltage is applied simultaneously. After a certain tension is reached the percentage failures increase very rapidly. It is found, however, that the number of failures is not connected with the combined electrical and mechanical tests. It will be found that practically the same percentage of failures occurs whether the voltage is applied simultaneously with the mechanical test or following it. It is also very important that insulators be non-porous.

Puncture.—In making routine electrical tests it is important that they be of such a nature that the insulation is not damaged.

The characteristic voltage-time puncture curve for an actual insulator is shown in Fig. 8. It will be noted

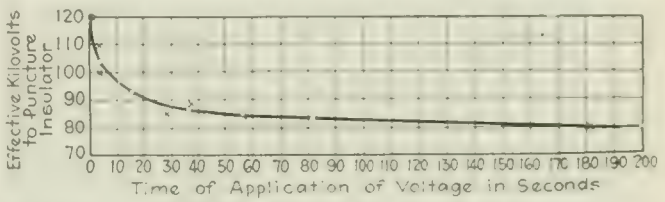


FIG. 8—VOLTAGE-TIME PUNCTURE CURVE OF LINE INSULATORS

that if any voltage above a certain fixed value is applied to the insulator, puncture will occur after some definite time. The application of any voltage above the value that causes failure in infinite time will injure the insulation. The amount of injury will depend upon the voltage and time of application. Long-time high-voltage tests at operating frequency are not logical as there is nothing to be gained from them and they mean a likelihood of serious damage without any external evidence.

The effects of very high lightning voltages are cumulative as may be illustrated by the following test made on 3.2-mm. oiled pressboard:

Kv. Maximum of Impulse Applied	Number to Cause Breakdown
100	∞
140	100
150	16
155	2
165	1

An "infinite" number of lightning strokes at 100 kv. failed to cause puncture. At 150 kv. sixteen strokes were required, yet there was no external indication of failure up to the fifteenth stroke.

Discussion of Electrical Tests.—Various kinds of electrical tests have been suggested or advocated from time to time as a means of detecting porous porcelain or other faults in insulators. No electrical test is known that will anticipate mechanical failure or detect porous material when it is dry. It may be useful, however, to outline the characteristics of the various tests, most of

which are of interest only in the study of design and in developmental work:

1. The 60-cycle test, or test at operating frequency, is the best for general use and is most practical and desirable as a standard test. It can be quite accurately reproduced. It is the most effective in testing either old or new insulators. It will readily puncture porous insulators that have absorbed moisture.

2. Resistance measurements are generally of use only in detecting porous or cracked insulators that have absorbed moisture. On new dry material it indicates little even when measurements are made at 50 kv. or 100 kv.

3. Damped high-frequency tests are often made. Generally a frequency of the order of 100 kilocycles is used. This is obtained from an oscillating circuit giving 120 very highly damped wave trains per second. It acts as a series of impulses. Because of time lag a higher voltage can be applied without spark-over than at 60 cycles. It will not detect old porous insulators that have absorbed moisture. The discharge has a tendency to spread over the insulator surface, and it may thus detect flaws in the petticoats more readily than some other tests. It is not desirable as a standard because it is very difficult to duplicate results. The test is affected by the capacity of the test piece, etc.

4. The impulse test is of use as a design test in determining the impulse ratio, etc.

5. Undamped high-frequency tests will cause failure in insulators at very low voltage because of heat. It is a condition that does not occur on transmission lines.

6. The direct-current spark-over voltage is approximately $\sqrt{2} \times$ the 60-cycle spark-over voltage. It varies somewhat depending upon whether the cap is positive or negative. The puncture voltage is relatively much higher.

7. The 60-cycle test has the desirable characteristics of all the other tests, except that possibly it does not so readily detect flaws in petticoats. This feature is not always important but can be added to the 60-cycle test by making the arc of the insulator part of an oscillatory circuit by limiting the current in the arc by resistance. By this means the oscillatory wave is superposed upon the 60-cycle wave.

In making measurements the sphere gap should be used for oscillatory or transient voltages, the sphere gap, a step-down transformer or a voltmeter coil with a crest voltmeter for 60-cycle voltages. Tests should be made with one side grounded.

The following record of tests on 5-mm. oiled pressboard is an example of the great difference in the effect of various tests on the puncture of insulators:

	Maximum Kv., Application for Sixty Seconds
60 cycles	185
High-frequency alternator, 90,000 cycles	20
Damped oscillations, train frequency (120 per second), 200,000 cycles	120

Ratio of Puncture to Spark-over.—It is now generally conceded that an insulator should be so designed that it will spark-over repeatedly without puncture. The ratio of spark-over to puncture should, therefore, be such that the spark-over voltage will not damage the insulation.

In an early issue of the ELECTRICAL WORLD a continuation of this discussion will appear, covering the characteristics of insulators for very high voltage, the development of factors of safety and insulator selection.

Repair and Inspection of Hydraulic Turbines

When to Take Machines Out of Service—Having Repair Parts and Tools in Readiness for Work—Gaining Access to Different Parts

By L. W. Wyss
Iron Mountain (Mich.) Electric Light & Power Company

THE time to take hydraulic turbines out of service for internal inspections and repairs is governed by the load conditions of the plant or system. If the system is combined steam and hydraulic, the turbine shut-down should be made during a period when no extra coal will be consumed at the steam plant if possible. In order to do this the work may have to be done during low-water periods, or on Sundays and other holidays. If all of the turbines in a station are needed to utilize the total river flow and it is desired to shut down a turbine for a certain period, the plant may be so loaded as to lower the reservoir elevation sufficiently to insure that the surplus will fill the reservoir instead of going over the spillway while the shut-down lasts. This would, of course, not be practicable if the plant were already running with full load or if the extra load to lower the pond could not be obtained. Some plants have no reservoir capacity, while others must maintain a steady flowage for downstream plants. These conditions would prevent using the above-mentioned scheme.

When inspecting turbines it is advisable to learn what repair parts will be needed in the future. Then the work should be planned ahead so that it can be done in as short a time as possible.

In the case of a large turbine being out of service and coal having to be used during the shut-down, every possible scheme for cutting down the period of outage should be employed. If the work is new to the crew employed, some advance instructions are advisable. The power-house crane should be in first-class condition and a signal system decided on. Sets of steel-rope slings should be in readiness to facilitate the dismantling and assembling of heavy machinery. The repair man can copy the erector who avoids the clamping and unclamping of his hoisting cables and instead has a few slings which he can attach through eye-bolts, etc., using a bolt to hold cable. Some spare nuts and bolts are convenient to have on hand in case any are lost or damaged. It may be necessary to make some special wrenches to speed up the work, and it is advisable to have all of the tools ready. Setscrews and bolt threads which are to be submerged should always be covered with red or white lead when assembling.

In order to make repairs, especially with vertical units, it is often necessary to dismantle the generator; but at a few plants of the latest design the large vertical single runners may be taken out through the draft chamber if need be. It may be necessary to drain the draft tubes for certain work, in which case slots can be provided for stop logs to keep the tailwater out and pumps used to empty the draft tube. Holes may be drilled in turbine penstocks which will allow cables to pass through and permit using the crane to handle machinery inside. These holes can later be tapped and plugged.

As the latest turbines seldom have more than two runners and since exposed gate mechanisms are gaining

prestige, interior inspection of them is much simpler than that of turbines with as many as eight runners and all gate mechanism submerged—a typical form of installation a few years ago. Runners should be inspected to see that there are no blocks of wood lodged in between the vanes and that the vanes are not cracked or corroded excessively. Corrosion is usually observed on the backs of the runner vanes where voids are formed at part-gate opening. Grease plugs are provided on some turbines so that grease can be inserted by hand or with a grease gun to lubricate the gate machinery. All of the wicket gates should be inspected to see that they open and close properly and that there is no excessive wear in the links or gate-shaft connections. Such wear may prevent the gates from opening wide, cutting down the waterwheel output, or from closing tight so that it is difficult to stop the unit. Besides, water is wasted during shut-down.

The lignum vitæ used for submerged turbine bearings should be examined to see that it is not rough and that the shaft is not cut or worn. The bearings should also be set in their proper positions so that they will carry their proportionate parts of the weight of a horizontal shaft, and in case the shaft is vertical they should be set so that they hold the shaft in proper alignment.

Erecting engineers use levels or similar instruments to align shafts, but it is exceedingly difficult to obtain an accurate level reading on a corroded or pitted shaft that has been in service a year or more. This difficulty may be overcome by inserting a thickness gage at different points around the circumference of the runner at the stationary speed ring (also called running joint) where there may be clearances of about $\frac{1}{32}$ in. (0.8 mm.).

These points can be reached when the wicket gates are wide open. Provided the speed ring is not worn, it will serve as a guide to determine the shaft alignment. When adjusting the jackscrews care must be exercised to draw all screws on each side of the bearing to the same tension, otherwise the lignum-vitæ block will not line up with the shaft and will wear rapidly.

Double-runner horizontal units often have a center bearing inside the draft chamber accessible through a sealed manhole. This bearing can be adjusted to carry its proportional part of the weight after the end bearings are set correctly. These center bearings may be rather difficult to inspect or replace and some sort of scaffold must be arranged for the work. Removing the lower part of the bearing housing gives access to the lignum-vitæ block. The center bearings, with which the writer has had experience, have had this housing held in place with about six vertical machine screws. To lower the housing two of the setscrews were removed and threaded bolts were screwed in their place. Nuts were then screwed up on these bolts to hold the housing while the remaining screws were removed. The housing could be lowered by turning the nuts down on the bolts.

It is of the utmost importance to prevent the runner, speed ring or seal rings from wearing (owing to the shaft being out of alignment) because leakage of water will ensue, cutting down the efficiency, causing end thrusts and possibly bearing troubles. When seal rings are worn they can be replaced with some degree of convenience; however, large runner or speed rings are very expensive to replace. While inside the turbine it may be a good idea to look over the grease pipes which convey grease to the bearings and also to clean the screens where water is taken for gages, water-cooled bearings, etc.

Where ring-oiled babbitt bearings are employed for horizontal shafts access thereto is usually provided by some sort of steel or concrete inspection tunnels. Since the satisfactory performance of a vertical turbine depends upon the degree of generator-bearing perfection, ample attention should be given these parts.

It is often inconvenient to shut the water off from a turbine to repack packing glands on the main shaft, gate shaft or individual wicket-gate shafts, so it should be done while the turbine receives its regular inspection. While square hydraulic packing is usually used, some water-plant men prefer round packing because its elasticity holds the water with relatively little compression compared to square packing. At one plant containing exposed-gate machinery and non-adjustable wicket-gate glands trouble was encountered with water leaking until soft round packing containing a rubber center was used.

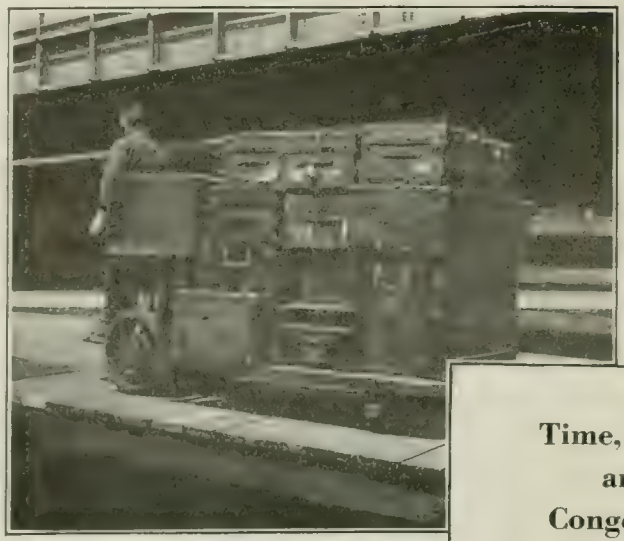
As the shaft is usually damp just outside the packing gland, it corrodes there. For this reason it is advisable to keep the gland as full as possible, because where the packing bears on the shaft it is kept clean. However, if a shaft runs a few months with the stuffing gland drawn up nearly tight and then is repacked, the rough shaft may ruin the new packing unless the rust is polished off.

While most glands are packed to withstand water pressure, some have to prevent air from leaking into the draft chamber. To assure a good vacuum seal water is discharged into a gland through a pipe connected to the penstock. These glands can be packed without shutting the water off from the penstock. Just enough water to keep the packing moist should be allowed to seep through a packing gland. The vicinity of a gland is often an eyesore because the dripping water is not handled properly. Some funnels and piping made to meet the individual requirements are advisable to improve the appearance.

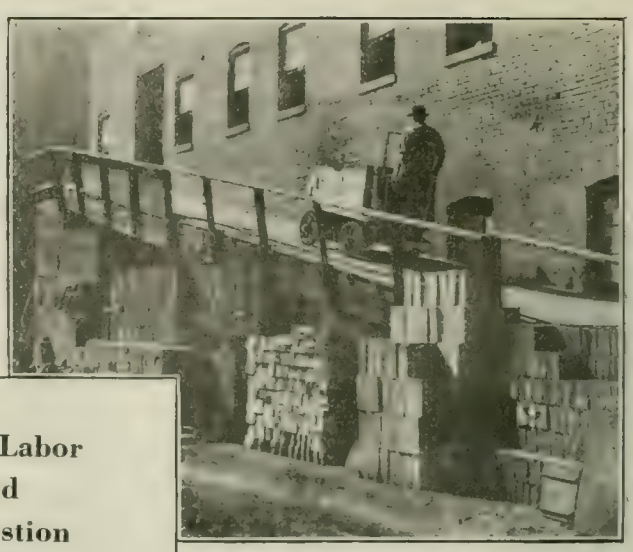
Mercury-Vapor Lamp for Alternating Current

A NEW form of high-voltage alternating-current mercury lamp developed by Henri Georges was described recently in the *Revue Générale de l'Electricité*. In ordinary circumstances it is only possible to run such lamps on an alternating supply by the use of special electrodes. M. Georges, however, overcomes the difficulty by introducing neon gas into the tube, which is of quartz.

The lamp is connected to a 110/3,000-volt transformer and when first switched on exhibits the characteristic spectrum of luminescent neon. This, however, is quickly replaced by the mercury spectrum as the mercury volatilizes, and in seven minutes the lamp attains a steady state. There is then a drop of 125 volts per inch (50 volts per cm.) of tube, and an internal temperature of 1,300 deg. Fahr. (700 deg. C.) is attained. The present lamp takes 1 amp. at 2,250 volts, but it is hoped to construct lamps taking up to 10 kw. and furnishing the most powerful source of ultra-violet energy known.

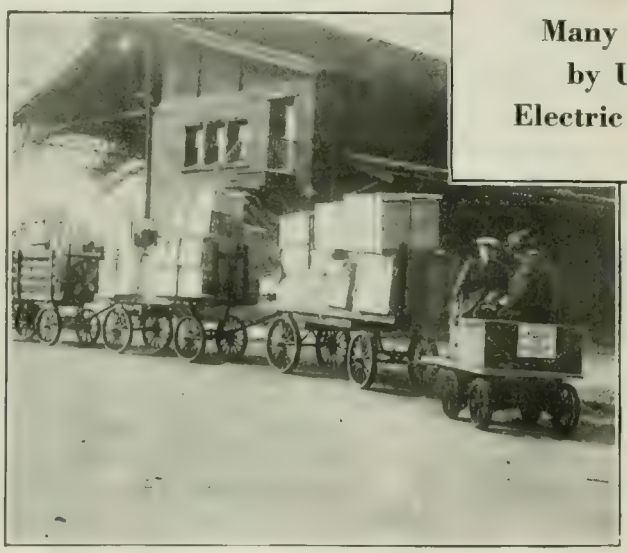


A service where speed and avoidance of congestion are important.

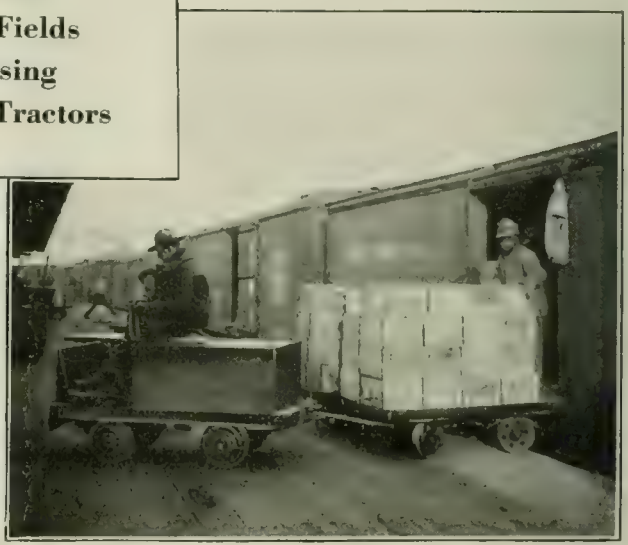


Electric tractors are particularly advantageous on grades.

Time, Labor and Congestion Are Being Saved in Many Fields by Using Electric Tractors



Several trailers, each the equivalent of several hand trucks, being pulled by one tractor.



Avoiding the delays which result from ingress and egress of hand truckers.



Simplicity of electric tractors permits use of any kind of labor



Internal transportation is a large field for electric tractors.

Central-Station Costs and Income

Tendencies that Appear Under Present Conditions—Vigorous Efforts Are Apparent to Increase Plant Efficiency and Render Larger Service in Face of Higher Costs—Larger Revenue Helping to Meet Unusual Requirements

WAR-TIME service problems of New England central stations were reviewed in an extended article in the ELECTRICAL WORLD of May 17, 1919, page 1007, special emphasis being laid upon the plant expansion forced upon the companies by the great conflict, increased costs of operation and enormously enlarged outputs. How well these central stations "did their bit" is established for all time, and what was true of New England applied similarly to other parts of the country. It is now possible to examine typical central-station operations since the war attained its height, and by plotting the operations of a representative group of companies from 1914 to 1920 inclusive to analyze the tendencies of the full period and in so doing draw the inevitable conclusion that the prosperity of the industry, of which these companies are a partial cross-section, demands scientific administration, broad direction and a plane of income far above former levels if the public is to be served properly.

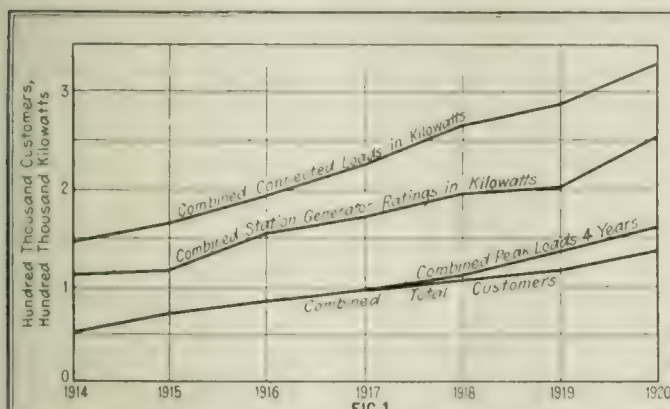


FIG. 1

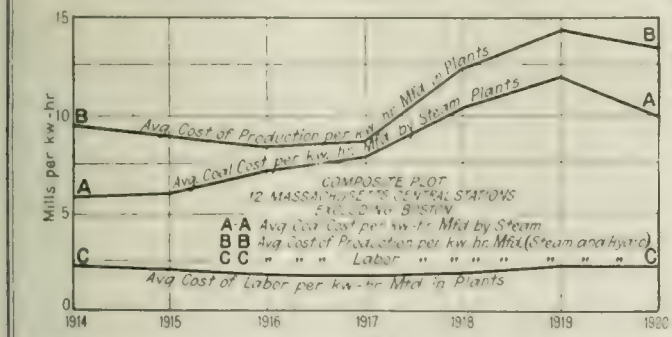


FIG. 2

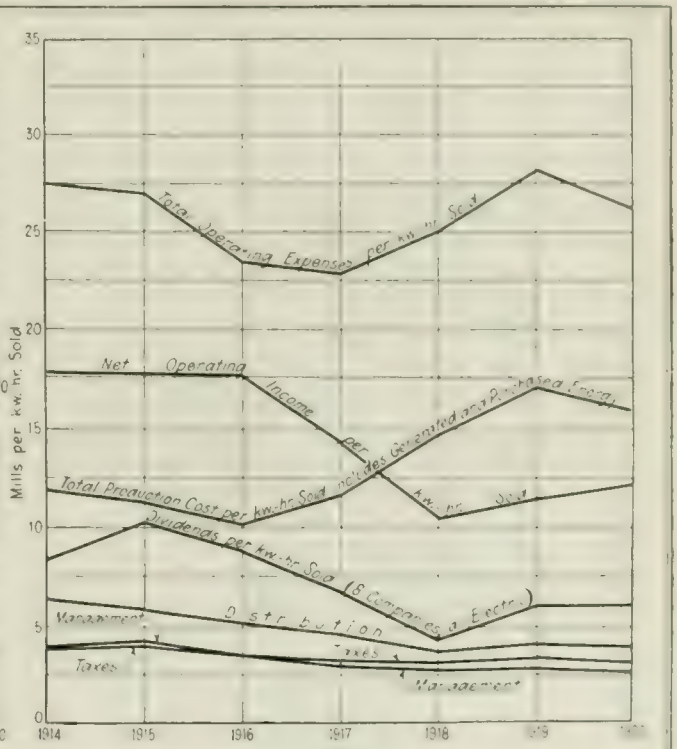


FIG. 3

FIG. 1—AGGREGATE COMBINED GROWTH IN CONNECTED LOAD, GENERATING-PLANT RATINGS AND TOTAL CUSTOMERS OF TWELVE MASSACHUSETTS STATIONS. FIG. 2—AVERAGE COST OF PRODUCING ELECTRICAL ENERGY IN MASSACHUSETTS INCREASED 65 PER CENT FROM 1914 TO 1920. FIG. 3—NET OPERATING INCOME REACHED LOWEST LEVEL IN 1918

Twelve Massachusetts central stations have been grouped in deriving the combined charts presented, viz., the companies at Brockton, Cambridge, Fall River, Fitchburg, Haverhill, Lawrence, Lowell, Lynn, New Bedford, Salem, Springfield and Worcester. Fig. 1 shows the growth in connected load, generating plant ratings and total customers for the seven years. The twelve plants were more than doubled in capacity, and the increase from year to year paralleled the connected load, although the development of the interconnection idea may be responsible for a perceptible "spread" between the capacity and connected load curves from 1917 forward. With interconnection local loads can be handled with smaller installations, so that the ratio of connected load to plant rating can safely be increased. A better diversity-factor goes with the larger connected load, it is safe to say, and this element, combined with the ability to exchange reserve capacity at convenient times, means a relatively smaller investment for a given volume of business. Only about one-half these companies as yet make extended use of interconnection, so that the benefits would be much more evident were the practice common to all.

The number of customers served by the twelve stations increased to nearly three times the total of 1914, or to about 140,000. So much emphasis has been laid upon the growth of these plants in industrial load that this evidence of a more popularized service is most gratifying. As 1.85 kw. of plant rating is required per customer today, compared with 2.14 kw. per customer in 1914, it appears that care has been taken to make the investment work harder, thus tending to reduce the burden upon the public for a given service.

The increased cost of coal during this period has been the most striking single item of operating expense. Fig. 4 shows that the twelve companies paid nearly $9 per ton for fuel during the last two years, compared with about $4.20 from 1914 to 1916 inclusive. Notwithstanding the difficulty experienced in obtaining coal of high quality during the height of the war, the actual coal consumption per kilowatt-hour produced in the steam plants shows a progressive decrease from slightly

over 3 lb. for the twelve stations averaged in 1914 to about 2.4 lb. in 1920. It is interesting to learn that a decided improvement in the load factors of individual stations has been attained during the past few years, partly as a result of the expansion of output and partly owing to more skillful management of plants. In the year ended June 30, 1920, the following load factors were attained by the several companies, defining the load factor as the ratio of the average load at the station buses for the entire year (including both generated and purchased energy) to the maximum load carried on the system:

	Load Factor per Cent		Load Factor per Cent
Brockton	38.8	Lynn	36.3
Cambridge	36.2	New Bedford	40.2
Fall River	35.9	Salem	39.8
Fitchburg	44.0	Springfield	28.4
Haverhill	28.0	Worcester	30.6
Lawrence	34.5	Boston Edison	41.0
Lowell	38.4		

Many former analyses of Massachusetts central-station operation, dating back five to ten years, showed load factors ranging from 25 to 35 per cent.

The ascending cost of coal during the war period, and after the signing of the armistice, in fact, was so rapid that it increased the coal cost per kilowatt-hour manufactured in the steam stations far above the pre-war level. Roughly, this increase was from 6 mills to 12 mills from 1914 to 1919 in the twelve stations. The value of coal as war material appears in the early and rapid rise in its cost even two years before the United States entered the conflict. Fig. 2 shows the increase in the fuel cost per kilowatt-hour in the twelve stations, computed upon steam-generated energy alone. On the same chart are plotted curves showing the variations in labor cost per total kilowatt-hours produced in the twelve plants and in the average total cost of production in these plants, including both steam and hydro-electric energy but not purchased energy.

The total cost of production increased only about 58 per cent against practically a 100 per cent increase in fuel cost between 1914 and 1919. One reason for this was the increased use of hydro-electric energy and another was the remarkably steady curve of labor cost per kilowatt-hour manufactured. Although wages of operators advanced all along the line, the increased outputs of the plants practically offset these advances, the twelve plants averaging not far from 2 mills per kilowatt-hour manufactured throughout the greater part of the period analyzed. It should also be borne in mind that as the policy of interconnection developed large blocks of energy were interchanged between plants with very little increase in labor requirements.

To compare the operations from the commercial standpoint, data based upon the energy sold are most helpful, and Fig. 3 shows the combined results of the twelve companies averaged per kilowatt-hour delivered to customers. The total operating expenses of the companies decreased from about 2.75 cents in 1914 to about 2.3 cents in 1917, and then rose rapidly to a maximum of about 2.8 cents in 1919. Production costs rose so much that the net operating income per kilowatt-hour fell off sharply from about 1.75 cents in 1914 to 1916 down to about 1.05 cents in 1918. Along with this decline went the dividends per kilowatt-hour sold, which dropped in the eight electric companies of the group (gas combination companies were not plotted as to dividends) from about 1 cent per kilowatt-hour sold to about 0.46 cent. Management expenses, distribution expenses and taxes per kilowatt-hour sold did not change as materially, and owing to increased outputs some good declines in these were obtained. Total taxes, of course, rose substantially during these years.

Before 1917 was far advanced toward its close the need of increased rates became apparent to the managers of central stations, and rising cost of commodities in general accustomed the public to paying more for products and service of all sorts. Rate increases were put into effect in many companies, in the form of coal clauses, percentage increases or surcharges on bills for energy. Fig. 5 shows the average revenues derived per kilowatt-hour sold for commercial lighting, power and total sales of energy in the twelve companies. When the war broke out these companies were selling energy for commercial lighting at an average of about 8.9 cents per kilowatt-hour and power

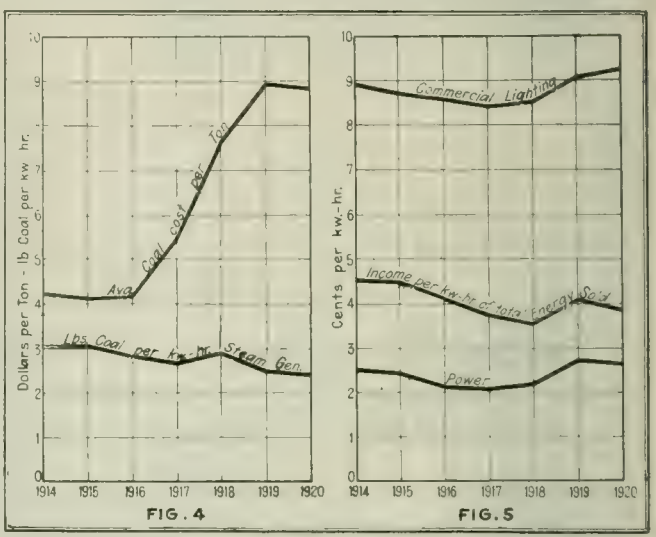


FIG. 4 — FUEL BURNED PER KILOWATT-HOUR GENERATED BY TWELVE MASSACHUSETTS COMPANIES DECREASED FROM 3.05 LB. IN 1914 TO 2.48 LB. IN 1920. FIG. 5 — AVERAGE INCOME FROM COMMERCIAL LIGHTING AND POWER OF TWELVE MASSACHUSETTS COMPANIES

at about 2.5 cents. Increases in output unaccompanied by immediate sharp advances in operating costs, coupled in some cases by a continuation of the policy of lowering rates from time to time as business developed, brought down the average yield per kilowatt-hour to about 8.4 cents for commercial lighting in 1917 and for power to about 2.1 cents. From these low points the rate revisions forced by war prices resulted in higher average returns in following years, but the actual average return per total kilowatt-hours sold did not increase until 1918. This was probably due to the increased sale of energy between companies, which involved the interchange of large blocks at comparatively low rates. At the close of the war the commercial lighting return among these companies was about where it was at the beginning, and the power yield per kilowatt-hour was perhaps a little better. Both lighting and power yields are now on higher planes than the pre-war figures occupied, but rate adjustments upward are still proceeding and the further advance of the net income is becoming appreciated as necessary by both the public and the companies, in order that capital needed for expansion shall flow into the utility field. The evidence of recovery, although slow, afforded by such charts as the foregoing is an encouraging sign to believers in the stability of electric utilities.

Status of Austrian Electrical Industry

Although the Austrian Republic Is Broken Down Politically and Economically, the Industrial Future of the Nation Under Possible Conditions of Electrical Development Has Elements of Promise—Market in Eastern Europe for Austrian Products

By I. SEIDENER and A. GRUENHUT
Editors "Elektrotechnik und Maschinenbau"

WHILE it would be possible to make a very pessimistic sketch of conditions in Austria at present, nevertheless a bright future awaits the electrical industry of that country if it is sufficiently supported. When it is considered that the sales territory of eastern Europe can be reached with smaller freight charges than from the United States, it becomes clear that the starting up of new industries in Austria furnishes a brilliant opportunity for American capital.

There is a deplorable absence of mineral resources, but the country possesses a wealth of water power which could be developed at a reasonable expenditure owing to low building costs and to the fact that wages are much lower than in the United States. For a thorough understanding of the problems which would face interested capital a knowledge of the political and economical situation resulting from the war is essential.

It is easier to divide a nation politically with one stroke of the pen than it is to adjust the economic relations of the divided parts. Agriculture, commerce, industry and transportation formed a tie that nourished and supported the tremendous organization of the old dual monarchy of Austria-Hungary.

Division of the Monarchy After the War

The effects of the war have shown themselves most plainly in the destruction of the monarchy, which fell apart like an arch from which the centerstone had been taken. After the partition by which parts of the empire were assigned to Czechoslovakia, Poland, Rumania, Italy and Jugoslavia, or the so-called national states, the Austrian Republic was reduced to an area of 32,800 square miles (85,000 sq.km.), with a population of 6,500,000. Of this population about one-third lives in the city of Vienna. The old monarchy had an area of 260,000 square miles (673,000 sq.km.), with a population of 50,000,000. In other words, the present republic is one-eighth the size of the fallen empire.

Like all industries of the old empire, the electrical industry has been influenced by the tremendous changes of late years. Large concerns in Vienna have been separated from their branches and installation bureaus in the national states. These territories of trade have not only been separated politically but also cut off economically through the establishment of export and import regulations. As a result of these restrictions and difficult formalities the economical condition of all concerned has been reduced to a state recalling the Middle Ages. The reduction of freight and passenger transportation and the decreased efficiency of telegraph and telephone service are also contributing factors to the chaotic situation.

Not only have the selling organizations been disarranged through the separation of the different states but production also has felt its influence deeply. It is true that the change of the industry from a war to a peace basis was accomplished without delay through the efficiency and ability of manufacturers and employees, but the new policy of separation worked more hardship than the war blockade. The electrical industry formerly obtained coal, coke and lubricating oils from Poland, coal, coke, pig iron, steel castings, forgings, paper linen and cotton thread as cable materials, insulation for pipe covering, glass and porcelain for insulators, apparatus and lighting fixtures and chemicals for the different processes from Bohemia.

The local steel and rolling mills cannot produce cast-iron and steel shapes for dynamos and transformers without coal and coke, which is found in German Austria in small quantities. There is therefore a scarcity of raw materials which could formerly be obtained in any quantity. Particularly depressing is the scarcity of coal, and as a large majority of power plants are steam driven, the result is a drastic reduction in output. Many factories now produce their own electricity, but these also are no better off, since they have to buy American or English coal at fabulous prices. The basis of price calculation has therefore had to be revised with the rising prices of materials and wages.

The impossibility of keeping prices at a level for any length of time has prevented manufacturers from making any definite arrangements or working systematically. Wages increased almost from month to month, keeping step with the cost of living, while falling foreign exchange caused foreign products to increase to as much as a hundred times the peace-time price.

In a factory for electrical apparatus the monthly wages for female employees increased from the end of 1918 to March, 1920, from 400 kr.* to about 1,300 kr., those of the male employees from 1,000 kr. to 3,000 kr. In one of the large factories making all kinds of electrical apparatus average wages per hour for first-class workmen increased in 1918 from 5.70 kr. to 11 kr., for laborers from 4.30 kr. to 9.80 kr., for temporary help from 2.80 kr. to 7.20 kr., for boys from 2 kr. to 4.50 kr., and for women from 2 kr. to 4.50 kr.

Production has decreased 25 per cent, and many social changes have made themselves evident in different ways. Contact with the working force has become easier, but a general lack of energy can be observed, not only in the workers as a group, through shortening of the working day, frequent strikes and demonstrations, but also individually, in spite of all wage increases. The cost of living has gone up to such an extent that even the most economical and level-headed workman is undernourished, and he may besides be suffering physically in other ways as a result of the war.

Selling on credit or checks has stopped completely. The rule is no longer cash on delivery of the goods but when the order is placed. Months pass between the placing of the order and its execution, and therefore much capital is required to keep business going. Price offers are no longer binding, for the seller sets the price on the day of delivery. Certain groups of manufac-

*The exchange rate on the Austrian crown before the war was 20.26 cents. Late quotations range from .55 to .33 cent.

turers have, however, protected themselves in a measure by mutually agreeing upon and announcing a monthly increase in prices. Most producers determine this individually, as they please, and without any effective opposition. The buyer is compelled to submit, no matter how high the price has gone up by the time the goods are delivered—even if delivery is delayed for a great length of time through local ordinances, transportation difficulties or import or export regulations.

Outlook More Hopeful at the Present Time

Although the prevailing conditions have not been sketched too severely, it must be admitted by those familiar with them that a little light is beginning to show which warrants hope for the future. The increased capitalization of all industries is not the result of the decrease in value and the scarcity of money, but is partly a preparation for work when more normal times arrive. If there are prospects for the development of any industry, the electrical industry is surely the one. The wealth of the country is formed by its water power, and the utilization of this power has become urgent because of the lack of the coal and crude oil which could be obtained formerly in any desired quantity. The contemplated electrification of the railroads will furnish employment and orders for the different industries for years to come, even if foreign capital insists on participation of its own industries in the execution of the orders. It is true that this would not be sufficient to keep the plants running regularly. This would only be the case if all the other industries could start up at the same time.

ECONOMIC TIES WHICH HAVE BOUND THE AUSTRIAN ELECTRICAL INDUSTRY WITH THE SECTIONS OF THE DIVIDED MONARCHY ARE SHOWN IN THIS TABLE

Factories for the production of	Number of Workmen		Value in Millions of Kronen			Sales, in Millions of Kronen					Connections with the National States		
	Now	Normally	Buildings	Products	Capacity Hp.	Austria	National States	Hungary	Foreign Countries	Work Produced by Workmen in Percentage of the Peace Production	Expedition Branches	Offices	Warehouses
Electrical machines and apparatus—transformers, meters, etc	1,000	12,000	40	130	3,500	42	66	12	10	60-70	10	100	15
Telegraph apparatus, telephones, signal installations, railroad-safety devices	4,000	6,000	15	30-40	1,000	10-14	17-22	3-4	.	60-70	2	...	..
Electric lamps	3,000	5,000	8	10	1,200	3 5	1	0 5	5	60-70	..	..	..
Cables	2,500	2,800	25	58	1,500	11 5	35	3 5	8	50-70	50	15-20	60

Great Need for Raw Materials

Austria cannot exist without an assured supply of coal and raw materials. As soon as this question is solved normal conditions will prevail again which will lead to renewed activity and prosperity for the electrical industry. It will be able to develop with the erection of light and power installations in houses and factories, in city and country, the enlarging of old installations and the work of supplying local demands as well as those for export. As far as the last are concerned, the balance of business in peace times was always passive since imports and exports were practically equal. The needs of the country were so large that the newly developed industries could only partly fill the demand. For instance, the imports in 1910 amounted to 27,299,000 kr., while in 1913 they were 38,809,000 kr.; the exports in 1910 amounted to 9,756,872 kr. and in 1913 to 12,129,-355 kr.

Austria-Hungary could always export certain special articles, especially electric lamps, which found a market in many European and oversea countries. The electric lamp exports, for instance, reached in 1912 the value of 6,500,000 kr., and in the same year 655,000 kr. worth of lamps were imported. This can be explained by the demand for special foreign products by the branches of foreign concerns. It would seem reasonable to suppose that exports have been completely crippled by the constantly increasing transportation difficulties. Just the contrary, however, is the case. The export of electrical merchandise has grown considerably. In the second half of 1919 more goods were exported by the German-Austrian concerns alone than the total quantity for the entire monarchy in the best years of peace. The imports of the country dropped very sharply, which shows the difficulties experienced by the trade in supplying the market, since the present trade policy, instead of assisting all industrial forces in their development, is based on the supposition that exclusion of foreign trade must be helpful to the home industries.

Although the growth of exports can be traced largely to the low foreign exchange quotations, it has also been due to the excellence of Austrian electrical products having become known in other countries. A large part of the newly acquired customers will undoubtedly continue ordering these products.

Electrotechnical Society in Vienna Is Aiding in Industrial Development

The members of all branches of the electrotechnical industry of Austria are united in the "Electrotechnical Society of Vienna," founded in the memorial year 1883 of the international electrical exhibition in Vienna. This society has acquired a large membership under the guidance of the most prominent men in the electrical industry and can look back on a period of thirty-seven years of far-reaching and successful work. Prof. Carl Schlenk is president of the society at the present time. The society publishes its own paper, *Elektrotechnik und Maschinenbau*, which enjoys an international reputation as a valuable trade journal.

In a succeeding article the power possibilities of Austria, together with the status of the central station industry, will be discussed.

"UNFAIR *methods" include all those practices which, while not illegal, are economically and industrially wasteful, because such success and profit as they produce is gained at the expense of the public, instead of by reduction of costs or improvement of quality and methods. . . . Unfair methods; such as accepting rebates, local underselling at a deliberate loss, bogus competition, running down a competitor's goods, bribing his salesmen, false litigation, etc., may or may not be unchristian, but they are bad because they are economically unsound, tend to inefficiency, corrupt monopoly, high costs and high prices.*—PHILIP CABOT.

Hold-Down Magnet Control for Vertical Plate Shears

Standardization in Design of Adjustable Pulpit for Control of Hold-Down Magnets Thought Desirable—Arrangement of Treadle Switches

BY S. L. GUTHORN
Electrical Engineer, Perin & Marshall, New York

IF THERE is coming to be an extensive use of electromagnets for holding plate at vertical shears, it seems that some standardization should be attempted. With that standardization in view a number of equipments have been laid out with features adaptable to all shears of this class. Each equipment consists of from one to four hold-down magnets, the number depending upon the size of the plate, mounted within the lower knife-holder casting, two treadle switches and one push-button station at the shear, and a contactor panel remotely placed. The push-button is hand-operated; one treadle switch is foot-operated and the other shear-operated. The operation is briefly as follows:

When a plate has been set at the shear the operator presses the foot switch, energizing the hold-down magnets which hold the plate. It is not necessary to retain the foot switch in the reverse (closed) position, for the contactor circuit, once made, is maintained through, and current reduced by, the holding resistance on panel. The operator then brings down the upper shear blade, cutting the plate. At the bottom of the shear stroke a push rod connected to the upper shear blade operates the treadle switch, opening the circuit through the hold-down magnets. The hold-down magnets then retain only their residual magnetism.

As the shear blade returns to normal it releases the shear blade switch for the next cycle. In order to demagnetize the hold-down magnets and release the plate, the push-button is now touched and a small demagnetizing current is established to counteract the residual magnetism. This frees the plate, permitting its being passed on. Should it be decided that a plate held by the magnets owing to the initial operation of the foot switch is not to be cut, then the normal interruption of the magnetizing current by the shear-blade switch is performed by the push-button.

Fig. 1 shows the control equipment arranged on a pulpit, also the hold-down magnets, push rod and shear, while Fig. 2 shows enlarged views of the complete pulpit proper. It consists of frames *A* and *B*, made as shown, and of 1½-in. x 2-in. (3.8-cm. x 5.1 cm.) angles. They are bolted together by four ⅜-in. (1.6-cm.) cross-rods. Each frame carries a treadle switch and counterweighted foot lever—frame *A* that for shear operation, and frame *B* the foot switch. Frame *B* is

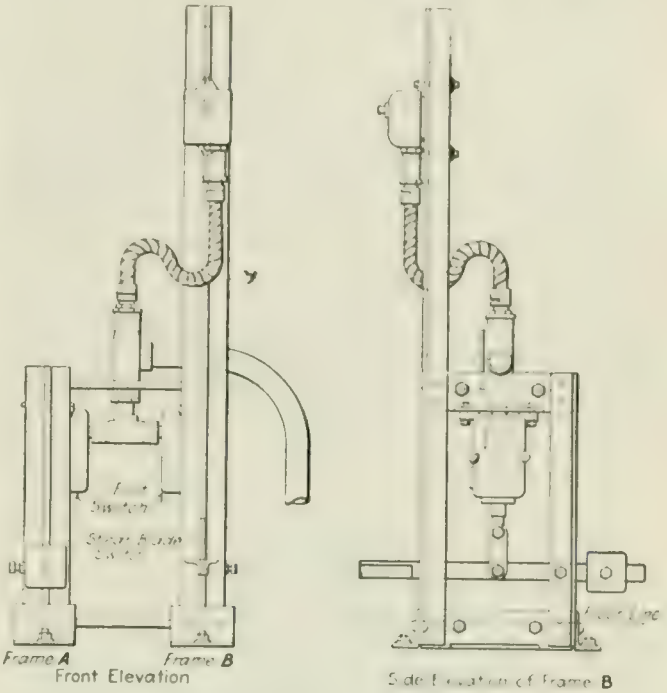


FIG. 2—METHOD OF MOUNTING SHEAR AND TREADLE OPERATED SWITCHES

extended to carry the demagnetizing push-button station. It also permits adding the master control of such an auxiliary as the scrap-handling apparatus. By means of the ⅜-in. (9-mm.) spacers in frame *B*, the push-button station is adjustable to the height desired by the operator. The flexible-conduit connection allows this adjustment to be made with ease. Frames *A* and *B* may be interchanged or their centers adjusted by means of the four cross-rods.

The circuits, in sequence, resulting from the above cycle are as follows: Referring to Fig. 3, when a plate has been set at the shear, the operator presses foot switch, closing its contacts and taking current from the plus side of the line *L*-2 through terminal *B*, to operating coil of magnetizing contactor through terminal *F*,

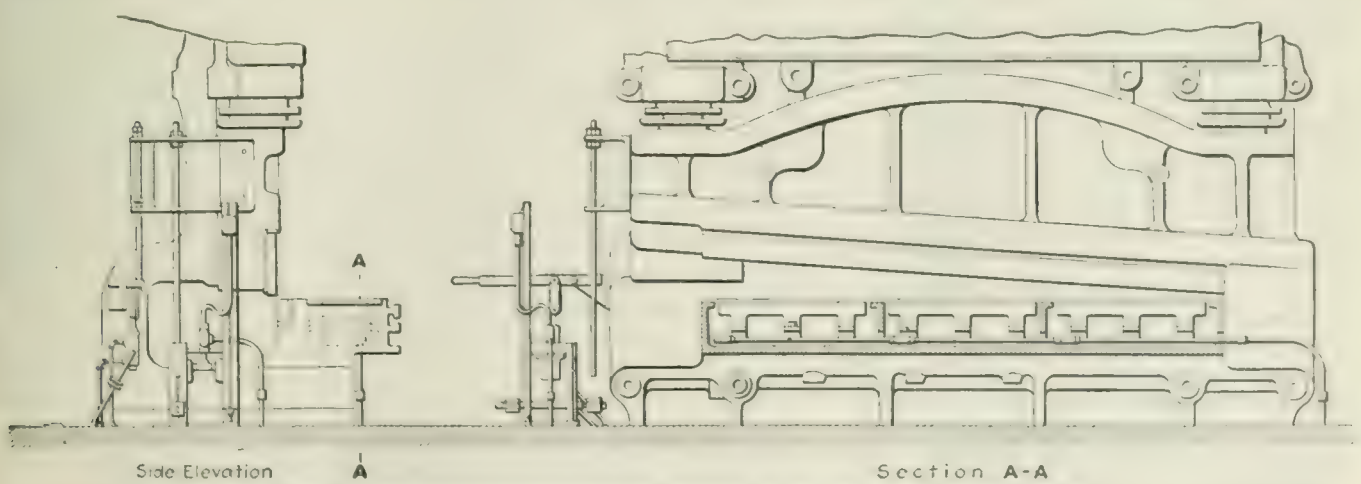


FIG. 1—ARRANGEMENT OF CONTROL EQUIPMENT ON PULPIT OF PLATE SHEAR

thence to terminal *S*-2 through the foot switch, the normally closed contacts of the shear-blade switch, through the normally closed contacts of the push-button switch, back to terminal *S*-1; thence to terminal *R*-2 to the negative side of the line at blow-out coil terminal and *L*-1. The magnetizing contactor, thus energized, closes upward, taking current directly from the line *L*-2 through its blow-out coil and contacts, its pigtail to the terminal *T*-2, thence to the set of three hold-down magnets in multiple, returning to *T*-1 and *L*-1, thus energizing the magnets and holding the plate. It is not necessary to retain the foot switch in the reverse (closed) position, for the contactor circuit, once made by depressing the foot switch, is maintained through, and current reduced by, the holding resistance *F*-*E* across terminals *S*-2 and *S*-3.

The next operation in the cycle is to bring down the upper shear blade, cutting the plate, and at the bottom of the stroke the push rod operates the shear-blade switch, opening its contacts, thus interrupting the main-

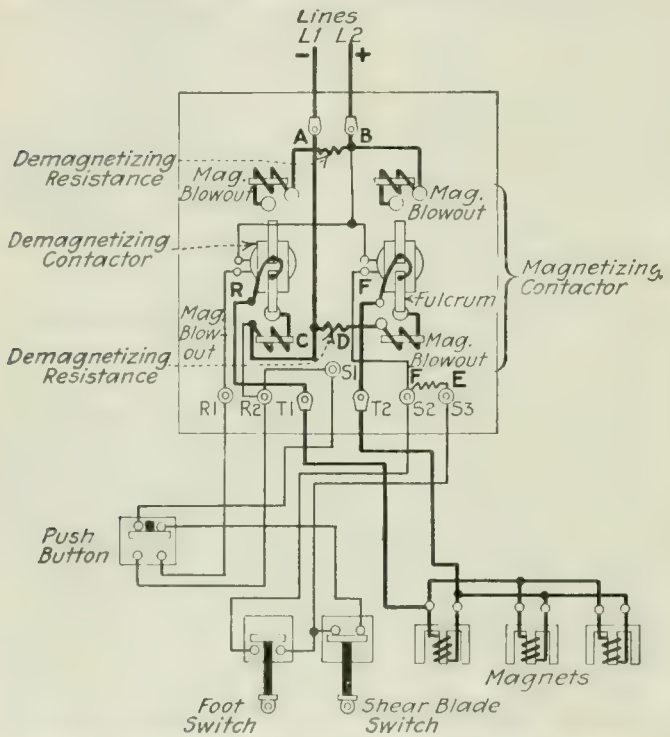


FIG. 3—WIRING DIAGRAM FOR SHEAR-CONTROL CIRCUITS

contactor holding circuit, which opens the circuit through the hold-down magnets. The hold-down magnets then retain only their residual magnetism.

The shear blade now returns to normal, permitting the shear-blade switch contacts to close. The plate, however is held by residual magnetism. In order to demagnetize and release the plate, the push-button is now pressed, closing its normally opened contacts and passing current from the plus side of the line *L*-2 through the demagnetizing contactor coil, through R-1, push-button, *R*-2, returning to the negative side of the line *L*-1. The demagnetizing contactor is thus closed and takes current from the positive side of the line *L*-2 through resistance *A*-*B*, blow-out coil and contacts, through its pigtail *R* to *T*-1, to the negative wire of the hold-down magnets, returning through terminal *T*-2 to pigtail of magnetizing contactor in its normal (downward) position through blow-out coil, demagnetizing resistance *C*-*D* to the negative side of the line. Thus a small demagnetizing current is maintained to counteract the residual magnetism during the period that the demagnetizing push-button is depressed. This frees the plate, and it passes on.

Should a plate come up to the shear and be held by the magnets owing to the initial operation of the foot switch, and should it be decided not to cut the plate, then the normal interruption of the magnetizing current by the shear blade switch as above described is performed by the push-button, for in depressing the latter it first interrupts the magnetizing current, since its normal contacts are in series with those of the shear-blade switch, while the continuation of the pressing of the push-button performs the demagnetizing function above described.

The induced current, or reactive kick of the magnets caused by interrupting the magnetizing current, is discharged through the circuit formed of magnets *T*-2, normal or lower magnetizing contactor terminal, blow-out coil, discharge resistance *CD* through demagnetized contactor, blow-out coil and pigtail to *T*-1, returning to magnets.

This arrangement of control equipment was first worked up for the Tala Iron & Steel Company, Sokchi, India, as a standard design.

Power of New Battle Cruisers Comparable to Largest Central Station

BATTLE cruisers designed for a speed of 35 knots an hour with a shaft horsepower of 180,000 or 160,000 kva. have placed the power requirements for this class of work on a par with the largest central station. For example, the Northwest station of the Commonwealth Edison Company, Chicago, is rated at 165,000 kw. and the Fisk Street station at 230,000 kw. The Fifty-ninth Street station of the Interborough Rapid Transit Company, New York, is rated at 195,000 kw.

The present naval program calls for the following new classes of battleships and battle cruisers, which are compared with the Tennessee, the latest capital ship to be placed in commission:

	Tennessee	New Battleships	New Battle Cruisers
Length over all, feet	624	684	874
Beam, feet	97	105	90
Draught, feet	31	33	31
Displacement, tons	33,000	43,200	43,500
Speed, knots	21	23	35
Main battery	12 14-in guns	12 16-in guns	8 16-in guns
Shaft, horsepower	30,000	60,000	180,000

The new battleships are to be electrically driven, and the main propelling equipment of four of them—the Indiana, Montana, South Dakota and North Carolina—will consist of two Westinghouse 28,000-kva. turbine-generators and four 15,000-hp. Westinghouse propeller motors. The turbines are to be of the complete expansion, impulse-reaction type and will develop their full rated load at 265 lb. (120 kg.) steam pressure, 50 deg. Fahr. superheat and 28½ in. (124 mm.) vacuum. Electric power will be generated in the form of three-phase, 60-cycle, 5,000-volt alternating current.

The statistics of the new battle cruisers given in the table indicate that these vessels are to be very unusual in many respects, but their most remarkable feature is the enormous power of their turbines. Two of these vessels, the Ranger and the Constellation, will have four main turbines to develop 49,750 b.-hp. each.

Readers' Views and Comments

Centralized Stream-Flow Records Would Be Helpful

To the Editor of the ELECTRICAL WORLD:

SIR: In many engineering investigations pertaining to water power, water supply, etc., it becomes of great value to have as large a number of rainfall and stream-flow records as possible. Still, there are a large number of rainfall stations maintained by various private and public interests which are not reported to the Weather Bureau. For this reason it has been the idea of the writer for some time that the publication of all available rainfall data as well as stream-flow data in a single bulletin or other publication would be of very great value. Having this in mind, a letter was written to Prof. Wilford M. Wilson of Cornell University and the head of the United States Weather Bureau in New York State, asking if the bureau would be willing to publish records if they are obtainable. A reply has been received stating that the bureau will receive, publish and file all records of rainfall made under proper supervision in the state. The records must be reported on blanks furnished by the bureau and can be mailed in franked envelopes.

The various interests which maintain rainfall stations could well afford to turn in reports each month to their section director and have them published. They would thereby be conferring a great benefit on others who might have use for rainfall data and in addition to that would be making the climatological data of more use to themselves, as all the obtainable information for the state would be included in the one publication.

The same thing applies also to the matter of stream-flow records. The subject of stream flow is now so well understood that there is no advantage in holding any particular information under cover, as it is a matter of no great difficulty to compute the approximate flow of a given stream by comparison with others. It would, however, be of the greatest advantage to have every possible record of flow published by some central authorized agency as a matter of comparison with other records. In this way discrepancies between various records of flow on the same stream or river system might be checked up and many errors eliminated.

It is suggested that such additional records of flow might be published either by the State Engineer or the Conservation Commission, or both, in their annual reports and that suitable arrangements be made between the various parties maintaining such stations and one or the other of these authorities for the keeping and publishing of such records. It seems that there might be from two to three times as many records of flow brought together under the covers of one book as are now obtainable from the publications of these two departments.

As an extension of this idea I would suggest that it might be that the American Society of Civil Engineers could well collect and collate the various stream-flow and rainfall records obtainable for past years and publish them in some form so that they would be available to those who desired them. At the present time stream-flow records are scattered in many places, and it is extremely difficult to secure records extending back for any great period of time unless one has been fortunate enough to come into possession of records which are now out of print. It is suggested that this collection of records might take the form of a loose-leaf book of standard letter size, 8½ in. x 11 in., or of small bulletins covering a given stream or stream-flow station which could be punched and inserted in a standard loose-leaf cover. The same system could be applied to rainfall records. This would make an extremely valuable collection which would undoubtedly be availed of by a large number of engineers and interests having use for such records.

The making of these records in loose-leaf or bulletin form would permit the insertion from time to time of any records which might come to light or be offered for publication subsequent to the original publication of such a comprehensive record. It would also enable interested parties to obtain the particular information in which they are interested without going to the expense of purchasing the entire collection.

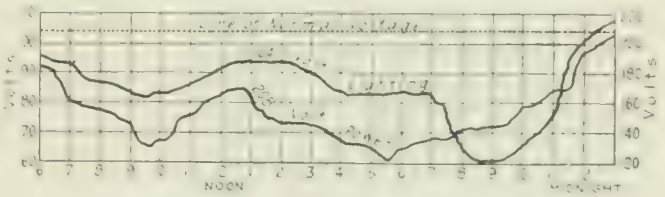
Utica Gas & Electric Co., BYRON E. WHITE,
Utica, N. Y. Engineer.

South American Operating Conditions

To the Editor of the ELECTRICAL WORLD:

SIR: It may be of interest to manufacturers in the United States, especially to those engaged in the export of electrical machinery to South American countries, to know some of the conditions encountered in these countries in the operation of electrical machinery and apparatus.

One of the most common hindrances to be found is the poor voltage regulation. Here in Lima the insufficient generating capacity, the obsolete condition of the



EXTREME FLUCTUATION OF VOLTAGE ENCOUNTERED IN SOME SOUTH AMERICAN CITIES

distribution circuits and the absence of voltage regulators have brought about intense voltage variations which seem almost incredible. A voltage chart plotted from readings of two circuits, one industrial power and the other lighting, both fed from the same high-tension circuit, is shown herewith.

Among the immediate results of this state of things are lack of power in the motors and low power factor with consequent heating. It should be borne in mind that when the voltage falls considerably the power becomes very low as it varies with the square of the voltage. For instance, a 5-hp., 220-volt motor when operated at the lowest point of the voltage curve can give only about 1.5 hp., and the speed is also very low.

While it cannot be affirmed that the voltage conditions in all South America are so bad as they are in Lima, neither can it be said that in other places they are much better, as in these countries much remains to be done in regard to the establishment of modern electric service standards.

Lima, Peru. VÍCTOR M. ARANA, Consulting Electrical Engineer.

Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

System for Keeping Primary Line Records Up to Date

COMPLETE data covering the primary circuits of the East St. Louis (Ill.) Light & Power Company are given in several 8½-in. x 11-in. (21.6-cm. x 28-cm.) loose-leaf books which are distributed to the various departments interested every month. Every month the data are brought up to date, the maps being revised by a simple method described later.

At the front of each book is an index which shows, under the location number, the make, location and size of all transformer installations. Following this index are the circuit records. Each circuit is arranged as simply as possible on a map showing the section of the city covered by the circuit, but the detailed data are written on a separate sheet rather than on the map, as may be seen by the illustration. The description of each individual circuit begins with a statement of whether it is single-phase or three-phase, the number and size of wire and the routing of the line. In the next column are given the location number, the number and size of transformers and their street location. At the right of the sheet the distance of the transformers from the station is given in feet.

The key copy of the circuit data book is kept up to

D. Power Circuit — Sheet #1

T.R.W.P. Solid Copper Wire Unless Otherwise Specified.

3-phase, 3-#4/0 wires from Station 3 to east side of Winstanley Yards, north to State, west on south side State to 19th, north on east side 19th to Baugh, west on south side Baugh to 9th, thence to north side Baugh, then west to 7th St., south on east side 7th to St. Clair, west on north side St. Clair to 1st pole west of 1st, then across barn to trolley poles in Stock Yards, thru Stock Yards to Swift & Co. transformer house.	D-427 - 2 - 25 Kva. 926 Baugh ave.	7100
	D-474 - 2 - 25 Kva. 925 St. Clair Av	11500
	D-419 - 3 - 200 Kva. Morris & Co. in trans. house.	
	D-420 - 3 - 175 Kva. Swift & Co. in brick Transformer house.	13600
3-phase branch, 3-#4 wires from Baugh south on east side 18th to St. Clair, west on north side St. Clair to 2nd pole west of Natchez and intended.		5500
3-phase branch, 3-#6 wires from St. Clair, south on east side Collinsville to NE corner Pennsylvania.	D-417 - 3 - 20 Kva 700 Collinsville	9600
3-phase branch, 3-#4 wires from St. Clair south on east side Vandalia R.R. tracks to Tank of Purina Mills.	D-454 - 3 - 125 Kva. Ralston Purina Milling Co.	13150

FIG. 1—CIRCUIT DESCRIPTION, KEPT IN LOOSE-LEAF BOOK

This 8½-in. x 11-in. typewritten sheet describes a 2,300-volt power circuit and all its branches as shown on blueprint map of the same size (see Fig. 2). Triple-braid, weatherproof, solid-copper wire is used unless otherwise specified. The first number in the second column, as, for instance, D-427, is the transformer location number. The next figure represents the number of transformers, and the next number the rating. Underneath is the street address. The distance from the station is shown in feet to the right. All transformers are connected in delta or open delta as the case may be.

date by daily pencil notations from work orders. The copies in the hands of the new-business department, service department, load dispatcher's office, etc., are corrected monthly by new revision sheets issued from the construction office.

For the purpose of revising the map, a zinc plate of a map of suitable scale, covering the entire city, was obtained, and from this zinc a stock of maps were

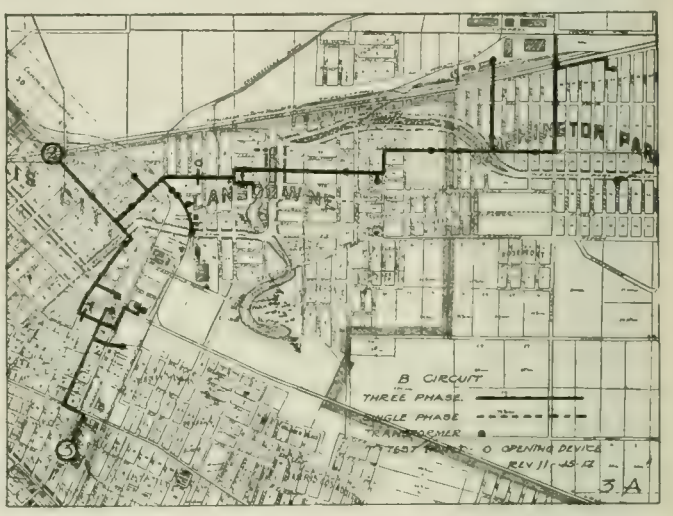


FIG. 2—MAP OF PRIMARY DISTRIBUTION CIRCUIT, WHICH IS REVISED EVERY MONTH

This is a section cut out of an onion-skin map of the entire city. After the circuit is drawn in and the legend is written, this is used as a tracing from which blueprints are made for the different data books.

printed on onion-skin paper. The circuit is drawn in on one of these onion-skin maps, a border and title are added, and the rest of the map is cut away. This is a very inexpensive way of obtaining a complete tracing from which blueprints can be made at very little expense.

This method of keeping up the primary line records has been in use for a number of years with practically no change from the original plan, which has worked out very satisfactorily for all concerned.

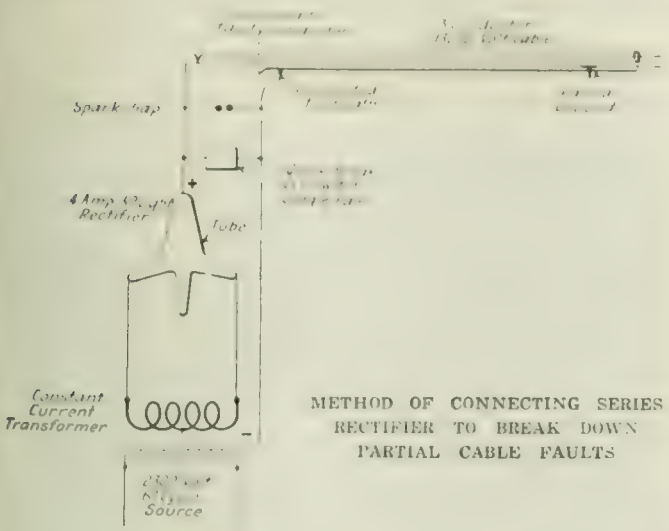
JOHN H. MITCHELL.
East St. Louis Light & Power Company,
East St. Louis, Ill.

Constant-Current Rectifier Locates Cable Faults

A PARTIAL ground or short circuit on an underground cable may be further broken down by means of a mercury-arc rectifier so that a low-resistance ground or short circuit is established which can be readily located with a telefault. A 4-amp. fifty-lamp (about 3,500-volt) rectifier has been successfully used for this purpose in St. Louis on 13,200-volt paper-insulated cable. The rectifier is started up on short circuit through a small quick-break oil switch connected across the direct-current leads which connect the rectifier with the defective cable. The opening of the switch causes a rapid rise in the direct-current voltage,

which finds the weak spot in the cable and establishes a more complete fault. To protect the cable insulation against excessive voltage from the rectifier a spark gap is connected across the direct-current leads. The gap is set at 18,000 volts. The current is not sufficient to damage the cable seriously because the direct current is limited by the rectifier transformer to about 6 amp.

This breaking down could be accomplished by connecting the cable to a live power line, but this often results in damage to the cable and other equipment.



METHOD OF CONNECTING SERIES RECTIFIER TO BREAK DOWN PARTIAL CABLE FAULTS

WALTER H. MILLAN,
Superintendent of Substations.
Union Electric Light & Power Company,
St. Louis, Mo.

Operating Small Hydro Plants Without an Attendant

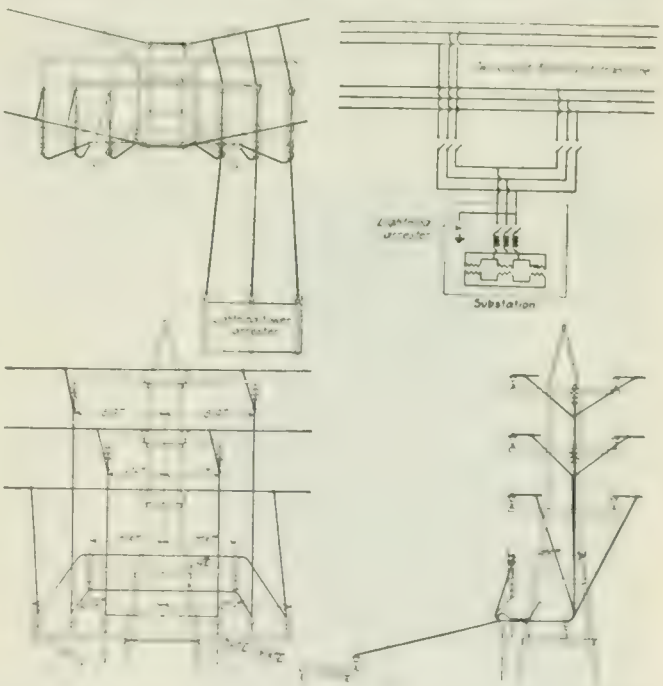
UTILIZATION of small water-power plants that are not physically worn out but whose output does not warrant the expense of an operator is accomplished by the Consumers' Power Company by means of some home-made devices for automatically closing the waterwheel gates. In Battle Creek the old hydraulic station was equipped with a 150-kw., 2,300-volt synchronous generator belted to a 254-hp., 74-in. (188-cm.) horizontal waterwheel. The gate-operating mechanism has been supplied with a drum around which is wound a cable which passes up over a pulley and suspends at its other end a weight which is heavy enough to close the gates when released. On starting the machine the gates are set to take whatever water is available. Connected to the waterwheel by a belt is a small fly-ball governor mechanically connected by a light cable to a trigger that normally locks the cable drum on the gate-operating mechanism. Any undue increase in the speed of the wheel causes the governor to trip the cable-drum trigger, and the weight shuts the machine down by closing the waterwheel gates.

At the west side plant in Grand Rapids no existing machines were available, as the old waterwheel equipment was past the point of satisfactory repair. Two 200-hp. induction motors were installed and belt-connected to two 205-hp., 59-in. (150-cm.) open-flume wheels. Automatic oil switches and panels to control each machine were installed and fly-ball governors were belted to the waterwheel shafts. A cable drum and trigger similar to those at Battle Creek prevent overspeeding. Tripping of the oil switches will also operate the trigger. The induction generator is put on the line by bringing it up to approximately synchronous speed and closing the oil switch. Load is then picked up by opening the wheel gates and raising the generator speed until the machine is taking full load or all the available water.

In both of these plants the only attendance is a visit of inspection twice a day to see that everything is in proper condition and to supply oil if necessary. Trouble that results in tripping a generator off the line requires that some one go to the plant to put the machine on the line again. The cost of attendance has been reduced at these stations to such an extent that the limiting feature of their use is in the maintenance cost of the hydraulic equipment and structures. H. J. BURTON.
Consumers' Power Company,
Jackson, Mich.

Standard Tower Adapted for Switch Mounting

TWO straight-through 30,000-volt transmission lines are tapped to supply a substation, and the two sets of disconnecting switches required are mounted on the steel tower shown in this drawing. This is accomplished by adding supporting steel members to the tower as shown to hold the two sets of disconnecting switches and the insulators which carry the necessary conductors. The switches are so connected that the substation can be fed from either of the lines or from both lines tied together.



TWO LINES TAPPED BY DISCONNECT SWITCHES ON THE TOWER TO AVOID EXPENSE OF A SWITCHING FRAME

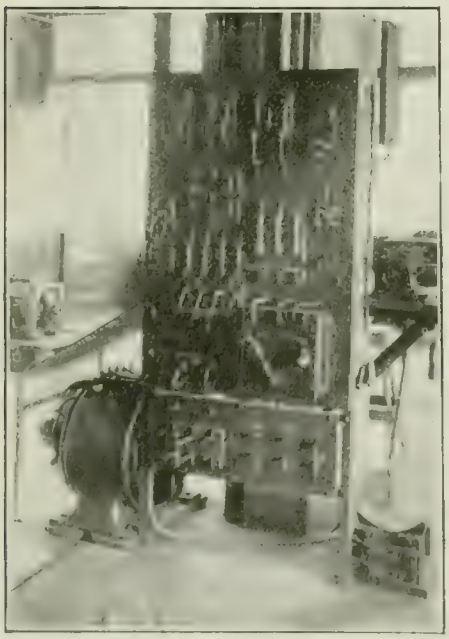
The operating handles of the disconnecting switches are easily accessible from the ground. The lightning arresters and the transformers are shown in the schematic diagram of the entire installation, but the transformers have been omitted from the drawing of the steel structure. F. C. Stanford, electrical engineer of the Cleveland Cliffs Iron Company, Ispeming, Mich., planned and supervised this installation for his company.

Industrial Applications

The Economical Utilization of Electrical Energy in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

Convenient Home-Made Switchboard for Testing Motors

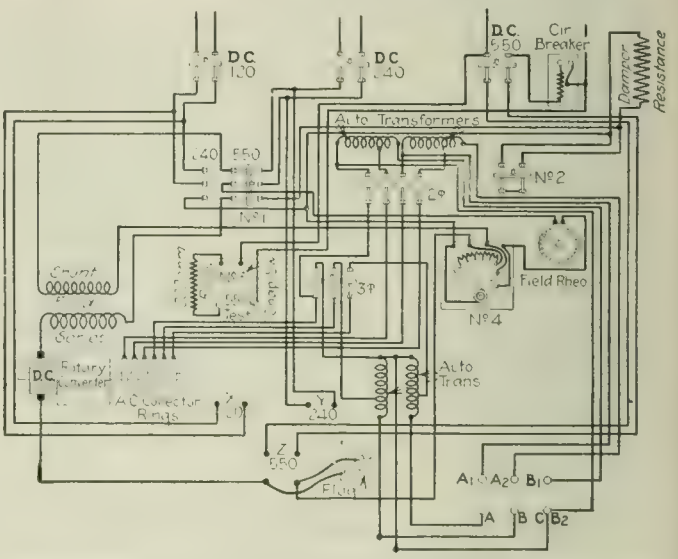
DIRECT-CURRENT and alternating-current motors of any commercial frequency and for 120 volts to 550 volts can be tested on the switchboard made in the shop of the Electric Motor Repair Company, Springfield, Mass. Very simple starting equipment is included in the arrangement which will handle motors as large as 100 hp. Energy for testing is supplied at 120, 240 and 550 volts direct current from a power plant in the building. To obtain alternating current an old 7.5-hp. motor was fitted up as a rotary converter by adding the necessary winding taps and collector rings, and either two-phase, single-phase or three-phase energy is obtained from this machine through the connections and auto-transformers illustrated in the accompanying diagram. The panel is only 80 in. high by 35 in. wide (2 m. x 90 cm.), and on it are mounted ordinary slate-back switches. A wide and smooth range of frequency adjustment is obtained by varying the speed of the rotary converter through shunt-field and armature voltage control. No starting compensators are required. Three direct-current voltages (120, 240 and 550) are used to get the corresponding voltages in alternating current without changing transformer taps and also to give a greater flexibility as far as frequency is concerned. The operation is as follows: For 120 volts, 60 cycles, throw switch No. 1 to the left. This connects the shunt fields and armature across 120 volts. Push plug at the bottom of the board into the holes marked *X* and start the rotary with No. 4 box. Move the field rheostat until proper speed is obtained. For single-phase or two-phase energy connect to the lower terminals at the right marked *A*-1, *A*-2, *B*-1, *B*-2, and throw in the switch marked 2φ. For three-phase energy connect to *A*, *B*, *C* and close switch 3φ.



SEVERAL VOLTAGES AND FREQUENCIES AVAILABLE ON THIS BOARD FOR TESTING MOTORS

For 240 volts put the plug into the holes marked 240 or *Y*. Throw switch No. 1 to the left for frequencies of 50 cycles or over. This will connect the fields on 120 volts and the armature on 240 volts. For lower frequencies throw No. 1 to the right. This will connect the fields of the rotary to 240 volts, reducing the speed and lowering the frequency.

For 550 volts put the plug into holes marked 550. Throw No. 1 switch toward the right only. The fields



WIRING DIAGRAM OF BOARD USED FOR STARTING AND TESTING MOTORS UP TO 100 HP., 550 VOLTS

are then on 240 volts and the armature is on 550 volts.

To lower the inrush on the rotary converter when large motors are started up a damper resistance is connected in series with the motor. When the motor is up to speed switch No. 2 is thrown in, short-circuiting the damper and giving the motor full voltage. This board operates entirely without any other starting arrangements for motors besides the two switches marked 2ø and 3ø. No compensators are used. Motors rated at 100 hp., 550 volts, have been operated without trouble. Switch No. 3 operates a 550-volt circuit used with a 1,000-ohm resistance tube to test for minor grounds or short circuits where a higher voltage is not required.

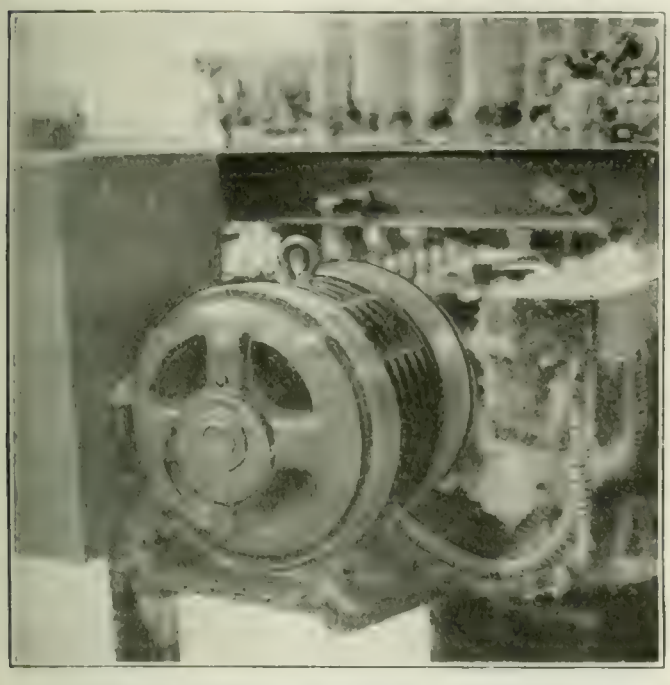
Electric Motor Repair Company, Springfield, Mass. M. HAMAN.

Textile Motors Attached Directly to Spinning-Frame Cylinders

IN CHANGING from group drive to individual motor drive of 128 ring spinning frames at the Indianapolis (Ind.) Bleaching Company some time ago the motors were attached directly to the frames without moving the existing machines. Previously the machines were driven through line shafts attached to the ceiling. These line shafts were removed and the motors were mounted on cast-iron brackets fastened to the end of each spinning frame. They were connected directly

to the cylinders on the Lowell frames. The diameter of the cylinders did not have to be changed as the proper motor to give the correct speed was obtained. These motors are 5-hp., three-phase, 550-volt, 60-cycle, 1,150-r.p.m. Westinghouse textile motors.

The motors are controlled by textile drum-type switches with the shipper-rod device which was formerly used with belt drive. The switch is attached to a shipper rod on the frame so that the motors and machines can be easily started and stopped from either end. By the utilization of this control the change-over has no effect upon the operation, and the



INDIVIDUAL DRIVE MOUNTING ON END OF LOWELL SPINNING FRAME

machine is handled in the same manner as it was before. Directly below the switch are the fuses for the motor entirely inclosed in the steel cabinet. Connections from the switch and fuse box to the motor are made through wires covered with flexible steel conduit.

By the installation of the motors driving the machines directly all shafting was eliminated. This resulted in better lighting and decreased noise. Furthermore, the maintenance of bolts and shaft bearings was obviated and the possibility of oil dropping on the frames was removed.

L. R. WEST.

Indianapolis, Ind.

Maintenance Costs per Motor Average 50 Cents a Month

THE cost of maintaining about 1,500 220-volt, three-phase, 60-cycle motors, ranging in size from ½ hp. to 225 hp. and aggregating about 2,200 hp., averages 50 cents per motor per month in the plant where the writer is connected. The motors are up to twelve years old and have probably been in service, on an average, five years. The cost given is an average for the past six months and includes the labor and material for replacing contacts, burned-out windings and bearings, the labor of inspecting, oiling and testing the motors, plus the regular factory overhead expense.

With the exception of the time given to the renewal of lamps and making repairs to the lighting system, three men devote their entire time to keeping the motors running and properly loaded. These men inspect the motors about twice a week, but some motors like the synchronous machines driving the air compressors are inspected only once a week, while there are 20-hp. and 30-hp., 3,600-r.p.m. blower motors which are inspected four times a day. The motormen are held responsible for keeping the motors fully loaded, and if manufacturing conditions change so that a motor appears to be overloaded or underloaded, they have an ammeter cut-in circuit and report the load to the office. They are then instructed to change the motor to one of the proper size for the load.

During the past seven years a 185-hp. synchronous motor and a 30-hp. wound-rotor induction motor were the only large motors that were burned out. All the other machines that have been sent in to the shop for rewinding have been of 10 hp. or less. A repair force of one armature winder and a helper is maintained, but in addition to the rewinding, which comes under the head of motor maintenance, these two men repair electric tools, chucks, etc.

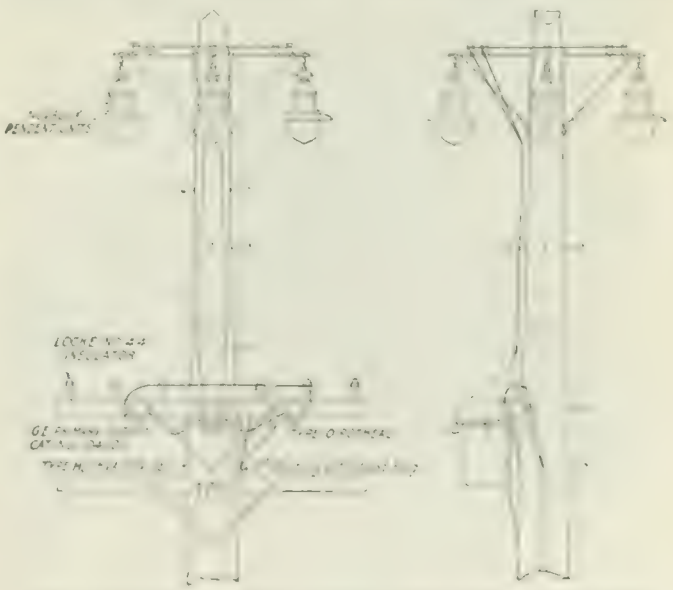
H. L. BURNS,
Chief Electrician.

Domestic Engineering Laboratories Company,
Dayton, Ohio.

Yard Lamps and Transformers Carried on Same Pole

TRANSFORMERS, lamps for lighting the yards and all distribution lines are carried on the same pole in the Hog Island shipbuilding yards. Four of these lamps are supported on strap-iron brackets near the top of the pole, so that there is light on all sides of the pole. The transformer with its cut-outs is mounted on a cross-arm several feet below the lighting units, and secondary wires are run on porcelain knobs up to the lamps.

This type of construction was used to save the cost



FOUR LAMPS DISTRIBUTED AROUND POLE PREVENT SHADOWS

of erecting separate poles. All distribution was necessarily overhead in these yards because changes in the buildings were repeatedly being made and underground work was in danger of being torn up at any time.

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

Power Shortage Relieved by Isolated Plants

"I WOULD as soon give a little extra money to the utility as to pay it to the government in taxes," said a prominent business man in the Twin Cities when the St. Paul Gas Light Company asked him to operate his isolated plant for three and a half months this winter to tide the company over its winter peak. This is typical of the help being given the St. Paul central station company by many downtown business men and factory executives who are temporarily operating their isolated plants, some of which have been shut down for a number of years. With this arrangement it will not be necessary for the utility to curtail the electric service to its customers. It will increase the cost of service to these large customers, but they get much lower rates than the smaller customers, and, realizing the predicament of the utility and its customers, they are willing to stand the extra expense.

The Milwaukee Electric Railway & Light Company also is receiving help from the isolated plants of Milwaukee. For a number of years it has had agreements for interchange of power with some of its large industrial customers. This year the power shortage is more acute, so in addition to utilizing the available generator capacity of these large customers, the company is connecting up to industrial concerns which are not customers and is purchasing their surplus energy. This condition will be relieved when the Milwaukee utility can start its new pulverized coal-fired generating station, which will probably be ready for service early in the new year.

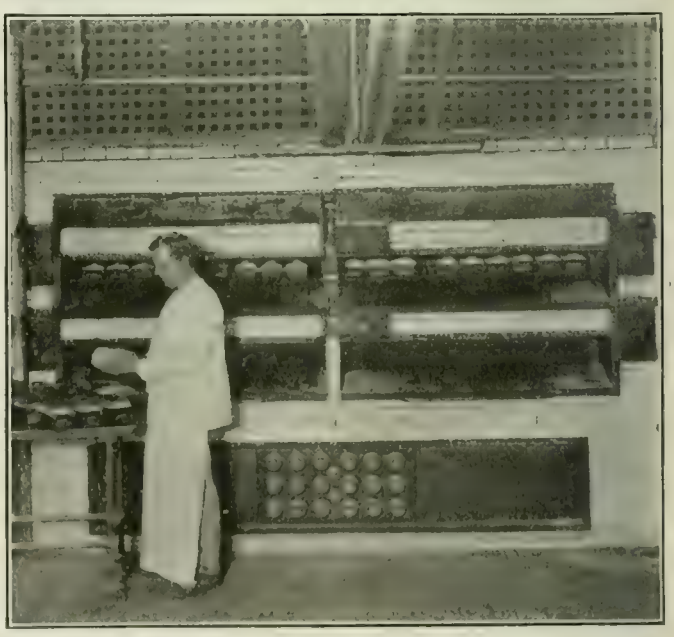
Electric Bake Ovens a Desirable Central-Station Load

By George W. Cole

ALTHOUGH the idea of electric cooking is not new, it is only recently that its application has become commercially successful. The Utah Power & Light Company was one of the first central stations to attempt to put the electric range into actual use. Nearly two years of constant effort was required to establish a foothold in Salt Lake City and convince the people that an electric range would cook, that the cost of operation would not be prohibitive and that electric cooking was the most modern and satisfactory way of preparing food.

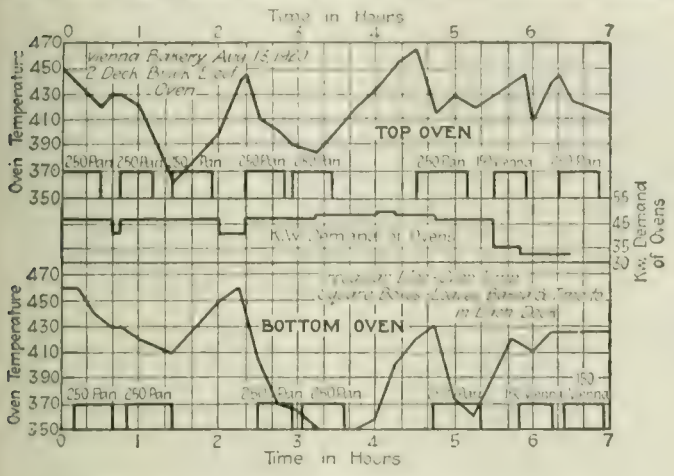
Naturally, as soon as the residential cooking idea was established, a new field was opened in commercial cooking and baking which it appeared would soon develop into a more desirable load than the domestic range. The first few customers were skeptical—the idea of domestic cooking was all right, but turning out foodstuffs in commercial quantities was apparently out of reason and the price presumably would be proportionately out of line. A demonstration of an electric oven in one of the largest retail stores secured the first order. The Utah Power & Light Company furnished everything and allowed the store's baker to operate the oven. After a six-day trial the meter was read, the output checked, and it was found that, instead of being more expensive to operate, the oven actually did more work at less expense than the fuel then used by the store. From the first installation of this oven sales have steadily increased until at present there are about forty ovens working every day in Salt Lake City and about twenty in use in other sections of the company's territory.

This company looks upon the bake oven as a very desirable business as it is in steady use from five to sixteen hours each day and maintains a fairly high load factor. The investment cost to obtain this business is little or no greater for smaller-size ovens than for the electric range and revenue returns equal eight to ten ranges. In most cases no additional investment is necessary as the load is connected in the commercial section, where feeders and transformers are of ample capacity to handle a greatly increased load. The baking hours are so arranged by the class of work that the operation seldom overlaps a peak. If the oven is used during the day, it misses the morning peak and is turned off before the evening; if used during the night, it also misses both morning and evening peaks, thereby improving the load factor by filling in the valley of the load curve that is a problem to all central-station engineers.



DOUBLE-DECK BRICK TYPE ELECTRIC OVEN, CONNECTED LOAD 88 KW.

The largest oven connected in Salt Lake City is a Hughes No. 415 brick-type electric oven with a connected load of 88 kw. This oven has been in use for three years and has proved very satisfactory. It is operated on a load-factor rate, and to keep operating cost as low as possible tests have been made to find the lowest demand on which the oven can operate and maintain the maximum output of bread. A series of tests has been made and 50 kw. demand shows



OPERATION CURVE OF ELECTRIC OVEN MAXIMUM DEMAND 50 KW.

the greatest efficiency. With this maximum it is possible to bake bread as fast as it can be cooked through without burning and with no appreciable loss in temperature in the oven. The bakery is turning out a 19-oz. loaf, 250 in each deck, baked in thirty minutes. The output of this bakery is 10,000 loaves daily, approximately 34 per cent of which is baked in the electric oven, the rest in three brick ovens. The accompanying diagram shows the operation curve of this oven for a typical day.

Available figures on all the ovens in use in Salt Lake City show that the average demand is about 50 per cent of the name-plate rating. This, of course, is dependent on the number of hours' use, but over an eight-hour baking period it holds true. Longer hours reduce this percentage somewhat and a shorter use necessarily increases it, but the average holds.

From the customer's standpoint the oven is very desirable as it does the work that any fuel-fired oven will do and does it better. The ovens are especially adapted for high-class pastry work, as uniform heat distribution, perfect control and the absence of dirt or fumes make them particularly suitable for this kind of baking.

One representative installation turned out during twenty-six baking days:

Cream puffs	1,800	Tarts	540
Cup cakes	2,160	Apple turnovers	540
Package squares	720	Layer cakes	300
Buns	3,600	Cinnamon rolls	3,000
Filled rolls	1,800	Buttered rolls	1,800
Bath buns	1,080	Parker House rolls	3,600
Sausage rolls	920	Biscuits	1,080
Pies	450	Corn bread	270

This represents a consumption of 1,525 kw.-hr. Two ovens baked 3,000 pies and 5,250 layer cakes in the same time.

Pacific Gas & Electric Reports Record Increase of Customers

THE Pacific Gas & Electric Company of California reports an increase in the number of customers on the company's distribution system at a rate unprecedented in its history. In the first nine months of the current year 28,995 new consumers were added to the company's lines. The total gain for the year was 57,566, of which 37,500 represented normal growth. The remaining 20,066 were brought on the company's books through its purchase of the Northern California Power Company, Consolidated and the Sierra & San Francisco Power Company. The normal growth for the month of September alone showed a net addition of 5,075 customers.

Central-Station Office on Tip of Cape Cod

QUAINT old Cape Cod ends at Provincetown, Mass., and a central-station office and appliance salesroom are one of the "attractions" for summer visitors and year-round denizens of this picturesque spot. Energy is distributed to about 800 all-year customers by the Provincetown Light Company, and notwithstanding the absence of day service, about 500 electric flatirons are in use on the system. The present rate is 20 cents per kilowatt-hour. Electricity is purchased from the Cape Cod Cold Storage Company, and the lighting load includes motion-picture establishments, stores, hotels and bungalows in the artist colonies as well as the snug



CENTRAL-STATION OFFICE AND ELECTRIC SHOP AT TIP OF CAPE COD

retirement quarters of former sea captains. Little or no power business is in sight in this territory, apart from the operation of refrigerating plants, which at present are steam-driven. The one electric shop of the town, as shown, was formerly a private residence.

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

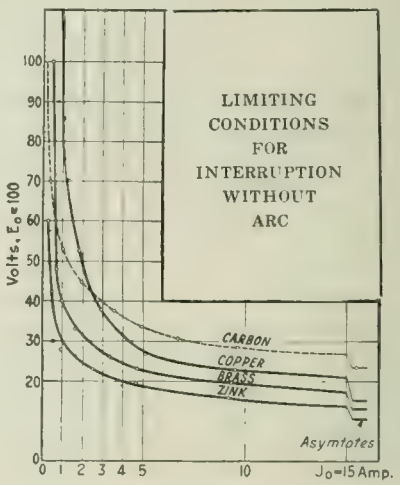
Construction of Alternating-Current Generators.—S. L. HENDERSON.—In the first of these two articles ventilation of alternating-current generators is discussed, with a comparison between radial and axial ventilation schemes, while the second deals with the construction of rotors, with special reference to the subject of slotting.—*Electrical Review,* Sept. 4 and Oct. 2, 1920.

Continuous, Occasional and Intermittent Loading of Electric Motors.—BLANC.—Since the rating of a motor is fixed by maximum temperature attained when working it will depend on the conditions of load; that is, on whether the load is continuously, occasionally or intermittently applied. The author investigates the heating conditions in an intermittently loaded motor which within a relatively short time period passes through a full cycle of loading, so that it runs at full load during a certain time but is unloaded during the rest of the loading cycle. The rating of the machine, or safe working load, then is a function of the loading factor, or ratio of full-load time to idle time for one load period. It is difficult to test a machine under intermittent load. The author, however, presents formulas by means of which the intermittent rating for a given loading factor may be computed from the continuous rating.—*Elektrotechnische Zeitschrift,* Oct. 14, 1920.

Generation, Transmission and Distribution

Planning, Designing and Erecting Transmission Lines.—ALFRED STILL.—The author explains the economic considerations encountered in laying out a line and shows the importance of the preliminary work leading up to the location of supporting structures, methods of erecting and anchoring steel towers, setting the wooden poles, etc.—*Electrical Review,* Oct. 2, 1920.

Current Interruption Without Arc.—BURSTYN.—The paper begins with a detailed review of an article by Kraus (*Elektrotechnik und Maschinenbau,* 1913, vol. 31, page 717) describing the results of certain investigations made to determine the conditions which permit arcless interruption of continuous current. An analysis of the Ayrton arc formula leads to certain relations between current and voltage in the case of infinitely short, or negative, arc length, and Kraus succeeded in proving experimentally that a well-defined limiting state exists when the arc length is zero—that is when no arcing occurs. Burstyn now reports on more recent researches, the results substantiating Kraus' work. The limiting conditions involve only the current before interruption, and the voltage after complete interruption in circuits without inductance and capacity. Below the so-called *arcing voltage* any current strength may be interrupted without an arc. For higher voltages arc-free current is rapidly getting smaller, and from the cathode drop voltage on even the smallest current will give rise to an arc or, at least, to a luminous discharge. The arcing voltages for silver, german silver, iron, steel, zinc, tin, brass and lead lie between 14 and 16; for copper the value is higher, 18 volts, and for gold and platinum it reaches 20 volts. The cathode drop in air was determined by Burstyn for several metals. He found, for instance, 310 volts for copper, 305 for platinum and 285 for nickel. The limiting current is determined mainly by the tendency of the cathode to emit electrons. If graphite cathode was used with a



platinum anode, at 200 volts, the limiting current was 0.190 amp. However, when the current was reversed up to 2.8 amp. could be interrupted without any arcing. For most metals the limiting current at 200 volts lies around 200 millivolts. A set of curves given by Kraus, which show the limiting conditions for different metals, is reproduced. For all voltage and current values which plot below the curve interruption will take place without arcing.—*Elektrotechnische Zeitschrift,* June 30, 1920.

Washery Sludge Burned in Pulverized Form at Seattle.—CHARLES H. BROMLEY.—During the war, when it appeared that the government might restrict the use of oil for steam-raising purposes in the vicinity of Seattle, a study was made of the possibility of utilizing local grades of coal in pulverized form. An outcome of this study was the efficient utilization of a 200,000-ton sludge dump at the Renton mine just outside the city limits. In adopting this fuel there was the important advantage of leaving the existing oil-burning equipment immediately available in efficient form. Details of preparing the coal for burning are given.—*Stone & Webster Journal,* September, 1920.

Traction

Single Phase in Thirteen Years' Successful Operation on the Erie.—Q. W. HERSHEY.—Feeders to the Erie Railroad between Rochester, Avon and Mount Morris have been electrified and are using Niagara power. Twenty-five-cycle, three-phase energy at 60,000 volts is transformed to two-phase, 11,000 volts by means of a

simple transformer substation requiring no manual attendance. It is said that during thirteen years of operation no general tie-up of the railroad existed at any time from storm conditions with the exception of one last year, during which the steam roads in the vicinity were tied up from ten hours to three days, whereas the electrical section was tied up for only four hours. The operation of the system, including station lighting, car heating and repair shops, is carried on with a ton-mile energy purchase of 79 watt-hrs.—*Electric Journal*, October, 1920.

Electric Braking of Direct-Current Vehicles.—W. M. HUTCHISON.—The term electric or dynamic braking is said properly to refer to the braking effect secured by converting the propelling motors to series generators driven by the momentum of the vehicle. Rheostatic braking, magnetic braking and emergency dynamic braking are specifically discussed in this article.—*Electric Journal*, October, 1920.

Installations, Systems and Appliances

Electrical Equipment of the Super-Power Station at Golpa, Germany.—H. PROBST.—The steam generating plant at Golpa from the beginning was intended to provide the nitrogen-fixation plants at Piesteritz with 500,000,000 kw.-hr. of electrical energy a year and also to supply a large nitric-acid plant in the neighborhood with about half of this amount. The generating plant is located close to a lignite mine, and cable cars take the coal directly from the mine to the stokers. The daily consumption is 7,000 tons. There are sixty-four steam boilers, feeding eight A. E. G. turbines, each coupled to one 22,000-kva. generator for 6,000 volts and 50 cycles. From five of the units power is transmitted over a 25-km. (15.5-mile), 80,000-volt line to Piesteritz. After the shutdown of the war-time nitric-acid plant the output from the other units was taken over by the city of Berlin, the power being transmitted over a 125-km. (78-mile), 110,000-volt line (see Digest, Jan. 17, 1920). The Golpa generating plant, the switching equipment and the transmission lines are described in detail in this article, which is richly illustrated.—*Elektrotechnische Zeitschrift*, Sept. 2, 1920.

Electrophysics and Magnetism

Self-Oscillations and Critical Frequency in Single-Layer Coils.—GOTHE.—This problem has been attacked by several German writers, with widely different results. Rüdenberg, Böhm and Wagner replace the coil, for purposes of analysis, by an artificial line with capacity and mutual induction between sections. In this way Wagner was led to the conclusion that every coil has a number of self-oscillating frequencies, forming a series which converges upward toward a certain limiting "critical frequency." Rogowski, using an entirely different physical scheme (see Digest of Jan. 1, 1920), showed that there is a fundamental lowest frequency and above this an infinity of higher modes of oscillation such that their frequency ratios approach the series of integer numbers. The present author has made an experimental investigation of high-frequency oscillations in two large specially built single-layer coils. The coils were excited from a vacuum-tube oscillator, and the current distribution in the winding was observed with little search coils, carried on glass rods close to the coils and connected to wave-meter circuits with thermocouples. In this way no fewer than thirty successive harmonic oscillations were observed on a coil of 46.8 cm. (18.5 in) length and 19.75 cm. (7.8 in.) diameter. The fundamental wave length was 645 m., and in the thirtieth mode of oscillation the coil had a wave length of 31 m. The ratio of successive overtone frequencies corresponds well to the Rogowski theory, and the author concludes that the Wagner-Rüdenborg sectionalized "artificial coil" does not represent the real facts. Values of self-oscillating frequencies computed according to the Lenz formula for short coils were found to check within 10 or 20 per cent with measured values. Bundles of transformer plate inserted in the coils increased the wave length of the lower harmonics enormously, but had almost no effect on the higher ones.—*Archiv für Elektrotechnik*, April 15, 1920.

Telegraphy, Telephony and Signals

Wave-Length Relation for a Generalized Bessel's Antenna.—A. PRESS.—The differential equations for an antenna of negligible resistance and leakage conductance are set up. Proceeding from previously deduced values of the inductance and capacity per centimeter along the antenna, the solution is obtained in terms of Bessel's functions for the voltage and current distribution along the antenna. After simplification, the solution is interpreted and curves enabling its ready employment are given.—*Proceedings Institute of Radio Engineers*, October, 1920.

On Beat Reception.—MEISSNER and SCHEIFFLER.—The article contains a number of experimental curves concerning interference reception in radio-telegraphy and showing audibility as a function of received current and of superposed current. When pyrite detectors were used, the audibility was found to be practically proportional to the received current. On the other hand, when the superposed current was increased the audibility gradually increased toward a maximum value, decreasing for still greater superposed current strength. Similar conditions were found when using an audion detector, in grid-condenser connection. For large grid-leak resistances a limiting value of audibility was observed, which stayed constant, whatever the adjustment of the superposed current, above a certain critical value; but for smaller grid-leak resistance the audibility curve showed a pronounced maximum at a certain value of superposed current. Damped oscillations, it was found, can be amplified by interference reception if the following conditions are fulfilled: (1) The audion bulb must work at the lower bend of the characteristic curve. (2) The superposed current must be out of tune with respect to the received current so that a phase change of 180 deg. will take place between two wave trains. (3) The trains must not be so long that they run into each other. Clear tones, however, could be obtained only for wave lengths below 1,000 m. (decrement < 0.04, 1,000 sparks per second).—*Zeitschrift für Fernmeldetechnik*, Nos. 2 and 3, 1920. (For an extensive abstract see *Elektrotechnische Zeitschrift*, Sept. 16, 1920.)

Miscellaneous

Electric Heating.—de LA BROSSE.—The author sharply opposes the idea of using night power for heating purposes, stating that whenever electric power is produced by steam-driven machinery the use of electric current for heating will be a waste. Even when electric power is produced by hydraulic machinery, the author says, the energy should be reserved for mechanical and electrotechnical purposes rather than used for heating.—*Revue Générale de l'Electricité*, Sept. 11, 1920.

News in Brief

Summary of Market Conditions and of Recent and Approaching Happenings of Importance to the Industry

HERBERT C. HOOVER was elected president of the American Engineering Council, the governing body of the Federated American Engineering Societies, at the Washington convention of the council. A quantitative study of the waste occasioned to industry by intermittent employment, non-employment, strikes and lockouts is to be made as one of the first activities of the new organization, which has a large tentative program before it. Charter-member societies may come in up to July 1.

OPPOSITION to the merging of the old Engineering Council into the new American Engineering Council set up by the Federated American Engineering Societies has been expressed by the American Society of Civil Engineers, whose representatives on the old council have been instructed not to consent to the change. Under the council's rules this will block action.

INTERCONNECTION and storage are given as the chief elements in the cure for coal troubles in a recommendation drafted by Herbert C. Hoover for a committee of the American Institute of Mining and Metallurgical Engineers.

FIFTEEN orders for turbines rated at from 20,000 kw. to 35,000 kw. constitute a partial list of the large turbine orders received in the last year by the General Electric Company.

FUTURE prices of coal, process coal, return of power to the line and need of broader state legislation were among the topics discussed at Super-Power Survey meetings held recently.

A REFERENDUM vote on the street-railway situation, based on eight recommendations by its committee on public utilities, is being taken by the United States Chamber of Commerce. The recommendations favor private ownership with prompt and flexible regulation and oppose unfair competition.

THE HIGH prices of today will not be accepted by the California Railroad Commission in valuation proceedings to fix a rate base, according to an expression of opinion by Commissioner Devlin.

NOTHING fundamentally wrong exists in the business situation at the present time, according to the views of F. H. Goff, president Cleveland Trust Company, as expressed before the Electrical Supply Jobbers' Association. He looks for almost normal conditions to prevail in the business world with the arrival of early spring.

REPORTS of a fair amount of buying come from the different sections of the country, improvement over the recent past being noted in some instances. Supplies of electrical materials are in good volume, jobbers are expending greater sales effort, and stocks are moving. Reductions running as high as 30 per cent in the prices of building material are reported, following the investigation into the housing situation in New York, but construction activity remains at a low ebb. Cancellations and price cutting are not creating the havoc that was feared a few weeks ago.

THE SUPER-POWER committee of the American Institute of Electrical Engineers is to meet with the engineering staff of the Super-Power Survey on Dec. 3. An important meeting of the advisory board of the Super-Power Survey is scheduled for Dec. 1.

S. B. IRELAND of Montgomery, Ala., was elected president of the Southeastern Section, N. E. L. A., at its Miami (Fla.) convention. The third vice-presidency and two memberships on the executive committee were accorded to the manufacturers.

A SWEDISH commission consisting of three prominent engineers is now in the United States studying railway electrification. Sweden is soon to electrify the 300 miles of track between Stockholm and Gothenburg. A 220-volt transmission line between the super-power plants at Trollhättan and Alfkarleby is also to be erected.

KANSAS is to hold a water-power congress at Topeka on Dec. 15 to adopt a state policy on its water resources.

MANY public utilities are reported to be still badly off for coal. This is particularly true of those using gas coal from certain regions.

BY RESOLUTION of the board of directors of the A. I. E. E., only a limited number of technical papers will be presented at the Salt Lake City convention next year, and the midwinter convention will be made the heavy technical meeting of the Institute.

ELIMINATING trouble makers was held by Henry L. Doherty, speaking before the H. L. Doherty Organization, to be the best method of stimulating production, active co-operation between employers and employees the second best, and wage reductions the last resort.

AUTHORITY to issue $30,000,000 of 7 per cent ten-year bonds and to increase the capital stock of the company from $75,000,000 to $125,000,000 was granted to the Westinghouse Electric & Manufacturing Company at a special meeting of stockholders.

A POLICY of close co-operation with the Forest Service in giving priority in Alaska to applicants purchasing timber is announced by the Federal Power Commission. The legal situation developed by the withdrawal of water above Niagara Falls is to be investigated.

PROGRESSIVE standardization during the next ten years was predicted by President James Burke at the semi-annual meeting of the Electric Power Club at Hot Springs, Va. Co-operation in creating public sentiment in support of utilities was discussed by Martin J. Insull, president of the N. E. L. A., and the relations of the Electrical Manufacturers' Council to the Electric Power Club and other bodies were explained.

AN ABSENCE of domestic interest in steel transmission towers is reported, although foreign orders and inquiries are active. Italy, France, the Scandinavian countries, Japan and South America afford the most promising markets.

THE LONG scarcity of pliers and other linemen's tools due to the absence of exportations and the scarcity of skilled tool makers is nearly over, and it is said that pliers will soon be available on sixty-day and eighty-day orders, instead of in twelve to eighteen months.

EXCELLENT commercial results are reported in Montana from the first electrical show of that state, held recently in Butte.

A BRIGHTER side to present trade conditions is being seen by electrical jobbers in New York territory, who find that demand compares fairly well with normal business periods.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Doherty Would Stimulate Production by Throwing Out Trouble Makers

REDUCTION in production costs can best be accomplished by the elimination of trouble makers, with the consequent disappearance of friction within an organization, Henry L. Doherty told the 300 members of the H. L. Doherty Organization who met in New York on the first three days of this week. The next best way, Mr. Doherty said, was to stimulate production by active co-operation between employers and employees, and lastly came the method of wage reductions.

In taking over public utilities Mr. Doherty said that the aim of his organization was not to "clean house" by a general discharge of all old employees but to take over the organization and retain its members just as long as they co-operate and follow the parent company's methods.

This meeting was in line with the practice of the Cities Service Company to call its managers together every year or eighteen months for a general conference. At this time particular stress was put upon questions of public policy and the necessity of rate adjustments to meet present operating costs. In addition to various company problems which were discussed, a general plan of operations was outlined for the coming year.

Many Utilities Still Suffer from the Coal Shortage

DESPITE a gradual improvement in the general coal situation many public utilities are in very bad condition. This is particularly true of those dependent on the gas-coal region served by the Louisville & Nashville Railroad and those using Monongahela gas coal. Utilities drawing their supplies of coal from the central Pennsylvania region are now getting better deliveries.

California Commission Will Not Base Rates on Present-Day Costs

THAT the high prices of today will not be accepted by the California Railroad Commission in arriving at a rate base on which to allow a reasonable return was the declaration of Commissioner Frank R. Devlin made at a recent hearing of the application of the Great Western Power Company for a permanent adjustment of its rates for electricity. "I hold this view personally," said Mr. Devlin, "and I am sure that the other members of the commission will agree with me."

Commissioner Devlin made the declaration following the discussion of the methods to be pursued in fixing the value of the properties of the Great Western Power Company for the purpose of rate fixing, during which it was brought out that among the valuations to be submitted by the power company to the commission in the proceedings was one based on reproduction cost new as of June 30, 1920. Company representatives announced that it was not their intention to base their request for a reasonable return on this type of valuation. They said it would be presented as a measure of aid in arriving at a proper valuation.

Coal Prices Receive Attention in Super-Power Survey

SINCE the price of coal in the future has a direct bearing on super-power plans, there has been some discussion at the Super-Power Survey meetings as to coal prices a few years hence. All agree, apparently, that coal will not go back to its pre-war price. One of those present at a recent meeting predicted that it would go as low as $2. Samuel Taylor was quoted as estimating that coal bought in large quantities on contract would be worth $3.25 in 1926 and $3.50 in 1927. After considerable speculation as to the probabilities in that connection the whole matter was referred to C. E. Lesher, editor of *Coal Age*, with the request that he estimate the price level which will become the new normal one.

That the engineers on the Super-Power Survey are taking process coal seriously may be judged from the fact that room for a process plant probably will be provided when it comes to selecting sites for the super-power plants.

Some evolution of thought has taken place among the super-power engineers in regard to the return of power to the line. There was a very general opinion at first that this practice would do much to equalize the load factor, but such investigation as has been had leads to a half-formed conclusion that any general effort to return power to the line would probably lower materially the factor of reliability.

Attention has been called to the need of broader legislation in certain states. In Pennsylvania, for instance, condemnation proceedings may not be resorted to for transmission lines in steam systems. In the same state power producers are not permitted to share with the public earnings growing out of economies, the Super-Power Survey has been informed.

Attention of the survey has been called to a site in the anthracite-coal field where sufficient water exists to take care of condensing for a plant of 200,000 kw. or 300,000 kw.

The work of the Super-Power Survey may be divided into three periods. The first three months were devoted to a study of the broad outlines of the problem, in an effort to choose the elements which must be considered. The second period is that in which the necessary data are assembled. The survey's work is now in this second period. The third period is the one in which the data will be digested and the report written. There is the

fullest determination to have the report in the hands of the Secretary of the Interior not later than June 30, 1921.

A. I. E. E. to Emphasize Social Activities at June Convention

ONLY a limited number of technical papers will be presented at the annual convention of the American Institute of Electrical Engineers to be held next year at Salt Lake City so that more time can be devoted to discussion and to social activities. The heavy technical meeting will be the midwinter convention. This action was taken at the Nov. 12 meeting in Chicago of the board of directors in a resolution which read as follows:

Resolved, that the board hereby confirms its action of last spring to the effect that the social features of the summer convention benefit and strengthen the technical interests of the Institute and the engineering profession, and reaffirms as a policy of the Institute that the principal meeting of the year for the presentation of technical papers shall be the midwinter convention, an dthat the program of the annual convention in June shall include only a limited number of technical papers, to be presented in not exceeding four sessions, with ample time for discussion, thus allowing time for excursions and other social features which may be arranged by the convention committee.

The board also called attention to the present high cost of Institute publications and urged that these costs be watched as there is little likelihood of any increase in appropriations being granted for the present year. The sum required to complete the printing of the 1920 *Transactions* was omitted from the budget for the present appropriation year because of the existing financial condition of the Institute.

Large-Turbine Orders of General Electric During Past Year

DURING the past year the developments in the central-station field have been largely along the line of extending or completing existing stations, although some large new plants have gone up. In spite of adverse financial conditions orders have been received for a large number of machines of a rating of 20,000 kw. and greater. These machines are of the single-cylinder design.

A partial list of such orders received by the General Electric Company for large turbines during the past year is of interest:

United Electric Light & Power Company, Hellgate station, two, 35,000 kw.

Philadelphia Electric Company, Delaware station, two 30,000 kw.

Beech Bottom Power Company, Windsor station, two, 35,000 kw.

Detroit Edison Company, Marysville station, two 30,000 kw.

Boston Edison Company, Boston, Mass., station, one, 30,000 kw.

Commonwealth Edison Company, Commonwealth station, one, 30,000 kw.

Cleveland Electric Illuminating Company, two, 25,000 kw.

Union Gas & Electric Company, West End station, two, 25,000 kw.

New York Central Railroad, Port Morris station, one, 20,000 kw.

The demand for the intermediate and smaller sizes of turbines, it is stated, has been greater than heretofore experienced.

Power Club Told It Must Take More Active Part in Safety Code Preparation

THE semi-annual meeting of the Electric Power Club was held at Hot Springs, Va., Nov. 15, 16 and 17. The first day was given over to section meetings, of which there were seven, and to meetings of standing committees. President James Burke in his address at the general meeting on Tuesday called attention to the vast amount of work which the committees of the Electric Power Club do and the importance of that work to the electrical industry. He intimated that the work of standardization has only just begun and will in all probability be greatly modified during the next ten years owing to the greater knowledge of materials which has been forthcoming as the result of the work of research laboratories. With reference to progressive work Mr. Burke said that it was obligatory on the Electric Power Club to take a more active part in the preparation of electrical safety codes, since the designers and inventors of electrical apparatus are best qualified to originate such rules.

Prosperity Linked with Utilities

"How the Electric Power Club Can Co-operate with the National Electric Light Association in the Creation of Proper Public Sentiment Toward Electric Public Service Corporations" was the subject of an address by Martin J. Insull, president of the National Electric Light Association. Mr. Insull told of the difficulties confronting electric public utilities in raising money for new developments and extensions—difficulties due to the fact that the earnings of the utilities are such as to preclude the possibility of their competing in the money market with industrial concerns. He said that, backed by a properly informed public, commissions will grant rates sufficient to rehabilitate the credit of the utilities and permit them to obtain sufficient equipment to handle present and prospective business properly. In the campaigns of education now being carried on by the National Electric Light Association, Mr. Insull said, the electrical manufacturing companies could assist by devoting a portion of their advertising space to goodwill advertising and by bearing part of the expense of the educational propaganda. Mr. Insull showed how the prosperity of the electrical manufacturing industry was linked in a large way with the continued prosperity of the electric light and power industry.

Frederic Nicholas, secretary of the Electrical Manufacturers' Council, spoke on co-operation and co-ordination between the Electric Power Club and other bodies, explaining in detail the functions of each and their relation to the Engineering Standards Committee. S. L. Nicholson explained the workings of the Electrical Manufacturers' Council.

At the Wednesday session a very excellent report was made by the cost accounting committee, of which H. L. Stratton of Cleveland is chairman. The committee discussed what relates to cost accounting rather than cost accounting itself and gave consideration to swollen and ragged inventories, management and labor, taxes, cancellations and the status of the industry.

Reports were also submitted by the underwriters committee, the large-power committee, the fractional-horsepower-motor committee, the section on mining and industrial locomotives, the transformer section, industrial control section, power-switchboard and oil-circuit-breaker section, and by the committee on foreign trade.

Hoover Elected First President of Federation

CREATED for public service, the Federated American Engineering Societies got under way last week, electing Herbert Hoover, former Food Administrator and president of the American Institute of Mining and Metallurgical Engineers, as president of the governing body, the American Engineering Council. This first meeting of the council was held at the Willard Hotel in Washington on Nov. 18 to 20, and was attended by delegates from all but one of the twenty-one charter-member societies and by some representatives of bodies that expect to become charter members.



HERBERT HOOVER

Mr. Hoover, in accepting the presidency and later in a prepared speech, indicated in a broad way the part that the federation is to play. He stated that an engineering association stands somewhat apart among other economic associations, such as farmers, bankers, etc., in that it has no special economic interest for its members.

"Its only interest in the creation of a great national association," said Mr. Hoover, "is public service, to give voice to the thought of the engineers on these questions. And if the engineers, with their training in quantitative thought, with their intimate experience in industrial life, can be of service in bringing about co-operation between these great economic groups of special interests they will have performed an extraordinary service. The engineers should be able to take an objective and detached point of view. They do not belong to the associations of either employers or labor, of farmers or merchants or bankers. Their calling in life is to offer expert service in constructive solution of problems to the individuals in any of these groups. There is a wider vision of this expert service in giving the group service of engineers to group problems."

Mr. Hoover also stated that he believed it to be the duty of the federation to undertake a constructive consideration of the problems involved in increasing production and "to give assistance not only to the Federation of Labor but also to the other great economic organizations in this problem, such as the Employers' Association and the Chambers of Commerce."

One of the first activities of the new body will be a survey under Mr. Hoover's direction to determine quantitatively the amount of waste motion in industry. Included in this survey will be the threefold waste in production occasioned by (1) intermittent employment, (2) non-employment arising in shifting industrial currents, and (3) strikes and lockouts.

The meeting was called to order on Thursday, Nov. 18, by Richard L. Humphrey, chairman of the Joint Conference Committee, who reported on the history of the movement and the work done to bring the organization into being. Edwin S. Carman, president-elect of the American Society of Mechanical Engineers, was elected temporary chairman, and temporary committees on program, credentials, constitution and by-laws, nominations, plan and scope, budget and resolutions were appointed.

It was decided to elect only twenty members of the executive board of the council, leaving four vacancies to be filled by other societies which might later become charter members. On the basis of membership the national societies were entitled to fourteen members on the board and the local regional and state organizations to the remaining six places by districts. These districts are:

District No. 1. — New York and New England States.

District No. 2. — Michigan, Wisconsin, Minnesota.

District No. 3. — Ohio, Indiana, Illinois.

District No. 4. — New Jersey, Pennsylvania, Delaware, Maryland and District of Columbia.

District No. 5.—Virginia, West Virginia, North and South Carolina, Alabama, Kentucky, Mississippi, Louisiana and Texas.

District No. 6.—North and South Dakota, Nebraska, Kansas, Oklahoma, Arkansas, Missouri and Iowa.

Territory west of the above states has not been divided into districts.

The elections to the executive board were as follows:

American Institute of Chemical Engineers.—Harrison E. Howe.

American Institute of Electrical Enginers.—H. W. Buck, William McClellan, Charles F. Scott, Lewis B. Stillwell.

American Institute of Mining and Metallurgical Engineers.—Arthur S. Dwight, Edwin Ludlow, Philip N. Moore.

American Society of Agricultural Engineers.—Samuel H. McCrory.

American Society of Mechanical Engineers.—L. P. Alford, Arthur M. Green, Jr., E. S. Carman, Fred J. Miller.

Taylor Society.—M. L. Cooke.

District No. 1.—W. B. Powell, Engineering Society of Buffalo, N. Y., or Bion E. White, Mohawk Valley Engineers' Club, Utica, N. Y.

District No. 2.—B. A. Parks, Grand Rapids (Mich.) Engineering Society, or D. J. Sterrett, Detroit Engineering Society.

District No. 3.—J. F. Oberlin, Cleveland Engineering Society.

District No. 4.—W. W. Varney, Engineers' Club of Baltimore.

District No. 5.—O. H. Koch, Technical Club, Dallas.

District No. 6.—L. B. Smith, Kansas Engineering Society

After a long discussion Washington, D. C., was chosen as the place to establish headquarters. The appointment of a secretary was given over to the executive board, which has named a committee, composed of L. W. Wallace, Philip N. Moore, Charles F. Scott, John F.

Oberlin, L. P. Alford and Calvert Townley, to report a list of qualified persons.

It was decided to extend until July 1, 1921, the time within which societies may become charter members.

Officers were elected on Friday, the election resulting as follows: President, Herbert Hoover, American Institute of Mining and Metallurgical Engineers; vice-presidents for two years, Calvert Townley, American Institute of Electrical Engineers, and W. E. Rolfe, Associated Engineering Societies of St. Louis; vice-presidents for one year, Dexter S. Kimball, American Society of Mechanical Engineers, and J. Parke Channing, American Institute of Mining and Metallurgical Engineers; treasurer, L. W. Wallace, Society of Industrial Engineers.

Some minor changes were made in the constitution and by-laws to make for smoother operation. An attempt was made to change the section relating to publicity, but it was voted down.

A report by the committee on plan and scope indicated a number of activities, many of which are inherited from the Engineering Council, in which the new organization could well engage. The following list was presented and is not supposed to be exhaustive:

1. Serving the public interest by investigation and advice to the public and to governmental and voluntary bodies upon national problems which involve industrial and economic questions.
2. Furthering the proposed national Department of Public Works.
3. Conservation of national resources, such as water, coal, oil, etc.
4. Maintenance of a co-operative attitude toward other national organizations, both professional and commercial.
5. Technical education.
6. Transportation in its various forms, particularly highways.
7. Advice with and assistance to regional, state and local organizations upon their request.
8. National Bureau of Economic Research.
9. Public fire prevention.
10. Patents.
11. National Board of Jurisdictional Awards.
12. International Affiliation of Engineers.
13. State organization of local affiliation.
14. Uniform licensing and registration laws.
15. Classification and compensation of engineers.
16. Bureau of employment.
17. Russian-American engineers' committee.

This committee in concluding its report said: "Every care should be exercised to avoid any action partaking of political bias or partisanship and to keep the activities and pronouncements of the Federated American Engineering Societies within the pale of sound engineering, good judgment and upon the broad basis of a real and mutual co-operation."

The executive board met on Saturday morning and appointed L. P. Alford as its temporary secretary. A resolution was passed recognizing the importance of the movement for a national Department of Public Works.

Civil Engineers Take Steps to Block Federation

IT BECAME known last week that the American Society of Civil Engineers, which voted not to become a charter member of the Federated American Engineering Societies, has taken steps to hinder the functioning of the new American Engineering Council of the federation by trying to perpetuate the old Engineering Council.

The board of direction of the society instructed its representatives on the Engineering Council that they "cannot participate in any action by the Engineering Council in transferring its activities to the Federated American Engineering Societies," and also "to express to the council its hope that the Engineering Council will for the present continue to carry forward its work."

The Engineering Council was formally to cease functioning on Jan. 1, when it was to place all of its files of unfinished business in possession of the new body. At that time the supporting societies with the exception of the civil engineers will begin to support the new organization. Under the rules of the old Engineering Council that body can take no action with the members of one of the founder societies voting against it. This whole matter will probably come to a head at the meeting called for Dec. 16.

Nothing Fundamentally Wrong with Business, Banker Tells Jobbers

NINETY-SIX electrical jobbing houses and 304 manufacturers were represented at the semi-annual convention of the Electrical Supply Jobbers' Association, held at the Hotel Cleveland, Cleveland, Ohio, Nov. 17, 18 and 19. The opening day's sessions were reported in last week's ELECTRICAL WORLD, and on page 1092 of this issue there appear in full the figures presented by Chairman Thomas of the committee on costs, showing the jobber's expense for handling each of twelve representative lines.

F. H. Goff, president of the Cleveland Trust Company, discussed the general financial and business situation saying that nothing is fundamentally wrong with trade or industry. He said that the public has simply held off buying, believing that the bottom of the swing in prices has not yet been reached. The speaker ventured the prediction that if liquidation goes on as at present, the early spring would see general conditions almost normal again. With the enhancement of interest-bearing securities, that season would be a better time than now for financing a business by issues of bonds.

Resumption of active conditions in the spring may, however, bring on another later crisis, unless labor meanwhile also liquidates. The deflating process must go slowly, and present values, which were three or four years in inflating, should have a similar period for orderly descent. Mr. Goff counseled patience among groups in all industries, urging business men, at this time above all others, to be considerate of each other.

On Thursday morning A. A. Gray, counsel for the association's publicity committee, told of the committee's plans for extending its publicity work and made a plea for sympathetic co-operation by association members with the electrical press. The trade press, he pointed out, can and is eager to put before the trade interesting news of the jobbers' activities.

At the afternoon session M. C. Turpin of the Westinghouse Merchandising Bureau and J. A. Corcoran of the General Electric Company spoke on electrical merchandising. E. B. Seitz, secretary of the American Association of Washing Machine Manufacturers, on Friday morning told the jobbers how the washing-machine men are co-operating with the United States government's agents in educating women in the use of the electric washing machine.

The spring meeting of the association has been set for May 25, 26 and 27 at Hot Springs, Va.

Kansas to Hold Water-Power Congress

A WATER-POWER congress, to be held in the State House at Topeka, Kan., Dec. 15, has been called by Governor Allen. The congress is called to agree upon and adopt a state policy with reference to the investigation and use of water resources and the effect of such a policy on state activities.

Transmission Line at 220,000 Volts Planned for Sweden

TO UNITE the hydro-electric resources on the eastern and western sides of Sweden and make their output more extensively available the Swedish government has decided to construct a 220,000-volt line between the super-power plants at Trollhättan and Alfkarleby. The plans are to have the line completed by December, 1921. While the line will be constructed for the voltage mentioned, it will be initially insulated for 132,000 volts and rated at about 30,000 kw. Later, when the water powers to the north must be utilized, the voltage, and hence the rating, will be increased.

Commissioner Edgerton Defends California Railroad Commission

DECLARING that criticism of the California Railroad Commission is usually based on misstatements of a fact or a purpose, Edwin O. Edgerton, president of the commission, in an address made before a meeting of the League of California Municipalities at Chico recently, told the representatives of California towns and cities present that they owed it to their constituents to inform themselves fully as to public utility matters.

It must be clearly understood, Mr. Edgerton said, that if California is to progress industrially there must be an immense increase in the facilities of the companies performing public utility service. Expressed in terms of money, this will mean several hundred million dollars in the next few years. It must be admitted that there is no power to force investment in the securities of these companies, and sound policy becomes of vital importance as an assurance to the investor.

United States Chamber of Commerce to Hold Street-Railway Referendum

A REFERENDUM vote of its membership is being taken by the United States Chamber of Commerce on proposals for bringing about an improvement in the situation of the street railways of the country. The recommendations on which the ballot will be cast have been advanced by the Chamber's committee on public utilities. They are eight in number and read:

1. Existing traction facilities should be conserved.
2. The attitude now taken toward street-railway problems should be based upon the present and future needs of the community.
3. The attitude which is taken toward street-railway problems should contemplate private ownership and operation.
4. Regulation should everywhere be instituted that will promptly follow changes in the situation of the companies rendering services of local transportation.
5. Provision should be made against the consequences of unfair competition.
6. All burdens unrelated to the service performed should be removed from street railways.
7. Official responsibility should be definitely fixed for the application of regulation.
8. Each company should seek to have available for the public at all times the facts as to the results of operation and should have resident responsible executives wholly conversant with local requirements.

A summary of the committee's report accompanying the referendum ballots deprecates opposition to fair treatment of the railways because of alleged past mismanagement and dwells on the need of adequate revenues if good service is to be performed. Prompt and flexible regulation is advocated.

Readjustment Without Panic Is Predicted by Archer W. Douglas

POST-WAR readjustment finally is at hand with no prospect of financial panic in sight, according to Archer Wall Douglas, chairman of the committee on statistics of the Chamber of Commerce of the United States, whose monthly report on business conditions has just been made public. The course of prices, the report sets forth, will continue downward. Merchandise stocks by Jan. 1 will be smaller than for many years.

"Demand in all lines is slackening," Mr. Douglas says. "It is everywhere a case of most conservative buying rather than any great increase in supply. Manufacturing and mining are meeting the situation, in the usual fashion, by running on reduced time or shutting down altogether. This has already meant in some cases reduced wages. Talk of stabilizing prices to save the situation no longer interests any one save a few hopeless theorists. The laws of supply and demand will regulate matters. Industrial life in time will doubtless be more democratized than at present, but we are not headed in the direction of running factories by committees."

Power Company Wins Right to Supply Bulk Energy in Competitive Territory

AGAINST the protest of the Webster & Southbridge Gas & Electric Company, the New England Power Company has been authorized by the Massachusetts Department of Public Utilities to supply energy in bulk to the Slater Mills, in Webster, and to transmit energy over certain public ways in Webster and Oxford. The former company objected on the ground that it is meeting the requirements of the community which it serves. The decision is important in relation to the policy of the state in permitting energy to be supplied in bulk in competitive territory. This is the first case in which a local company, willing that the New England Power Company should pass through its territory, has contended that the larger company should be altogether and permanently excluded from doing business in the local company's territory.

The commission holds that the Legislature has never expressly granted to any electric company the monopoly of the business in a specific territory. The entry of a second company is left to the judgment of the commission and the issue is to be decided with regard to its broad effect upon the public welfare. It is held that the supply of electricity in bulk in most instances can be accomplished without the evils incident to unrestricted competition and multiplication of lines.

Westinghouse Stockholders Authorize Increased Capitalization

AT A SPECIAL meeting of the stockholders of the Westinghouse Electric & Manufacturing Company held on Nov. 18 at East Pittsburgh an increase in the indebtedness of the company by the sum of $30,000,000 was indorsed. This is the official authorization of the ten-year 7 per cent bond issue which was offered to investors last month.

The stockholders at this meeting voted also to authorize an increase in the capital stock of the company from $75,000,000 to $125,000,000. It is understood that no new stock will be issued at this time.

Federal Power Commission Activities

THE first rulings of the Federal Power Commission on the "declaration of intention" provided for in the water-power act were made at the regular meeting of the commission on Nov. 22. It was ruled that a proposed development at Ada, Mich., on the Thornapple River, would affect the interests of interstate or foreign commerce and that the commission would have jurisdiction in passing upon the project. A declaration of intention was filed by the Peshtigo Pulp & Paper Company for a proposed development 7 miles below Peshtigo, Wis., on the Peshtigo River. The commission found that the project did not affect the interests of interstate or foreign commerce.

The chief counsel of the commission was instructed to investigate the legal situation with reference to the use of water power developed by the withdrawal of water from Niagara River above the falls. The chief counsel was instructed also to take up the question of the jurisdiction of the Federal Power Commission where power development is incidental to irrigation.

It is understood that the Niagara Falls Power Company is practically ready to submit its statements covering the valuation of its property. It also is understood that the Utah Power & Light Company soon will submit a valuation statement. So far as is known, no valuations of these properties have ever been made by any public authority. In the case of the Niagara Falls Power Company the matter of valuation is complicated by the maintenance of a plant in standby condition. Since the checking of valuations is an expensive undertaking, the commission must receive a new appropriation before such work can be undertaken.

Pennsylvania-Ohio Company Segregates Railway and Power Property

THE Public Utilities Commission of Ohio has authorized the purchase by the Pennsylvania-Ohio Power & Light Company of part of the properties of the Pennsylvania-Ohio Electric Company, Youngstown, Ohio. The properties included in this purchase are the street-railway lines in and around Sharon, Pa., the interurban line from Sharon to Youngstown, Ohio, and all light and power properties of the Pennsylvania-Ohio Electric Company, except that in New Castle, Pa. The railway properties involved comprise, in earning power, about 10 per cent of the street-railway and interurban lines of the Pennsylvania-Ohio Electric Company.

In accordance with the order the old company has sold its light and power and a portion of its street-railway holdings for $13,297,950 cash, $1,800,000 8 per cent preferred stock and $6,000,000 common stock of the Pennsylvania-Ohio Power & Light Company. Ownership passed to the new company on Nov. 1.

New Officers for the Southeastern Section, N. E. L. A.

THE new officers elected at the close of the convention of the Southeastern Section of the National Electric Light Association, held at Miami, Fla., Nov. 16 to 19, are as follows: President, S. B. Ireland, vice-president and general manager Montgomery (Ala.) Light & Water Power Company; first vice-president, J. M. Cheney, secretary and treasurer Orlando (Fla.) Water & Light Company; second vice-president, F. D. Mahoney, commercial manager Alabama Power Company; third vice-president, George E. Watts, Southern sales manager, Locke Insulator Manufacturing Company, Atlanta, Ga.

On the executive committee a representative from each of the states which the Southeastern Section comprises was appointed as well as two representatives of manufacturers. The membership includes: R. L. Lindsey, Durham, N. C.; H. A. Orr, Anderson, S. C.; C. D. Flanegan, Athens, Ga.; L. L. Newman, Birmingham, Ala.; F. E. Fletcher, Tampa, Fla.; H. A. Coles, Atlanta, Ga.; E. H. Grim, Atlanta, Ga., and P. A. Tillery, ex officio.

This year an elaborate entertainment program was carried out under the direction of H. H. Hyman, general manager of the Miami Electric Light & Power Company. One of the enjoyable features was a six-hour sail from Miami to Bimini Island, one of the British Bahamas, where the annual banquet was held on Thursday evening, Nov. 18.

Montana's First Electrical Show



THE results of the first electrical show ever held in Montana are showing up in the sales of all kinds of electrical appliances in Butte. The show was held Oct. 4 to 8 in the Butte offices of the Montana Power Company, which was the sponsor for the affair. About 15,000 people visited the exhibit and demonstrations. Publicity was given by means of newspaper advertising in the local papers and by folders mailed to the consumers of the power company. Local supply jobbers and dealers co-operated by placing their specialties in the exhibit and supplying demonstrators. It is planned to make the show an annual event.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Vancouver, B. C., Has an Electrical Show.—The first electrical show ever held in Vancouver, B. C., took place this week under the auspices of the newly formed British Columbia Electrical Cooperative Association.

Electricity in Ocean Propulsion.—What is said to be the first electrically driven ocean-going cargo vessel under private operation, the Eclipse, left New York recently for the Dutch East Indies with general cargo. It is a Shipping Board vessel of 11,800 tons, operated by the United American Steamship lines.

New Central Maine Issue.—The Central Maine Power Company has been authorized by the Maine Public Utilities Commission to sell at not less than $107.50 per share and accrued interest not more than 24,315 shares of 7 per cent preferred stock to meet the cost of improvements and consolidations and furnish working capital.

Memphis Advances Rates.—The following schedule of advanced electric rates has been announced by the Memphis Gas & Electric Company under authority of the Tennessee Public Utilities Commission. First 50 kw.-hr. a month, 9 cents per kilowatt-hour; next 150 kw.-hr., 7 cents; next 300 kw.-hr., 6 cents; next 500 kw.-hr., 5 cents; more than 1,000 kw.-hr., 4 cents; minimum bill, 90 cents a month.

Toronto Rates Go Up.—Increases of rates ranging from 11 to 35 per cent are announced by the Toronto & Niagara Power Company, formerly the Toronto Electric Light Company, to become effective Dec. 1. Higher labor costs, increased costs of materials, higher taxes and workmen's compensation rates are the reasons given by the company for the increase. The Hydro-Electric Commission of Toronto has not taken on any new customers for some time owing to the existing shortage of power.

Maritime Province Power Developments.—It has been decided by the Electric Power Commission of the Province of New Brunswick, Canada, to proceed at once with the development of the water power afforded by the Musquash River, which empties into the Bay of Fundy. Three generators rated at 2,700 kva. and driven by 3,200-hp. turbines will be installed in a power house to be erected near St. John, the chief city of the province. In the neighboring Province of Nova Scotia the hydro-electric plant under way on St. Margaret's Bay, 15 miles from Halifax, is well on toward completion.

Hydro-Electric Power in the Dordogne Basin.—A concession has been granted by the French government to the Orleans railroad for exploiting the water powers in the basin of the Dordogne. In *Le Génie Civil* an estimate of the horsepower capable of development in this region is made by G. Tochon, who puts it at 1,400,000 during the flood periods in the spring and fall. At present only about 7 per cent of this potential power is utilized, though plans under consideration call for the development of about 585,000 hp. A saving of 3,000,000 tons of coal a year by the electrification of railroads is one of the advantages kept in view by the government and the promoters of the project.

Speeding Up Canalboat Loading.—Just one-quarter of the time formerly taken to load or unload a canalboat lying at an East River pier in New York is required since the recent installation of electrically driven overhead wharf cranes, according to the *Edison Monthly*. The former method of handling the cargo was by hand with the aid of a whip boom, block and tackle and a horse. With one crane and two men in the hold of a barge, it is now possible to unload in one day 175 tons of miscellaneous freight. At the pier in question two barges may be loaded or unloaded at once by the use of two cranes, or by using one crane at the forward and another at the after hatch one boat can be unloaded in double-quick time. The cranes are equipped with 220-volt direct current Shaw motors, the hook hoist and rack motors are of 18 hp. and the boom and travel motors of 8 hp. The hoist and rack have a speed when carrying a full load of 125 ft. a minute, and in moving the boom from a horizontal to a vertical position the rate of travel is 100 ft. a minute.

A Remarkable Scheme for Domestic Generation of Electricity.—A French scientist, E. Colardeau, has, according to a press dispatch, expounded before the French Academy of Sciences a plan by which he is said to hold that every family in Paris could generate electrical energy without expense and in useful quantities. The plan is based on utilization of the power from the water supply. In his own house, the inventor is reported as saying, he has fixed on his supply pipe a high-speed water turbine, connected to a dynamo, with a little battery of accumulators. Every time that the taps are turned on the little generating station works and the batteries accumulate the energy from the water. With his own installation the scientist claims he can light one 500-cp. lamp or twenty lamps of from 15 cp. to 20 cp. In his house he uses no other installation and it never gives out and never costs him anything. In the country places M. Colardeau would use the wind to pump water up to the required height and so transfer the wind energy into water energy, which in turn would be transferred into electrical energy in the manner already described.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Engineers' Club of Philadelphia.—At a meeting of this club on Dec. 3 a discussion will take place on the use of powdered anthracite and the recovery and use of "river coal."

St. Louis Electrical Board of Trade.—It was announced at the meeting of this body on Nov. 9 by President C. E. Michel that a series of talks dealing with standardization had been arranged. I. P. Kelso presided at the meeting.

Indianapolis-Lafayette Section, A. I. E. E.—The first meeting of this section was held recently in the University Club at Indianapolis, when the following officers were elected: Chairman, L. Lloyd Wayne; secretary, D. C. Pyke; vice-chairman, Prof. C. F. Harding; chairman of the membership committee, D. J. Angus; local membership, M. J. Luichinger. Meetings will be held on the third Friday evening of each month.

American Physical Society.—Among the papers presented at the 150th regular meeting of the American Physical Society, held at Cleveland on Friday and Saturday of this week, were the following: "Conductivity of Insulating Materials Near the Breakdown Voltage," by J. E. Shrader, Westinghouse Research Laboratory, and "The Magnetic Mechanical Analysis of Manganese Steel," by Sir Robert Hadfield, F. R. S., London, and S. R. Williams and I. S. Bowen, Oberlin College. Other papers dealt with the Nernst effect, the vaporization of tungsten electrostatic measurements, electromagnetic induction, thermionic discharges in evacuated tungsten lamps and the electromagnetic theory applied to the Copernican atom.

Coming Meetings of Electrical and Other Technical Societies

Indiana State Electrical Contractors and Dealers' Association—South Bend, Dec. 1 and 2.

A. I. E. E. (New York Section) and A. S. M. E. (Metropolitan Section)—Joint meeting, New York, Dec. 3.

Association of Iron and Steel Electrical Engineers—Philadelphia Section, Dec. 4; Chicago Section, Dec. 11; Cleveland Section, Dec. 13.

Rivers and Harbors Congress—Washington, Dec. 8-10.

Illinois State Electric Association—Chicago, Dec. 9-11. (For program see issue of Nov. 6, page 942.)

A. I. E. E. and A. S. M. E.—Philadelphia Sections, joint meeting, Philadelphia, Dec. 13.

American Physical Society—Annual meeting, Chicago, Dec. 28-Jan. 1.

American Institute of Electrical Engineers—Chicago, Jan. 14.

Western Association of Electrical Inspectors—Detroit, Jan. 25-27.

Association of Municipal Electrical Utilities of Ontario—Toronto, Jan. 27 and 28.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

What Constitutes Confiscatory Rates.—Rates of an electric company, the Illinois Public Utilities Commission asserts, cannot be said to be confiscatory where they are only very slightly lower than the rates which, upon the utility's own showing, have yielded a return of 12 to 13 per cent upon the rate base, besides a fair allowance for depreciation.

Customers' Rights Superior to Company's.—In adjudicating a water company's petition for increased rates the Maine Public Utilities Commission declared that if it becomes a question whether a utility shall receive an adequate return or the rates shall be reasonable and just to the customer the company must yield to the superior rights of the customer.

Efficient Operation.—An exhibit showing the average amount of coal burned to generate a kilowatt-hour to have been 11.8 lb. in 1918 and 11.19 in 1919 indicates inefficient central-station operation, in the opinion of the Illinois Public Utilities Commission, which believes that a coal consumption of less than 7 lb. per kilowatt-hour should be attained in a plant serving a city of 11,000 population and contiguous places.

Rules Governing Service by Municipal Plant.—Entertaining a complaint against the rates for electricity charged by the town of Kennebunk, the Maine Public Utilities Commission declared that a municipal plant should be operated on a safe basis but without profit. A municipality which operates its own electric light plant and charges for street lighting an amount less than the cost of rendering that service is guilty of illegal discrimination, since it follows that the other customers of the company are paying a part of the bill for street lighting.

Fixing Amount of Minimum Bills.—The Illinois Public Utilities Commission has permitted the Centralia Gas & Electric Company to increase its minimum bill to $1 per meter per month, the evidence showing that the operating expense incident to furnishing the service was 84 cents per consumer per month, to which must be added an amount to care for depreciation, uncollectible bills, interest and taxes on the investment necessary to serve the customer. Irrespective of how much cash a company may have on hand, it is proper, the commission says, to permit it to earn a fair rate of return on a reasonable amount of cash working capital.

Court Receivership Does Not Abrogate Commission Control.—In granting increased rates to the Commonwealth Public Service Company the Arkansas Corporation Commission asserted that it had jurisdiction of the property and the rates to be charged for service even though the property was being operated temporarily by a receiver under court direction. The financial adversities which forced the company into the receivership could not, the commission said, remove it from operation of the statute and the jurisdiction of the commission so long as the company continued to exercise its functions in any capacity.

Need for Adequate Working Capital.—Quoting a declaration of the Supreme Court of the state that what a public service company is entitled to ask is a fair return upon the value of that which it employs for the public convenience, the Georgia Railroad Commission adverts to the need of adequate working capital. "We are not suggesting here," it says, "a separate valuation of what is commonly called 'going concern' value, as a distinctive item, or that other thing called 'good will' which may go with properties devoted to certain uses, but solely that added value in the physical properties themselves attaching because of their assembly, unification, adaptation and utilization in the purposes for which, as a whole, they were designed. In the proper functioning and operation of these physical properties there is need of a cash working fund, with which, pending the collection of its revenues, necessary supplies may be purchased and kept in stock for use as needed, and out of which payrolls may be met."

The Utah Commission's Ruling on Special Contracts.—In asserting its power to modify or change rates, charges, facilities and conditions of service in existing contracts with the Utah Power & Light Company for electric service (see ELECTRICAL WORLD, Oct. 23, page 843, and Nov. 6, page 909), the Public Utilities Commission of Utah said: "The contention of the companies holding special contracts that they come under the exception clause has been ably presented, but it appears to the commission that it is in line with the spirit of the law in concluding that such an exception does not and was not intended to prevent an investigation such as is undertaken in this case. If the rates in special contracts, such as those now under consideration, were to be made special matter of legislative enactment and relieved from any investigation, with a view of protecting and perpetuating such rates, as is claimed by the contract consumers, it would seem that a matter of such importance would have received the direct attention of the Legislature in such a manner as to place the subject beyond any question as to what was intended. . . . We find no warrant," the commission declared, "for accepting the theory that such action was taken or intended to be taken by the Legislature."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Commission's Power to Change Franchise Rates Not Unconstitutional.—In a suit brought by the city of Camden, Ark., against the Arkansas Light & Power Company the act establishing the Corporation Commission of the state was attacked as unconstitutional. The Arkansas Supreme Court found that the contention was without force inasmuch as the power conferred on the commission was an exercise of the state's police power, which cannot be contracted away, and therefore that the act is not invalid as impairing the obligations of a contract in contravention of the United States Constitution. (224 S. W. 444.)*

Delegated Authority and Commission Regulation.—In City of Sapulpa vs. Oklahoma Natural Gas Company the city contended that in the Territorial days of Oklahoma the United States delegated to Sapulpa authority to regulate service and fix rates and that said authority could not have been set aside by the United States prior to the adoption of the state constitution and could not now be set aside by the state. The Supreme Court of Oklahoma held that, the contract not being for a definite period, the United States prior to statehood could through Congress have revoked the authority and that upon Oklahoma becoming a state this power passed to the Legislature of the state. (192 Pac. 224.)

Dams That Do Not Interfere With Navigation Are Not Nuisances per se.—The construction of a power dam across a navigable river is not a nuisance *per se*, according to the finding of the Supreme Court of Wisconsin in Eau Claire Dells Improvement Company vs. City of Eau Claire, where all attempted navigation of the river is in fact carried over the dam, so that its navigability is not materially affected and no person suffers damage thereby. Where a city which had leased to a corporation the dam and surplus water power over that needed for the city's waterworks had afterward acquiesced in the building of a mill over the lock required to be maintained by the lease and had not only agreed but required that lessee maintain flashboards raising the water above the specified height, it was estopped to declare a forfeiture of the lease for those violations of its terms after they had continued for a period of more than twenty years. (179 N. W. 2.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

James A. Perry, elected president of the National Association of Railway and Utility Commissioners for the coming year, is a man whose past actions prove that he will exert himself to the utmost to strengthen the prestige of the state regulatory bodies. He strongly opposes any curtailment of their powers at the hands either of the federal government or of the municipalities. He has long been active in the work of the association and prior to his election as president occupied the office of vice-president. Mr. Perry for ten years past has been a member of the Railroad Commission of Georgia. He has done much to build up that body and to place its operations on a basis of efficiency. As a member of the commission he has



J. A. PERRY

had a voice in deciding many important questions affecting the utilities of the state. He was born in Gwinnett County, Ga., in 1875, and obtained his early education in the rural school of that county. He was graduated from the law school of the University of Georgia in 1898. Two years thereafter he was elected mayor of Lawrenceville, Ga., and later in the same year was elected to the State Legislature. In addition to his public duties, Mr. Perry conducted a law practice in Lawrenceville. He is now president and treasurer of one of the largest industrial companies in Lawrenceville, operating a cottonseed-oil mill and a guano plant.

Dr. Joseph F. Merrill, who as chairman of the Utah Section of the A. I. E. E. is building up a marked interest in Institute work in that section, is dean of the engineering college at the University of Utah and widely known in electrical engineering circles. Dr. Merrill was born at Richmond, Utah, Aug. 24, 1868. He received the degree of B. S. from the University of Michigan in 1893 and that of Ph.D. from Johns Hopkins in 1899. His first teaching experience was as assistant professor of chemistry at the University of Utah in 1897. He became director of the Utah State School of Mines and Engineering at the University of Utah in 1898 and professor of physics and electrical engineering at that institution in 1899. Dr. Merrill has contributed largely to the electrical engineering profession through extensive research work, which includes investigation of the effect of dielectrics on electrical resistance, effect of temperature and pressure on electrolysis of silver nitrate and of the reliability and durability of commercial electric integrating meters.

Harry D. Stokes, power engineer Worcester (Mass.) Electric Light Company, has been elected chairman of the Worcester Electrical Contractor-Dealers' Association.

H. H. Koelbel, superintendent of sales for the Consumers' Power Company in the Muskegon district, has recently been appointed secretary of the Century Club, the city's business men's club.

Dr. William H. Walker, director of the division of industrial co-operation and research, Massachusetts Institute of Technology, has resigned to enter private practice in chemical engineering. He will be succeeded by Prof. Charles L. Norton of the institute.

O. O. Alenderfer, formerly in charge of commercial sales of the Rogue River division of the California-Oregon Power Company, has resigned and entered into partnership with A. B. Cunningham in the firm of the People's Electric Store at Medford.

R. A. Schuyler has been appointed manager of the Bozeman branch office of the Montana Power Company. He was formerly foreman of the Great Falls plant and has been with the Montana Power Company in various positions since 1912.

D. B. Rushmore, chief engineer of the power and mining department of the General Electric Company, recently returned from Europe, where he has spent some five months investigating trade and industrial conditions. Mr. Rushmore visited the war-devastated sections of Europe and also went to Germany, and reports marked progress in the re-establishing of trade activities.

Percy C. Henry has been appointed superintendent of distribution, New England Power Company, succeeding F. J. Sill, resigned. Mr. Henry is a graduate of Purdue University, electrical engineering department. After service with the Indiana Steel Company at Gary, he became electrical superintendent of the Aluminum Company of America, with headquarters at Massena, N. Y

Fred M. Abbott, who has been special investigator and safety inspector for the Public Utilities Commission of Utah for the last three years, has tendered his resignation. Mr. Abbott, in addition to his investigating work, has had charge of general safety conditions.

William V. King has been chosen to fill the position of chief accountant of the Federal Power Commission. Inasmuch as a most intricate system of accounting is required for projects under the water-power act, the greatest difficulty was experienced in finding an accountant with the experience necessary to qualify him to work out a suitable system. It is believed that Mr. King will meet all the requirements, since his long experience with Interstate



W. V. KING

Commerce Commission accounting has familiarized him with many of the fundamentals which must enter into the Federal Power Commission's accounting system.

Obituary

Adam Shoop Carr, manager of the Philadelphia office of the Robbins & Myers Company, Springfield, Ohio, died Oct. 13, from typhoid fever.

Charles Ernest Acker, an electrochemical engineer, who built the plant of the Acker Process Company at Niagara Falls and was known as the originator of processes for the manufacture of tetrachloride of tin and carbon tetrachloride, died at his home in Ossining, N. Y., on Oct. 18, in his fifty-second year. Mr. Acker was for several years a practicing electrical engineer in Chicago.

C. B. Kidder, general manager of the Otter Tail Power Company of Fergus Falls, Minn., died on Sept. 20 as the result of electric burns. Mr. Kidder became associated with the Otter Tail Power Company about ten years ago and helped to develop its system of high-tension transmission lines now radiating from Fergus Falls.

Trade and Market Conditions

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

Standard Lamp Voltages to Reduce List of Stock Items

LAMP manufacturers are now making a decided effort to standardize service voltage at 110, 115 and 120 volts in order to reduce the long list of stock items and the consequently heavy inventories. When the carbon lamp was most used it was necessary to have different service voltages so as to use up the lamps that were produced. It was not possible to foretell accurately what the voltage of a carbon lamp would be.

This condition has changed, however, and manufacturers have had no difficulty rating type-B lamps before production. Some of the larger central stations were of the opinion that the type-C lamp could not be so accurately gaged, and it was not until recently that they became convinced that the type-C lamp could be produced with the same high accuracy. These utilities have as a result withdrawn their objection to standard-service voltages and the manufacturers are encouraging complete adoption.

This is not a new activity on the part of the lamp manufacturers. They have been studying and analyzing the situation for some time. It was not until these objections were withdrawn, however, that all of the manufacturers felt they were in a position to push these standards.

Farm-Light Producer Builds Up Plant Sales

IN ORDER to build sales of farm-lighting plants, one manufacturer in Michigan, the Automatic Light Company, Inc., has worked out a plan to obtain new dealers and to "liven up" old ones.

Starting on the basis that only 7 per cent of the farmers of the country have electric light, that the farmers are "sold" on electric light and power, and that they have the money and will listen to salesmen who have confidence in their goods and in themselves, this company has equipped three light sedan automobiles with a plant where the rear seat should be and sent the salesmen out in comfort to demonstrate. The results in two months have been beyond fondest expectations, for not only have sales per week increased but the trail of live and interested "prospects" is reported very satisfactory. The first step, however, was to reduce the price of the set. The Main Electric Company of Cleveland has also reported a scale of prices which became effective Oct. 15, showing reductions on all generating sets of about 12 per cent.

In the Middle West sales are reported to have been off in the last few weeks because of a break in grain prices. However, the demand has returned, and increased activity is now reported in this line.

Jobbers' Costs of Handling Twelve Principal Lines

THE accompanying tables give in detail the results of the preliminary thirty-day study of the expense of handling each of twelve principal lines of goods distributed by electrical jobbers, as presented before the Cleveland convention of the Electrical Supply Jobbers' Association on Nov. 17, by H. F. Thomas of St. Paul, Minn., chairman of the committee on costs.

The figures are based upon an analysis of the business during one month (April, 1920) of four representative jobbing houses in different parts of the country. The four houses studied did together $1,400,000 of sales during that month, with a total expense of $162,000, indicating the average ratio of total expense to total sales to be about 11.6 per cent. The twelve lines reported on in the tables constituted about one-half of the total sales of these four jobbing houses.

In computing the figures neither interest on investment nor income or excess profits taxes was included. The ratios of the separate elements of cost making up the total expense for each line were analyzed, and the figures show the percentage of "financial" expense (accounting, billing, collection and credit expense), warehouse expense and sales expense for each line studied.

While the figures shown cover only a thirty-day period, the results obtained were presented before the convention at this time to illustrate the methods employed and to invite suggestions and criticisms concerning future work of the same kind in other jobbing houses, covering all lines and extending over a longer period.

Hearty appreciation of the scientific cost studies made by Mr. Thomas' committee was evident on the part of the jobbers and an additional fund of $10,000 has been voted the committee to extend the studies to cover all lines handled by six different jobbing houses, the study to extend over six months.

It is expected that the figures for the first three months of this new survey will be ready for reporting before the Jobbers' Association spring meeting, scheduled for Hot Springs, Va., in May.

WHAT IT COSTS JOBBERS TO HANDLE TWELVE LINES

Lines Reported	Amount of Sales, Four Jobbing Houses, Month of April, 1920				"Financial" Expense		Sales Expense		Warehouse Expense		Total Expense	
	Warehouse	Delivered	Direct Sales	Total Sales	Amount	Percentage of Sales	Amount	Percentage of Sales	Amount	Percentage of Sales	Amount	Percentage of Sales
Schedule material	$48,098 82	$7,879.74	$14,223.18	$70,201.74	$3,192 80	4 42	$5,047.94	6 96	$4,402.34	7 68	$12,643.08	17.07
Rubber-covered wire and lamp cord	61,736.06	7,430.86	24,893.53	94,060.45	1,567.59	1.62	3,120.68	3.36	2,421.21	3.56	7,109.48	7.67
Rigid conduit, elbows, bushings, etc.	40,689 33	4,308.75	5,904.94	50,903.02	1,071.83	2 14	2,379.78	4.87	2,599.61	5.68	6,051.22	12.25
Porcelain knobs, cleats and tubes	10,382.96	825.48	465 43	11,673 87	387 48	3 42	1,367.79	13.13	1,073.52	7.72	2,828.79	27.15
Weatherproof wire	52,094 98	2,335.03	40,682.65	95,112.66	981 59	0 96	1,965 88	2.62	1,006.86	2.03	3,954.33	4.93
Condulets or similar fittings	15,840.84	2,984.69	1,153.33	19,978.86	1,305.18	6.98	1,701.36	8.56	1,641.86	9.15	4,648.10	24.03
Flashlights and flashlight batteries	4,710.41	1,202.02	1,951.38	7,863.81	550.15	7.62	929.95	11.10	702.31	10.66	2,182.41	28.71
House goods (bells, push-buttons, etc.	1,342 29	502 80	529.69	2,379.78	198.64	9 24	474.63	14 09	262.23	16 58	935.50	37 93
Dry batteries	10,739.82	933.39	935 12	12,608.33	266.99	2 22	983.69	8 72	615.40	5.84	1,866.06	16 33
Heating devices	23,554 63	3,074.59	6,835 08	33,464.30	1,078 89	3 06	2,810.17	7.81	1,797.05	6.79	5,686.11	16 44
Commercial fixtures	10,926 28	928 93	2,668.67	14,523 88	380 01	2 77	1,555.78	10 49	961.96	7.58	2,897.75	19.48
Pole-line hardware	13,666 96	2,020.34	18,538.57	34,225.87	873.22	2.96	3,254.87	8 10	2,423.43	7 71	6,551.52	19 79

New York Jobbers See Bright Side to Present Trade Conditions

IT IS EVIDENT that the disquieting situation affecting electrical supply jobbers in New York territory is not so bad as has been painted, despite reports of excess stocks, decreasing demand, cancellation of orders and cutting of prices.

It was pointed out by several representative houses that the present level of demand and of inventories, instead of being considered in the light of the banner year 1919, do not shape up unfavorably when compared with a normal average period of business. A recession in sales is to be expected following a peak year of business, and growing stocks, it is said, are noticed especially at present, following the shortage heretofore existent in many lines. Too much concern, it is admitted, has been expressed regarding the cancellations, prices and surplus stocks of competitors. This, it seems, has led to a more pessimistic outlook on present conditions than the situation warrants. Taken individually, almost every jobber in the metropolitan territory personally disclaims being hard hit by adverse conditions, while admitting their prevalence with competitors. Therefore it would seem a wise policy in the trade at present to stop crying "Wolf! Wolf!" and to concentrate efforts upon pushing one's own business.

It is understood that in the slack season of 1907 a well-known electrical jobber, instead of following the example of competitors and releasing salesmen wherever possible, made capital out of the pessimism of others by taking on several additional excellent salesmen who had been let go. With this augmented force the house in question showed a larger volume of sales for 1907 than any previous season. A similar policy is being successfully followed by a representative jobber in New York at the present time. This firm has recently taken on six new salesmen and is pushing sales harder than ever before. As a result, it is said, orders for the month of October reached a larger total than in any previous month this year except one, and November sales thus far bid fair to outstrip those of October. It is difficult to trace the ultimate destination of this business at present, but the fact of its existence is indisputable. Several other jobbing houses that report inventories at a favorable level, few cancellations and little resort to price cutting to move goods state that increased sales efforts are responsible.

Flexible-Armored-Conductor Market Is Weak

TWO or three months ago, it is safe to say, the shortage of flexible armored conductor was acute in most sections of the country. At present the general condition with respect to this commodity is a glut in the market. Several reasons are advanced for this complete reversal of form. Probably the chief one has been the removal of embargoes which previously prevented manufacturers both from receiving material and from shipping the finished product. As a result, when restrictions were suddenly lifted producers flooded the market with cable to such an extent that demand was not only satiated but stocks grew too large. And about this time consumer demand on the part of building construction began to slump. Furthermore, raw-material difficulties that had been existent, such as the dearth of steel strip, then began to be relieved. Today manufacturers of steel strip are able to ship carload lots in a week to ten days' time. Deliveries of finished cable can also be made almost immediately, ranging up to two weeks' time.

During the period of a weakening market prices performed queer stunts as the result of jobbers' efforts to keep down inventories. Manufacturers, however, did not follow suit with price cuts as stocks of high-priced material prevented any decline. Many cancellations and requests for extensions of time resulted. So far as can be learned some manufacturers quite recently were still holding to their old price levels, though others have now reduced their quotations.

Reports are current that No. 14 two-wire, double-strip cable can be purchased as low as $75 per 1,000 ft., which is considerably below the quotations of most manufacturers, whose prices for the size mentioned range from about $78 to $85 per 1,000 ft. On the other hand, some jobbers in the East are quoting as high as close to $100 per 1,000 ft. for No. 14 and report fairly good sales at that figure. These instances appear to be isolated cases of exceptional activity in the house-wiring field, however.

Manufacturers in general appear to be optimistic regarding the return of the building industry and consequent good demand for cable next year. At least they are going steadily ahead with production. Factory stocks as yet are not large, especially in the larger size of cable, which has been in greater demand from industries.

Linemen's Tools Becoming Available

JOBBERS and others who have been discouraged by their inability to get linemen's tools except on deliveries of from twelve to eighteen months will be able to get pliers in sixty to ninety days by January or February of next year, according to the estimate of one of the foremost manufacturers of this line. The war cut off the foreign supply of these tools, and the necessary skilled labor became so scarce that up to a few months ago the manufacturers of linemen's tools were getting further and further behind with their orders.

Pyramided orders have been canceled and all the needed labor and material have been obtained, so that the delivery not only on pliers but on connectors, climbers, etc., is being gradually reduced. This is especially true of climbers, which are intermittently obtainable from manufacturers' stocks.

The Metal Market Situation

LITTLE change is evident in the copper market, except that the attitude of "watchful waiting" on the part of both producers and consumers is perhaps a bit more pronounced. Certainly large buying orders remain as much lacking as ever. Further wage cuts and reductions of output are announced, the latter in an effort to reduce the large surplus stocks of copper known to exist in the country.

Producing interests show little desire to sell at the figures offered by consumers. Large operators are asking 14.75 cents for copper delivered over the remainder of this year and 15 cents delivered covering the first quarter of next year. Some shading of these prices by small producers is rumored. In the outside market 14.25 cents delivered is asked for prompt shipment, and 14.75 cents over the first three months of 1921. Foreign demand remains very weak.

In view of recent developments in the iron and steel market the statement of Judge Elbert H. Gary, chairman of the board of the United States Steel Corporation, issued last week, to the effect that there will be no change at this time in base selling prices of products handled by the corporation, is interesting. The base selling prices quoted at present by the corporation are those which were mutually suggested at a meeting of iron and steel interests with representatives of the United States government in March, 1919.

NEW YORK METAL MARKET PRICES

	November 15	November 22
Copper	£ s d	£ s d
London standard spot	85 15 0	78 10 0
	Cents per Pound	Cents per Pound
Prime Lake	Nominal	Nominal
Electrolytic	14.75–15.00	14 25–14 75
Casting	14 25	14 00
Wire bars	17 00–17 50	16 00–16 50
Lead trust price	7 00	6 50
Antimony	6 00	5 87
Nickel, spot	43 00	43 00
Sheet zinc, f.o.b. smelter	11 50	11 50
Zinc, spot	6 85	6 60
Tin	36 00	36 25
Aluminum, 98 to 99 per cent	32 90	33 10

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	12 00–12 50	12 00–12 50
Brass, heavy	6 00– 6 50	6 00– 6 50
Brass, light	4 50– 5 00	4 50– 5 00
Lead, heavy	5 00– 5 25	5 00– 5 25
Zinc, old scrap	3 75– 4 00	3 75– 4 00

THE WEEK
IN TRADE

A LITTLE better tone is apparent in the jobbing trade this week. Almost without exception the reports from the different sections of the country show a fair amount of buying, and in some cases better buying than in the recent past. Supplies of electrical materials are being received in good volume, but while some stocks are building up in pretty good shape, in many instances jobbers are keeping down their inventories by expending greater sales effort. The answer to this effort is that stocks are moving.

Building remains at a low rate, as a general thing, although here and there some activity is found. Since the investigations into the housing situation in New York City pronounced reductions in building materials have been reported, some reductions running to 30 per cent. These investigations are digging into alleged combinations in the control of building materials.

Cancellations do not appear to have taken such an active part in the situation as was feared some time ago, and the practice of price cutting is much less serious than was threatened a few weeks back by accumulating stocks and falling off in demand.

NEW YORK

A significant feature of the week is that almost without exception jobbers report a favorable inventory level, and the success of efforts to avoid overstocking is apparently not due to price cutting to any great extent. Cancellations, too, are conspicuous by their absence, and collections for the first time in several weeks are reported better by jobbers.

Though compared with some months ago a depression of trade undoubtedly exists, several jobbers report fairly good sales. Some lines such as wire, tape and armored cable are moving especially slow, but light demand in one line is very often offset by activity on another item.

Although residence construction work is very light, the volume of sales to electrical contractors is good. This is probably due to the large number of industrial and commercial projects that have been under way for a long time and have now reached the stage of electrical work. This is borne out by one of the leading electrical contractors in this section, who says business never has been better than at the present time.

Shipments from the steel-producing district are still irregular. Stocks of rigid conduit, outlet boxes, etc., are consequently spotty, though the first break toward an easier market on pipe is seen

Safety Switches.—In spite of the fact that open switches are reported being gradually superseded by the safety type, demand is not large at present and stocks are held down. Prices remain steady.

Rubber-Covered Wire.—Some jobbers are making good sales despite a general weak market. Stocks are kept at a fairly low level, but prices are all over the lot, No. 14 ranging from $9.50 to $10.50 per 1,000 ft.

Tape.—Demand is weak, but jobbers' stocks are held within reasonable limits. The price of friction and rubber ranges all the way from 50 cents to 60 cents a pound on each, in lots of 100 lb.

Schedule Material.—Considerable complaint is heard of porcelain holding up the supply. Pull sockets are plentiful, but not so other types. Although stocks with some are not moving, most jobbers report a fairly good demand. Prices show no change.

Outlet Boxes.—Most stocks are short as sheet steel is holding up the supply. Demand is spotty. In small quantities the discount on black is 20 per cent, and on galvanized from 10 to 15 per cent.

Flexible Armored Conductor.—Jobbers are meeting with success in holding their stocks to a low level in the face of a very weak market. No. 14 two-wire is quoted at from $80 to $85 per 1,000 ft., in 5,000 ft. lots.

Conduit.—Although demand holds up as strongly as ever in some cases and one jobber at least is entirely out of the market, reports are now received that sales have slumped within the past month and that supplies are plentiful. Shipments from the Pittsburgh district remain very bad, however. Large sizes are most scarce. One-half-inch black ranges close to $90 per 1,000 ft., and ½-in. galvanized is quoted at $100 in quantities of 2,500 lb.

Heating Appliances.—Hollow ware is scarce, but other items are plentiful. Demand is fairly strong, but sales do not appear to be so large as was anticipated.

CHICAGO

With remarkable consistency prices in the electrical industry are remaining firm in this territory, and the effect is gradually to establish public confidence in the stability of these goods and to cause a resumption of buying. This tendency is only slightly noticeable so far, but it is significant that in practically every other line dependent on retail trade for support the "buyers' strike" is still in effect and can be temporarily broken only by radical price reductions, while the electrical line, in which no cuts have been made, is feeling a stiffening in demand.

Dealers still feel uncertain as to the volume of Christmas trade and in many instances are understocked. Jobbers, with more confidence in the consuming power of the public, are well supplied and can take care of any reasonable volume of trade. Orders for Christmas tree lights are beginning to come in and bid fair to absorb all stocks.

Lightning Arresters.—Prices are unchanged and demand light, but manufacturers are still behind on orders. Even with present dull business continuing, it will take several months for jobbers to build up any stocks.

Circuit Breakers.—Carbon circuit breakers are obtainable from manufacturers' stock in reasonable numbers, but the oil type are still scarce and from ten to twelve weeks is necessary to secure delivery. Demand has fallen off.

Transformers.—Supply of station transformers is getting better and orders are light. Volume of inquiries holds promise of steady demand for the future. The demand for outside transformers for farmers' use has practicaly ceased, but with the advance of crop marketing should soon again make itself felt.

Farm-Lighting Plants.—Increased activity in this line is general throughout the territory.

Copper Wire.—Copper wire is obtainable at various prices, depending on how badly the holder wants to make the sales. Price ranges as wide as $1.50 are heard of, but the larger interests are holding firm. Demand is only fair, and supply in all but No. 6 triple-braided weatherproof is adequate for present needs.

Cross-Arms.—No price change has as yet occurred, but sales are at a minimum, the trade being apparently waiting for the cut they believe to be inevitable. Coast yards can make immediate shipment in any quantity, and plentiful supplies are in local stocks.

Poles.—The season is ending with an unusually heavy demand well taken care of. Stocks, as usual this time of year, are very low. Indications are for a good labor supply in the woods this winter and ample supplies at perhaps lower figures next year.

Washing Machines.—Retailers report improved sales, the volume of business being directly proportionate to the effort expended. Those districts in which real sales effort is being made are experiencing a handsome return for their work and this is being done in enough places to make the aggregate of orders placed with jobbers have a very encouraging look.

BOSTON

A slight improvement in the market was noted at the close of the week. While many manufacturers and jobbers are busy on back orders some new business is being booked. Contractor-dealers are buying more wiring material and a large amount of old-house wiring and a good deal of central-station line extension work is in progress in New England. Industrial plants are doing considerable rehabilitation and betterment work. The building trades are rather quite but the total building and engineering contracts for New England from Jan. 1 to Nov. 17 amount to $288,171,662, compared with $202,250,000 for the same period last year. A leading jobber reports 91 per cent greater business for October this year than last and is running ahead of last November's business this month. Close attention to collections is yielding better returns on the work of credit departments. General business in New England is largely marking time. Prices are steady in most electrical supply lines except where overstocks force retail cuts.

Wire.—Rubber-covered wire is steady with little demand at $9.50 per 1,000 ft. in 5,000-ft. lots; weatherproof base is 23 cents with no weakness in late quotations, and bare is running on 20 cents base. Magnet wire is still being sold on very long deliveries and so far, prices have not reflected recent reductions in cotton and silk quotations.

Dry Cells.—Current demands are being met with little difficulty. In barrel lots No. 6 dry cells are quoted at $37.50 per 100, and the ignition type at $38.35.

Washing Machines.—Jobbers' stocks are filling up, while trade is a little quieter. So far prices are holding firm.

Lamp Cord.—Plenty of this material is now in hand. No. 18 twisted pair is quoted at $25 to $26 per 1,000 ft. in 1,000-ft. lots, running to about $21 or $22 on 5,000-ft. lots.

Meters.—Shipments are still being allotted to regular customers, and no distribution for central-station stocks is encouraged.

Friction Tape.—Good supplies are in hand, with moderate demand. The ¾-in. black tape is quoted at 57 cents per pound on small lots and at about 54 cents on 100-lb. orders.

Motors.—Stocks are very spotty, and deliveries run into months on most of the leading types and sizes. Widely scattered orders are reported. Prices are firm in the main.

Non-Metallic Flexible Conduit.—A fair amount is being sold. Some jobbers look for a reduction in prices before long, but present quotations are steady. The ½-in. size brings $33 per 1,000 ft. in 5,000-ft. lots, and the ¾-in. size $36.50.

Rigid Conduit.—Uneven stocks still prevail, but transportation conditions are so much better that little complaint of famine conditions is justified today, even among smaller jobbers.

Flexible Armored Conductor.—This material is moving fairly well, with a healthy demand from contractor-dealers. In 5,000-ft. lots the price is still $85 per 1,000 ft.

Belting.—A reduction in price of from 10 to 15 per cent was made by the Graton & Knight Manufacturing Company, effective Nov. 18, on their leather belting.

ATLANTA

The financing of the Federal Foreign Finance Corporation mentioned last week has got well under way, nearly all of the important banking institutions in this section having subscribed heavily to the stock of the new institution, which is classed as being only second in importance to the Federal Reserve System itself. The view is very generally expressed that the psychological effect of this new organization will be reflected at once in more stable business conditions through the rural districts. The crop report for November shows slight increases in quantity of potatoes and sweet potatoes, a large increase in the peanut yield but a slight decrease in corn, tobacco and apples, the report on the whole showing conditions to be more favorable than last year. When marketed these crops will tend to offset somewhat the low price of cotton, with its consequent poor collections and slack business.

Business, on the whole, is reported slow, retailers and jobbers placing orders with unusual care and for immediate demands only. There have been only isolated instances of the suspension of industrial plants, most of the manufacturing concerns continuing production in anticipation of heavier orders after the first of the year. Most of the textile mills which suspended operation a month ago are getting under way again, while the cotton-oil mills are at last running on nearly normal schedules. This has prevented any general lack of employment, though labor is in greater supply than for some time past.

Heaters.—The sudden cold snap has brought this line again to life, the trade reporting a brisk movement. Retailers are giving especial attention to this specialty and stocks are very good.

Meters.—The shortage continues. Although a large shipment was recently received, it was immediately absorbed by back orders. One of the largest manufacturers reports sufficient orders on hand to absorb the entire output for the next nine to twelve months.

Distributing Transformers.—The demand has eased off somewhat in this line, owing to receipt of heavy shipments in the last few days. These will continue to move well for some time as the supply is still insufficient for all back orders.

Lamp Cord.—Some jobbers are overstocked in this line, while others report shortages. Interchange of stock is the result. Demand holds up fairly well with prices at $25.50 per 1,000 ft.

Fuses.—Renewable fuses continue scarce, and a large number of back orders remain unfilled. The demand continues to hold up well with no change in price. Plug-fuse stocks are in good shape and moving quite satisfactorily.

Washing Machines.—The demand has slowed up all along the line and customers seem to think a reduction in price is in order. Retailers are holding out for heavier discounts and are realizing considerable support from jobbers in this territory. Stocks are heavy.

Ironers.—These do not respond satisfactorily to sales or advertising campaigns, and high prices seem to hold off sales. A few jobbers have rather large stocks on hand.

ST. LOUIS

Jobbers report a satisfactory number of inquiries, but the number of orders placed has not been large. The dull market has not induced pessimism here, inasmuch as electrical men do not expect excessive deflation and feel that they can adjust themselves to a smaller demand during the coming winter. Stocks are large in the staple lines, and in instances where prices have not dropped a healthy deflation of about 10 per cent is expected to be in effect by the first of the year.

Collections are being maintained at about sixty days, but it is requiring more work on the part of the collection departments. The situation is not causing much worry, however.

Wire.—Jobbers have not been able to reduce their large stocks to any extent, but quotations are still on the 23-cent base, No. 14 rubber-covered selling for $9.75 per 1,000 ft. in lots of 5,000 ft. The drop in demand is noticeable, particularly in the size of the orders, as well as their number. Central stations are still buying, but are staying close to their immediate needs. Jobbers report some orders for feeders and for small rural lines.

Rigid Conduit.—While jobbers have much better stocks than was the case a month ago, their reserve stocks, especially in the smaller sizes, are not satisfactory yet. They report a slower demand and are building up their stocks. Shipments from manufacturers are not normal but are much improved.

Linemen's Tools.—Jobbers report no abatement of the long-continued shortage and cannot promise specific delivery in any length of time. Tool manufacturers, however, are reported catching up on orders, and there are hopes that the situation here will improve.

Cross-Arms.—There are good stocks on hand and these

are moving fairly well. Rural-line demand is showing up well and railroads and central stations are also placing orders. Jobbers are promising three weeks' delivery on reasonable quantities.

Poles.—Jobbers have good stocks in yard, but are still having difficulty in getting the right sort of cars for shipping. Demand is becoming slower as the season advances. Base prices at mill quoted here range from $11.35 on the Western cedar 8-in., 40-ft. pole to $20 on the Northern white cedar 8-in., 40-ft. pole.

Washing Machines.—Retail demand is getting a trifle better, but is still below normal. Immediate deliveries can be made by manufacturers.

Locust Pins.—Large stocks of pins are being reduced with difficulty. Some small orders are being placed for building feeders and small extensions. The 1½-in. x 9-in. pins are quoted at $60 per 1,000 in lots of 5,000, and the 1¾-in. x 8 in. pins are quoted at $30 per 1,000.

SAN FRANCISCO

Contractors are very busy, and although their store business has considerably decreased, this is caused perhaps by a little tardiness in appreciating the sudden change from a sellers' to a buyers' market. Therefore, while the timorous are planning for a year of retrenchment, shrewder observers feel assured that 1921 will be a prosperous year for California, considering such factors as big railroad expenditures, the completion of gigantic power projects and merchandising co-operative efforts. Heavy rains have caused disastrous floods in the rice districts because of breaks in the Sacramento levees.

Shipments from the East are heavy and are coming through in good time. Few of the early back orders remain and future purchases must be figured on a basis of prompt delivery. This quick change in manufacturing conditions will doubtless pile up local stocks for a while. Collections are better, through the vigorous shepherding of the credit managers. Credit extensions are made very sparingly.

Fixtures.—Fixture business in general is good, especially in southern California, where an exceedingly large proportion of the building permits cover bungalows and other small dwellings. Clever and consistent selling effort has produced a steady call for the new patented fixtures. A big Christmas business in portables and standards with silk and parchment shades is expected. Stocks have never been so large or so well assorted.

Vacuum Cleaners.—This business is certainly far larger than it was a year ago, but whether its profits for the dealer have increased proportionately may be doubted. The number of aggressive manufacturers who promise results through vigorous campaigns has so grown that in many districts the saturation point for present clean-up methods of selling has been reached. One result has been an almost general increase in the variety of makes carried by each dealer and a consequent decrease in his rate of turnover.

Washing Machines.—The same conditions apply to the washing-machine market, where the very necessary element of turnover has been overlooked by many dealers. There is an insistent call for a searching investigation into the high overhead reported by some of the dealers who have staged the most spectacular sales efforts, and the next four weeks may reveal totally new methods of handling washer business.

SEATTLE—PORTLAND

Business was more or less uneven all during the past week, with slackness or negligible buying in some lines and a brisk volume of sales in others. Light movement was recorded in schedule materials, motors and pole-line materials, but sales of domestic appliances, portable lamps, etc., showed pleasing increases. Farm-lighting plant sales also picked up, although the volume is not nearly so large as originally predicted. Dealers who have been consistently advertising appliances are noting a steady increase in their sales. The transportation is good, cars west of Chicago coming through in splendid time.

Portland jobbers state that business is holding up. In some cases buying is brisk, although the general tendency seems to be to withhold buying awaiting further drop in prices. Heating devices are not moving so fast as a year ago. The buying of good-grade standard lighting fixtures and reflectors indicated a tendency on the part of stores, offices and factories to improve lighting conditions. Part of the present movement is traceable to the effect of the recent industrial code adopted in Oregon and part to the general educational propaganda relative to improved lighting.

The campaign relative to convenient outlets is also having its effect as indicated by the rapid increase in the demand for receptacles. Jobbers' stocks of flashlights and batteries are improving and are considerably better than they have been for at least a year. The demand for renewable fuses is increasing rapidly, particularly in the 600-volt class, while the sale of non-renewable fuses has fallen off approximately 50 per cent the past year.

Active inquiry in regard to pole-line materials indicates the probability of a great deal of work of this sort being done in the spring period. Many mills closed temporarily are taking advantage of this condition to remodel and improve, and thousands of dollars are being spent for electrical materials and equipment. Contractors and dealers report business good, and most contractors have enough work to keep them going very satisfactorily for some time.

Motors.—Demand for fractional-horsepower motors is still in excess of supply, and deliveries are exceptionally hard to obtain. The call for large motors, generally speaking, is light, although several sales to sawmills of consequence have been made during the week.

Flatirons.—Stocks are not in good condition, and deliveries are far from satisfactory. Demand is consistently good and showing material increase.

Lamps.—Stocks are in good shape and deliveries prompt. Sales volumes increased steadily all during the month, particularly on residence types.

SALT LAKE CITY—DENVER

A close analysis of the electrical trade in the Intermountain region shows that conditions are relatively stable. It is passing through a critical merchandising period along with other industries but is beset with fewer perplexing conditions than most of them. Through persistent selling tactics stocks are kept moving, though sluggishly. The general trend is hopeful, though not by any means satisfactory. The Intermountain distributing branch for one of the largest electrical manufacturing concerns in the United States reports business better here than in nearly any other section. With eight jobbing centers it moved more electrical merchandise last month than a Southern area with twenty-two jobbers.

Thus far most jobbers have been able to keep clear of financial straits. They are canceling their paper in fairly prompt order and taking their regular discounts. Dealers, however, are having a worse time of it, finding it necessary in many cases to resort to cancellation of orders. They are working to a program of fast turnovers and small quantities in stock. No one is looking for an immediate fall in prices. Jobbers are well stocked and claim to be working on a margin that would mean disaster with any material reduction of the present price schedule. They look for an ultimate recession to a normal basis, but believe the readjustment will have to come very gradually.

The market for agricultural products is in a demoralized condition in some sections. Hay that would have brought $20 a ton and upward two years ago is now waiting in storage with no demand. Farmers are showing some disposition to hold their wheat and potatoes for better prices. This is reflecting adversely on the market for electrical goods. As yet the wave of non-employment has not seriously affected the Intermountain West. This is due mainly to the relative absence of large manufacturing plants.

The prospect for a satisfactory holiday trade is a little brighter with the near approach of Christmas. Dealers are yielding more and more to jobbers' entreaties to stock.

NEW APPARATUS & APPLIANCES

A Record of Latest Developments
and Improvements in Manufacturers' Products
Used in the Electrical Field

Commercial Ceiling Fixture

One more of the new unit ceiling fixtures for commercial use has been brought out by the F. W. Wakefield Brass Company, Vermilion, Ohio. It



CHAIN SUSPENSION MAY BE USED

has been especially designed for adaptation to the Phoenix Gas Company's unit 11-8-12. The units come in 4-in. and 6-in. sizes for medium-type sockets and in 6-in. size for mogul socket.

Ironer with Automatically Shifting Shoe

By moving a small level conveniently placed at the right of the feed board the shoe of the new Thor electric ironer developed by the Hurley Machine Company, Chicago, is shifted into the closed



NEW SHIFT CONTROL USED

position or one of three open positions. Two buttons on the control lever are shifted up or down to select the position desired, and the shifting is done by the motor through gear trains, leaving the operator free to guide the pieces being ironed and making it possible for him to work while sitting down. The cylinder has two speeds, 8 ft. per minute for heavy pieces and 12½ ft. per minute for light pieces. Direct-shaft drive is used and all gears are inclosed, running in lubricant.

Electric Oven for Drying Armatures, Etc.

For drying armatures, field coils, etc., in electrical repair shops a new electric oven has been developed by the Service Station Supply Company, 30 East Larned Street, Detroit, Mich. It was originally designed for heating batteries before opening them. This "Hyrate" oven is made in two types, for 110 volts and 220 volts respectively, either direct or alternating current. A handle on each end of the oven enables it to be tipped for inspection or removal of the contents.

Vacuum-Cleaner Connector

The Bryant Electric Company, Bridgeport, Conn., has just placed on the market a new Spartan connector for use with vacuum cleaners. It is the Spartan receptacle handle connec-



FIBER AND PORCELAIN HANDLE CONNECTOR

tor No. 138, made of a heavy fiber tube longer than the porcelain connector body. The body is provided with contact slots for plug caps and binding posts for wires.

A Flush Screw Receptacle

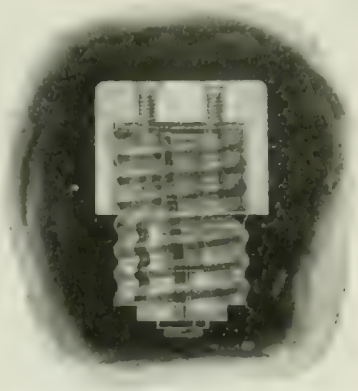
A new porcelain-base flush screw receptacle has been developed by the Paragon Electric Manufacturing Company, 679 Miami Street, Akron, Ohio. This receptacle is rated at 250 volts and 660 watts. One feature is an extra-long screw which will not fall out of the receptacle when it is being installed or connected. The shoulders are made flush with the outlet box. A long screw slot permits half an inch of play.

Loom and Armored-Cable Boxes

Two types of boxes have been developed by Clemence Brothers, 164 Linden Avenue, Irvington, N. J. The "Sterling BX box" is used for armored cable work and is made in both straight electric and combination styles. It has no clamps, the cable being gripped by two screws which will hold cables of different sizes. The "Meleady loom box" is used for knob and tube work. This box is also made for straight electric or combination work. The underwriters have approved both boxes.

Renewable Plug Fuse

The new renewable plug fuse announced by the Pierce Fuse Corporation, 752 Main Street, Buffalo, N. Y., consists of a porcelain core, a porcelain case with the brass plug shell attached, and the link of which the brass plug-end contact disk is a part. To renew the fuse no tools are needed. Contact is made by bending the link over so that as the plug is put to-



RENEWABLE FUSE WHICH HAS ONLY THREE PARTS

gether the link is engaged between the core and the brass shell of the case and held tight. To test the plug the plug-end contact disk is pulled—it will pull out if the fuse has blown. The fuse is made in the standard-plug size, with links for all capacities to 30 amp.

Fractional-Horsepower Motors

A ¼-hp. split-phase motor is being produced by the H-G Manufacturing Company, 1215 Pine St., St. Louis, Mo. Features claimed for the motor are that no live parts are exposed, that the housing is splash-proof, that special ventilation is employed and that starting torque is high with low starting current, high efficiency and power factor.



LIBERAL OVERLOAD CAPACITY CLAIMED

The motor is made with a high-carbon steel shaft, phosphor-bronze bearings and large-capacity oil wells of the wick-filled type. It is made in ¼-hp. and ⅓-hp. sizes for 110-volt and 220-volt single-phase operation.

MANUFACTURERS' ACTIVITIES

Record of Changes Affecting Sales and Distribution
Together with Trade Personals and Notes on Foreign Trade,
Jobbers' News and New Trade Literature

JOHN KELLY has resigned as vice-president and general sales manager of the Edison Storage Battery Company, Orange, N. Y.

THE J. A. WEBB BELTING COMPANY, Buffalo, N. Y., has increased its capital stock from $25,000 to $50,000.

THE ECONOMY FUSE & MANUFACTURING COMPANY, Chicago, announces that C. B. Merrell, who has been for a number of years in the general offices of the company, has been appointed district sales manager of the Philadelphia office, 523 Widener Building, vice E. J. Watson, resigned.

THE CONNECTICUT BLOWER COMPANY, Hartford, Conn., has filed notice of active capital stock of $200,000. The company will manufacture mechanical blower apparatus.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, East Pittsburgh, Pa., has recently installed the largest induction feeder regulators ever built in the company's works, in the Philadelphia Electric Company's outdoor substation at the Philadelphia end of the 66,000-volt transmission line between Philadelphia and Chester. The capacity of each regulator is 1,750 k.v.a., the capacity of the largest built previous to these having been 1,000 k.v.a.

THE PEERLESS LIGHT COMPANY, manufacturer of lighting fixtures, electrical specialties, etc, has purchased the six-story building and site it occupies at the corner of Washington Boulevard and Union Street, Chicago. The company has remodeled the building to meet its requirements, at a cost of $175,000.

THE HAESE ELECTRIC COMPANY, Punputawney, Pa., is plannng to establish an office and warehouse in Wheeling, W. Va., in the near future. The company deals in mining machinery, high-voltage motors and general electrical equipment.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., has awarded contract for construction of a new factory building, 160 ft. x 300 ft. at its Lynn (Mass.) plant, to cost about $150,000.

THE MEEHAN MANUFACTURING COMPANY, 709 M. & M. Building, Milwaukee, Wis., contemplates building a factory, 80 ft. x 100 ft., in Jackson, Wis., for the manufacture of farm-lighting plants. The company, it is understood, has already secured a site for the proposed plant

THE BLAW-KNOX COMPANY is planning to erect a two-story extension, 81 ft. x 90 ft., at its plant in Blawnox, Pa., for which it is understood, bids have been asked.

THE MASON REGULATOR COMPANY, Dorchester Center, Boston, Mass., has recently made a $150,000 addition to its pressure regulator factory, permitting the permanent housing of machinery which has been operated in wooden buildings during and since the war. The building is of modern steel and brick construction, and the machinery is driven by individual motors. Special emphasis has been laid on giving every advantage to the employees, according to Eldon Macleod, treasurer, so that their best efforts may be reflected in the quality of the product.

THE CHAIN BELT COMPANY, Milwaukee, Wis., announces the appointment of Clifford F. Messinger as general sales manager to succeed L. C. Wilson, who has resigned to become secretary of the Federal Malleable Company, closely associated with the Chain Belt Company. C. E. Stone has become assistant to the vice-president, and J. A. Monahan purchasing agent.

THE BRADFORD SALES COMPANY is the name of the new selling organization which has recently been formed from the Manufacturers' Sales Company by C. C. Bradford. The offices of this company, which will represent not more than two manufacturers as a district sales office of each, are at 310 Leader-News Building, Cleveland, Ohio.

THE NATIONAL LAMP WORKS of the General Electric Company, Ferry Street and Fillmore Avenue, Buffalo, N. Y., has made application to the City Council for permission to construct its proposed new two-story plant building at this location, contract for which was recently awarded. The factory will be brick and steel, 82 ft. x 132 ft., and will be equipped for the manufacture of light precision equipment as used in electric lamp production. It is estimated to cost about $120,000.

THE BLACK & DECKER MANUFACTURING COMPANY, Towson Heights, Baltimore, announces that its net sales as of Oct. 31, 1920, are 163 per cent of the total net sales of the year 1919, and the company expects that by the end of the present year the net sales will exceed those of 1919 by almost 100 per cent.

THE WESTINGHOUSE ELECTRIC PRODUCTS COMPANY, Mansfield, Ohio, has recently completed a new five-story building which will double productive capacity. Offices will be on the fifth floor, with the warehouse on the fourth floor, connected to the shipping room on the first



WESTINGHOUSE'S NEW FACTORY FOR PRODUCTION OF HEATING DEVICES

floor by means of a spiral chute. The second and third floors are devoted to electric ware assembly. In addition to the new building a third floor is being added to the older building which will be used as a cafeteria.

W. S. QUIGLEY, president of the Quigley Furnace Specialties Company, New York City, has just returned from Europe after an extensive trip made in connection with large installations of the Quigley powdered-coal system in Italy and Belgium.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY has moved the sales and service offices of the automotive equipment department, previously at New York and East Pittsburgh respectively, to 82 Worthington Street, Springfield, Mass.

THE ELECTRIC SPECIALTY COMPANY, Louisville, Ky., has applied for an increase in capital from $5,000 to $35,000.

GEORGE H. WALBRIDGE and LYMAN P. HAMMOND have opened an office at 120 Broadway, New York City, and will undertake special executive work in the investigation, organization, reorganization and financing of public utility and industrial corporations for various investment and commercial banking institutions. They have resigned as vice-presidents of Bonbright & Company, Inc., but continue as active officers of the Colorado Power Company, the Arizona Power Company, Pacific Gas & Electric Company of Phoenix and as directors of other public utility and industrial corporations in which Bonbright & Company are interested.

THE ADVANCE ELECTRIC COMPANY, St. Louis, Mo., has decreased its capital stock from $150,000 to $110,000.

THE EMERSON ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., has increased its capital stock from $2,800,000 to $3,000,000.

F. M. THEBO and R. C. STARR have formed the firm of Thebo & Starr, engineers and contractors, Sharon Building, San Francisco, Cal., to specialize in hydro-electric and irrigation projects, appraisals, investigations, design and construction. R. C. Starr still remains as construction engineer in charge of hydro-electric construction and design for the San Joaquin Light & Power Corporation, Fresno, Cal.

THE IDEAL ELECTRIC & MANUFACTURING COMPANY, Mansfield, Ohio, has arranged with the Baker-Joslyn Company, 183-199 First Street, San Francisco, Cal., as head office, with offices and warehouses in that city, Seattle and Los Angeles, to handle its products on the Pacific Coast. The company's new factory, now under construction in Mansfield, will triple the production.

THE SAFETY CAR HEATING & LIGHTING COMPANY, 206 Erie Street, Jersey City, N. J., has completed the removal of its plant to its new works at New Haven, Conn., comprising a number of buildings formerly occupied by the Marlin-Rockwell Corporation. The lamp and mantel department is still being operated at the Jersey City works and will not be removed to the new location until the spring of the coming year, when suitable quarters will be arranged for occupancy under increased output.

THE OHIO GREASE COMPANY, Londonville, Ohio, announces that R. W. Beardsley has been elected treasurer. The capital stock has been increased from $250,000 to $500,000 and a large addition to the factory has been finished which will triple the capacity.

Supply Jobbers' Notes

THE REQUA ELECTRICAL SUPPLY COMPANY, Rochester, N. Y., announces the appointment of H. L. Ball as sales manager. Mr. Ball held the same position with the Rochester Electric Supply Company for the last three years, and during the twelve years previous he was with the Westinghouse Electric Manufacturing Company in a sales and engineering capacity. The company has recently opened an apparatus department to handle motors and similar equipment.

J. E. McCLERMON has resigned as president of the Northwestern Electric Equipment Company, electrical supply jobber at 35 Vestry Street, New York City, to look after personal interests in the West, for which section he is leaving the early part of December.

Foreign Trade Notes

BOLIVIAN ELECTRICAL IMPORTERS.—List L. A. 11014 of importers of electrical apparatus and supplies in Bolivia has been received by the American Manufacturers' Export Association. This list is available at the New York office of the Bureau of Foreign and Domestic Commerce, Custom House.

AMERICAN COMPANIES BUILDING IN TORONTO.—The Coruse-Hinds Company of Canada, Harvey Hubbell and the Hubbell-Mack Machine Screw Company have purchased five acres of land in Toronto, Canada, and will erect a three-story brick, concrete and steel building for producing electric fixtures, machine screws, condulets, switches and panels. Cost will approximate $500,000.

CENTRALIZATION OF DANZIG'S ELECTRICAL SUPPLY CONTEMPLATED.—The Council of State has submitted to the Constitutional Assembly a project providing for the creation of an electricity board whose duties would cover all questions connected with the free city's supply of electric current. The ultimate object in view is the creation of a central authority empowered to regulate all questions connected with the production and distribution of electricity for light and power. According to certain versions, the acquisition of all power plants by the future free city government is contemplated.

GERMAN FIRM GETS BRITISH CONTRACTS.—The A. E. G. of Berlin has just taken a contract worth from £155,000 to £200,000 to equip a plant in the north of England with generators, motors, switchboards and other electrical equipment.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A firm of manufacturers' agents in South Africa (No. 34,044) desires to secure an agency on a commission basis for the sale of electrical goods, such as heating and cooking appliances, fans, lamps, wiring appliances and fittings.

A company of commercial representatives in Mexico (No. 34,045) desires to secure exclusive agencies for the sale of electrical equipment, such as generators and supply parts, etc.

Trade Publications

FANS.—The Emerson Electric Manufacturing Company, St. Louis, Mo., has issued a new bulletin, No. 3512, listing Emerson alternating-current ventilating fan motors, designed for vertical or horizontal discharge.

PUMPS.—The Duriron Company, Dayton, Ohio, has issued bulletins 112, 115 and 116 on single-stage centrifugal pumps, acid-resisting.

HEATERS.—The Ross Heater & Manufacturing Company, Buffalo, N. Y., is circulating catalog F, on Ross instantaneous and storage liquid heaters, condensers, coolers, evaporators and expansion joints.

MOTORS.—American Radio & Research Corporation, New York City, has published Bulletin A on "Fractional Horse-Power Alternating-Current Motors."

RADIO.—The American Radio & Research Corporation, New York City, is distributing bulletin R on "Amrad Standard Parts" for radio builders.

New Incorporations

THE LOUISVILLE ELECTRIC MANUFACTURING COMPANY, Louisville, Ky., has been incorporated with capital stock of $75,000 by C. E. Wiley, J. E Willey and William Watts. The factory will be erected at Thirty-first and Magazine Streets to produce portable electric tools.

THE NEW ADVANCE MACHINERY COMPANY has been incorporated with a capitalization of $100,000, by business men of Van Wert, Ohio, who purchased the plant and interests of the Advance Machinery Company on Sept. 8 at receiver's sale. The new owners will conduct the business along modern lines. The following officers have been elected: W. H. Dailey, president and general manager; H. M. Gee, vice-president, and F. W. Fraylick, secretary and treasurer.

THE ISKO ELECTRIC COMPANY, Tulsa, Okla., has been incorporated with a capital stock of $100,000 by E. R. Kemp, R. H. Hardin and Edgar A. De Neules.

THE ORIOLE SPECIALTY CORPORATION, Belair Road and Southern Avenue, Baltimore, Md., has been incorporated by Thomas Heur, Charles B. Mills, and Harry L. Robinson. The company is capitalized at $100,000 and proposes to do an electrical and mechanical engineering business.

THE F. V. L. SMITH BATTERY COMPANY, Atlanta, Ga., has been chartered with a capital of $300,000 to manufacture electric batteries; also to establish a chain of general service stations. F. V. L. Smith is president and S. L. Munson is secretary of the company.

THE EMCO SALES CORPORATION, Buffalo, N. Y., has been chartered by W. F. Emerson, W. C. Carroll and I. Rabinowitz, Buffalo. The company is capitalized at $25,000 and proposes to manufacture electrical appliances.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

BAR HARBOR, ME.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., contemplates the erection of radio buildings at this place. (Specification 1333.)

SPRINGFIELD, MASS.—The United Electric Light Company, 73 State Street, is considering the erection of a new substation at Boulevard and Rose Street, East Springfield (Springfield P. O.). McClintock & Craig, 33 Lyman Street, are electrical engineers.

SPRINGFIELD, MASS.—Permit has been granted to the Diamond Match Company, Howes Street, for the erection of a power house to cost about $110,000.

FAIRFIELD, CONN.—The DuPont Fabrikoid Company plans to increase its substation capacity to 100 kva. and the motor load by 250 hp.

Middle Atlantic States

LAKE GEORGE, N. Y.—The cottage colony on the east side of Lake George, in the town of Caldwell, is considering the establishment of a lighting district.

LIVERPOOL, N. Y.—A resolution was adopted at a meeting of the Liverpool Improvement Association to investigate the advisability of establishing a municipally-owned lighting system and distributing plant.

NEW YORK, N. Y.—Plans have been filed by the Department of Public Welfare for the erection of a power house at the Metropolitan Hospital, Blackwell's Island, to cost about $25,000.

BELVIDERE, N. J.—W. C. Albertson and S. L. Mershon, care of Fort, Hunt & Shipmen, 31 Clinton Street, Newark, have applied for permission to erect a power house, dam and transmission lines on the Delaware River at Foul Rift (Belvidere P. O.).

EAST ORANGE, N. J.—The city officials are considering plans for an extension to the street-lighting system recently installed in a portion of the business section.

NEWARK, N. J.—The Duratex Company, 134 Frelinghuysen Avenue, contemplates the erection of a power house at its leather manufacturing works to cost about $30,000.

ALTOONA, PA.—The City Commissioners contemplate the erection of a reservoir, including two electrically driven automatically controlled pumps, etc., to cost about $20,000. H. G. Hinkle is city manager.

PITTSBURGH, PA.—The Board of Trade has recommended the installation of cluster lights on certain streets and avenues of the city.

WAYNESBORO, PA.—The Council is considering the establishment of a hydro-electric plant at this place. Surveys of sites and water facilities are being made by Borough Engineer Payne.

BALTIMORE, MD.—An appropriation of $1,150,000 was voted at a recent election for construction of additions and extensions to the conduit system for electric light, telegraph and telephone wires.

BALTIMORE, MD.—Considerable electrical equipment will be installed in the new state hospital for colored persons to be erected by the State Hospital Commission, Annapolis, on a site near Baltimore, to cost about $500,000.

BALTIMORE, MD.—The Baltimore Car & Foundry Company has filed plans for a new power house at its plant at Curtis Avenue and Locust Street, Curtis Bay (Baltimore P. O.), to cost about $20,000.

BALTIMORE, MD.—The Coca-Cola Company, Pratt and Concord Streets, contemplates the establishment of a power plant for factory service in connection with its proposed new plant at Fort Avenue.

BALTIMORE, MD.—The Northern Maryland Electric Company recently organized as a subsidiary of the Consolidated Gas, Electric Light & Power Company, Lexington Building, has applied to the Public Service Commission for permission to issue $86,000 in securities, the proceeds to be used for extensions and betterments to its plant in the vicinity of Clark's Ferry. Plans include the installation of new overhead and underground lines, the erection of a new transmission line from Sylmar to Rising Sun and the connection of its Sylmar lines to existing utility systems in the Oxford section.

North Central States

CHEBOYGAN, MICH.—The city officials contemplate the installation of a pumping and power unit for the water-works to cost about $72,000.

DETROIT, MICH.—The Board of Education, 50 Broadway, will receive bids until Dec. 21 for the erection of a technical high school to cost about $2,500,000. Electric light equipment and power equipment for shops will be installed.

DETROIT, MICH.—The Detroit Packing Company, 40 Bushey Street, contemplates the establishment of a power plant in connection with its proposed packing plant to be erected at a cost of about $1,000,000. The Packers' Architectural & Engineering Company, Manhattan Building, Chicago, Ill., is architect and engineer.

IRONWOOD, MICH.—According to the officials of the Ironwood & Bessemer Railway & Light Company, the erection of a power plant on the Flambeau River to generate 20,000 hp. is contemplated at a cost of about $3,999,000.

OAKWOOD, MICH.—The Detroit Rock Salt Company contemplates the erection of a 38-ft. x 45-ft. boiler house and power plant.

CLEVELAND, OHIO.—Bids will be received by C. M. Osborn, city manager of East Cleveland (Cleveland P. O.), until Dec. 15 for furnishing about 1,000 electric light poles and electric wire.

MURRAY, KY.—The power plant of the Murray Light & Power Company, it is reported, has been destroyed by fire, causing a loss of about $75,000.

TAYLORVILLE, KY.—It is reported that a recent fire destroyed the local power plant owned by M. S. Cheek, also his garage and blacksmith shop, causing a loss of about $15,000.

WAUKEEGAN, ILL.—Contract will soon be awarded by the Victory Memorial Hospital, care of Schmidt, Gardner & Mortin, architects, 104 South Michigan Street, for the erection of a hospital and power house to cost about $300,000.

LA CROSSE, WIS.—The Wisconsin-Minnesota Light & Power Company, 120 North Fifth Street, contemplates the erection of a 10,000-kw. steam power plant to cost about $50,000. Plans also include the extension of electric lines to Hokah, Minn., and Sparta, Wis. F. G. Felton is manager.

DULUTH, MINN.—The Great Northern Power Company, Superior Street and Fifth Avenue, West, is having preliminary surveys and plans made for the construction of a power plant on the St. Louis River to cost between $1,000,000 and $2,000,000.

KIRKMAN, IOWA.—At a recent election bonds to the amount of $6,000 were carried for an electric light system. E. B. Tucker is city clerk.

MOUNT VERNON, MO.—The Lawrence County Water, Light & Cold Storage Company, Aurora, is negotiating for the purchase of a municipally owned water and light plant at this place. The company is also contemplating the installation of a lighting system at Crane.

TYNDALL, S. D.—Arrangements have been made for the issue of $50,000 in bonds for the erection of an electric light plant.

Southern States

SCOTLAND NECK, N. C.—The city officials contemplate the installation of a new electric light system to cost about $50,000.

SPRUCE PINE, N. C.—Col. D. W. Adams, Old Fort, is promoting a hydro-electric project to be developed on the Toe River near this place at a cost of several hundred thousand dollars.

WILMINGTON, N. C.—It is reported that a recent fire damaged the power plant and other departments of the Widemer Lumber Company, causing a loss of about $100,000.

MONTGOMERY, ALA.—The State Public Service Commission has granted a writ of convenience to the Alabama Power Company, Birmingham, for the construction of a hydro-electric plant and dam near Lock 12 on the Coosa River.

McCOMB, MISS.—A special election will be held on Dec. 2 for the purpose of submitting to the voters a proposition to issue $200,000 bonds for the erection of an electric light and power plant.

PASCAGOULA, MISS.—The Navy Department, Washington, D. C., contemplates the extension of the naval reservation at this place. Plans include the erection of a 40-ft. x 80-ft. power house and several other buildings.

DALLAS, TEX.—The officials of the city and county of Dallas contemplate the erection of a hospital to cost about $450,000. Plans include installation of X-ray equipment.

EL PASO, TEX.—The El Paso Electric Railway contemplates the expenditure of $1,029,000 for extensions and improvements as follows: Installation of a 7,500-kw. turbine for power plant $785,000; short-line extension, $60,000; high-tension buses and switches, $10,000; additional high-tension transformers, $30,000; miscellaneous power-plant items, $3,700, etc.

PORT ARTHUR, TEX.—Bids will be received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Dec. 15 for the erection of a 14-ft. x 39-ft. radio building at this place.

Pacific and Mountain States

SAN FRANCISCO, CAL.—The Electro Metals Company, 729 Call Building, has applied for permission to divert 300 sec.-ft. of water from Salmon River for power purposes. Plans include the erection of a power house, dams, etc. W. G. Devereaux is president.

SAN FRANCISCO, CAL.—J. G. Van Zandt, care of W. L. Huber, First National Bank Building, has applied for permission to develop a power project on Bear and Santa Anna Creeks.

SAN FRANCISCO, CAL.—The Snow Mountain & Power Company, care of Pillsbury, Madison & Sutro, Standard Oil Building, has applied for permission to erect dams, transmission lines, install conduits, etc.

STOCKTON, CAL.—The Western States Gas & Electric Company has applied for right-of-way for the erection of transmission lines and permission to enlarge the American River conduit. H. M. Byllesby & Company, are engineers.

WILLIAMS, CAL.—R. G. McDonald has applied for permission to erect two power houses, transmission lines, etc., at Convict Creek, for mining and pumping purposes.

FORT KLAMATH, ORE.—Application has been made by the Fort Klamath Meadows Company for permission to appropriate water from Anna Creek for power purposes. Plans include the installation of a Pelton turbine waterwheel and a dynamo. The cost of the installation is estimated at $50,000.

FILLMORE, UTAH.—The Telluride Power Company, 415 Walker Bank Building, Salt Lake City, has plans under way for the extension of its power line for pumping purposes from this place through the artesian-well belt, McCormack and other adjoining towns.

NEPHI, UTAH.—The Big Springs Electric Company, Fountain Green, is negotiating with the town officials of Levan for the extension of the company's lines down the Nephi canyon to that place.

PROVO, UTAH.—F. W. C. Hathenbruck has filed application with the State Engineer for permission to divert 6 sec.-ft. of water from the subsoil flow in Slate Canyon to operate a 300-hp. hydro-electric plant for mining purposes at this place.

HAXTUN, COL.—The city officials have plans under way for the erection of an extensive addition to the light and power plant.

Canada

ROLAND, MAN.—A bylaw was recently passed authorizing the extension of the provincial hydro-electric power system to this place. J. M. Leamy, Winnipeg, is power commissioner.

LONDON, ONT.—The Utilities Commissioners will have plans prepared for the erection of a substation on Cabell Street to cost about $85,000. Plans include the installation of transformers, generators, switches, etc. E. V. Buchanan, Hydro officer, is engineer.

MONTREAL, QUE.—The governors of McGill University, Sherbrooke Street, West, contemplate extensions to the mining and electrical building to cost about $500,000.

Record of Electrical Patents

Notes on United States Patents

(Issued Nov. 16, 1920)

14,984 (reissue). Electric Battery; Harry F. French, Fremont, Ohio. App. filed May 13, 1919. Elements kept separated until put into action.

1,358,691. Commutator Cylinder; Vero M. Allen, Cantley, England. App. filed Nov. 1, 1917. Large number of bars in cylinder of given diameter.

1,358,701. Protective Means for Contact Terminals; Clarence A. Boddie, Pittsburgh, Pa. App. filed Nov. 9, 1918. For a voltage regulator.

1,358,704. Control System; Andrew H. Candee, Pittsburgh, Pa. App. filed May 2, 1917. Electric railway vehicle.

1,358,713. Automatically Controlled Vapor-Converter Substation; Edward P. Dillon, Wilkinsburg, Pa. App. filed Sept. 9, 1916. Controlled by clock.

1,358,717. Flashlight Battery; Nathaniel D. Forbes, West Haven, Conn. App. filed April 13, 1920. Cells in case.

1,358,718. Electrical Protective Device; Charles Le G. Fortescue, Pittsburgh, Pa. App. filed Oct. 6, 1916. Prevents damage by high temperature.

1,358,720. Signal System and Apparatus; Herbert M. Friendly, Portland, Ore. App. filed Nov. 23, 1915. Telephone.

1,358,781. Branch Connector for Electric Conductor; William A. Harvey, Scranton, Pa. App. filed Feb. 25, 1918. Replaces spliced joint.

1,358,735. System of Control; Rudolf E. Hellmund, Swissvale, Pa. App. filed April 18, 1917. Several motors on one load.

1,358,736. Commutator Cylinder; Rudolf E. Hellmund, Swissvale, Pa. App. filed Sept. 10, 1917. Means for connecting conductors to bars.

1,358,737. System of Control; Rudolf E. Hellmund, Swissvale, Pa. App. filed Oct. 24, 1916. Railway vehicle.

1,358,738. System of Control; Rudolf E. Hellmund, Swissvale, Pa. App. filed Oct. 24, 1916. Regenerative.

1,358,758. Telephone Trunk Circuits; George W. Kuhn, Brooklyn, N. Y. App. filed July 12, 1917. For testing.

1,358,769. Control Apparatus; Paul L. Mardis, Altoona, Pa. App. filed June 4, 1915. Prevents abuse of motor.

1,258,790. Control System for Ventilating Apparatus; Wirt S. Scott, Edgewood Park, Pa. App. filed May 23, 1919. For enameling ovens.

1,358,809. Dynamo-Electric Machine; Charles E. Wilson, Wilkinsburg, Pa. App. filed May 4, 1916. Poles bolted on.

1,358,811. Adjustable Cluster for Electric Light Fixture; Lauritz W. Anderson, Waterbury, Conn. App. filed April 25, 1918. For table lamps.

1,358,839. Battery Hand Lamp; George D. Gallagher, Washington, D. C. App. filed June 8, 1920. Flashlight.

1,358,858. Diaphragm for Electrolytic Cells; Milo W. Krejci, Chicago, Ill. App. filed Jan. 16, 1920. Compressed vitrified filaments.

1,358,896. Recording Device; Charles B. Thwing, Philadelphia, Pa. App. filed Nov. 30, 1918. For insuring return of needle of recording galvanometer to zero.

1,358,900. Automatic Heater and Holder-on for Rivets for Riveting Purposes; John C. Van Haagen, Philadelphia, Pa. App. filed Dec. 17, 1919. Rivets in magazine heated singly just before driving.

1,358,901. Electrical System; Thomas W. Varley, New York, N. Y. App. filed Aug. 9, 1916. Engine ignition.

1,358,945. Measured-Service Telepone System; John Erickson, Chicago, Ill. App. filed Sept. 18, 1918. Coin box.

1,358,963. Shoe Form; Patrick J. McGrath, Brooklyn, N. Y. App. filed Feb. 24, 1920. Electrically heated for drying.

1,358,982. Automatic Heater for Water and Other Liquids; Antonio Papini, Philadelphia, Pa. App. filed April 26, 1920. Carbon cylinders in series with heating coil.

1,358,992. Apparatus for Rectifying High-Tension Alternating Currents; Walter A. Schmidt, Los Angeles, Cal. App. filed June 22, 1916. For precipitation of suspended particles.

1,359,000. Evaporizer; Carl L. Stottmeister, New York, N. Y. App. filed Dec. 18, 1919. For perfumes, medicine, etc.

1,359,001. Method of Manufacturing Electrically Welded Tubing; Richard Stresau, Wauwatosa, Wis. App. filed July 17, 1920. From sheet metal.

1,359,002. Electrolytic Cell; Bruno Thomas, Seattle, Wash. App. filed June 10, 1918. Construction allows continuous action.

1,359,023. Call Box; Samuel R. Boone, Baltimore, Md. App. filed July 2, 1919. For bank tellers, etc.

1,359,061. Telephone Receiver; Erich Hausdorf, Berlin, Germany. App. filed Nov. 7, 1919. Placed on the ear, not held.

1,359,067. Arrangement of Electric Furnace Electrodes; Thorleif M. Hvidsten and Arne H. Ingelsrud, Christiania, Norway. App. filed March 19, 1919. Three-phase arc.

1,359,134. Stem and Mount for Incandescent-Lamp Filaments; Miner P. Wetmore, Newark, N. J. App. filed July 18, 1918. For automobile headlamps and gas-filled lamps.

1,359,143. Generator Disconnector Box; John A. Amos, Chicago, Ill. App. filed June 27, 1918. Railway.

1,359,171. Electric Attachment Plug; Max Herskovitz, Chicago, Ill. App. filed Jan. 11, 1918. Not disassembled when connecting wires.

1,359,199. Machine and Method for Electric Heating for Upsetting and Forming; Ernest Riemenschneider, Highland Park, Mich. App. filed June 7, 1920. Heat only where needed.

1,359,201. Dry Battery; William H. Sheahan, Philadelphia, Pa. App. filed Dec. 13 1918. Not subject to deterioration during non-use.

1,359,211. Process of and Apparatus for Producing Phosphoric Acid and Compounds of the Same; Frank S. Washburn, Rye, N. Y. App. filed April 21, 1919. Utilizing gaseous products from electric furnace.

1,359,222. Current Interrupter for Electric Circuits; Charles E. Bennett, Atlanta, Ga. App. filed May 19, 1919. Gap for lightning arrester.

1,359,259. Electric Storage Battery; Matthew Lechner, New York, N. Y. App. filed July 29, 1918. Supports for plates.

1,359,273. Electroplating Apparatus; Forrest G. Purinton, Waterbury, Conn. App. filed Feb. 25, 1920. Plating barrel.

1,359,274. Electric Sign; William Recke, New York, N. Y. App. filed Oct. 30, 1916. Face of many changeable elements.

1,359,275. Electric Stove; William P. Robertson, New York, N. Y. App. filed July 5, 1918. Folded into compact form.

1,359,280. Detachable Connector; Edward Schwartz, New York, N. Y. App. filed Oct. 10, 1918. Connects cable ends.

1,359,300. X-Ray Tube; Edmund Wander, Chicago, Ill. App. filed July 21, 1919. Heating unit and regulator.

1,359,310. Detector Condenser; John J. Aurynger, Brooklyn, N. Y. App. filed June 24, 1918. Radio receiver.

1,359,369. Electric Cigar-Lighter Tip; Franklin H. Hart, New Haven, Conn. App. filed Jan. 15, 1920. Heated coil in screw plug.

1,359,390. Electric Percolator; Frank Kuhn and Jay A. Hand, Detroit, Mich. App. filed Feb. 1918. Used in an ordinary coffeepot.

1,359,400. Electric Heater; Edwin N. Lightfoot, New York, N. Y. App. filed June 22, 1920. Resistor in tubular jacket.

1,359,463. Telegraph Transmitter; Edwin H. Piersen, Topeka, Kan. App. filed June 1, 1915. Movements of keyboard recorded and released later to form characters.

1,359,469. Cigar Lighter; Mathew Spinello, Kansas City, Mo. App. filed March 14, 1919. Electric.

Electrical World

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Fiasco of Government and Municipal Ownership

FOLLOWING close on the great losses which attended the government operation of the railroads come the startling revelations of government inefficiency and profligacy in the administration of the Shipping Board. Here we have another proof of the results of political management of business interests, and there are further revelations to come just as soon as investigators can obtain possession of the records. Less deplorable results were hardly to be expected. In the crisis confronting the country during the war a few enthusiasts succeeded in putting into operation some of their pet theories. It is well that these theories were tried and found wanting at a time when the government could afford the experiment. That the effect of the experiments was not lost was plainly indicated in the November elections. Although on a somewhat smaller scale, the same inefficiency and profligacy which characterized the entrance of the national government into business is reflected in municipal affairs, and those who plead for municipal ownership would do well to read the reports of the Lockwood committee of New York.

Labor Is Not Superior to Economic Forces

LABOR is exhibiting decided signs of returning common sense. The workman is beginning to realize that he must adjust himself to conditions and return once more to a sane basis of living. Significant of this is the day-by-day increase in labor efficiency that is becoming so widespread as to attract frequent notice. The feeling that labor costs were going to mount indefinitely, which was prevalent a few months ago, can and should be replaced by a recognition of the fact that both the business man and the laborer have been attempting the impossible in trying to keep rising prices going indefinitely and that the sooner such recognition arrives and the more positive are the steps to assist in the readjustment the less will be the hardship suffered.

Safety Work of the Power Club

THAT standardization of apparatus in the electrical industry has hardly commenced and may be revised during the next ten years as new physical limitations are discovered by laboratories and further knowledge is forthcoming on insulating materials is the pronouncement of James Burke, president of the Electric Power Club. In the field of commercial electrical standardization in which the Power Club is engaged a vast amount of constructive work has been done. This is not always appreciated, but a consideration of conditions before the Electric Power Club was in existence is convincing evidence of the truth of this statement. Engaged as the club has been on the more intimate details of its work, it has not heretofore been sufficiently aggressive in initiating and developing safety codes, and other organizations, less qualified, have essayed the task. The importance of this work is now realized, and the Power Club, in conference with other interstate organizations, is preparing a number of safety codes dealing with electrical apparatus, feeling that no one is better qualified to originate such work than the designers and inventors of electrical equipment. A certain sense of obligation exists on the part of manufacturers of electrical apparatus to protect customers against innovations which add very little in fact to safety and very much to the cost of electrical apparatus.

Beware of the Pessimist

PROSPERITY in all lines of industry and commerce depends in large measure upon the prosperity of local farming communities. Although crops as a whole have been good this year, with production slightly greater than normal consumption, the farmer finds that he must sell at prices which show little or no profit. The cotton crop will bring to the South $750,000,000 less than last year, while the monetary value of the corn, wheat and oat crops of that section will be less by another $750,000,000. Secretary of Agriculture Meredith has stated that the farmer who was forced to sell his crop in October received a price which was 36 per cent below the prices prevailing when he planted and obligated himself to meet the cost of production. This is the unfortunate reaction that follows times like those just past when the process of deflation is put into effect—the quick passage from one price level to another. Such reductions in revenue from farm products are bound to be reflected by a like reduction in demand for all commodities. Jobbers of electrical goods are affected by this condition, and they are taking close inventories of stocks and preparing for a period of hand-to-mouth buying. Owing to a profitable business during the first half of this year, however, the jobbing interest is still very healthy and will rapidly recover from the present retrenchment as soon as buying revives. This revival is looked for early in the spring, when the returns from the movement of fruits and vegetables from the Southern States and Far West will counteract the present recession in buying. The need for electrical apparatus and supplies cannot long go unfilled, for there is a demand for power by all industries exceeding by far the capacity of all generating plants. Construction programs must be started at an early date. Though at the present time many things seem out of gear, the business of this country is sound financially, commercially and indus-

trially. With the public convinced of this fact business will be revived and things set booming again. This is the time when the optimist can perform a national service by preaching the economics of his industry and thus removing from the minds of both the buyer and the seller, in spots where fear exists, a feeling based upon facts with little real foundation.

Carrying the Convenience-Outlet Idea to Industrial Plants

GIVEN a plant in which the size, number and location of the machines are permanent fixtures, it is comparatively easy to lay out a rather simple wiring at comparatively low cost; but this condition of industrial stability is one which cannot be taken for granted, and provision must be made for changes and growth. It is not at all unusual for variation in design of the product to require re-equipment of part of a plant with machinery adapted to do the new work more cheaply and efficiently than was the old plant. Furthermore, the construction of factories of reinforced concrete or brick and steel and the necessity for flexibility of equipment despite the inflexible structure have made new methods of dealing with the situation imperative. Some of these are set forth in the current issue in an article on the wiring plans adopted in two plants of the General Motors Corporation.

In building these plants it was decided very wisely to put in adequate feeder and panel capacity to within 15 feet or 20 feet of any point on the manufacturing floors where power might be needed, and the engineers therefore set to work to make as simple and "foolproof" a layout as possible which would allow machines to be installed anywhere that might be necessary and to be interchanged in the future without the excessive expense of alterations in the general wiring system of a completed building. Starting with a close estimate of the volt-ampere feeder capacity required for the area of the manufacturing floors, the installation was planned to allow an ultimate connected load varying from 1 hp. for each 73 square feet up to 1 hp. for 4 square feet, all with an assumed load factor of 50 per cent. The source of the supply in both cases is three-phase primary power from central-station service, and the primary voltage is in every case brought as close as possible to the center of distribution.

The power-distributing panels are 30 to 40 feet apart and the feeders which run across the shop to the distribution panels are of uniform size of conductor, for it was found actually cheaper to continue the full size to the end of the run than to cut and splice. These cross-circuits cover from three to six distribution panels each, and each panel is planned to supply from eight to fourteen circuits to motors of various sizes up to 50 hp. As a general policy the circuit for each motor is carried in a separate conduit, thereby making it extremely easy to shift locations without disturbing anything except the leads to the machines concerned. Tables and diagrams give the details of these very interesting installations. They are capital examples of the change of practice that has come about from the intelligent study of the actual conditions in the latest types of motor-driven plants.

The principles involved should be studied by every industrial plant if the expense of adapting distribution circuits to changed processes is to be eliminated.

Insulating Lines of Extra-High Voltage

MEANS of grading the capacity of suspension insulator strings for high-tension transmission lines are of great importance in view of the rapid rise in operating voltages on long lines. Of the methods of grading, as brought out in the second of F. W. Peek, Jr.'s, articles on transmission line insulation, the use of the arcing shield at the line end of the spring for eliminating the capacity to ground is of special interest. This device, on the ground side of an insulator, has been known for a number of years, but it now takes on a new importance as being perhaps the simplest and most effective means of reducing the capacity current, and so the voltage, over the units nearest the line conductor.

An interesting curve is given showing the average practice of a number of successful operating lines in the matter of the so-called "factor of safety," this factor being the ratio of spark-over to operating voltage of an insulator. These curves show the decreasing values of this factor for increasing operating voltages, minimum values of three and two for the dry and wet spark-overs being standard in the higher ranges. The explanation of these low values is stated to lie in the fact that the higher the operating voltage the lower the excess of the average lightning disturbance over the operating voltage. It has often been stated that a further probable cause for the greater immunity of high-voltage lines is to be found in the relief offered by corona discharge accompanying abnormal rises of voltage due to lightning or other cause.

In the matter of factory tests of insulators a voltage test of short duration and normal frequency, together with mechanical tests to destruction, every day, will afford the most reliable indications of the run of the factory output. High frequency and prolonged voltage tests are apt to strain the product. There is no known electrical test that will anticipate a crack due to expansion or indicate porous porcelain. These properties can be determined only by breaking the unit.

Obtaining Maximum Accuracy in the Calculation of Run-Off

NOT infrequently it happens in somewhat undeveloped sections of the country that rainfall records are not available and that consequently it is difficult to obtain some of the necessary data regarding the hydraulic possibilities of a stream. A brief article in this issue by E. J. Crawford gives some very useful suggestions as to methods of working out the problem from correlated obtainable data. The particular undertaking was the estimation of the run-off of the north fork of King's River in the territory of the St. Joaquin Light & Power Corporation. The method of estimation, which seems entirely sound, was to obtain the value for the run-off of other parts of the same general watershed and then to apply a correction for altitude based on the best available figures. Nine year's records for the general watershed of which the required one was a part gave a pretty good reckoning of the average monthly run-off per square mile. The novel feature of the estimate was the method of working out the problem from correlated areas as before. The correction factor was for the increase of run-off with altitude, including a further correction for May and June, the maximum months where high altitudes are concerned. In this way a run-

off estimate has been made for the stream in hand which checks well with the probable data established in the general territory. The altitude correction, quite unfamiliar in the eastern part of the country, rises to considerable importance where the flow results from the melting of mountain snows accumulated at varying heights. The application of the correction thus derived makes a considerable change in the final results and in all probability a great improvement in the precision of the estimate.

Brightness and Allied Considerations

FROM a practical viewpoint illumination is dealt with as a certain flux of radiant energy of which each component, according to wave length, has its own stimulus value for the normal eye. The integral of these stimulus values defines the total value of the luminous sensation. If the original radiation is received on some, let us say, colored object, then its effect must be again integrated to obtain a proper measure of the sensation of brightness and color which the eye will receive. If all eyes were alike, which they are not, and were also free from the subjective impressions which lie back of the retina itself, one could pass without any great difficulty from the energy radiated at the source to the sensation registered in the brain, and a good many of our problems would be somewhat simplified. But the eye physiologically, and the brain behind it, play queer tricks, as when the perception registers bluish for a nearby mercury lamp and yellow-white for a tungsten, only to change suddenly to bright green and red when the two are brought into juxtaposition. Likewise the eye forms very different judgments regarding the same quantity of radiant flux received from a considerable area or from a point source. By point source we do not mean here the mathematical point—for whether there be such a thing or not, and whether it could radiate if it could be, is not a matter of the slightest consequence—but rather the physical point, which may be defined as a region subtending an angle so small that its cosine is sensibly unity for the problem under consideration, whether the actual dimensions are measured in microns or miles.

From the engineering standpoint the vital thing is to get the simplest and easiest direct linkage between the radiant energy and sensation within the best available limits of precision. How difficult this is with the ordinary instruments of photometry every experienced observer realizes. In a recent paper read before the Illuminating Engineering Society Bassett Jones has done a useful thing in emphasizing some intricacies of the situation by the better appreciation of which we may finally be led along the path of process. Looking at the whole matter of correlation between the physical and physiological from a purely practical standpoint, further investigation and elaboration of the methods of physical photometry seem extremely desirable. Could the photoelectric cell, say in the cæsium form which is sensitive in the middle of the spectrum, be reduced to a convenient portable form a great many existing difficulties would be put out of the way. Those left outstanding would be quantities of the second order, like ordinary individual differences in color perception, personal differences in adaptation, and in general brightness sensibility—values which probably must be obtained by general average, since like all small residuals they are very difficult to evaluate or eliminate.

Rational Tendencies in Power-Plant Design

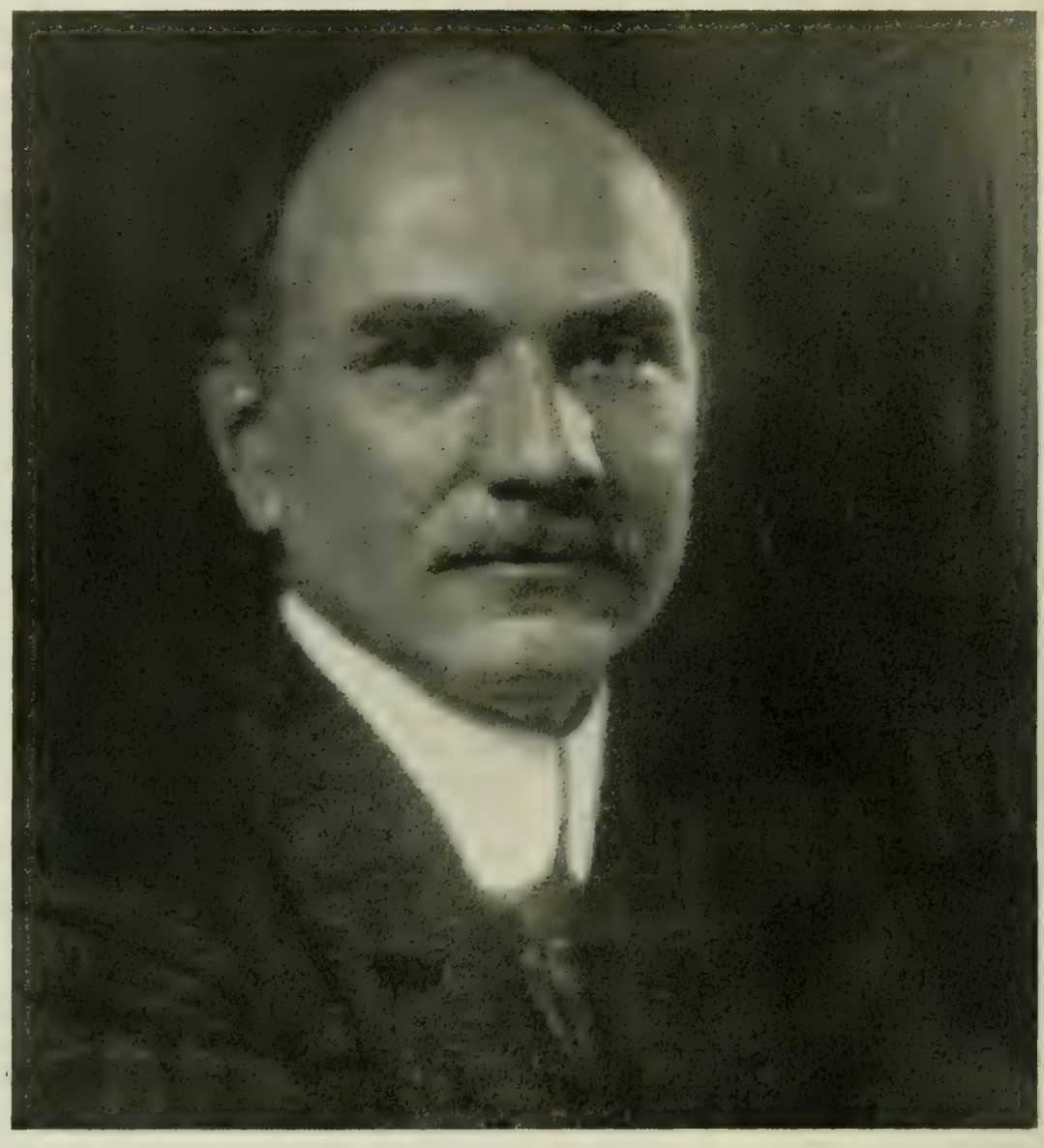
THE great increase in the size of generating units in modern power plants and the custom of interconnection are two very important factors in the electrical design of power stations. Ten or fifteen years ago there was a conventional type of design generally followed which consisted in providing a row of similar generators, a sufficient quantity of transformers and ingenious wiring plans whereby any one of the generators might be connected to any one of the transformers. The whole design seemed to be subordinated to the installation of as much busbar copper and as many switches as the finances of the company would allow. Such catalog engineering has been criticised by us for the past decade, so that it is a particular pleasure to describe in the current issue a plant of a very different kind—the Springdale plant of the West Penn Power Company.

This plant serves a distribution network which is fed from two other large plants, so that not only can the service be differentiated as between plant and plant, but the number of units in each bears no relation to individual spare capacity. The three stations are planned in such a manner that in one of them there will be ample reserve capacity in case of need for repairs, and particular attention has been given to precautions service be differentiated as between plant and plant with its two 25,000-kva. turbo-generators, is very sensibly arranged, each unit having its own boilers, auxiliaries and transformers. As the station capacity is increased the same idea may be followed out. This is the plain logic of station design—to consider the generating unit as extending from furnace to lines and then to take every logical precaution to see that the unit is kept in service. Provisions are made for interconnecting when and where it may be necessary, but the plant is built of units, not of permutations and combinations.

The protection of the electrical equipment is exceedingly good. Temperature coils are embedded both in the armatures and in the connected transformers to enable incipient trouble to be quickly detected, and each generator is piped for live steam so that a fire, if it should occur, may be quickly smothered. The chief units, including transformers, are protected by balancing relays; thus internal failure cannot cause serious damage. If more current flows from one terminal of an armature than from the other, the generator will be cut free from the bus, from its transformers and from the neutral connection. Besides, the ventilating fan will be stopped and the generator field will be opened. Unbalancing current in a main transformer will likewise immediately remove it from circuit.

Another interesting feature of the system as a whole is that the three big units, two at Springdale and one at Windsor, are intended to be operated at full kilowatt capacity, leaving the older Connellsville station to run as a peak-load plant and to take up the wattless kilovolt-amperes of the system. To improve the power factor rate schedules are so planned as to encourage installation of synchronous apparatus in addition to the use of synchronous condensers. The power factor on the entire system is thus brought up to nearly 90 per cent, while the Springdale plant itself can readily be brought to 95 per cent or better.

When the relations of every station to its system receive more consideration than is accorded to the station as a unit, design will be placed on a more logical basis.



Dugald Caleb Jackson

One of the electrical industry's foremost educators and engineers who has an international reputation as a valuation expert

THE responsible positions in the industry held by hundreds of men who received their electrical engineering education under Prof. D. C. Jackson are perhaps the best measure of his contribution to the advancement of the art. This academic year, were it not for the time spent in service in France with the A. E. F., would have marked Professor Jackson's thirtieth consecutive year as an educator. He was called to the University of Wisconsin in 1891 as professor of electrical engineering, and he developed there one of the earliest electrical departments in American universities. His work created such favorable attention that in 1907 he was called to the largest purely engineering school in the United States, the Massachusetts Institute of Technology, to fill the chair of electrical engineering. In the same year he was named head of the Institute's department of electrical engineering. During his entire educational career Professor Jackson has carried on a consulting engineering practice. It has been his belief—and results must certainly have confirmed it—that the head of an engineering department in a university must be active professionally.

By 1902 his consulting practice had grown so large that he formed a partnership with his brother under the firm name of D. C. & Wm. B. Jackson. This partnership was dissolved during the war in order to permit the members of the firm to enter the national service. About a year ago he and Edward L. Moreland established a partnership in Boston to conduct a consulting engineering business. In his consulting practice Professor Jackson has built for himself the reputation of being one of the foremost valuation engineers among the electrical body of the country. In fact, in 1911 he was retained by the British government as adviser in connection with the valuation of the national telephone system which that government had arranged to purchase.

Professor Jackson is a native of Kennett Square, Pa. In 1885, at the age of twenty, he was graduated from Pennsylvania State College in civil engineering. The two following years were spent at Cornell University, one as fellow in electrical engineering and the other as instructor in physics. Then, with J. G. White, now president of the international engineering organization of J. G. White & Company, Inc., and Prof. Harris J. Ryan, he formed at Lincoln, Neb., the Western Engineering Company, which built a great many, and at that time large, electric railway systems in the Middle West. When, two years later, this company was absorbed by the Edison interests, he became assistant chief engineer of the Sprague Electric Railway & Motor Company, and later he was made chief engineer of the central district of the Edison General Electric Company.

Besides being a member of a number of national engineering societies, Professor Jackson enjoys the honor of being a past-president of the American Institute of Electrical Engineers. He has written several textbooks upon electrical engineering topics, besides making many smaller contributions to the literature of the industry.

He went to France with a major's commission and was there charged with the duty of co-ordinating the electric service supply for American army activities. After the armistice his ability as a valuation expert was drawn upon in the determination of the money value of damage to physical property in the invaded area. A short time before his discharge he was promoted to a lieutenant-colonelcy in the Engineering Corps.

Transmission-Line Insulation in America

Practical Devices for Making Suspension Insulator Strings Suitable for Lines of Extra High Voltage Why Factor of Safety Is Higher for Low-Voltage Insulators and Bushings Than for High Voltage

By F. W. PEEK, JR.
Consulting Engineer General Electric Company, Pittsfield, Mass.

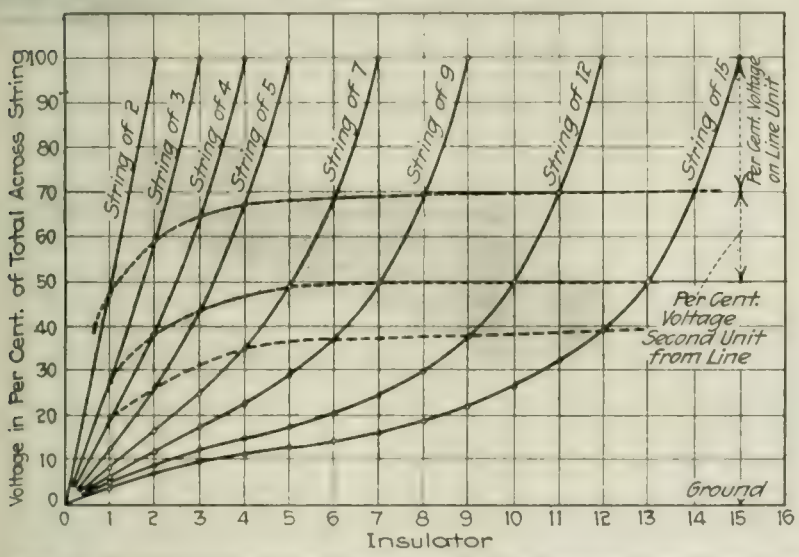
A FULL discussion of the factors affecting spark-over and puncture voltages of line insulators and bushings, together with an analysis of experience with porcelain insulators and tests for predicting their characteristics, was given by the writer in the Nov. 27 issue of the ELECTRICAL WORLD. The treatment is now extended to cover methods of controlling the voltage gradient of suspension insulator strings for lines of extra high voltage and the development of safety factors for insulators and bushings for low and high voltage. Curves are given showing an average of factors of safety for insulators as used on operating lines. The selection of insulators for any specific duty is also taken up.

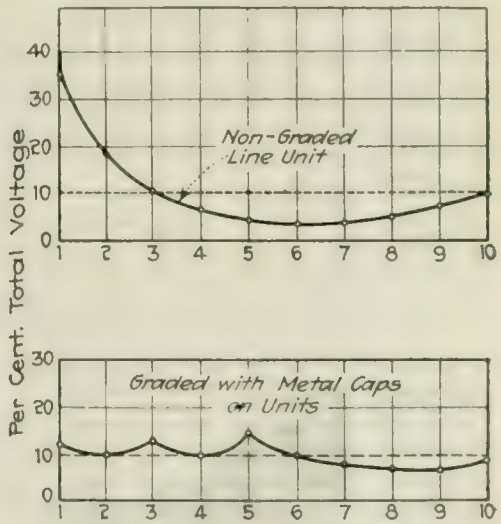
The characteristics so far discussed apply equally well to either high-voltage or low-voltage lines. There are, however, certain factors unimportant at the lower voltages which become of increasing importance as the voltage is increased to 154 kv. and above.

It has long been known that when insulators are placed in series in a string the spark-over voltage is not the sum of the spark-over voltages of the individual units, but less. This is due to the uneven division of voltage on the different units. A very high percentage is across the unit nearest the line. Typical curves are given in Fig. 9. Fig. 10 shows the percentage of the total voltage across each unit of a string of ten. Even distribution would put 10 per cent on each unit, as indicated by the dotted line. It will be noted on examination of Fig. 9 that for strings over five units in length there is always about 30 per cent of the total voltage across the insulator nearest the line. This will vary from 20 to 30 per cent with different types of insulators and with different hardware on the same type. The importance of a consideration of this factor at the higher voltages is at once seen since the maximum unit stress increases directly with the voltage. At 110 kv. the operating stress on the line unit is 19 kv.; at 220 kv. it is 38 kv., which is higher than is desirable. It is desirable to lower the operating stress on the units near the line.

The reason for the uneven distribution is shown graphically in Fig. 12. There are a number of ways that this may be corrected. Fig. 11 shows corrected distribution by varying the capacities of the units along the string in proportion to the currents. Fig. 14 illustrates one method of doing this.

Fig. 16 shows a means of distributing the voltage by the shield in Fig. 15. The shield, in effect, eliminates the capacity to ground. It has the advantage over other methods in that all of the insulators in the string are the same; it eliminates corona and acts as an arcing horn. By means of the shield unit stresses on 220-kv. lines are readily reduced below those at present existing on successful 110-kv. lines.





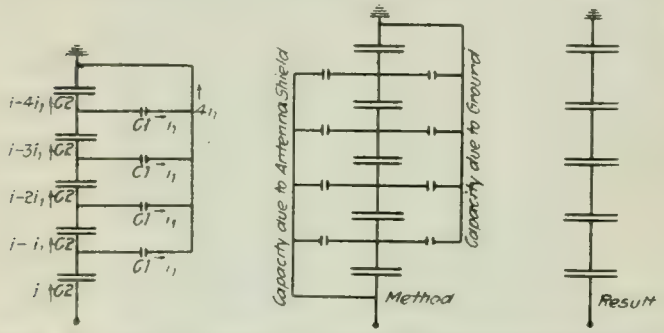
FIGS. 9, 10 AND 11—VOLTAGE DISTRIBUTION ON SUSPENSION INSULATOR STRINGS; EFFECT OF GRADING SUSPENSION STRINGS

An insulator or bushing is generally so selected that the wet and dry spark-over voltages at normal frequency are several times the operating voltage. The ratio of the spark-over voltage to the operating voltage is called the "factor of safety." It is interesting to study the "factors of safety" that are used on successful operating lines. It is convenient to divide this study into three parts, the pin-type insulator, the suspension insulator and the switch and transformer bushing. The pin-type insulator was the first used. As trouble arose weaker types and designs were replaced by stronger ones until satisfactory service was established. In this connection it must be remembered that the pin-type unit was generally used on wooden poles. The suspension insulator was generally used on steel towers and on larger systems where greater reliability was often demanded. There have also been various factors besides spark-over voltages that have determined the size of the insulator or number of units. For instance,

because of the mechanical deterioration of some porcelain there has been a tendency to add more units than are necessary when in good condition.

While the insulator practice has more or less grown up and been established by necessity, the bushing practice has probably been more systematically determined. Bushings in various parts of the country were studied and the ratio was found that gave practically no trouble.

A study of the ratio established by practice is the best guide in selecting insulation for the average line. Fig. 17 shows the ratio of spark-over to line-to-line operating voltage for pin insulators, suspension insulators and bushings respectively. The curves in Fig. 17 represent average operating factors of safety and up to 154 kv. were drawn from data compiled from over fifty transmission systems operating under widely different conditions. Up to 154 kv. these curves may, therefore, be termed "experience curves." Beyond 154 kv. the curves have been exterpolated. Fig. 18 shows the ratio-voltage characteristics of the pin-type insulator. The minimum dry spark-over voltage is 40 kv., the minimum wet spark-over voltage is 15 kv.



FIGS. 12 AND 13—CAUSE OF UNEVEN VOLTAGE DISTRIBUTION; SHIELDING REDUCES EFFECT OF CAPACITY TO GROUND

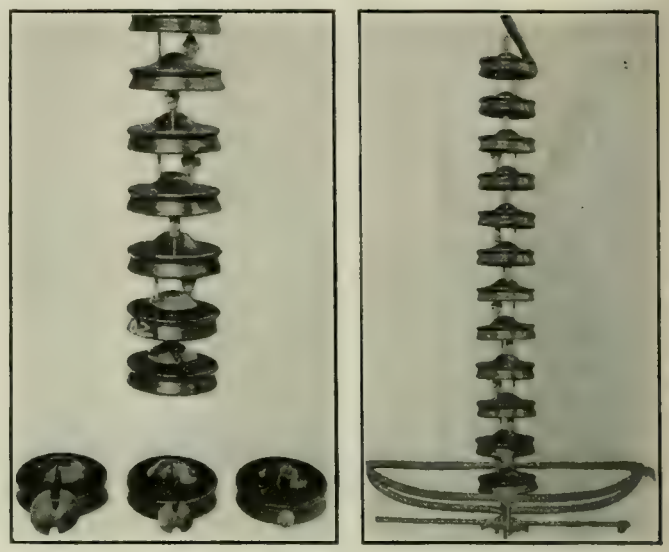
It will be noted that the general characteristics are the same. The ratio is quite high at the lower voltages. It approaches a minimum of three for dry spark-over voltages and two for wet or rain spark-over voltages. The suspension insulator ratio is generally higher than the bushing ratio. It is considerably higher than the pin-type ratio over the range of overlap.

The characteristics of the curves are logical. The factor of safety should be much higher on the low-voltage lines than on the high-voltage lines. This follows because all lines in a given locality are subjected to virtually the same lightning voltages. Investigations on an idle line in the mountains of Colorado showed that as operating voltages were increased the probable number of induced strokes exceeding the operating voltage decreased. Incidentally this shows that to call the ratio between spark-over and operating voltage a "factor of safety" is a misnomer as far as lightning is concerned. It is, nevertheless, a useful ratio. It has also been found that where there are parallel lines of a high and low voltage—for instance, 110 kv. and 22 kv.—there is much more trouble on the low-voltage line.

A minimum wet spark-over ratio of two at the higher voltages seems logical. Owing to internal disturbances, low-frequency surges of double voltage may appear on the line. The dry spark-over voltage is the controlling factor in external or cloud lightning.

The higher ratio for suspension insulators than for pin-type insulators has probably been due to several factors. The wood pole has been used to a considerable extent with the pin-type insulator. Suspension insulators have been used mostly on steel towers on the larger tors have been used mostly on steel towers on the more important systems where better service is demanded.

The minimum spark-over voltage of Fig. 18 was fixed



FIGS. 14 AND 15—SUSPENSION STRINGS WITH GRADED CAPS OR PLATES; ANTENNA FOR EQUALIZING VOLTAGE

to a great extent by a consideration of mechanical clearance.

It is reasonable that insulator practice should require higher spark-over voltages than bushing practice, since the insulator is subjected to rough usage and is not protected at its terminals by a lightning arrester.

In selecting insulators each case must, of course, be considered separately. It would be reasonable to place less insulation on a grounded-neutral system than on

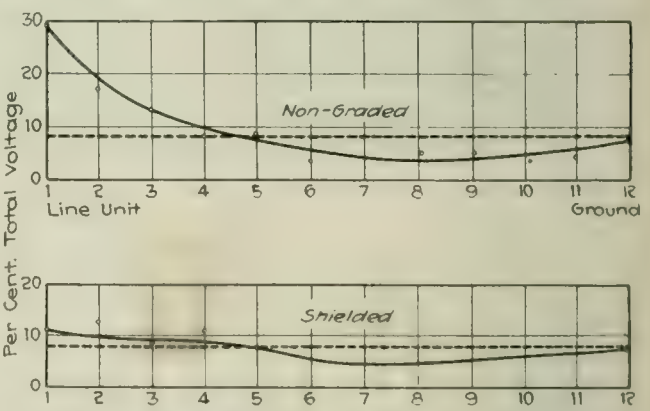


FIG. 16—CORRECTING VOLTAGE DISTRIBUTION BY SHIELDING

an isolated system. This has been amply borne out in practice. High-voltage systems with deteriorated insulators that have become almost inoperative with isolated neutral have been greatly improved by grounding. The question of accumulation of dirt, lightning protection, etc., must also be considered. However, data derived from the experience curves (Fig. 17) are necessary as a guide.

It is convenient to divide tests into design and routine. The object of the design test is to determine the characteristics of a given type or design. The characteristics may be wet and dry spark-over, puncture, impulse ratio, voltage distribution, mechanical strength, etc. These tests should be made under condi-

tions representing practice as nearly as possible and need be made upon only a few units. The object of the routine electrical test is to check the product as it goes through the factory for cracks and flaws in manufacture. Care must be taken not to specify voltages

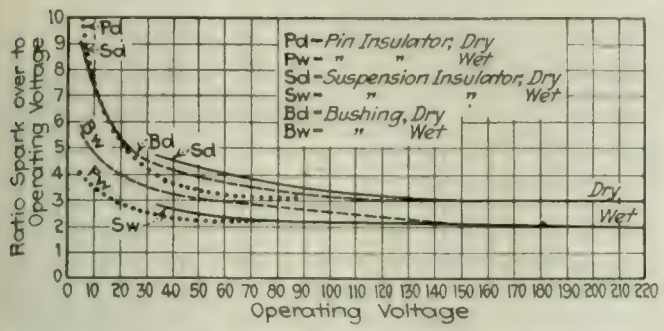


FIG. 17—FACTOR OF SAFETY FOR INSULATORS AND BUSHINGS

so high that damage to the porcelain will result. Nothing is to be gained by long-time tests. Such tests generally mean a loss of time and a deterioration of the material. It is best to make the routine tests at operating frequency, or about 60 cycles, and it is generally safe to apply the spark-over voltage for one minute. If actual spark-over voltage is applied, a series resistance should be used to break the arc at each half cycle and to limit heating. The electrical tests do not tell all that is desired. It is important to know if the product is running mechanically weak or porous. The only sure way of determining this is to test a certain percentage of the product to destruction from day to day and measure the mechanical strength and porosity. The porosity is readily measured by placing pieces in a dye solution under pressure and noting the depth of penetration. In making routine tests it is, of course, desirable to test a number of units or parts at one time. This is generally done in the pin-type insulator by immersing the head for about 2.5 cm. (an inch or so), or over the tie-wire groove, in a shallow tray of water. The pin cavity is then filled with water to cover the threaded portion. Contact is made by dropping wires or chains into the water. A number may be tested at one time. Sixty-cycle voltage is applied to give intermittent arcing. The arc current is limited by a reactance or resistance to prevent heating. Tests on parts are made in a similar way. (See Fig. 19.)

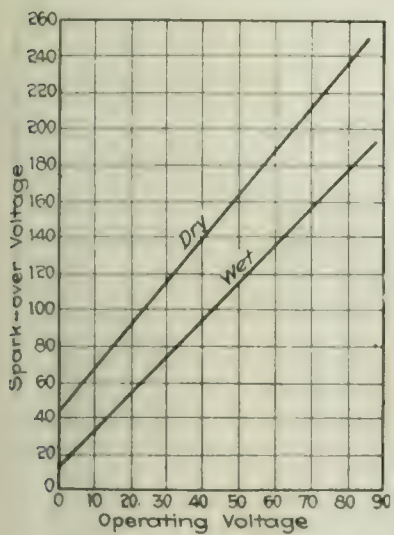


FIG. 18 — SPARK-OVER VOLTAGE AS A FUNCTION OF OPERATING VOLTAGE ON PIN-TYPE INSULATORS

In making rain tests the resistance of the water should be not less than 10,000 ohms per centimeter cube. The spray is generally directed at 45 deg. at the rate of 0.5 cm. (0.2 in.) per minute.

In selecting insulators for a given duty it is seen from what has already been said that the following factors should be considered:

Two insulators or bushings of equal low frequency, or 60-cycle spark-over voltages, may have entirely different lightning spark-over voltages. The design should be such that the lightning spark-over voltage is higher than the normal-frequency spark-over voltage. The lightning spark-over voltage is fortunately the same, wet or dry.

The spark-over voltage at high altitude is lower than at sea level. When insulators and bushings are intended for high altitudes proper allowances should be made. In places where there are long periods of dry weather, dust, salt, etc., may collect on insulators and cause considerable trouble during the first rain, fog or dew deposit. This may be especially serious near the sea or in places where dust is likely to collect. Insulator troubles resulting from the so-called deterioration of porcelain have been due mainly to cracking caused by expansion of metal parts, cement, etc., and to porosity. Selection of tough, non-porous porcelain in a design free from expansion troubles and high local mechanical stress is more important than any other factor. Various types of electrical tests, such as high frequency, etc., that are of interest in development work are of little use as factory or routine tests. There is no known electrical test that will anticipate a crack due to expansion or mechanically weak porcelain or indicate porous porcelain when it is dry. These properties can be determined only by breaking the units.

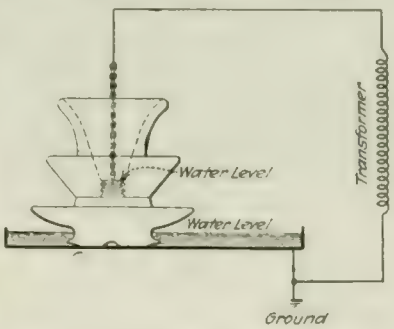


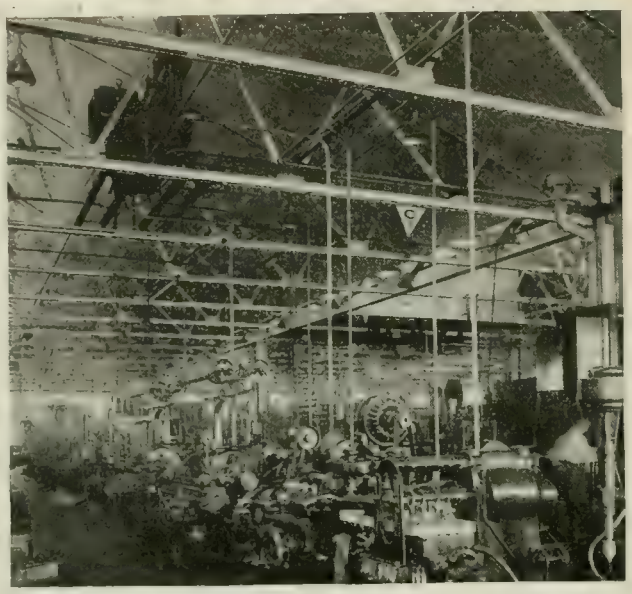
FIG. 19—ROUTINE TEST FOR PIN INSULATORS

It is desirable to have a high ratio of puncture to spark-over. However, it is of little use to have such a ratio if the design is such that a crack is likely to occur. Any insulation is injured if it is electrically overstressed. Over-voltage long-time tests are likely to cause damage without any gain. Injury may be done without external evidence. All such a test shows is that the insulation was good before test was made.

The above applies to all voltages. At the higher voltages, 154 kv. and above, a new problem enters. Owing to the capacities to ground the voltages along the string are not evenly divided. In fact, when there are more than five insulators in a string, 20 to 30 per cent of the voltage is across the insulator nearest the line. The uneven voltage distribution can be corrected by shields. By this means the unit stress can be made as low as on successful lines operating at lower voltages.

It has been shown that it is convenient to divide the tests into design and routine. The object of the routine test is to eliminate any units that have cracks or other flaws of manufacture. The object of the design test is to determine the characteristics of a given type. This test need be made on only a few units. It must be borne in mind that the electrical test does not eliminate porous or mechanically weak porcelain. Such material can only be checked by breaking a certain percentage of the product from day to day.

This article will be concluded in a later issue.



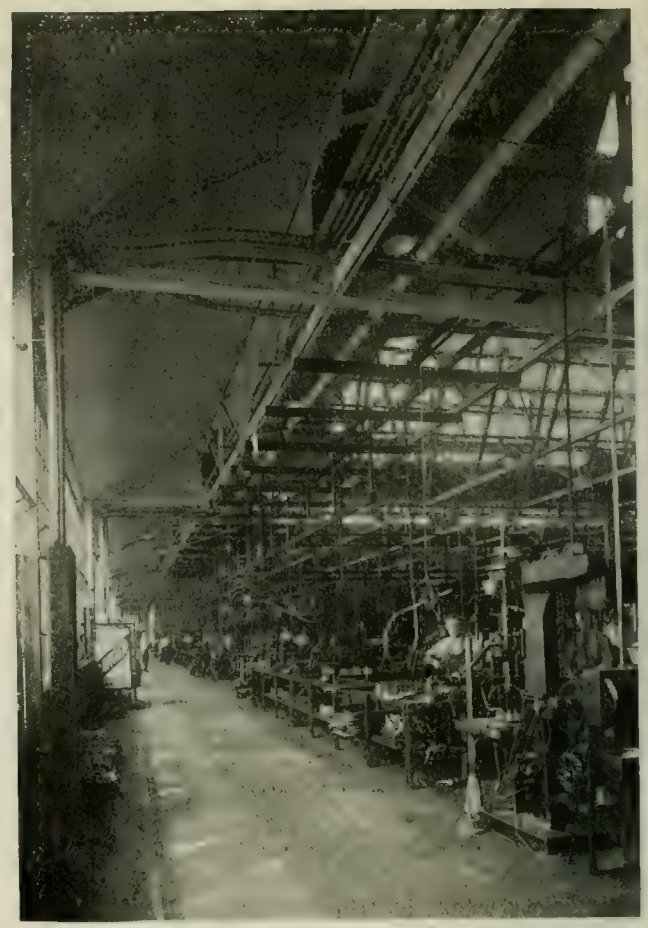
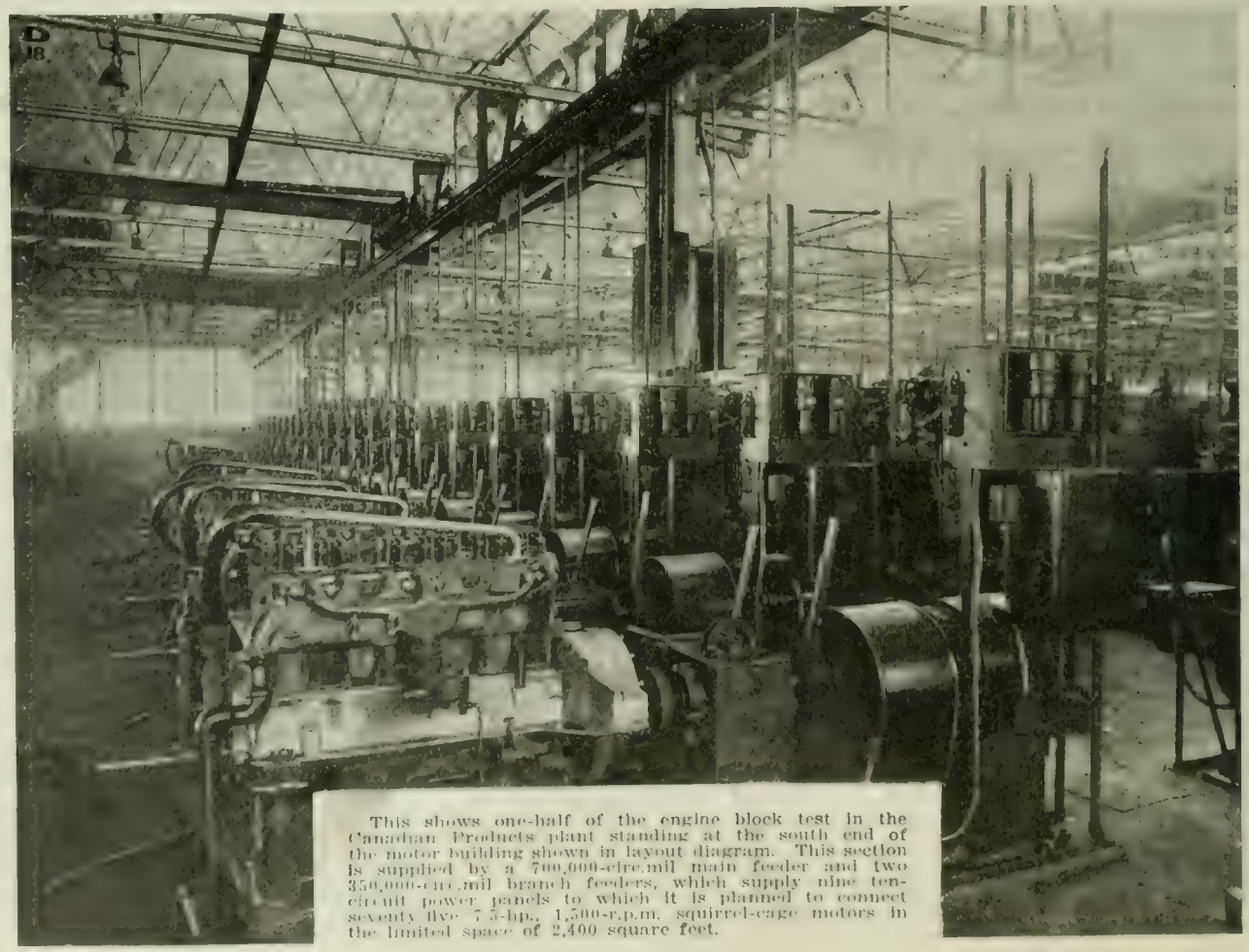


Fig. 1 — Changing Production Requirements Demand Distribution System That Facilitates Motor Relocation.

All circuits and panel boxes in the Canadian Products plant are laid out with a view of making future changes in motor location possible without disturbing other circuits. The motor circuits from the distributing panels to junction boxes in the roof trusses are grouped in large conduits as shown on the right-hand side of the illustration. The individual motor circuit conduits can be seen entering the overhead junction box. In the view at the right is shown the overhead fused junction boxes where the branch feeders are fused into the main feeders, which are controlled by individual oil switches. One of the danger signs, shown on the left of the aisle, is placed on each side of the oil switches.



This shows one-half of the engine block test in the Canadian Products plant standing at the south end of the motor building shown in layout diagram. This section is supplied by a 700,000-circ.mil main feeder and two 350,000-circ.mil branch feeders, which supply nine ten-circuit power panels to which it is planned to connect seventy five 7.5-hp., 1,500-r.p.m. squirrel-cage motors in the limited space of 2,400 square feet.

Making Industrial Distribution Flexible

Feeder Capacity Evenly Distributed—Panelboards Every Thirty or Forty Feet—Motors and Machines Can Be Placed Anywhere and Then Moved at Nominal Expense—First Cost Higher Than Old System, but Ultimate Cost Lower



FIG. 2—CARRYING THE CONVENIENCE OUTLET IDEA OF THE ELECTRIC APPLIANCE TRADE INTO THE DISTRIBUTION LAYOUT OF THE INDUSTRIAL PLANT

This plant of the Central Gear Company has a similar arrangement to that shown in the layout diagram (page 1110) of the Canadian Products Company. Feeders are laid out on a basis of power required per unit of floor space rather than for definite individual machine requirements. Motor panels are spaced uniformly throughout the working floor area.

CHANGES in products and persistent efforts to increase the production of modern factories result in such frequent rearrangement of machines that a system of electrical distribution is needed which, like a modern system of lighting, will be independent of the position or size of the individual machines. Initial expense has been a great detriment to the development of such a flexible system of electric power distribution, but the General Motors Corporation has proved to its own satisfaction that the advantages obtained by installing adequate feeder and panel capacity to within 15 ft. or 20 ft. (4.5 m. or 6 m.) of any point on the actual manufacturing floors more than offset the increased first costs.

The old inflexible method of wiring for a given installation of motors showed less first cost, but the subsequent expense was never ending. Large sums of money were continually being spent for changing or reinforcing the wiring when machines and motors had to be moved or increased in size to conform with changed manufacturing conditions. However, after each expensive change the wiring system was still adaptable only to some one particular set of conditions so that the ultimate cost has been much greater than with the flexible system of electrical power distribution described in this article and installed by the Central Gear Company, Detroit, and the Canadian Products, Ltd., Walkersville, Ont., both of which are owned by the General Motors Corporation.

In designing the wiring of these plants the engineers aimed to produce adequate, simple, "foolproof" layouts which would be flexible enough to permit machines to be placed anywhere on the manufacturing floor and then to be interchanged or moved in the future to any desired location without additional wiring expense except perhaps for a short run from a nearby panelboard.

The installation of well-distributed feeder and distribution panel capacity of a uniform volt-ampere rating per square foot for any one set of operations has made it possible to obtain the desired flexibility in individual-drive motor installations where the motor sizes do not vary between extremely wide limits. The number of volt-amperes in feeder capacity required per square foot will depend upon the manufacturing operations to be performed and the number of machines in a given area, and some of the figures obtained from the plants described in this article are given in Table I.

Power Requirements Figured on Floor Space

Very accurate information is available as to the floor area required by the different machines, and taking the average horsepower as specified by the machine manufacturers it is possible to check the estimated power requirements very closely. There are factors in different types of manufacturing which cause wide variations in the wattage required per square foot, and the figures given in this article are based mainly on the machine

TABLE I ULTIMATE MOTOR AND MAIN FEEDER CAPACITY REQUIRED

	Volt-Amp. of Main Feeder Capacity per Sq.Ft. Floor Space	Sq.Ft. Floor Space per Ultimate Connected Hp.	Sq.Ft., Including Aisles, per Machine	Description of Work
Central Gear Co.	22 6	27 35	130	Making gears for automobiles. Wide aisles between machine tools.
Canadian Products Co...	197 5	4 27	32	Block tests for running in [illegible] 35-hp., six-cylinder, 1,800 r.p.m.
	24 1	34 7	130	Manufacture of automobile engines.
	20 2	31 8	110	[illegible]
	17 5	72 7	204	[illegible]

work required in the manufacture of automobile motors, axles, transmission gear and parts that go with them.

The wiring installations discussed are based on factors varying from an ultimate connected load of 1 hp. for every 4 sq.ft. (3,700 sq.cm.) up to 1 hp. for every 73 sq.ft. (6.8 sq.m.) (see Table I). The average per ultimate connected horsepower in the engine plant is about 32 sq.ft. (3 sq.m.), in the axle plant 73 sq.ft. (6.8 sq.m.), and in the gear plant the average is about 1 hp. for every 27 sq.ft. (2.5 sq.m.). Records seemed to indicate that an individually driven factory in the automobile industry would have a load factor of not more than 40 per cent, but all feeders were based on a load factor of about 50 per cent to take care of additions or the development of improved machinery and to provide for the possible manufacture of small parts which may now be purchased elsewhere, but which may later be manufactured on the same floor with the rest of the parts. The power feeders must be designed with enough margin to allow for great flexibility and large variations in power requirements.

Both factories purchase three-phase primary central-station service which has been brought as close as practicable to the low-voltage motors driving the machines. In the Canadian Products plant the main transformers had to be placed some 600 ft. (180 m.) from the center of distribution, so 550 volts, the highest standard secondary voltage, was chosen for the motors. The service for the Central Gear Company is transformed to 440 volts at three points along one side of the 600-ft. main

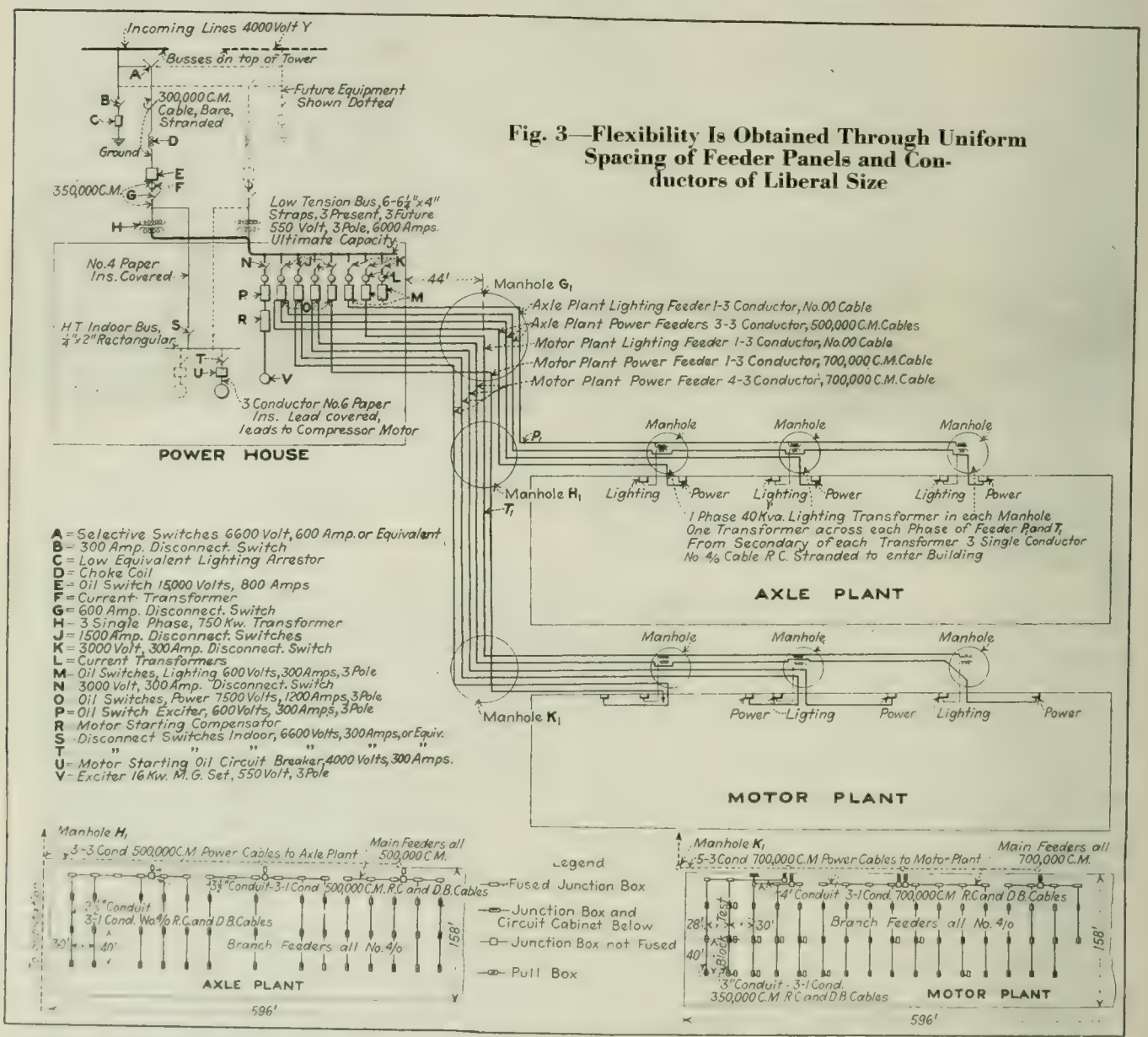


Fig. 3—Flexibility Is Obtained Through Uniform Spacing of Feeder Panels and Conductors of Liberal Size

Outside Distribution.—The incoming 4,000-volt, 25-cycle service is transformed in a 2,250-kva. outdoor substation to 550 volts for general distribution around the plant of the Canadian Products Company. However, a 225-hp. synchronous motor driving an air compressor is supplied with energy at 4,000 volts. All primary connections between the outdoor substation and the combined boiler house and indoor substation and all secondary connections between the different buildings are underground. All power feeders from the so-called power house to manholes and into buildings are three-conductor, 1,000-volt, paper-insulated, lead-covered stranded cables. The 110/220-volt secondaries of the manhole lighting transformers are single-conductor, 600-volt insulations, rubber-covered stranded conductors. All cables between power house and manholes are run in 4-in. fiber ducts; all cables from manholes into buildings are run in 4-in. iron conduit.

Inside Distribution.—This layout was designed on a basis of horsepower requirements per square foot of floor space. This varied from 1 hp. for 4 sq.ft. to 1 hp. for every 73 sq.ft. The two 350,000-circ.mil branch feeders, second from the left-hand end of the motor plant, supply power for testing engines. Branch feeders of the same size were also figured on at the right-hand end of the motor plant to carry the heavy milling machines used in that section, but tests indicate that No. 4/0 is large enough for this service. The main feeders are 500,000 circ.mil in the axle plant and 700,000 circ.mil in the motor plant.

factory building. Here it was possible to cut the distribution losses to a minimum by bringing the primary service so close to the points of application that the center of distribution on the longest secondary feeder is not more than 250 ft. (75 m.) from the transformers. The average secondary run to the motors is only 150 ft. (45 m.). The secondary side of the three banks of transformers may be operated independently or in parallel at will, making it possible to operate the plant from any one group or from any combination of the three groups of transformers.

The factory buildings of both plants are one-story structures with sawtooth-roof construction, brick walls 4 ft. (1.2 m.) high, continuous steel sash and ribbed glass above the brickwork, gypsum roof and maple flooring. The bays are 30 ft. x 40 ft. (9 m. x 12 m.), and on every column there is a power distributing panel which is fed from the side of the building, as may be seen in the layout diagram for the Canadian Products plant.

The sizes of the feeders running across the shops to supply the distribution panels are given in the drawings.

TABLE II ELECTRICAL INSTALLATIONS IN PLANTS HAVING FLEXIBLE POWER DISTRIBUTION AND INDIVIDUAL MOTOR DRIVE

	Central Gear Co	Canadian Products Motor Shop	Canadian Products Axle Shop
Manufacturing floor area, sq. ft.	184,800	81,600	81,600
Total number of motors installed	680	500	282
Number of motors for which installation was planned	1,400	685	400
Total number of power distributing panels	129	65	42
Total branch circuits from panels	1,742	540	336
Total rating of transformers, kva.	*2,250	†2,250	
Hp. of motors connected	3,246	1,875	790
Ultimate possible connected motor load on feeders at 50 per cent load factor, hp.	7,800	4,500	2,430
Total main feeder capacity, amp.	5,500	2,500	1,175
Secondary voltage of motors	440	550	550
Average initial connected hp. per panel	25	28.84	18.81
Motor sizes, hp.	¼ to 5	¼ to 50	¼ to 35

* Power only † Power and light.

It will be noted that the conductors are not diminished in size as it was found cheaper to run the full size throughout than to cut and splice them. The control and protection of these cross-shop power feeders are somewhat different in the two plants. Each cross-shop feeder in the Central Gear plant is a main feeder which comes back to a 300-amp., 440-volt automatic oil switch mounted on the switchboard directly above the nearest group of transformers. In the Canadian Products plant the cross-shop circuits are branch feeders, of which from four to six are tapped off each main feeder, the feeder being controlled by one 600-amp., 550-volt automatic oil switch in the motor shop and by 400-amp. switches in the axle shop. The cross-shop circuits in the Canadian plant, being branch feeders, supply only three distribution panels each, while in the Central Gear plant, where the cross-shop circuits are main feeders, they each supply five or six panels. Consequently about twelve distributing panels are controlled and protected by two secondary oil switches in the gear plant and by one secondary oil switch and four feeder fuses in the Canadian plant. The fuses were used in the Canadian Products plant to cut down installation costs without any sacrifice in flexibility.

The power distribution panels are designed for from eight to fourteen circuits to supply motors of various sizes up to 50 hp. The Gear Company is equipped with standard panels having three vertical busbars to which the individual motor circuits are connected through fuses. The Canadian Products plant has special distributing panels in which each phase is separated from the other two by barriers.

All wiring is in exposed conduit with not more than one individual motor circuit in each pipe as a general rule. However, to reduce the number of conduits the outgoing motor circuits are grouped between the panels and the roof trusses. In the Canadian plant all the motor circuits are taken from the distributing boxes through three conduits to an overhead junction box (as shown in the group of photographs), from which the circuit to each motor is carried in a separate conduit. In the Central Gear plant three motor circuits are taken in one conduit to an overhead condulet and distributed from there in individual pipes. Many of the motors are so close together that more than one circuit could conveniently be carried in a single conduit, but this would defeat the purpose of the installation, which is to make it easy and simple to change the location of any motor without disturbing any other motor or circuit.

The installation of the Canadian Products, Ltd., was designed by L. A. Blackburn of the Du Pont Engineering Company, Detroit, with a view to giving the plant manager a flexible installation and everything necessary to facilitate production for the lowest possible cost. The Central Gear Company's layout was designed by G. Wagschal of Esselstyn, Murphy & Hanford, engineers and architects, of Detroit, under the direction of W. R. Willett, the Gear company's general manager, whose primary consideration was production.

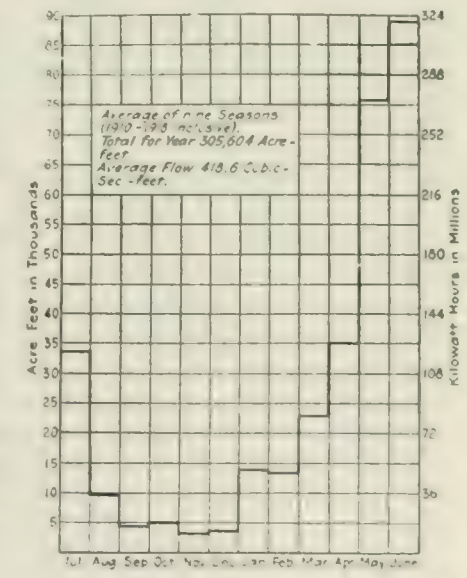
The description of the motor installations in these plants and the reasons for individual motor drive are set forth in the July 24 issue of the ELECTRICAL WORLD.

Calculating Run-Off with No Rainfall Records

Some Fairly Accurate Method of Calculation Is Necessary if Water Power Is to Be Properly Utilized and Continuous Service Assured

BY E. J. CRAWFORD
Assistant General Superintendent San Joaquin Light & Power Corporation

OWING to the inaccessibility of parts of the mountainous regions of the West and the comparatively recent development of the weather service through these districts, it sometimes occurs that a very important drainage area will be entirely without rainfall and run-off statistics. There are no permanent inhabitants of some of these areas who might have casual re-



MONTHLY RUN-OFF AVAILABLE FROM 178 SQ. MILES OF KINGS RIVER WATERSHED ABOVE 5,000-FT. ELEVATION

Total for year was 305,604 acre-feet and average cubic-foot second flow 418.6

ports of winter snowfall, and it becomes necessary to calculate probable run-off from estimates made on the basis of adjacent territory run-off.

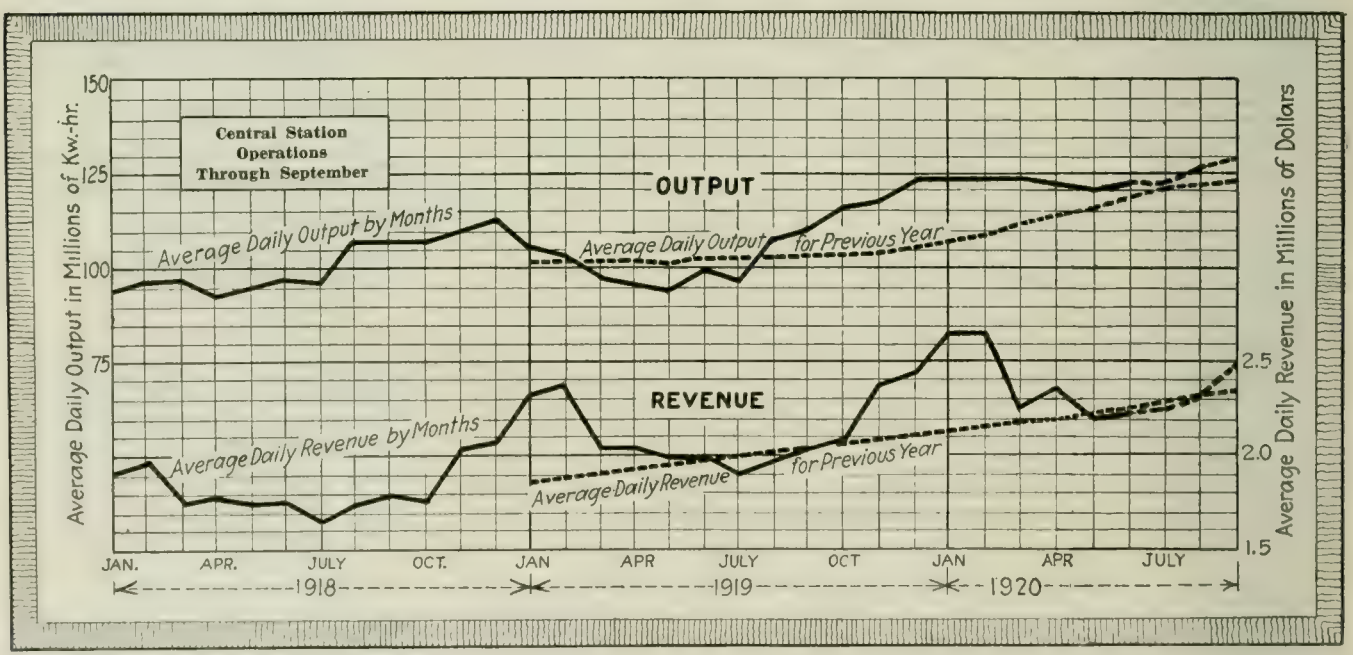
The San Joaquin Light & Power Corporation has faced such difficulties as this in the matter of the watershed back of the North Fork of the Kings River, where it plans to install its next big construction development. The method used in obtaining the desired figures was based on a calculation of unit area run-off secured from figures at hand regarding adjacent areas, as well as records of the total run-off obtainable from the stream flow records of the Kings River where it enters the valley.

It was possible to obtain complete records from 1910 to date for the adjacent watershed of Big Creek, as well as records to date covering the run-off data for the entire Kings River watershed. Data were also at hand from the Merced River, a similar mountain stream, showing the variation in unit run-off for stations of low and high elevation. Run-off per unit area from areas 5,000 ft. (152 m.) and higher is approximately 50 per cent greater than the average of the total mountainous drainage area of the stream. During the months of May and June, the months producing the maximum run-off from the higher levels, the unit run-off established per square mile for the entire area, as established at the lower level, should be increased by 75 per cent to obtain the flow per square mile from the mountains, for the reason that by far the greatest amount of the run-off comes from the higher levels at that period of the year.

Using the measurements taken at the Piedra station on the Kings River, which gives the run-off from an area of 1,740 square miles and taking a period of nine years, which covers both wet and dry years, it was possible to establish an average flow per square mile for the Kings River watershed as a whole. The 50 per cent increase for higher levels and 75 per cent for the high mountains in the months of May and June were applied and a curve drawn.

The results as thus established show a slightly higher run-off than that recorded on adjacent watersheds except in May and June. Owing to the position and height of the watershed in question, this was felt to be a conservative estimate, probabilities being that the calculations would be exceeded.

Increased Industrial Depression Fails to Lower Daily Output



RETURNS for the month of September received by the ELECTRICAL WORLD from central stations with more than 71 per cent of the total generator rating of the country indicate that a new daily output record was hung up during this month. In spite of an increased industrial depression over that reported during the previous month, every section of the country reported increased average daily output. The average daily output for the entire country was 128,300,000 kw.-hr., which was about 300,000 kw.-hr. in excess of the previous record daily output, recorded in August. The total output for the first nine months of the year was 34,070,000,000 kw.-hr., as against 28,010,000,000 kw.-hr. reported in the corresponding period in 1919, an increase of about 21.4 per cent.

A partial resumption of manufacturing activity during September was reported from the New England States. Government statistics, however, indicate that more than 600,000 spindles in that section were idle during the month and that many factories were operating conservatively running on shorter time or lower quantity of production. The demand for energy for lighting purposes increased materially with the advancing season, which, taken in connection with the partial

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE MONTHS

	Percentage of Installed Ratings Represented	Revenue from the Sale of Energy			Percentage of Installed Ratings Represented	Kw.-Hr. Output		
		1919 Thousands	1918 Thousands	Per Cent Increase		1919 Thousands	1918 Thousands	Per Cent Increase
Oct.	55	$35,492	$30,077	18.0	60	2,175,636	1,987,004	9 0
Nov.	53	37,439	31,927	17.2	58	2,055,428	1,895,693	8 2
Dec.	59	44,125	37,978	16.0	65	2,509,571	2,270,833	10 0
		1920	1919			1920	1919	
Jan.	57	46,614	39,002	19.8	67	2,581,096	2,186,732	18.0
Feb.	63	45,881	37,502	22.1	69	2,494,764	1,986,493	25.3
Mar.	65	46,155	36,840	25 0	70	2,698,890	2,103,587	28 0
April	65	45,547	36,541	24 5	70	2,603,692	2,098,559	24 1
May	65	43,888	35,512	23.4	70	2,631,560	2,179,916	21 2
June	66	44,434	35,328	24 5	71	2,630,831	2,175,645	20 2
July*	66	46 608	36 265	28 5	71	2 677 131	2 234 215	20 0
Aug.†	66	47,392	36,730	28.7	71	2,768,595	2,302,988	20 4
Sept.‡	66	48,912	38,292	27.8	71	2,733,942	2,326,924	17.2

*Includes estimates for twenty-three companies, representing 2 8 per cent of the total installed rating of all central stations.

†Includes estimates for thirty-one companies, representing 3 6 per cent of the total installed rating of all central stations.

‡Includes estimates for sixty one companies, representing 14 0 per cent of the total installed rating of all central stations.

resumption of manufacturing activity, accounts for an increased central-station average daily output of 220,000 kw.-hr. over that recorded in August.

The industrial depression appears to have descended more lightly on the factories of the Atlantic States. This was especially true of the South Atlantic States, where production continued to be active. Over 485,000 more spindles were reported in actual operation in this section in September than during a similar period in 1919. This continued industrial activity, together with the increased lighting demand, resulted in a record central-station daily output of this section of 45,600,000 kw.-hr. The industrial power demand in the North Central States during September appears to have been about the same as in August, but the lighting demand was largely increased. These conditions were reflected in an average daily energy demand of 39,600,000 kw.-hr., which equals the record output for this section hung up in December, 1919.

Central-station operations in the South Central States vary largely with the lighting demand, although the industrial load is exerting an increasing influence. The daily output for this section during September was 8,630,000 kw.-hr., or about 33 per cent greater than the daily energy demand reported for the high winter month of 1919.

Metal mining in the Mountain States during September still showed some stagnation. In California the State Power Administrator issued an order on Aug. 31 curtailing the use of electrical energy for non-essential lighting purposes, and this curtailment continued until the middle of October. General industrial conditions, however, continued active throughout the Mountain and Pacific States, resulting in a record daily output of 25,950,000 kw.-hr. This is about 300,000 kw.-hr. in excess of the record month of last winter.

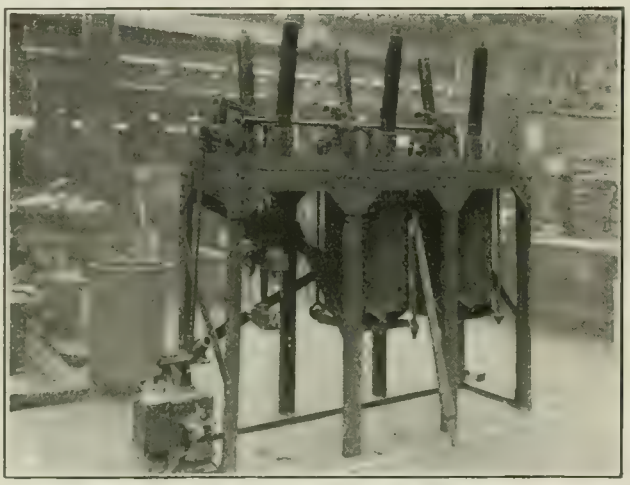
Possibilities of the Proposed St. Lawrence River Development

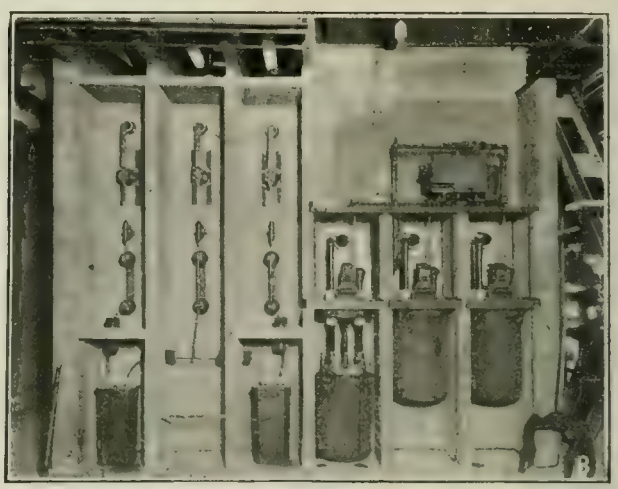
DISCUSSING "Some Engineering Features of the St. Lawrence Canalization Project" in the *Canadian Engineer*, Major John C. H. Lee, U. S. A., says: "The economical feasibility of developing the full available hydro-electric power opens a serious question. Between Lake Ontario and Montreal the total theoretical horsepower is readily computed as over 6,000,000. Owing to the unusually stable characteristics of the river it seems fair to assume that with a machine efficiency of 90 per cent, at least 75 per cent of the theoretical horsepower is possible of development, or 4,500,000 hp. Whether or not this amount should be made available from the start or be provided for at an increasing rate is a problem of industrial economics."

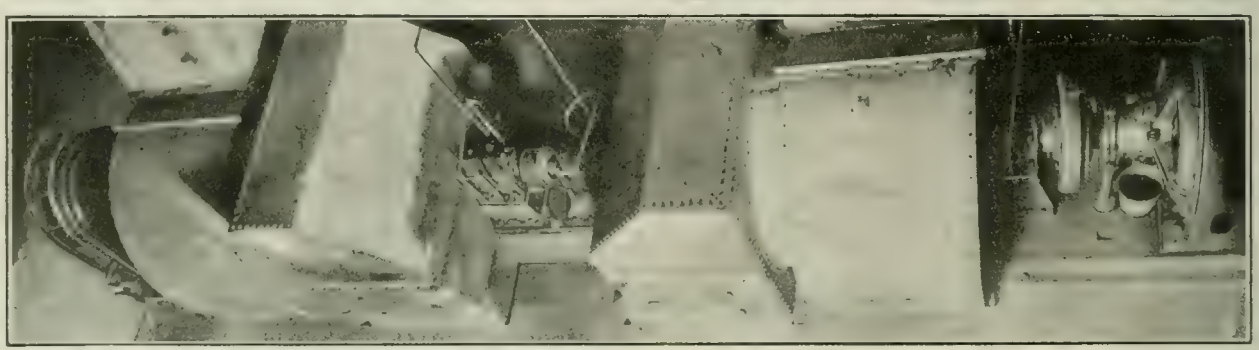
TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

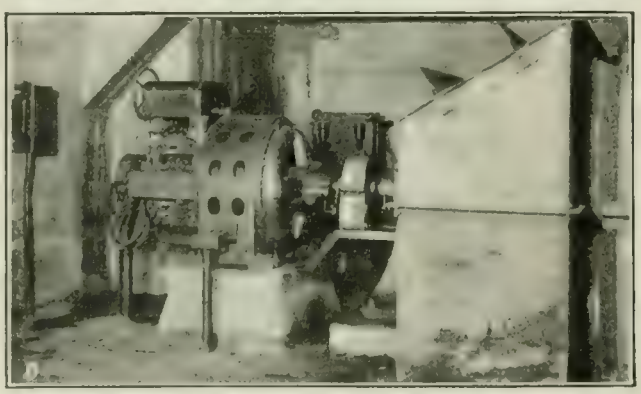
	Month	New England States				Atlantic States				North Central States				South Central States				Pacific and Mountain States		
		Percentage of Installed Ratings Represented	1919 Thousands	1918 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	1919 Thousands	1918 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	1919 Thousands	1918 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	1919 Thousands	1918 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	1919 Thousands	1918 Thousands	Per Cent Increase
REVENUE	Oct.	72	$4,127	$3,453	19.1	53	$12,684	$10,822	16.9	52	$11,401	$9,484	20.2	38	$1,840	$1,519	21.1	62	$5,440	[$4,799	13.9
	Nov.	71	4,432	3,800	16.2	56	14,738	12,761	15.7	44	10,541	8,689	21.2	39	2,063	1,694	21.8	63	5,665	4,983	13 9
	Dec.	73	4,908	4,254	15.1	57	15,926	13,806	15.8	49	11,660	9,833	18.3	44	2,496	2,070	20.0	77	9,135	8,015	14 2
			1920	1919			1920	1919			1920	1919			1920	1919			1920	1919	
	Jan.	78	5,635	4,718	19.8	59	17,659	14,625	20.9	51	12,885	10,799	19.6	53	3,047	2,538	19.9	75	7,388	6,322	16 1
	Feb.	82	5,354	4,368	22.1	61	17,245	14,343	20.4	55	13,191	10,403	26.0	53	2,949	2,360	24.7	79	7,142	6,028	18 3
	Mar.	82	5,136	4,044	27 0	63	17,696	14,299	23.7	57	13,270	10,469	26 5	54	2,910	2,287	27 8	79	7,143	5,741	24 2
	April	82	5,087	3,943	29 0	64	17,700	14,383	23.5	57	12,690	10,042	26.9	54	2,952	2,181	35 2	79	7,118	5,992	19 2
	May	82	4,897	3,741	30 1	64	16,624	13,631	21.9	57	12,471	9,853	26.8	54	2,829	2,140	32 0	79	7,067	6,147	15.1
	June	82	4,948	3,778	30 5	65	16,525	13,449	22 1	57	12,412	9,77[illegible]	26 9	54	2,849	2,127	33 9	79	7,700	6,398	20.5
	July	82	5,009	3,892	28.5	65	16,839	13,438	25.5	57	12,822	9,7[illegible]	30.9	54	2,747	2,194	25 0	79	9,131	6,948	31 5
	Aug.	82	5,069	4,091	24.0	65	17,216	13,762	25 5	57	13,399	10,15[illegible]	9[illegible]	54	3,153	2,268	39 0	79	8,455	6,457	31 0
	Sept.	82	5,394	4,294	25.6	65	17,980	14,455	24 0	57	13,725	10,487	30 8	54	3,174	2,385	33.0	79	8,639	6,671	29 8
KW.-HR. OUTPUT			1919	1918			1919	1918			1919	1918			1919	1918			1919	1918	
	Oct.	72	162,859	142,326	14 4	53	694,584	659,859	5.3	67	815,284	709,665	15.3	38	67,155	56,742	18.5	62	435,754	418,412	4 1
	Nov.	71	153,171	140,240	9.2	56	724,607	707,347	2.4	60	686,486	597,855	14.9	39	68,352	59,507	14.7	63	422,812	390,744	8 2
	Dec.	73	180,493	152,304	18.0	38	803,165	733,222	8.9	67	825,313	713,959	15.8	44	88,658	73,728	20 1	77	611,942	597,620	2 5
			1920	1919			1920	1919			1920	1919			1920	1919			1920	1919	
	Jan.	78	207,158	159,773	29 8	60	853,057	717,303	19.2	69	841,841	731,758	15.2	56	140,736	117,677	19 9	75	538,304	460,221	16.2
	Feb.	82	187,264	148,103	26.2	62	809,865	672,836	20.1	73	858,939	663,523	29.4	56	130,473	98,098	33 0	79	508,223	403,933	26.1
	Mar.	82	198,603	148,512	33.7	64	897,327	711,828	26.0	74	913,659	711,261	28 1	56	137,306	102,545	33 6	79	551,[illegible]	428,941	28 6
	April	82	187,174	144,922	29 1	65	883,264	701,778	25 9	74	857,467	687,751	24.7	56	135,140	99,877	35 2	79	540,647	464,231	16 7
	May	82	188,566	148,186	27 5	65	854,631	711,276	20 0	74	862,127	700,095	23 5	56	137,779	98,815	39 2	79	588,457	521,544	12 6
	June	82	189,934	149,807	26.5	66	8[illegible]5,714	721,688	19 [illegible]	74	855,013	681,789	25.5	56	132,733	99,660	33 2	79	587,437	522,901	12 [illegible]
	July	82	190,668	159,009	20 0	66	881,241	714,485	23.5	74	841,351	702,302	19.7	56	138,937	106,460	30 1	79	624,934	551,959	3 4
	Aug.	82	193,850	170,944	13.3	66	904,550	728,097	24 [illegible]	74	891,825	750,702	18.8	56	147,264	111,609	32 0	79	631,106	541,636	3 0
	Sept.	82	192,565	170,315	13.1	66	902,040	758,678	19.5	74	880,008	754,522	16.1	56	144,840	113,230	28 2	79	614,489	530,179	16 0

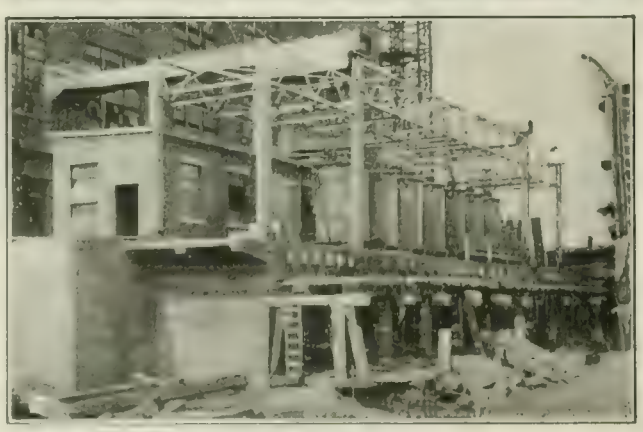
Reliability and Efficiency Are the Keynotes of the Springdale Station

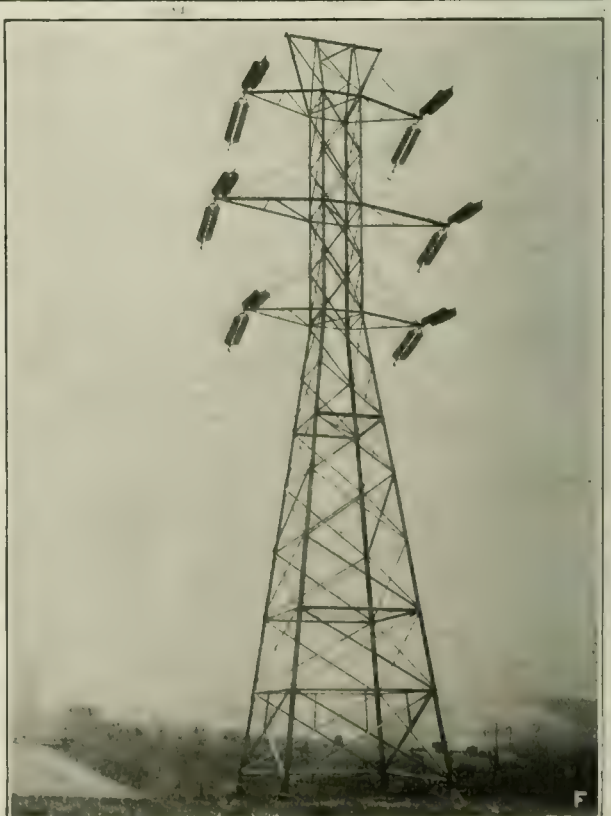












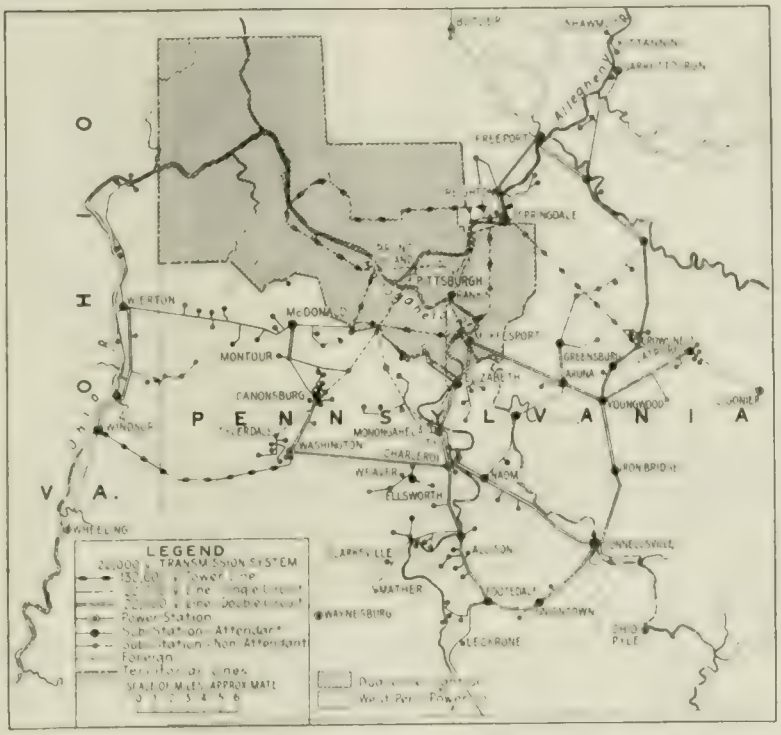
A—Oil switches for 25,000-volt circuits have especially high rupturing capacity. B—Heavy barriers for 11,000-volt oil-switch and instrument transformer compartments. C—Two induced draft fans driven by 175-hp. and 400-hp. motors. With either fan the boiler can be operated at 300 per cent rating. D—Brush-shifting motor drives forced-draft fan at high efficiency. E—Transformers installed outdoors save building construction costs. F—Transmission line designed for 130,000 volts, but operated for the present at 25,000; a dead-end tower is shown in the foreground.

Electrical Features of Springdale Plant

Station Will Be Operated at High Power Factor Temperature Detectors in Generators and Transformers, Flexible Scheme of Supply to Electrical Auxiliaries and Balanced Relay Protection Are Important Characteristics

By GEORGE S. HUMPHREY
Electrical Engineer West Penn Power Company

THE mechanical features of the Springdale station of the West Penn Power Company, situated at the mouth of a coal mine on the Allegheny River, near Pittsburgh, were described in articles by G. G. Bell which appeared in the ELECTRICAL WORLD for Sept. 25 and Oct. 9. The electrical end of the plant is likewise noteworthy because of certain novel features designed to insure continuity of service and simplicity of operation. Since the highest system economy will be attained by operating the Springdale plants at full kw. capacity, older plants will take up the wattless kva. of the system, so that Springdale may be operated at about 95 per cent power factor. Accurate information regarding internal temperatures will be afforded by resistance units which have been installed in both generators and transformers. The unit plan of connection has been adopted with bus reactors between units. All auxiliaries are in duplicate with two sources of energy provided. The position of the Springdale power plant with reference to the transmission lines and other generating stations of the West Penn Power Company and to the territory which is served by the Duquesne Light Company and the American Gas & Electric Company (in Ohio) is given in the map.



INTERCONNECTION OF WEST PENN WITH OTHER POWER SYSTEMS

At the present time the transmission systems of the West Penn Power and Duquesne Light companies may be tied together at nine different points where they come in close proximity at suitable switching points. The present ties are 25,000-volt connections. The main advantage of the tie connections is in the ability to transfer load without interruption from one system to the other as reserve capacity is needed or as trouble occurs on some outlying section of either company's lines. They also serve to give certain sections of the territory a duplicate supply and in general have added very considerably to the reliability of service. There is also the benefit derived from the diversity in their loads. When the Duquesne Light system was running on day-light-saving time and the West Penn system on Eastern standard time the diversity was considerable. The annual peaks of the two systems, moreover, occur at different times. The Duquesne Light Company's peak occurs during the Christmas shopping season, on account of the large lighting and street railway load, whereas the peak on the West Penn system occurs about the first of March.

The West Penn Power Company is interconnected at the Windsor station with the Ohio and West Virginia properties of the American Gas & Electric Company, which in turn are interconnected with the Akron properties of the Northern Ohio Traction & Light Company. These three systems are operated continuously in parallel; that is, the southwestern part of Pennsylvania is daily operated in parallel with the suburbs of Cleveland, Ohio.

The Duquesne Light Company will shortly put into operation its new Colfax generating station, which will have a possible ultimate capacity of about 300,000 kw. This station is one mile and a half from the Springdale station, which has the same possible ultimate capacity; but it is probable that these two stations will be tied together by a high-capacity line, so that each may serve as a reserve for the other and so that the two stations may be operated in parallel when desired.

As was stated in the previous article, the West Penn Power Company owns a 30,000-kw. unit in the Windsor station. This plant, like the Springdale plant, is adjacent to a coal mine, which delivers coal directly from the mine to the coal bunkers. These two stations will carry the base load of West Penn system. The 60,000-kw. Connellsville station, which receives its coal by rail and has at present the largest capacity of the three West Penn stations, will be run as the peak-load plant. The night load at Connellsville is thus brought within the capacity of the latest and most efficient unit. Rate schedules have been designed to encourage customers to install synchronous apparatus and to boost or buck as may be required to maintain a constant voltage, and synchronous condensers are used at several points. The peak-load power factor on the West Penn system is thus brought to around 90 per cent. The Springdale generators are rated at 25,000 kva. and the turbines have a maximum capacity of 25,000 kw. at full boiler pressure. By using the Connellsville generators to supply wattless current the power factor at Springdale can be brought to 95 per cent or better and the output per unit to nearly 25,000 kw.

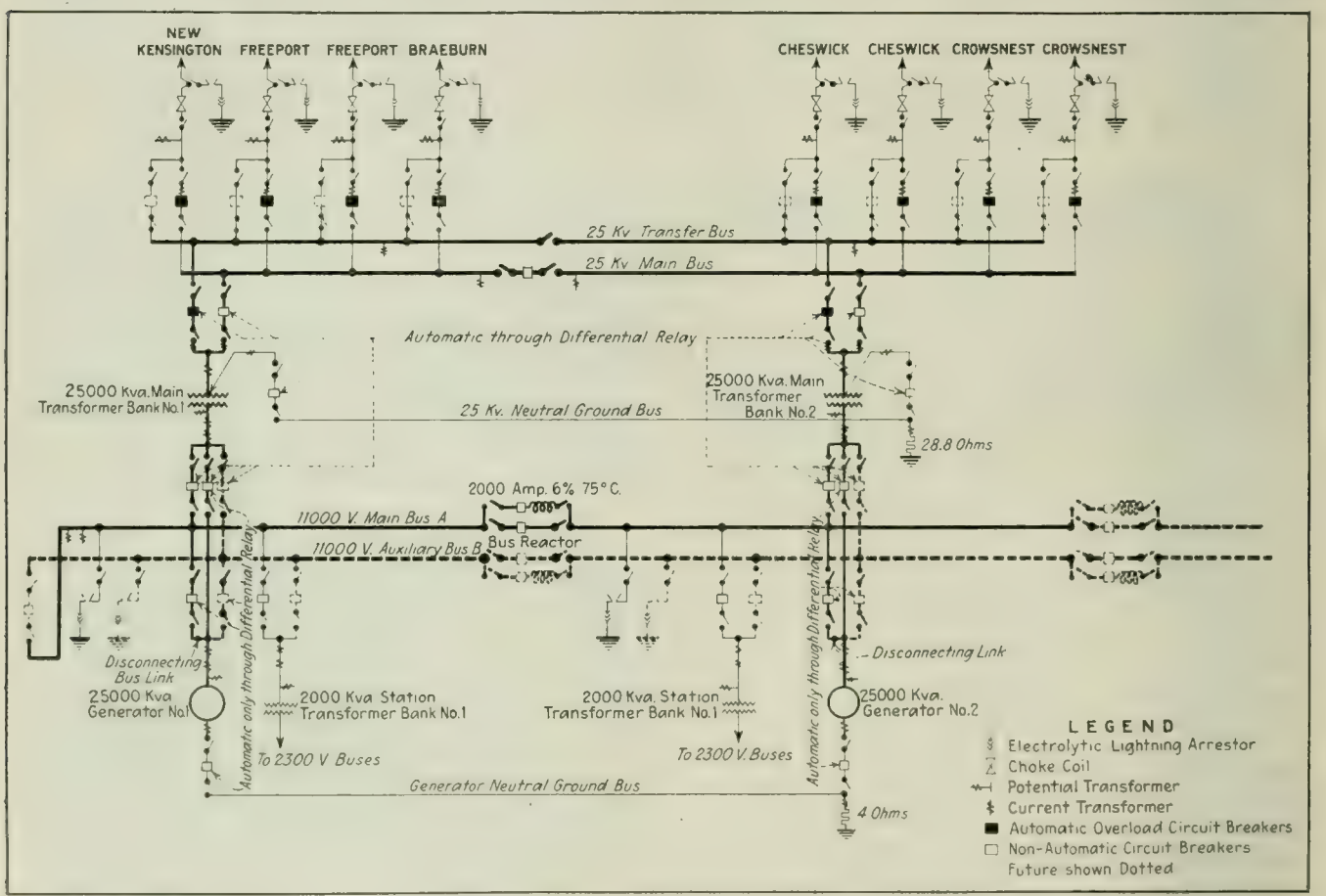
The new plant is arranged on the unit system, each main generator having its own boilers, auxiliaries, transformers and bus sections; thus each unit may be operated to full capacity entirely independent from every other unit. However, the boilers will ordinarily supply steam to a common header, and the main units may be paralleled through reactors on the 11,000-volt bus or directly on the 25,000-volt bus. Power is generated at 11,000 volts, and space has been provided for two 11,000-volt buses, although only one bus has been installed. This bus and the main switches are on the switch floor, and, as may be noted from the main wiring diagram, there are switches to connect each generator to the bus and each transformer bank to the bus and to parallel the two sections of the bus through reactors. There is on the floor under the main bus an

auxiliary switch which connects each generator directly to a bank of transformers, so if the main bus or any of the oil switches or other equipment on the main-bus floor should fail, or if it is necessary to work on them, the service may be maintained by connecting the transformers to the generators through the auxiliary switch and disconnecting the main switching gear by opening disconnecting switches.

The generator voltage is stepped up from 11,000 to 25,000, at which voltage power is transmitted from the station. There are two 25,000-volt buses, designated as the "main bus" and "transfer bus." Each of the transmission lines is connected through an automatic oil switch to the main bus and through disconnecting switches to the transfer bus. Space is provided for installing oil switches later to connect to the transfer bus, if operating experience should indicate that they are necessary. Each transformer switch is connected to the main bus through an oil switch which is non-automatic except through differential relays on the transformers. Each of the two sections of the transfer bus is connected through an automatic oil switch to a transformer bank. A line switch can be taken out of service without an interruption by closing the line disconnecting switches to the transfer bus and also the automatic oil switch connecting the transfer bus to the transformers before the line switch is opened. The oil switch connecting the transformers to the transfer bus will then serve as overload protection for the transmission line which is operating from the transfer bus. If so desired, all lines may be transferred to the transfer bus and the main bus disconnected entirely without interrupting service.

The voltage is stepped down from 11,000 to 2,300 to supply the station auxiliaries. There are two 2,300-volt buses, and each circuit is connected to each bus through an automatic oil switch. Each bus may be supplied from the house generator or from either of the two banks of house transformers, and each circuit may thus be supplied from any or all of the three sources. These buses will not ordinarily be operated in parallel. The circuit switches are interlocked so that it is impossible to close any circuit on to both buses at the same time unless the bus tie switch, which is controlled only from the operating room, is closed. Wherever auxiliaries are in duplicate one will be connected to the house generator and the other to the house transformers, so that half of the auxiliaries may be operated even if either source of power is interrupted. Duplicate 2,300-volt circuits for the boiler auxiliaries are taken to a group switch center in the middle of the firing aisle, where the stoker, forced-draft and induced-draft motors are controlled, and where they may be transferred from one 2,300-volt bus to the other. In a similar manner circuits are run from the 2,300-volt buses to group centers in the condenser pit, where the turbine auxiliaries are controlled. In addition to the advantage of reliability obtained from the duplicate circuits and apparatus and from the two sources of supply, this arrangement permits the regulation of the heat balance by transferring load from the house turbine to the house transformers or vice versa. This transfer of load may be controlled from the operating rooms or group center.

All of the high-tension equipment, except transformers and lightning arresters, is placed indoors. It



WIRING OF SPRINGDALE PLANT, DEVELOPED FOR UNIT SYSTEM WITH BUS REACTANCES

was originally intended to place all high-tension equipment out of doors on an elevated concrete platform. This platform would have to be about 20 ft. (6 m.) above present ground level to be out of reach of floods, and be supported on piles driven 15 ft. (4.5 m.) to gravel. Since there was space on the main switch floor which could be used it was decided to place the 25,000-volt switches indoors. The top conductors of the four circuits crossing the Allegheny River must be supported at a distance of 175 ft. (53 m.) above the ground. Since the building columns had ample strength to support these circuits it was decided to place the tower supporting the river crossing, and also the lightning arresters, on the roof. A considerable saving in structural steel, as well as in concrete, was thus realized by placing most of the high-tension equipment in the building and on the roof. Since there was room in the building to give the equipment and conductors practically the same spacing they would have had outdoors, and in addition to install barriers, it was considered that the reliability should be considerably greater indoors than outdoors.

The two 25,000-kva. generators are rated at 11,000 volts and have a reactance of 10 per cent. The generators are star-connected, with the neutral of each generator connected to a neutral bus through an oil switch and the bus grounded through a resistance of 4 ohms.

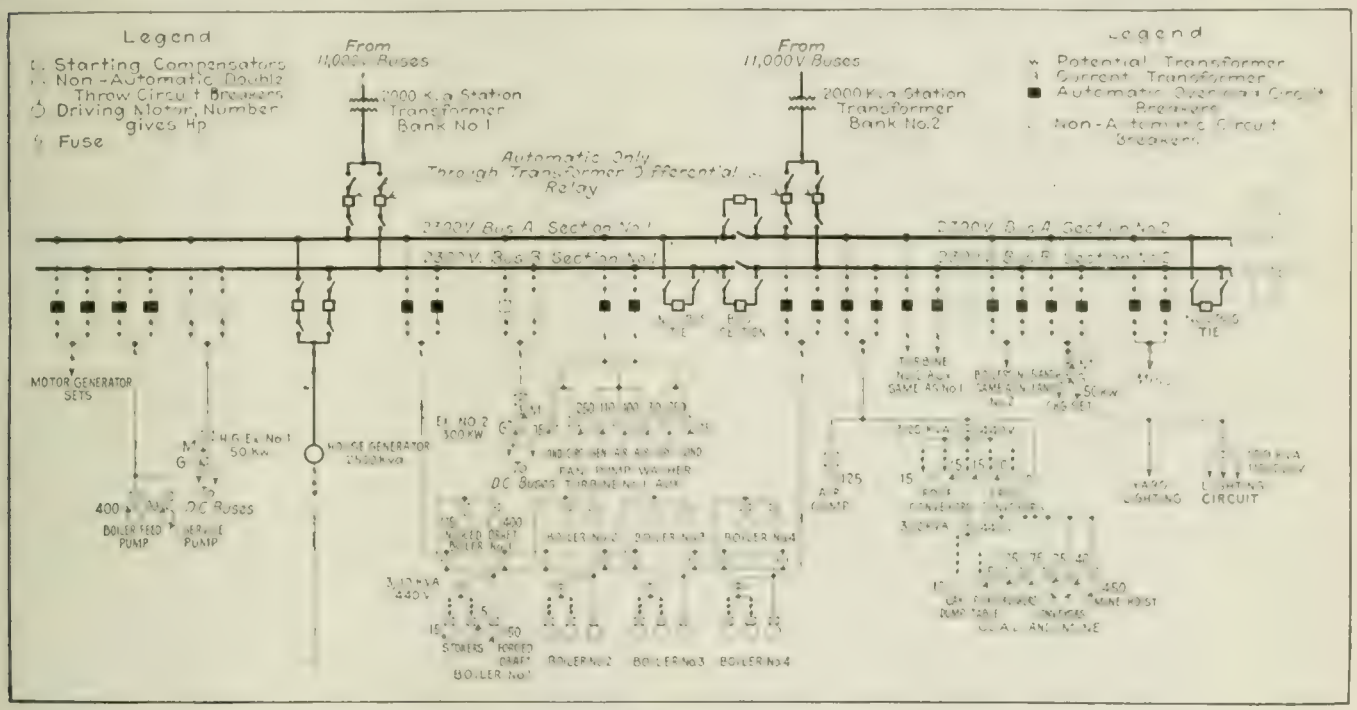
The two neutral oil switches are electrically interlocked so that only one generator may be grounded at a time. Each generator is cooled by washed air supplied by a separate fan, the air washer and fan being in the generator foundation. This air is taken either from the condenser pit or from the outside and discharged from the bottom of the generators into the intake to the forced-draft fans. The house generator is rated at 2,500 kva., 2,300 volts, and is star-connected with the neutral connected without resistance to ground through an oil switch.

The armature of each generator has six temperature coils embedded in it for indicating temperature on the generator switchboard panels. These temperature coils are embedded in the middle of the slot between top and bottom conductors and operate ammeters through variation in resistance of the coils caused by change in temperature. Each of the main generators will be provided with steam piping, so that a fire in the generator may be smothered by blowing live steam into the ventilating passages.

Each of the two banks of main transformers consists of three single-phase 8,333-kva. water-cooled units, which are connected delta on the 11,000-volt side and star on the 25,000-volt side. A seventh transformer is installed between the two banks as a "spare" and has water and oil piping connections. Leads with connectors are arranged so that the "spare" may be quickly connected to replace any transformer in either of the two banks.

The house transformers consist of two banks each with two 1,000-kva. single-phase water-cooled units connected in open-delta. The two banks of house transformers, or the house generator and one transformer bank, will carry the load at present, so a spare transformer is not necessary. Arranging the transformers in two open-delta banks gives a more reliable arrangement than installing them as one closed-delta bank with a spare, since a second set of oil switches and leads is thus provided, and the time required to connect the spare in place of one of the three operating transformers in case of failure is eliminated. When the station is extended a third transformer will be added to each bank, thus making them closed-delta banks.

Each transformer has water-flow alarm and temperature alarm, so that if the water should stop or the



STATION AUXILIARIES MAY BE SUPPLIED FROM HOUSE GENERATOR OR STATION TRANSFORMER

There are two 250-volt direct-current buses, one designated "exciter bus" and the other "power bus." Energy may be supplied to either of these buses by (1) a 300-kw. steam-driven exciter, (2) a 300-kw. motor-driven exciter, or (3) a 50-kw. motor-driven generator. The two main generators will ordinarily be excited from one of the two 300-kw. sets, the other being kept in reserve. The house generator will ordinarily be excited by the 50-kw. set. The direct-current power bus may in addition be supplied through a 50-kw. battery-charging set, which is ordinarily kept floating on the storage battery to supply this bus.

temperature get too high a bell will ring in the operating room. Each transformer has also an indicating and a curve-drawing thermometer on the transformer case and four temperature coils from which leads are brought to indicate temperature on the switchboard in the operating room. These coils are mounted near the top of the main coils in the hot oil.

The neutral of each main bank is connected to a neutral bus through an oil switch, and the neutral bus is grounded through a resistance of 28.8 ohms having a current capacity of 300 amp. for two minutes. This resistance consists of stacks of grids such as are used on street cars. There is on the switchboard a curve-drawing ammeter to record the total current flowing to ground and an indicating ammeter to show the current flowing from each transformer bank to ground. When the current to ground reaches a certain value a lamp is lighted, and when it reaches a certain larger value a gong is sounded. The operator can then select the grounded circuit from the indications of the ammeters, of which there are three for each 25,000-volt line, and disconnect it.

Circuit Breakers Have High Rupturing Capacity

The circuit breakers have exceptionally high rupturing capacity, being designed especially for this station. Each breaker is provided with disconnecting switches, so that it may be isolated for inspection or repairs. The 25,000-volt breakers are Westinghouse type "O-21" and are guaranteed to rupture 13,500 amp. at 25,000 volts two times with a two-minute interval and then be in condition to be closed and carry rated current until it is practicable to make inspection and necessary adjustments. The contacts are of the brush type, with the tips of the leaves toward the center, so that the magnetic force of a short-circuit current will force the leaf contacts down on the movable solid contacts, rather than tend to separate them, as would be the case if the tips were turned outward according to usual practice. These switches are provided with bushing-type current transformers, are frame-mounted, and each switch is installed in a separate compartment 10 ft. x 12 ft. x 25 ft. (3 m. x 3.6 m. x 4.5 m.) high, having walls of 3-in. (7.5-cm.) channel studs with ribbed metal lath and plaster on each side. The leads and bushings in these switches will withstand a test of 125,000 volts for one minute, and the assembled switch a test of 100,000 volts.

The 11,000-volt switches are type "O-2" and are guaranteed to rupture 23,000 amp. at 11,000 volts. These switches are mounted in concrete cells and are back-connected. They have tanks which are duplicates of the tanks of the "O-21" switches mentioned above. Each pole has four terminals and contacts, which are operated as two parallel paths. The disconnecting switches for the type "O-2" switches are arranged so that the opening of one door exposes all of the disconnecting switches which must be opened to disconnect the oil switch, and this door is interlocked with the oil switch so that it cannot be opened unless the oil switch is open.

All of the circuit breakers are operated by means of solenoids energized by 250 volts direct current and are controlled from the operating room. Direct current is used for automatic tripping, in order to avoid the complication in relays and wiring required for alternating-current tripping.

Further discussion of the electrical features of the Springdale plant covering the use of balanced relays for generator and transformer protection, interlocking doors over disconnecting switches to prevent the accidental opening of a disconnecting switch under load, a grounding device for protecting linemen when working on the 25,000-volt lines, a total station load indicator for installation at points distant from the switchboard and information regarding the 130,000-volt transmission lines will appear in an early issue.

Readers' Views and Comments

Actual Cost Versus Reproduction Cost in Public Utility Appraisals

To the Editor of the Electrical World:

Sir: An editorial in the Aug. 21, 1920, issue of the Electrical World advocates the actual or historical cost as the only sound basis of valuation of public utility properties for rates and return. The editorial very properly says: "Increases in rates due to increased operating costs bear no relation to investment and must therefore be justified on operating facts alone." With this statement I agree, but I cannot agree with the former one.

If a public utility property were a simple unit of definite life, with the initial installation made at pre-war prices, and an additional installation of 100, 50 or 25 per cent capacity was installed at one time at present-day prices, also going out of service on a definite date, say twenty years hence, then total cost on which to base a return, depreciation, etc., could be readily determined and adjusted. Unfortunately, a public utility property is a very complex unit, made up of innumerable parts with varying periods of life, some with a plus salvage value and others with a minus salvage value. Furthermore, the property is constantly changing. At one time a large or small addition is made to the steam generating plant if the property is of this description; at another time an addition is made to the electric generating plant, and at still another a whole or part of a substation is added. Almost continuously transmission or distribution lines are being added, altered or removed. After a cycle of ten years from the beginning of operation replacements begin for any of a number of causes. Cross-arms, pins and insulators may be replaced once or twice during the life of poles, poles may be replaced once or twice during the life of buildings, and so on.

In a growing city with an increasing density of business after a number of years the original installation loses its identity and becomes part of a complex whole, some parts of which wear out and have to be replaced each year, and it becomes difficult to keep track of and accurately to separate charges to maintenance, depreciation, betterments or extensions.

In the early days capital accounts were very crude. Today they are much improved, but even today, owing to the inherently complicated nature of the physical property, it is almost impossible, except at a prohibitive expense, to keep up from day to day or year to year an accurate cost of property. While we had a reason-

ably stable dollar it was difficult enough, but since our dollar has started fluctuating so badly, what would an accurate sum representing cost of property in dollars made up of 100-cent dollars, 80-cent dollars, 50-cent dollars and all intermediate values mean? Unless the payment for utility service is measured in terms of dollars of the same value as is the property, how can any equitable conclusions be reached?

Some will raise the point that more than 50 per cent of the investment in public utilities is on borrowed capital which was paid in old-fashioned pre-war 100-cent dollars, and that when those obligations mature they will be paid in present-day 42-cent to 50-cent dollars. However, they won't be; they can't be; there isn't a chance. Utilities are not in such a fortunate position. New securities will have to be issued for the old and at materially higher interest rates, together with brokerage and other costs of refunding. Further, owing to the present money market, many of those securities which were bought at par are now down in the sixties and seventies and if a holder is obliged to sell at this time, as many are, if sold at 70,

Original cost in 1900 (estimated twenty-year life)	$350,000
Estimated reproduction cost early in 1920, by consulting engineer for company	615,000
Commission engineers' estimated historical reproduction cost	$257,000
Deduction by commission engineers of investment allocated strictly to electrical energy generation	42,000
Net estimated historical reproduction cost by commission engineers	$215,000
Deduction for accrued depreciation by commission engineers (admitting property to be in 100 per cent service condition)	38,000
Present value of heating plant by commission engineers, recommended as basis for future rates	$177,000
Original investment in old-fashioned pre-war dollars, $350,000 converted into present-day dollars	$615,000
Replacement of plant out of new capital due to nothing being available from earnings	615,000
Total investment, physical property only, end of 1920, original and replacement, in terms of present-day dollars	$1,230,000

(Deficits in operation and fair return would exceed original cost, but were not considered by the commission's staff.)

the proceeds will only buy 35 per cent as much food, clothing, etc., as the investor could have bought when the investment was made.

Some men argue that if reproduction cost is to be used as a basis instead of historical cost, then the value of the outstanding bonds and return to bondholders should be increased proportionately, otherwise the stockholders will get all the benefits. If that could be brought about with equal justice guaranteed to the stockholders, it would have a very beneficial effect upon the public utility security market, particularly upon the value of present outstanding bonds; but I have never found any one who could figure out how this could safely be done.

The injustice of original cost of property as a basis for present and future rates can best be illustrated by an extreme case in which the commission required appraisals to be made. Above is a tabulation of figures introduced, which are not exact but approximate.

Assuming that the engineers for the company and the engineers for the commission were equally competent and conservative and that the difference between their figures is mainly due to one using reproduction cost and the other estimated historical cost less depreciation, would any fair-minded man competent to pass judgment on such matters say that $177,000, or even $215,000, would be an adequate sum or value on which to base present and future heating rates in this case?

An enterprise in which ordinary business judgment has been exercised in its conception and which is as closely regulated as a public utility ought to be allowed a value at all times equal to at least what it has cost. Where a property has been built up with dollars of varying value, or even though the present reproduction cost may be 100 per cent greater than the original cost, there is no enhancement in value allowed by using present-day reproduction costs. Compensation is merely made for the decreased value of the dollar.

Even if there should be an enhancement in value, the Supreme Court of the United States has repeatedly said that the utility is entitled to it; but utilities are having a hard enough time getting their investment, development expenses and deficits recognized without trying to get any enhancement in value of investment.

In view of the decreased value of our standard—the dollar—isn't it much simpler, more accurate and more equitable to use the reproduction cost when this is arrived at by able engineers of wide construction and operating experience, men of integrity and good standing in the engineering and financial world? More attention given to the qualifications and fitness of the appraiser will give more weight to the appraisal.

Actual or historical cost to me is unsound because of the fluctuating value of the dollar and the complex and changing nature of the property to be appraised. Further discussion on this important subject by those well qualified to express an opinion will be helpful.

HAROLD ALMERT,
Chicago, Ill. Consulting Engineer.

Excess Profits Tax Discriminatory

To the Editor of the ELECTRICAL WORLD:

SIR: The excess profits act vitally affects the amount of taxes paid by a corporation whose capital stock is issued for patent rights, compelling such a corporation to pay a higher tax than other corporations. The act provides that an 8 per cent exemption of income—*i.e.*, an exemption of 8 per cent of the invested capital—plus $3,000 shall be allowed a corporation; but the act goes on to say that intangible property shall be considered as invested capital only to the extent of 25 per cent of the capital stock issued, and it defines patents, etc., as intangible property. Thus it is clear that a corporation whose property consists of patent rights and other intangible property will receive an exemption less than the company whose assets are of a tangible nature. This is highly discriminatory. The ordinary company will receive an income exemption of 8 per cent on 100 per cent of its capital, whereas the company founded on patented inventions might receive only 8 per cent exemption on 25 per cent of its capital, or, in other words, 2 per cent of its 100 per cent capital. The tax thus places a penalty on corporations organized to develop patented inventions. All this is simply another reason why the excess profits tax should be repealed. JEROME REMTZ.

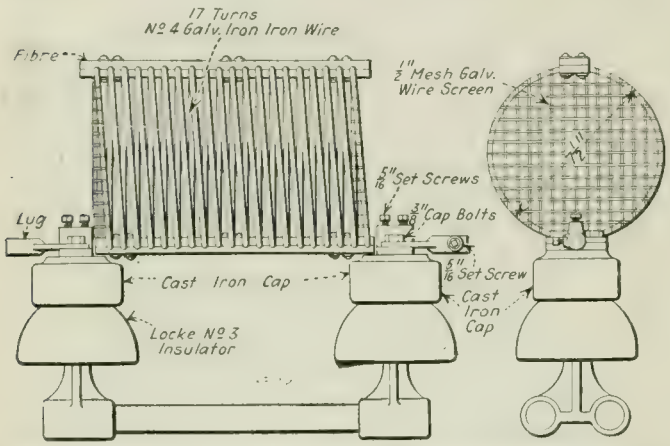
Brooklyn, N. Y.

Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Wire Screens on Ends of Choke Coils Keep Out Birds

TROUBLE used frequently to be caused on the lines of the Utah Power & Light Company of Salt Lake City by birds building their nests in choke coils in regions where trees are not plentiful. This nuisance has been abolished by placing galvanized-



BIRDS CANNOT BUILD NESTS IN THIS 15,000-VOLT CHOKE COIL

wire screens over the ends of the coils. These screens are of ½-in. (13-mm.) mesh, cut in a circular shape and fastened to the end turns of the choke coils.

The choke coil in the illustration is designed for 25 amp. on a 15,000-volt line. It is made of seventeen turns of No. 4 galvanized-iron wire, bent into cylindrical shape 7½ in. (19 cm.) in diameter. The distance from center to center of the insulators is 13½ in. (34.3 cm.). At the top and bottom of the coils are clamps made of two strips of fiber which hold the turns of the coils properly separated. The ends of the coil are held in blocks mounted on top of the insulator caps by means of ⅜-in. (8-mm.) bolts. To the same blocks are bolted lugs for receiving the line wire.

Utah Power & Light Co., Salt Lake City, Utah. — P. P. ASHWORTH, Distribution Engineer.

Plant Efficiency Improved by Conserving Drippings from Auxiliaries

BY THE use of a hot well into which the drippings from all auxiliaries and all condensation are drained by gravity the make-up water in an Iowa central station has been reduced from more than 5 per cent to about 1¾ per cent. Furthermore, the temperature of the make-up water has been increased from an average of 185 deg. Fahr. (85 deg. C.) to 218 deg. Fahr. (103 C.).

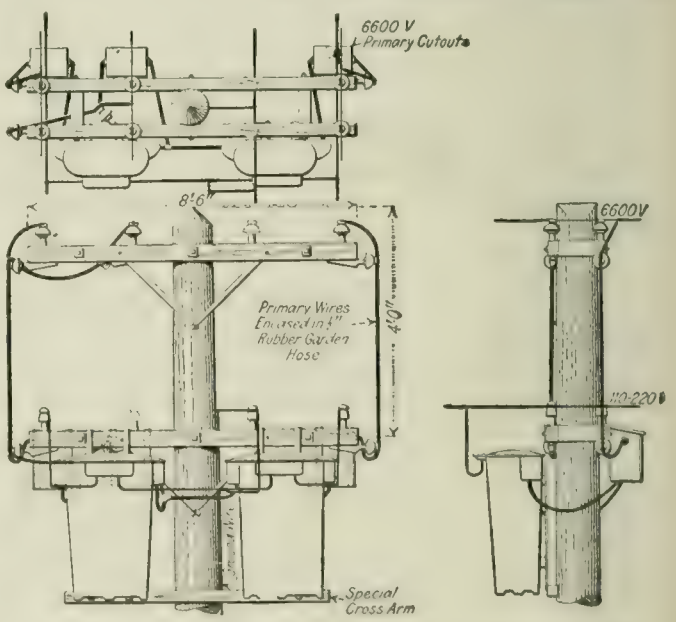
The evaporation of the plant is from about 500,000 lb. to 700,000 lb. (225,000 kg. to 315,000 kg.) every twenty-four hours, and the capacity of the hot well or surge tank, as it is called, is 30,000 lb. (13,500 kg.). The tank is built of a double thickness of concrete with tar paper in between, and there is a manhole cover on the top to permit of cleaning. A small motor-driven centrifugal pump circulates the water from the surge tank to the feed-water heater, and the water passes through an oil separator before entering the tank. There is a 2½-in. (63-mm.) pipe line from the tank to the pump and a 3-in. (76-mm.) overflow from the hot-water heater to the tank.

This plant supplies a hot-water heating system, and before the surge tank was installed much exhaust steam was wasted in summer. Now all surplus steam is used to heat feed water and a great saving has been effected even in the winter months. The surge tank provides a large hot-water reserve, which is of much help in maintaining steam pressure in the face of large and unexpected calls for power.

WILLIAM REINHARDT.
Iowa Railway & Light Company,
Boone, Ia.

Transformer Installation that Provides Clear Working Space

ABSOLUTELY clear working space is provided in the mounting for two 6,600-volt transformers shown in the accompanying drawing. In the mounting the primary wires are brought down over the ends of the cross-arms, where they are supported rigidly on



LINEMEN CANNOT ACCIDENTALLY TOUCH PRIMARY WIRES

brackets. They are inclosed in garden hose, which is split at the lowest point to allow escape of water. The transformer is mounted on the secondary arm and the secondary connections are all on the transformer side

of the pole. On the back of the pole the only high-tension wires within reach of the workman are at the fuse boxes. Fuses can be replaced by a man who is below all the conductors so that he is out of danger in case of

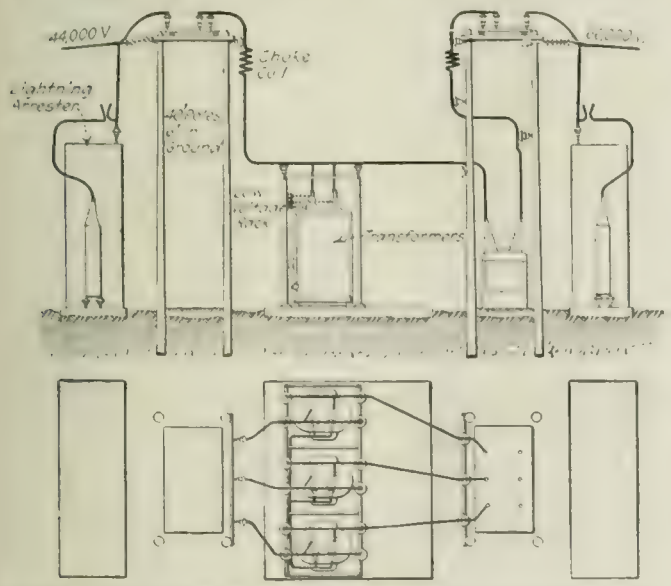
MATERIAL REQUIRED FOR SAFE MOUNTING OF TWO 6,600 220 110-VOLT TRANSFORMERS

Two 6,600-volt cross-arms, 3½ in. x 4½ in. x 8 ft. 6 in.
One special transformer cross-arm.
Four space blocks, 3½ in. x 4½ in.
Four crossarm braces, 1½ in. x ¼ in. x 26 in.
Fourteen 6,600 volt insulators, Thomas No. 1009.
Six 110-220-volt insulators, Thomas No. 1077.
Sixteen insulator pins, 1½ in. x 9 in.
Eight wood brackets.
Six machine bolts, ½ in. x 18 in. ave.
Four machine bolts, ½ in. x 4 in.
Two lag bolts, ½ in. x 4 in.
Twelve square washers for ½ in. bolts, 2½ in. x 2½ in.
Two 110-220-volt cross-arms, 3½ in. x 4½ in. x 7 ft.
Four round washers for ½ in. bolts.
One ground rod (¾ in. galvanized iron pipe), ¾ in. x 8 ft. ave.
40 ft. ground wire, No. 4 weatherproof copper.
35 ft. primary wire.
25 ft. secondary wire.
30 ft. ½ in. rubber garden hose.
Sixteen spikes for brackets, 20 d. and 12 d.
Three spikes for transformer cross-arm, 60 d.
Twenty wire staples.
Three 6,600 volt primary cut-outs.
Six wrought-iron hangers for cut-outs, ⅝ in. x 1½ in. x 22 in.
Two transformers and hangers, complete.
8-ft. ground wire molding.

flashes or short circuits. He can work on secondary wires without danger of coming into contact with the primary conductors. It will be noted that the entrance bushings on the 6,600-volt cut-out boxes have been changed to allow the leads from the primary line to enter near the top of the box. Although this is 6,600-volt construction the same plan can be used on circuits of lower voltage and also for single transformers.

Simplified Low-Cost Substation

ECONOMY of material is the keynote in the design of the Cochrane 12,000-kva. auto-transformer station connecting the 66-kv. transmission lines of the Wisconsin-Minnesota Light & Power Company with the 44-kv. lines of the Wisconsin Railway, Light & Power



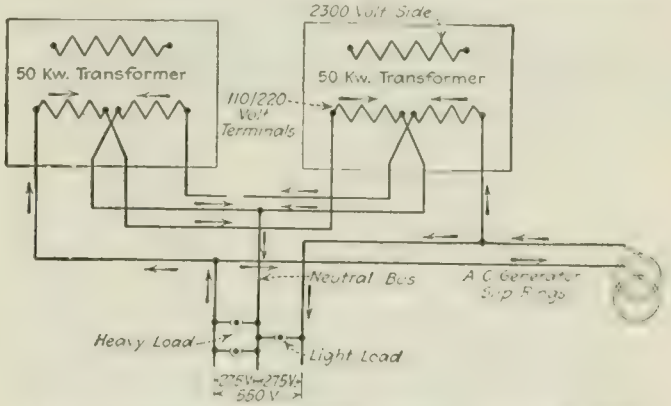
EVEN LARGE SUBSTATION ARRANGEMENTS CAN BE SIMPLIFIED

Layout of 12,000-kva. substation connecting Wisconsin-Minnesota Light & Power and Wisconsin Railway Light & Power systems

Company, near Winona, Minn. Two four-pole structures support the two sets of disconnecting switches, one of the structures also providing place for the oil switch on the incoming 66-kv. line, the 66-kv. circuit first coming to the air-break switch, then looping through the oil switch and direct to the pipe framework of standard inch pipe and fittings supporting the transformer wiring. The drawing shows the simplicity of the arrangement very clearly. The transformers are mounted on a 12-in. (30-cm.) concrete slab which also supports the framework carrying the transformer wiring. The lightning arresters have the standard mountings furnished by the manufacturer.

Two Transformers Used in Place of Damaged Balance Coil

BY USING two transformers to replace a burned-out balance coil a serious shutdown in one of the direct-current substations of the Denver Gas & Electric Light Company was avoided some time ago. The coil on the generator of a new 1,800-kw., 550/275-volt,



TWO TRANSFORMERS IN SERIES CORRECT AN UNBALANCE OF 400 AMP.

three-wire motor-generator set failed shortly after the machine had been installed. When the core was pulled the coil was found to have been damaged past repairing, and with a four-month manufacturer's delivery on a new coil some scheme of operation without the coil was necessary.

Two plans looked possible—to generate at 550 volts and let the unbalance fall on the other machines, or to try using transformers in place of the damaged balance coil. The second plan looked to be the most feasible, but no single transformer was to be had capable of carrying the necessary 10 per cent unbalance of 400 amp. It was therefore decided to try two in series.

The slip-ring frequency on the generator was 40 cycles, and the effective voltage was $0.707 \times 550 = 390$ volts. The 50-kw., 60-cycle, 2,300-110/220-volt distribution transformers were set in place and connected as shown in the sketch, with the windings crossed. The transformers were rated at 228 amp., but as the unbalance divides between them, more than sufficient capacity was secured for the 400 amp. unbalanced current.

With the connections shown, as may be seen by following the arrows, no resultant flux is produced in the coil by the unbalanced current, there is no choking of the pulsating unbalance current, and no dangerous voltages are induced in the high voltage winding.

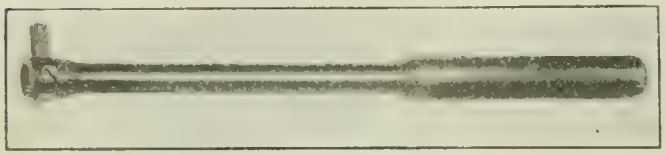
W. D. HARDAWAY,
Assistant Electrical Engineer.
Denver (Col.) Gas & Electric Light Company.

Industrial Applications

The Economical Utilization of Electrical Energy in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

Slotting Tool with Interchangeable Tool-Steel Blades

FOR slotting commutators the writer has made a device with a tool-steel blade which can be taken out for sharpening or replaced with blades of different thickness for differently sized slots. This device is made from an iron rod 10 in. (25 cm.) long, into one end of



CUTTING TOOL OF THIS SLOTTER IS REMOVABLE

which a square hole is cut to hold a ¼-in. (6.4-mm.) piece of tool steel. The rod is drilled and tapped to take a setscrew which holds the tool-steel cutter in position. By lifting the setscrew the cutter may be taken out and ground so that a sharp tool may be had at any time. Several of these blades have been made with cutting edges of different widths for working on commutators with correspondingly wide slots.

New York, N. Y. W. A. HARRIS.

Determining Economical Interval for Cleaning Lighting Fixtures

THE interval that should elapse between times of cleaning lighting equipment in order to insure the greatest economy depends on the cost of energy, the burning hours per day, the loss of light due to dirt and the cost per cleaning. Such a period is calculated in the following example, worked out for a large office building with 200-watt lamps, where energy costs 5 cents a kilowatt-hour, the lamps burn on an average six hours a day, the loss of light on account of dirt is as shown in the table reproduced and the cost of wiping is 5 cents and that of washing 10 cents for each unit. It is assumed that the lamps are washed every twelve weeks and that it is desired to know how often in addition they should be wiped off.

Total kilowatt-hours consumed =
(6 hours × 6 days × 12 weeks × 200 watts) ÷ 1,000 = 86.4 kw.-hr.

Case A.—Fixtures wiped every two weeks, washed every twelve weeks:

Cost of cleaning, 5 + 5 + 5 + 5 + 5 + 10 = 35 cents.

Equivalent power loss, 4 per cent (from curve), or 86.4 × 0.04 = 3.45 kw.-hr.

Cost of lost energy, 3.46 × 5 = 17.3 cents.

Case B.—Fixtures wiped every three weeks, washed every twelve weeks:

Cost of cleaning, 5 + 5 + 5 + 10 = 25 cents.

Equivalent power loss, 5½ per cent, or 86.4 × 0.055 = 4.75 kw.-hr.

Cost of lost energy, 4.75 × 5 = 24 cents.

Case C.—Fixtures wiped every four weeks, washed every twelve weeks:

Cost of cleaning, 5 + 5 + 10 = 20 cents.

Equivalent power loss, 7 per cent, or 86.4 × 0.07 = 6.05 kw.-hr.

Cost of lost energy, 6.05 × 5 = 30 cents.

Case D.—Fixtures wiped every six weeks, washed every twelve weeks, are calculated similarly and the values are plotted as shown in the curves.

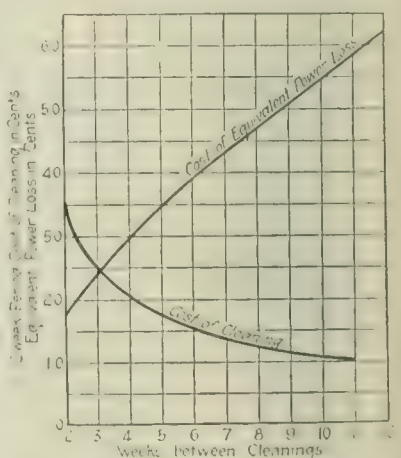
Case E.—Fixtures washed every twelve weeks.

The two curves showing graphically the results of these calculations cross at a point slightly beyond the three-week period; therefore any cleaning period greater than this value represents a saving, indicated by the distance between the two curves. Considering average conditions and typical equipment, the fixtures in an office should be wiped out at least once every month and removed for careful washing once every three or four months.

APPROXIMATE LOSS IN PERCENTAGE OF INITIAL ILLUMINATION ON WORKING PLANE IN CITY OFFICES

	Four Weeks	Eight Weeks	Twelve Weeks	Sixteen Weeks	Twenty Weeks
R. L. M. standard dome	5	8	10	12	14
Dense opal bowl, direct lighting	7	10	13	15	19
Prismatic bowl, direct lighting	9	13	16	19	22
Light density opal bowl, direct lighting	12	18	24	28	30
Semi-indirect	14	22	29	35	40
Totally indirect	20	29	37	44	50

Cost of cleaning varies with the type of equipment and labor charges. As typical figures for industrial plants with direct-lighting reflectors, from 3 to 5 cents for cleaning might be considered as average. The figures used here were obtained in a large office building having semi-indirect units of a fairly simple design, where the cost of wiping lamps and reflectors with a damp cloth and then drying is approximately 5 cents per unit. Removing the semi-indirect bowl and carefully washing costs approximately 10 cents. The table presents figures on the approximate loss of light for various lighting systems based on average office conditions in an industrial city.

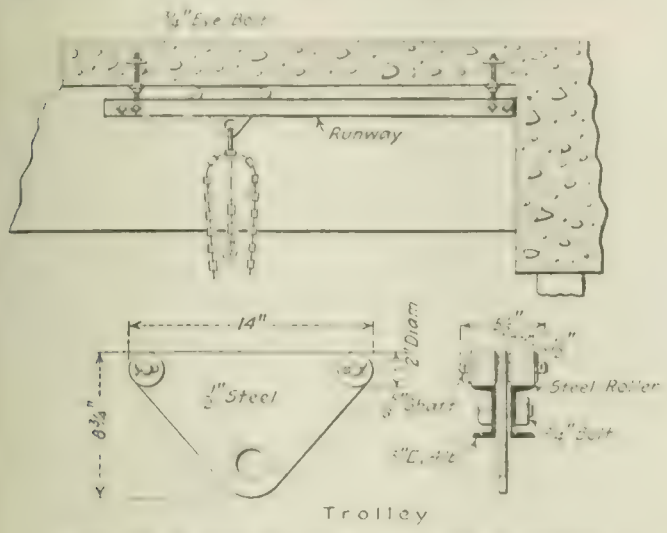


COMPARES COST OF CLEANING LIGHTS WITH COST OF WASTED ENERGY

This information was compiled by A. L. Powell of the lighting service department of the Edison Lamp Works of General Electric Company.

Serviceable Trolley and Runway

AN INEXPENSIVE runway and trolley which has proved very successful in moving heavy pieces of apparatus in a St. Louis shop is supported by eyebolts fastened to the ceiling. Channel irons bolted on each side of the eyebolts form the runway, and the trolley consists of a triangular piece of steel suspended from and between the channel irons on four rollers at two



DETAILS OF TROLLEY AND RUNNER FOR HANDLING HEAVY ELECTRICAL MACHINERY

corners of the trolley. A chain block is hooked into a hole at the lower corner of the triangular trolley for the purpose of raising the load, which can then be pushed along. If a greater distance must be traversed than the length of runway between two points of support the load is lowered when the eyebolt is reached and picked up again on the trolley from an adjacent runner.

The eyebolts were cast in position in the concrete ceiling as shown in the illustration. This installation was designed to lift 4,000 lb. (1,800 kg.).

WALTER H. MILLAN,
Superintendent of Substations.
Union Electric Light & Power Company,
St. Louis, Mo.

Safe Construction for Coal-Mine Distribution Circuits

FOR safe operation of alternating-current coal-cutting equipment several recommendations have been made by the United States Bureau of Mines. The recommendations applying to machine-feeder circuits state that five systems may be employed as described below:

1. Use lead-sheathed cable armored with steel wire or steel tape buried along the rib or supported either on the rib or props. Connections to mining machines can be made at suitable junction boxes placed at convenient intervals.

2. Use rubber-covered wire installed in iron conduit with junction boxes at convenient intervals. The joints in the conduit should be leaded or otherwise water-tight and the conduit should be so supported as to afford drainage in case moisture collects on it. The conduit should be well grounded.

3. Use separate wires installed on the roof back of the timbers of props on the "gob" side of the entry. Such wires should be protected by a narrow board supported on edge in hooks formed on the ends of iron pins wedged in drill holes in the roof.

4. Use separate wires installed on the "gob" side of the timbers. Such lines should be completely protected by boards to prevent accidental contact with them.

5. Use unguarded circuits, either of bare or insulated wire. Such circuits should be placed sufficiently high or far enough to one side of the road or traveling way to eliminate the possibility of accidental contact. Rubber or weatherproof insulation should not be considered as a protection against electric shock.

Armored cables and conduit may be supported by iron hooks attached to timber, roof or side of entry. Separate conductors should be supported on porcelain insulators placed at sufficient intervals to keep the lines away from timbers, coal and slate, and from each other. For 440-volt circuits the minimum size of wire should be No. 4 B. & S. gage and for 220-volt circuits, No. 1. In case the length of the circuit is in excess of 2,000 ft. (600 m.), or more than two machines are connected to the circuit, the size of conductor should be increased proportionally.

The following recommendations are made with respect to transformer installations: (1) If transformers are so located as to present any hazard due to accidental contact, they should be placed in a locked inclosure. (2) Lightning protection and disconnecting switches should be provided on the high-voltage or incoming side of all transformers. (3) The casings of all transformers should be provided with a ground connection separate from that provided for the lightning arresters. (4) Transformers connected in delta or open delta should not have their secondaries grounded.

It is suggested that new installations use nominal voltages of 230 for alternating current and 250 for direct current in the operation of coal-cutting and other portable equipment.

Improper Electrodes Will Stick in Operating Brass Furnace

TROUBLE from zinc clogging the electrode holes in a rocking brass furnace of a large brass mill was recently found to be caused by employing electrodes of poor quality. This one-ton Detroit furnace is used for melting brass in the casting shop. Owing to the high percentage of zinc in some of the mixtures, difficulty was experienced with zinc in a volatile state, cooling around the electrodes and thus clogging the electrode holes, making it almost impossible to withdraw the electrodes from the furnace. Investigation showed that the trouble was made serious by the use of a poor class of electrodes, which peeled away at the electrode holes through the furnace and left a large space for the zinc to occupy. Since the use of 4-in. (10-cm.) graphite electrodes selected and turned to size there has been no further trouble with the zinc clogging the electrode holes and the energy consumption was reduced from about 300 kw.-hr. to 250 kw.-hr. per ton (900 kg.).

JAMES S. BRUSSTER,
Assistant Mechanical Engineer.
Cleveland Brass & Copper Mills, Inc.,
Cleveland, Ohio.

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

Advertising Important to Central-Station Merchandising Policies

MERELY to sell appliances at a small margin above cost, declared W. S. Wyman, general manager of the Central Maine Power Company, recently, is to lose the advantage of publicity. One of the companies lately taken over by the Central Maine System had sold merchandise at 10 per cent above cost with no advertising expenditure. The result was an indifferent amount of merchandise business in the territory served. With the change in ownership, Mr. Wyman said, a new policy has been adopted. Merchandise has been marked at regular retail prices, not with the expectation of making more profit from appliance sales, but of putting the difference into local advertising. "We do expect," added Mr. Wyman, "to increase the use of electricity in this city and believe in the end it will prove more profitable both to the customer and the company."

Domestic Electric Refrigeration Should Be Developed

By Vernon Tallman,
Power Engineer Charles H. Tenney & Company, Boston

RECENTLY it became necessary for a New England central station to decide whether or not electricity for domestic refrigeration should be supplied at the regular heating and cooking rate. The company wished also to find out whether or not the domestic refrigerating field was a good one to canvass and develop.

Requests for information were sent out to representative central stations in New England in order to determine the current practice of these companies in fixing rates for domestic electric refrigeration. Replies were received from virtually all of these companies. The tabulation shows the average net rate per kilowatt-hour for a monthly use of 100 kw.-hr. From this it seems that the general practice among the companies is to put domestic refrigeration on the cooking rate where there is one and to put the larger installations, with motors of 1 hp. and above, on the power rate if no regular cooking rate has been issued or is available.

DATA ON ELECTRIC REFRIGERATION RATES IN NEW ENGLAND

Company	Rate Offered	Average Net Rate for 100 Kw.-Hr. Cents	Minimum Charge
1	Power	5.0	$2 00
2	Power	3 1	1 00
3	Cooking	3 5	.75
4	Cooking	2 9	1 50
5	Cooking	5.0	2 00
6	Cooking	5 0	....
7	Cooking	3 0	2 00
8	Cooking	4 6	2 10
9	Cooking	3 5	....
10	Power	5.0	1.25
11	Combination	6 0	.70
12	Cooking	4 6	1 00
13	Cooking	5 5	3 00
14	Cooking	3 4	....
15	Cooking	3 0	1.00
Average rate fifteen companies		3 9	

It has been found that the domestic electric refrigerator averages 2,880 hours' use of the demand per year. This is a use more than four times that of any other appliance, twenty-eight times the hours' use of demand of the household electric iron and nine times the hours' use of demand of the electric range. The figures show beyond doubt that the field will be profitable as soon as the machine is so developed that it will be available for use by the average consumer of electricity.

One electric company submitted the subjoined data comparing the amount of energy consumed by the electric refrigerating machine with that used for lighting purposes in the house. In this case refrigeration is at the power rate:

	Refrigeration			Lighting		
Case No.	Yearly Kw.-Hr.	Yearly Bill	Rate	Yearly Kw.-Hr.	Yearly Bill	Rate
1.	852	$44 92	$0 0527	904	$99 44	$0 11
2.	1,152	54 14	047	863	94 93	.11
3	1,732	83 08	048	1,460	160 60	.11
4.	633	36 00	058	454	49 94	11
5	978	45 62	047	376	41 36	.11
Average	1,069	$52 75	$0 049	811	$89 25	$0 11

The above shows that the average kilowatt-hour consumption of domestic electric refrigeration in the cases cited is 1,069 kw.-hr.—surely a good load in comparison with the average of 811 kw.-hr. used for lighting purposes. To be sure, all households do not use 811 kw.-hr. a year for lighting, nor is it possible to install an electrically operated refrigerator in every household, but these cases are for refrigerating machines in the types of houses which can afford to use them and where light is used for decorative as well as illumination purposes.

Refrigerating machinery manufacturers give as an average use from 500 kw.-hr. up to 1,000 kw.-hr. per year. In actual practice, however, this figure is exceeded, and 1,250 kw.-hr. annually does not seem excessive as the average for a great many machines which will be installed within the next year or two.

One of the large ice companies estimates that for the larger households which might install electric refrigerators the amount required might be as high as eight or ten tons. An average use of 8 tons at $13 per ton would give an expenditure for ice of $104 per year—with mud tracked in by the ice man free.

With an annual consumption of 1,250 kw.-hr. at the average heating and cooking rate of the fifteen companies reporting, the annual cost of the energy used for refrigeration would be $48.75. To this should be added the overhead charges on the installation, which on an outfit of $400, with 10 per cent depreciation and 6 per cent interest, would amount to $64 more, or a total

annual cost (exclusive of condensing water) of approximately $115, or less than $10 per month the year round.

From the data furnished it is readily shown that the domestic electric refrigerating load has a greater number of hours' use of the demand than any other domestic appliance now on the market, and as soon as suitable machines are developed at a price which will be attractive for the average business man's household central stations should develop this field, in order to secure the long-hour use of demand.

Family Spirit of Employees a Valuable Asset to an Organization

"FAMILY spirit" in an organization is the spirit that makes workers want to pull together, to work for the best interest of the company because they believe that by so doing they will enhance their own future and their own possibilities, declared Frank F. Hennaman of the Penn Central Light & Power Company, Altoona, Pa., in a paper, "Family Spirit, or Personnel in the Organization," read before the recent convention of the Pennsylvania Electric Association. Good-will in unstinted measure is what the public utility wants, Mr. Hennaman continued, and it is possible only through the attitude of the company toward the workers.

One great essential, Mr. Hennaman contended, is that every member of an organization have that feeling of surety in his position which will enable him to do his work without fear of sudden discharge. Fear of discharge or loss of position is one of the three great fears of human life, and the principal one, for it involves in the average man's life loss of money, discomfort for his family, even loss of a home, and frequently loss of self-confidence and pride. It is a cause of much unrest. When men are not sure they are uneasy and are endeavoring to get all they can while the opportunity exists. It is certainly a satisfaction to know one's job is secure. Men want permanent work and a permanent income. Layoffs and cuts are necessary in some businesses, but fortunately light, power and street railway companies are not affected in this way so far as the operating force is concerned, and such an attitude in the organization should not exist, although too often it does. Some managers feel that it keeps men on their toes, but it is only to get away to a job that offers surety and a permanent income. If members of an organization are to be of the highest caliber, there must be possibilities of advancement. This is the finest incentive that can be given if an organization is to be a "live-wire" outfit; drones cannot last, while real men thrive in it.

"Fill your big jobs from the inside," Mr. Hennaman advised executives. "Appreciate the talent you have. Don't let an outsider step in over your men. Use what you have and hire office boys. That is where the snap and satisfaction come from that will keep men on their toes. Promotions are not costly, but hiring often is, especially so in executive positions. It hurts the morale of the organization to see a rank outsider put in; but it is an incentive, an inducement, to see a man from the ranks promoted.

"Is your organization 'sold' to the employees? Do they believe in it, in its product, and are they interested in making it better? The public utility of today sells nothing but service, and for this reason it is particularly important to have competent and trained employees. It is possible to get them only through training and length of service. You can readily appreciate this when you consider the broad distribution of equipment and the operating methods peculiar to every company. Aside from this question of service, the public must be met.

"At a meeting of the Industrial Relations Association of America in New York last February a works manager in the audience 'exploded himself.' He claimed that in his organization everything had been done to content the worker. They had a cafeteria, group insurance, athletic field, gymnasium and various other things, and he wanted to know why so much trouble was experienced. Some one suggested that probably there was just a little lack of human interest in the plant, just a little less surety of occupation than there should have been, and possibly the family spirit did not exist and the attitude of the company was wrong. Employees do not care for paternalism. I do not mean to discredit cafeterias, group insurance, athletics, etc. They are excellent helps, but the organization that believes it can hold its employees by these means alone is wrong.

"A personnel department headed by a competent man will immediately show results by reducing labor turnover and by development of attitude. It is not a matter of a foreman or department head's fancy; it is a matter of justice. The right man in the personnel job will always see that justice is done, but the management must back him up, and the personnel supervisor must tackle his job without fear.

"The problems involved in handling inanimate materials can be made known and solved by skill alone, but the organization of a personnel department and the selection of the man in whose care you place these duties require not only skill but a sound heart."

Advantages in Use of Glass-Covered Meters

THE use of glass-covered meters is increasing, and many central-station men and manufacturers believe that they will be ordered in greater numbers when deliveries become easier. Companies which are using these meters find that they facilitate the settlement of complaints, especially when a meter is suspected of creeping. Customers prefer a meter that can be seen working. The objections to glass covers have for the most part been overcome. Unevenness of the edge of the cover which might cause a poor fit has been taken care of by a felt gasket, consequently no trouble from this source has been experienced. Condensation, which sometimes appears on the inside of the glass, could be present on the inside of metal covers without being noticed upon inspection from the outside.

Two large users of glass-covered meters placed the breakage at 1 per cent. If properly packed by the manufacturer, abnormal breakage means rough handling and should be adjusted by the transportation companies. At the meter conference of the Ohio Electric Light Association, where this subject was discussed, a vote showed that of the companies represented fifteen favored glass covers, nine were against them and four were undecided. The relative effect of temperature changes on meters with glass and metal covers is to be investigated by a sub-committee headed by M. F. Smalley of the Ohio Power Company, Newark, Ohio.

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

1,750-Kva. Slow-Speed Alternator.—This article relates to a 1,400-kw. alternator at 0.8 power factor, with terminal voltage of 5,200 between phases and the frequency of 50 cycles per second at a speed of 187.5 r.p.m. After discussing the characteristics of this machine the author gives the following data on losses and efficiencies at various loads:

	Full Load, Kw.	Three-Quarters Load, Kw.	Half Load, Kw
Iron losses, windage and friction	55 0	54 0	53 0
Stator current losses	28.0	16.0	7.0
Rotor current losses	18 0	15 0	12 0
Total losses	101.0	85 0	72 0
	Per Cent	Per Cent	Per Cent
Efficiency (actual)	93 3	92 5	90 7
Efficiency (guaranteed)	93.0	91.5	89 5

The data refer to operations at 5,200 volts and 80 per cent power factor.—London *Engineering*, Oct. 1, 1920.

Generation, Transmission and Distribution

Development of Rural Electricity Supply.—The steps which have been taken to develop electricity supply in Hereford, England, a city of about 22,000 persons, show an unusual development of load among the rural communities. Metallurgical coke-oven dust is used for steam-raising purposes. Tact in dealing with the customers and an ingenious scheme of charging for energy are given as the chief means by which this load was developed.—London *Electrician*, Oct. 22, 1920.

Distance Control in Three-Phase Systems.—ROTH.—The author describes a system, due to Wurmbach, for operating circuit breakers in a substation by the use of direct-current impulses from a control board in the central station. The direct-current impulses are transmitted over the high-tension lines connecting the two stations. The current enters at the transformer secondary neutral, passes along the three wires in parallel and leaves by way of the step-down transformer neutral, the ground being utilized as a return circuit. The current impulses are timed by means of an adjustable pendulum, and mechanically tuned relays are used for receiving. Several relays in the substation may be operated selectively, only that one responding which is tuned to the same frequency as the pendulum. The method has been used for some time in Danzig to operate two breakers a mile or so from the power station, and it is said to work well in practice.—*Elektrotechnische Zeitschrift*, Sept. 16, 1920.

Modern Methods for Transmission-Line Calculation.—BLONDEL.—The author first reviews some methods for determining the voltage regulation of long alternating-current transmission lines. These methods were described by himself, partly in conjunction with Le Roy, in numerous articles in the *Lumière Electrique* during the years 1906 to 1910. He then takes up the Brown transmission chart and discusses in detail its application to transmission-line problems. Finally a chart is described, under the name of the Blondel chart, which is said to permit a very quick and simple determination of voltage, current and power relations on long alternating-current lines. The chart is nothing but the well-known double family of harmonic circles, illustrating, in the Kennelly "Hyperbolic Charts," the tanh θ function, but with another chart superposed upon it. The superposed chart is a set of curves, which give values of the size of cosh θ, such as correspond to the tanh θ values read in rectangular co-ordinates on the fundamental complex plan of the graph. This type of plot has the advantage that power triangles for the beginning and end of any line may be traced on the complex plane in their true form, while line distance is counted along the curvilinear co-ordinates represented by the families of orthogonal circles, and voltage ratio is read off the third curve system showing the amplitude of cosh θ. Here θ at all times is taken to mean the electric length of the line, or the hyperbolic line angle, $\theta = \sqrt{YZ}$.—*Révue Générale de l'Electricité*, July 31 and Aug. 7, 14 and 21, 1920.

Traction

Electric Power Consumption on Electrified Divisions of Chicago, Milwaukee & St. Paul Railway.—REINIER BEEUWKES.—The author gives an extended description of the system of transmission and distribution feeding the railway electrification. After explaining how the energy is metered the following interesting tabulation is given showing the unit cost of maintaining and operating this system:

Account	Total All Services	Per Unit
Power substation buildings	$8,487	$606.00 per building
Power transmission system	1,773	4.87 per mile
Power distribution system	78,461	179 00 per route-mile
Power line poles and fixtures	24,299	55 50 per route-mile
Power substation apparatus	40,224	2,870.00 per station
Train and yard power produced	102,152	7,300 00 per station
Total	$255,396	

	Cents
1. Cost per 1,000 gross ton-miles trailing freight as actually distributed in accounts	28 8
2 Cost per 1,000 gross ton-miles train freight as actually distributed in accounts	24 9
3. Cost per 1,000 gross ton-miles trailing freight on basis distribution in proportion to freight, kilowatt-hours	30 2
4. Cost per 1,000 gross ton-miles train freight on basis distribution in proportion to freight kilowatt-hours	26 2
5 Cost per actual kilowatt-hour delivered to locomotives	1 1

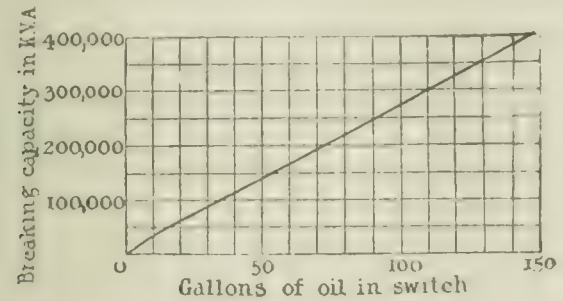
The above unit figures include the cost of power.—*Journal A. I. E. E.*, September, 1920.

Electrification of the Central Limones, Cuba.—O. WORTMAN.—A description of a system in the province of Matanzas, the total single-track length of which is 32.6 miles (525 km.). It is used principally for transportation of sugar cane and the finished products of the mills. The system in use is 1,500-volt direct current at the trolley. Some details of the locomotive equipment and distribution system are given in the article.—*Electric Journal*, October, 1920.

Alternating-Current Track Circuiting.—L. H. PETER.—The author urges the necessity of considering the apparatus forming an alternating-current track circuit as a whole and its operation under varying conditions of ballast resistance, traction current and other factors which differ on every road. He states that such alternating-current track circuits installed in England in recent years show great improvements over the earlier ones.—London *Electrician*, Oct. 8, 1920.

Installations, Systems and Appliances

Oil Switches for Large Electrical Supply Systems.—It is said that the chief problems relating to the control of systems fed from stations with capacities between 100,000 kva. and 200,000 kva. may be summarized as follows: (1) Means must be found to insure maintenance of voltage at all parts of the system and prevent disturbance of running machinery. (2) Arrange-



QUANTITY OF OIL WHICH IS REQUIRED IN LARGE CIRCUIT BREAKERS

ments must be made to limit the power which can be concentrated at any point on a fault occurring and to a figure not calling for excessive expenditure in the construction of individual pieces of apparatus. Short-circuit characteristics of alternators and speed of oil-switch openings with units of extremely large size are discussed in this paper.—London *Engineer*, Sept. 3, 1920.

Theory and Practice of Lightning Protection.—Q. A. BRACKETT.—The usefulness of the various elements of modern lightning arresters is taken up. The writer gives particular attention to the impulse-gap arrester which is designed for the purpose of discharging high frequency lightning disturbances at lower voltage than disturbances of operating frequencies such as 25 and 60 cycles.—Paper presented before Association of Iron and Steel Electrical Engineers, October, 1920.

Continental Switchgear.—W. A. COATES.—A short article dealing with circuit breakers and cubicle layouts common to European practice.—*Beama*, October, 1920.

Units, Measurements and Instruments

Metering of Wattless Energy.—R. KOPP.—After introductory remarks concerning the economical significance of poor power factor the author takes up the question of metering and charging for wattless energy and in this connection describes and criticises several metering and charging systems in use in Germany. The Rheinisch-Westphälische power company, in addition to ordinary kilowatt-hour meters, also uses similar instruments so connected that they measure the so-called blind killowatt-hours, or the integral of $e \times i \times \sin \phi$. The consumer then has to pay an extra charge of 0.5 pfennig per kilowatt-hour for the amount with which the number of blind kilowatt-hours exceeds three-fourths of the active kilowatt-hour consumption, then the power company pays the consumer 0.25 pfennig per kilowatt-hour for the difference. The author describes a new type of Ferraris meter, built by Koerting and Mathiesen, which automatically tallies active as well as reactive energy on the same register. The instrument is provided with only one torque disk, but has two sets of magnets with several legs each. The meter may be adjusted to make the reactive energy automatically weighted. Thus, if a certain number of revolutions of the meter corresponds to 1 kw.-hr. of active energy, a given less number of revolutions will correspond to 1 kw.-hr. of reactive or blind energy. The meter thus will register $(\cos \phi + 1/n \sin \phi) \times$ kva.-hr., the weighting factor n being adjustable so that the meter can be adapted to the needs of each particular plant or customer. The advantage clearly is that no computations are needed for determining the charge other than a simple multiplication of the meter reading with the conventional price per kilowatt-hour.—*Elektrotechnische Zeitschrift*, Sept. 30 and Oct. 7, 1920.

Telegraphy, Telephony and Signals

Conductor-Directed Radio-Telephony.—COUNT ARCO.—The Telefunken system of conductor-directed radio-telephony for intercommunication between power plants by high-frequency waves sent over the transmission lines is described in this article. The carrier frequency is taken as high as 150,000 to 200,000 cycles, in order to cut down disturbances from surges. The telephone stations are supplied from a storage battery which is kept charged from the lighting mains by means of automatic switches. The heating current for the vacuum tubes is taken directly from the battery, while the anode potential is delivered from a small motor-generator, driven from the battery and giving 600 volts direct current on the generator side. Electric filters keep out the commutator tones from the anode voltage. Two antennas and two different wave lengths are caused at each station, one for sending and one for receiving. The author states that conductor-directed radio is cheaper than ordinary two-wire telephony on special poles as soon as the distance exceeds 20 km. (12.5 miles). The cost of operation is estimated to be about 2 per cent of the first cost when the station is used one hour a day.—*Elektrotechnische Zeitschrift*, Oct. 7, 1920.

Miscellaneous

"Sonic" Power Transmission.—DAVAL.—A Rumanian engineer, G. Constantinescu, is said to have invented a system for transmission of power by means of mechanical vibrations, propagated through water, or some other medium of low compressibility. The so-called "sonic currents" are conducted along metal tubes, filled with water, and are said to show great analogy with alternating electric currents. "Sonic motors" of synchronous and non-synchronous types may be designed, and the "sonic transmission" of energy appears to take place with rather good efficiency. No details of the system are yet disclosed, but "sonic power transmission" is said to have important applications as a supplement to electric power transmission in places where explosive gases make the use of electric motors dangerous. Another application is a "sonic foghorn," which at a power consumption of 1 hp. makes as much noise as a 10-hp. steam whistle.—*Révue Générale de l'Electricité*, July 31, 1920.

NOTICE has been given by the three chief electric light and power companies of Greater New York that a differential of 0.05 cent per kilowatt-hour will henceforth be added to or subtracted from the bills of all consumers for each 10 per cent advance or decrease above or below $3 per ton in the price of coal. Hitherto coal clauses in these companies' rates have been applied only to high-tension and power rates.

A LONG-TERM bond issue to yield only 6½ per cent and two other issues to yield 7 per cent are among the items in November's tabulation of electric light and power company financing. The total for nine bond and note issues by such companies is $16,250,000.

THE EMERGENCY service order and the last of the open-top-car priority orders have been canceled by the Interstate Commerce Commission, leaving public utilities without any preferential treatment in obtaining coal.

A TENDENCY to skepticism concerning the merits of the "service-at-cost" method of rate fixing which has been largely applied to street railways has become evident on the part of some public service commissioners and was recently voiced by E. I. Lewis, chairman of the Indiana Public Service Commission in a public statement.

TWENTY-TWO water-power projects in various sections of the country have been advertised recently by the Federal Power Commission. The applications submitted to the commission up to Nov. 20 covered a projected development of nearly 8,000,000 hp.

A BUSINESS revival is predicted by Dwight P. Robinson, construction engineer, who looks for a great amount of new building in the near future.

UNLESS the city of Seattle succeeds in disposing of its bond issue voted for the Skagit River power project work on that development, which has already been cut down to a quarter of the former activities, may be entirely suspended. It was planned that the plant, which will probably cost $9,000,000, should be in operation by next July.

A RULING by the Missouri Public Service Commission limits the amount of hydro-electricity from the Keokuk Dam plant that may be supplied to twenty contract customers of the Union Electric Light & Power Company of St. Louis, in order that other consumers may share in the benefits of this development.

A CONTINUATION of the slight improvement in the electrical market previously noted is reported, and there is a buoyant note from nearly all sections, despite the demoralization of the cotton market in the South and of the wool and grain markets in the Intermountain States. Collections hold their own on a sixty-day average. Efforts are concentrated to hold down inventory levels. Labor is plentiful. Holiday and seasonal goods are in demand.

News in Brief

Summary of Market Conditions and of Recent and Approaching Happenings of Importance to the Industry

A COMPARATIVE test of electric drive and Diesel-engine drive for cargo ships is being made by the United States Shipping Board, which has equipped the ship William Penn with the oil-burning engines and the Eclipse with the motor-generators.

A COMPILATION by Dow, Jones & Company shows approximately $500,000,000 of public utility securities to be in default of interest. Of this amount only $9,102,000 is in bonds of purely electric light and power companies.

NEW ISSUES of bonds and stock in the amount of $5,500,000 each are announced by the Detroit Edison Company, subject to the approval of the Michigan Public Utilities Commission.

CORROSION and the electrolytic production of organic chemicals will be the subjects of symposiums at the spring meeting of the American Electrochemical Society.

TO CONSTITUTE a clearing house and bureau of information for scientific and industrial research the Research Information Service has been established by the National Research Council.

"GET-TOGETHER" meetings have been held in Seattle, Spokane and Portland by the newly organized Electric Service League of the National Electric Light Association.

INDIANA electrical contractors through their state association have pledged aid to the public utilities of the state in selling securities.

A LONG discussion of power-factor problems was held last week by prominent representatives of the Association of Edison Illuminating Companies.

THE ANNUAL convention of the Electrical Credit Association of Chicago on Thursday and Friday of next week will mark the twenty-fifth anniversary of the association.

IN RECOGNITION of his contributions to the art of ship propulsion the Elliott Cresson medal has been awarded to W. L. R. Emmet by the Franklin Institute.

CO-OPERATION between the different divisions of the electrical industry is being promoted in Atlanta, where an electrical association has been formed to further their joint interests.

CUSTOMERS and employees of the Narragansett Lighting Company may subscribe for a limited quantity of 8 per cent stock now being offered by that company, the issue being restricted to them.

AN ISSUE of $4,000,000 of 6 per cent thirty-year gold bonds at 87½, to yield more than 7 per cent, has been disposed of by the Niagara Falls Power Company.

ADDITIONAL securities have been authorized by the Massachusetts Department of Public Utilities to the amount of $1,025,000 as follows: Pittsfield Electric Company, bonds, $125,000; Webster & Southbridge Gas & Electric Company, $200,000 in stock, and Fall River Electric Light Company, $700,000 in stock.

CAMPAIGNS for the customer ownership of electric utility securities are growing in New England.

FOREIGN orders for high-tension porcelain insulators are still active, despite the rate of exchange, and some manufacturers report enough domestic business to insure the absorption of production.

A DECREASE in the purchase of electric sheets is reported, and shipments of material ordered now may be made after the first of the year.

SATISFACTION prevails in the steel trade because of the action of the Jones & Laughlin Steel Company in revising prices to meet those quoted by the United States Steel Corporation. A stabilizing effect on the steel market is anticipated, with an increase in buying.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Almost 8,000,000 Hp. Involved Already in Water-Power Applications

APPLICATIONS submitted to the Federal Power Commission up to and including the week ended Nov. 20 covered a projected development of 7,726,651 hp. This greatly exceeds the estimates made during the discussion of the water-power bill in Congress. At that time the most optimistic estimate was that the first year would see applications filed covering 2,000,000 hp. In this calculation the capacities of Niagara projects are rated as limited by the diversion now authorized by the treaty. Should the treaty be modified to permit the diversion of 20,000 second-feet additional the above total would be increased by 400,000 hp. The applications covering projects on navigable streams involve 4,790,350 hp., while those on public lands and reservations involve 2,936,301 hp. The projects which require property valuation involve 738,200 hp.

Few Electric Light and Power Utilities in Default of Interest

VERY little of the huge public utility debt on which interest has been defaulted is in electric light and power securities. Of a total principal amount in default, as compiled by Dow, Jones & Company, of around $500,000,000 only $9,102,000 is in bonds of purely electric light and power companies. There is $41,278,000 in combination railway and electric properties, $5,159,000 in gas and electric properties and $2,500,000 in water and electric properties. Of this combined total of $57,615,000 it is interesting to note that $32,446,000, or roughly 60 per cent, is in securities of utilities operated and controlled by the same interests.

I. C. C. Emergency Coal Order for Utilities Vacated

WITH the vacating by the Interstate Commerce Commission on Nov. 24 of service order No. 21 all preferential transportation of coal for utilities has been stopped. This order, which had been on the books since Oct. 8, superseded the general preferential order for utility coal and applied only to emergency cases. In setting the order aside the commission stated that "the emergency which caused the commission on the eighth day of October, A. D. 1920, to make and enter its service order No. 21 has in general been measurably relieved."

A few days later the I. C. C. canceled order No. 20, the last of the open-top car coal transportation priority orders.

The Interstate Commerce Commission rescinded this priority order against the advice of many coal specialists. It is believed necessary to continue maximum production during December to insure against scant supplies later on with the attendant price increases.

The commission very evidently is of the opinion, however, that most of the open-top cars will continue in the coal trade despite the withdrawal of the order owing to the limited amounts of building and road materials which are shipped at this season of the year. In some quarters it is feared that the lack of open-top equipment during recent months has led to an accumulation of stocks of materials best handled in that type of car and that immediate advantage will be taken of the lifting of the order to make these shipments. It is pointed out, however, that should other commodities absorb an undue proportion of the open-top cars the commission could reinstate the order on short notice.

Dwight P. Robinson Sees Business Revival Ahead

THAT an unprecedented volume of construction must be executed in the coming year is the belief expressed by Dwight P. Robinson, president of Dwight P. Robinson Company, Inc., construction engineers.

When recently interviewed on this topic Mr. Robinson said: "Now that the election is behind us and the general uncertainty from that quarter removed, it is my feeling and that of my associates that a strong revival of general business activity will soon be evident in all parts of the country. The demand for living accommodations and office space must be met. To take care of their rolling equipment the railroads must build new terminals and shops deferred by the war. To public utilities generally sufficient rate increases are being granted to permit operation at a profit, and the money will therefore be available for the vitally necessary extensions to power, lighting and traction property. Many manufacturing plants must further increase their production by building plant extensions."

Coal Rider Applied to Domestic Rates in New York City

COAL riders heretofore applied to high-tension and power rates were extended on Dec. 1 in New York City to all consumers. The three companies in greater New York City whose rates are thus affected are the New York Edison Company, the United Electric Light & Power Company and the Brooklyn Edison Company.

The coal rider is the same for each of the three utilities and provides for a change of fifty one-thousandths of a cent per kilowatt-hour for each 10 per cent advance or decrease in the price of coal above $3 per ton. This was the average price in effect in 1916, when the present rate schedule was authorized.

In discussing the rider Arthur Williams, general agent of the New York Edison Company, pointed out that on Jan. 1, 1917, the rates were decreased from 8 cents per kilowatt-hour to 7½ cents, and again on July

1, 1917, to 7 cents. At that time the New York Edison and United companies reserved the right to go back to 8 cents if conditions were reversed. The current average price for coal, he stated, is $8.50. With an advance of one-twentieth of a cent for each 30 cents in the coal price the advance in December bills amounts to 9 mills.

Mr. Williams added, however, that while the utilities were making a coal preferential of 0.05 cent the actual increase in company costs would amount to 0.057 cent.

City officials appear to be disturbed because, as they claim, no public hearing was given on the advance. The schedule was filed with the commission Nov. 1, according to the law which requires that changes in rates cannot be placed in effect until they have been on file with the commission thirty days. Customers received notices from the utilities on Dec. 1.

In its letter to the Public Service Commission accompanying the riders the New York Edison Company referred to the right to go back to 8 cents, saying:

It is understood that as these riders are filed in accordance with the reservation of the company, when the existing maximum rate of 7 cents a kilowatt-hour was adopted, to return to a maximum of 8 cents if justified by the conditions of cost, the company will not permit the increase in the cost of coal to produce a corresponding increase in the cost of electric energy beyond 1 cent a kilowatt-hour without first going to the commission and reporting to you any conditions which might cause a cost beyond that figure. Thus, though the company has no guarantee that the increased cost of coal will not exceed 1 cent a kilowatt-hour, the company guarantees that under the riders here filed the increased cost to the consumer shall not exceed 1 cent a kilowatt-hour without first reporting the matter to you for such action as you may deem justifiable.

Accompanying the notice of change in rates an announcement was sent to customers by the New York Edison Company showing how the riders work and explaining the company's position.

The statement reads in part as follows:

When these schedules were adopted we were most apprehensive of future conditions, and the right was then reserved, as shown by the records of the Public Service Commission, to increase our rates by 1 cent a kilowatt-hour should conditions justify. Notwithstanding the constantly rising cost of coal, labor and supplies, with which all are familiar, we hoped to get through the entire war and readjustment period without making any change in our schedules. This would have been accomplished as planned, probably, were it not for the abnormal increase in the cost of coal, which has now reached a point where it can be carried no longer without jeopardizing seriously the financial position of the company.

The adjustment for low-tension service is fifty one-thousandths of a cent a kilowatt-hour for each increase or decrease of 10 per cent above or below the average cost of coal of $3 a ton in 1916, when the present rate schedules were adopted. The actual increase in the cost of coal in each of the 10 per cent steps during the past three years has been slightly in excess of fifty-seven one-thousandths of a cent for each kilowatt-hour; hence we shall continue to bear part of the increased cost of coal over the prevailing averages of 1916, and, in addition, the entire added cost of labor, material, supplies and taxes. We shall endeavor to carry these elements of additional cost throughout the present period of readjustment, trusting that it may not be necessary to ask the Public Service Commission for any further modification of our schedules through which the cost of the service would be increased.

Under an order from the Public Service Commission for the First District, the exact cost of coal is reported from month to month, and this adjustment is covered by a monthly rider which is on file at the offices of the Public Service Commission.

It will be apparent that under the "sliding scale" principle upon which this adjustment is based any reduction in the cost of coal will immediately accrue to the benefit of the consumer. This company is of course in no way responsible for any of these increases in the cost of service. On the contrary, they have been largely, if not entirely, the result of the war and post-war conditions, and many were either approved or actually established by the federal government at Washington as a necessary feature of our part in the great war effort.

Detroit Edison to Issue New Stock and $5,500,000 Bonds

TO MEET its capital requirements for the completion of work now in progress and for the coming year the Detroit Edison Company, in a letter to its stockholders, is offering ten-year 8 per cent convertible debenture bonds up to 20 per cent of the amount of outstanding common stock of record Dec. 11, 1920. The convertibles will amount to about $5,500,000. In addition, the company purposes to issue a like amount of its capital stock. Stockholders of the Detroit Edison Company have been invited to waive their right to purchase this new stock. It is the intention of the company to sell such stock as thus becomes available to its customers. The issue of the convertible bonds and of the additional capital stock will be submitted for approval to the Michigan Public Utilities Commission.

Long-Term Issues Yield as Low as Six and One-Half per Cent

FOR the first time since February of this year the yield column in the November tabulation of the public utility financing carries a figure as low as 6.5 per cent. This is a long-term issue of $600,000 in bonds of the Blackstone Valley Gas & Electric Company to mature Jan. 1, 1939, and it bears 5 per cent interest and was sold at 84. There are also two thirty-year issues of gold bonds, both offered at 87½, to yield as low as 7 per cent. One of these issues is of $2,500,000 by the Adirondack Power & Light Corporation, the other of $4,000,000 by the Niagara Falls Power Company. With but one exception the offerings are long-term obligations. The exception is $1,000,000 in first lien and general mortgage gold bonds of the Dayton Power & Light Company, sold at 97½, to yield 8.2. This issue falls due March 1, 1923. The following table gives the nine issues in detail.

Company	Amount of Issue	Period	Class of Security	Rate of Interest	Per Cent Yield	Offered at
Arkansas Valley Railway, Light & Power Co.	$1,400,000	11-year	First and refunding mortgage sinking-fund gold bonds	7	8.05	96
Pennsylvania-Ohio Power & Light Co.	2,250,000	10-year	Bond-secured sinking fund gold notes	8	8.6	96
Blackstone Valley Gas & Electric Co.	600,000	27-year (due Jan. 1, 1939)	First and general mortgage bonds	5	6.5	84
Dayton Power & Light Co.	1,000,000	3-year (due Mar. 1, 1923)	First lien and general mortgage gold bonds	7	8.2	97.5
United Light & Railways Co.	2,000,000	10-year	Bond secured gold notes	8	8.45	97
Massachusetts Lighting Co.	1,000,000	10 year	Gold debenture bonds	7	....	....
Adirondack Power & Light Corp.	2,500,000	30-year (due Mar. 1, 1950)	First and refunding mortgage gold bonds	6	7	87.5
Nevada-California Electric Corp.	1,500,000	10-year	Secured gold notes	8	8.15	99
Niagara Falls Power Co.	4,000,000	30-year	First and consolidation mortgage gold bonds	6	7	87.5
Total	$16,250,000					

Northwest Electric Service League Begins Activities

IN THE last ten days the newly organized Service League, founded under the auspices of the Northwest Geographic Division of the National Electric Light Association, has started functioning with "get-together" meetings in Spokane and Seattle, Wash., and Portland, Ore., on Nov. 25, 29 and 30, respectively. Representatives of the advisory committee visited these cities to meet with all branches of the industry to explain further the purposes of the league and increase enthusiasm.

Since the September convention of the association in Spokane the new executive committtee has ratified the action of the convention and has formally instructed the advisory committee of the league to proceed. At the annual meeting of the Oregon Contractor-Dealers' Association the purposes of the league were approved and support was pledged. Similar action was taken on Nov. 4 by the Washington Association of Contractor-Dealers.

Providence Company Offers Stock to Customers and Employees Only

COMMENCING on Dec. 1 the Narragansett Electric Lighting Company, Providence, R. I., offered its customers an opportunity to purchase a limited quantity of its 8 per cent preferred stock. The offer is available only to the company's customers and their families who are not already stockholders, and no application will be accepted for more than five shares. It is the desire of the management of the company to have its securities as widely distributed among its customers as possible, and the stock purchased under this plan may be paid for in cash or in quarterly payments beginning Jan. 1.

Recently the Narragansett Electric Lighting Company offered its preferred stock to employees under a subscription plan whereby payments for stock were deducted from employees' salaries. Within a week after this plan became effective 204 employees had subscribed for 1,012 shares. Three years ago more than 1,000 shares of the company's capital stock were taken by employees on the subscription plan, and in June, 1919, approximately 4,000 shares were sold to customers on the partial-payment plan.

Co-operative Idea Spreads to Atlanta

ACTIVE co-operation between the manufacturers, jobbers, contractors, dealers and the central station has spread to Atlanta, Ga., where there has been formed the Atlanta Electrical Association. Nearly all of the local electric companies and firms are actively represented in this organization, which has undertaken an advertising campaign for the general betterment of the industry in and around that city. This campaign includes the mailing of booklets by the central station, together with instructive literature, with each of its 25,000 monthly bills, while a fund of $1,750 has been subscribed by members of the association to cover direct-by-mail and newspaper advertising for the coming year. Under arrangements between the association and the power company the association will furnish only the booklets and stuffers. The power company will furnish the labor for mailing and will prepare and keep up to date all mailing lists. Interesting booklets dealing with old-house wiring and urging an increase in the number of outlets and proper selection and use of appliances will be sent to all architects and building contractors and to those taking out building permits and will be designed to tie in with the power company's direct-by-mail advertisements.

Awarded Elliott Cresson Medal



W. L. R. EMMET

THE Franklin Institute has awarded to W. L. R. Emmet of the General Electric Company the Elliott Cresson gold medal in recognition of his contributions to the art of ship propulsion.

West Virginia Company Would Equalize Rates by Zoning

FOR THE purpose of what it terms "equalizing the rate of charges for electricity," the West Virginia Utilities Company will make application to the Public Service Commission of West Virginia to permit the enforcement of a new schedule of rates. While in many cases the rate will remain comparatively the same as that now in force, it is aimed to eliminate all the existing "special" contracts. The new rate is based on present-day cost of producing energy.

The greatest change was made in zoning the large power customers into two zones. The first zone includes virtually all of the coal mines and industries within the area embraced by Morgantown, Richards, Strafford, Sabraton and Riverside. A sliding scale is made according to the amount of power used, which begins at 1.5 cents and is graduated down to ½ cent. The second zone includes all of those plants outside of the area bounded as above, and to the regular rates charged in those instances is added an amount to compensate for the additional wire necessary and the expense of transmission.

Niagara Falls Power Issues $4,000,000 of Thirty-Year Bonds

FOR the purpose of reimbursing the treasury for expenditures involved in installing the three 37,500-hp. generating units and other work the Niagara Falls Power Company has sold $4,000,000 of first and consolidation mortgage series AA 6 per cent gold bonds, which are being offered to investors at 87½, yielding over 7 per cent. This is a thirty-year issue, due Nov. 1, 1950, and brings the total funded debt of the corporation up to $32,226,000.

Special Symposium on Corrosion for Spring Electrochemical Meeting

PLANS have already been made for the spring meeting of the American Electrochemical Society, which is to be held at the Hotel Chalfonte, Atlantic City, April 21-23, 1921. A special symposium on corrosion will occupy the morning and afternoon programs of one day and will bring out the latest information on this subject. For another session it is planned to hold a symposium on electrolytic production of organic chemicals. Social features of the meeting will include a smoker and lecture on one evening and some moving pictures of appropriate electrochemical subjects, followed by a dance, on another evening. Dr. Carl Hering, Philadelphia, is chairman of the committee on arrangements.

Edison Association Discusses Power Factor

AT THE request of a number of leading men in the industry, Walter H. Johnson, president of the Association of Edison Illuminating Companies, called a conference, in Philadelphia on Nov. 22, of the representatives of a number of the central stations in the country where the power-factor problem is an important one and where that problem has grown to such a point that measures are necessary for its correction.

The conference lasted from 10 a.m. to 4 p.m., adjournment being taken for luncheon. The first part of the program contained abstracts of discussion upon Charles J. Russell's paper on the topic "Commercial Aspects of Power Factor, Its Measurement and Correction," presented at the New London convention of the association by L. L. Elden and A. S. Knight of the Edison Electric Illuminating Company of Boston, Philip Torchio of the New York Edison Company and George P. Roux of the Philadelphia Electric Company.

This was followed by the reading of new written discussions by those whose names and companies follow: L. E. Sinclair, Potomac Electric Power Company; R. H. Tillman, Consolidated Gas, Electric Light & Power Company; Robert Lindsay, Cleveland Electric Illuminating Company; G. W. Van Derzee, Milwaukee Electric Railway & Light Company; Henry H. Lyon, Buffalo General Electric Company; N. L. Pollard, Public Service Electric Company of New Jersey; Charles S. Dawson, Scranton Electric Company; B. F. Cleaves and W. H. Wade, Penn Central Light & Power Company; C. W. DeForest, Union Gas & Electric Company; E. W. Babcock, T. I. Jones and S. D. Sprong, Brooklyn Edison Company; H. B. Gear, Commonwealth Edison Company, and H. W. Eales, Union Electric Light & Power Company.

In the afternoon Mr. Russell, who had received the written discussion in advance and collated the various points covered, replied to the questions raised. F. S. Dellenbaugh, Jr., of the Massachusetts Institute of Technology, discussed in an informal way some of the important aspects of the power-factor situation as it affects revenue and station capacity. A summing up of the entire discussion was then made by Dr. C. P. Steinmetz, who drew attention to certain aspects of the power-factor problem which had not previously been considered.

President Johnson appointed the following committee to carry on research, with the idea of making a report containing definite recommendation at the next annual convention of the Association of Edison Illuminating Companies: C. J. Russell, chairman, Philadelphia; C. S. Dawson, Scranton; C. W. De Forest, Cincinnati; L. L. Elden, Boston; W. B. Gear, Chicago; H. H. Lyon, Buffalo; S. D. Sprong, Brooklyn; C. P. Steinmetz, Schenectady, and G. W. Van Derzee, Milwaukee.

Doherty Company Predicts Cheaper Money for Utilities

ASSERTING that bonds yielding 10 per cent or more are steadily becoming fewer, Henry L. Doherty & Company in an announcement issued recently predict that the day of the short-term corporation note is passing and that of long-term bonds is again dawning. Commodity prices are declining, the purchasing power of the dollar is increasing, and quotations for income-bearing securities are advancing. Public utility bonds, especially, the company says, are selling at prices most attractive to investors. Much activity has been noticeable in the bonds of companies supplying electric light and power and the price tendency in these issues is distinctly upward. Quotations are beginning to reflect the much better times in store for these companies. The decline in commodity prices will be of vast benefit to them as it will mean lower operating costs and increase in earnings. Many rate advances, too, have recently been granted. While this class of companies suffered most severely under war conditions, the Doherty company points out that few of them defaulted in payment of interest on their bonds. Many of these issues are now selling at twenty-five points and more below prewar quotations notwithstanding that the companies are now in stronger financial position and have greater earning possibilities than was the case when their securities brought higher prices.

Additional Water-Power Projects Advertised

PROJECTS recently advertised by the Federal Power Commission are sponsored by the following companies and individuals: Niagara County Irrigation & Water Supply Company, St. Lawrence River Transmission Company, Pit River Power Company, Western New York Utilities Company, Hydraulic Race Company, Niagara Falls Power Company, Western Tie & Timber Company, Louisville Power Corporation, Lower Niagara River Power & Water Supply Company, Niagara, Lockport & Ontario Power Company, city of Buffalo, J. Kennard Thomson and Peter A. Porter, Niagara Gorge Power Company, Columbia Valley Power Company, A. P. Seybold, William Park Mills, Rock Creek Power Company, J. G. Van Zandt, and Alabama Power Company.

Water-power projects were advertised by the commission during the week ended Nov. 27 as follows:

Utah Light & Power Company, Salt Lake City, preliminary permit, power development in Bear River; objections may be filed until Feb. 15. United Mills Company, Hickory, N. C., preliminary permit, power development, Harpers Creek, near Mortimer, N. C.; objections may be filed until Feb. 21. Merced Irrigation District, Merced, Cal., preliminary permit, power development on Merced River; objections may be filed until Feb. 21.

Indiana Contractors Pledge Utilities Aid in Selling Securities

IN ANNUAL convention at South Bend, Ind., this week the Indiana State Association of Electrical Contractor-Dealers pledged itself to active support of the public utilities of the state and to render them immediate assistance in the sale of their securities. This action followed noteworthy addresses by Morse Dell Plain, president of the Indiana Electric Light Association, and W. L. Goodwin of the General Electric Company on the advantages to be gained by closer co-operation between contractor-dealers and central stations.

Mr. Dell Plain said: "The Indiana Public Service Commission has kept the utilities of the state one step ahead of the sheriff by allowing the companies meager rate increases which did not come within 25 per cent of being the rates to which the central stations have been entitled. The utilities of the state are unable to extend and take on new business at a profit, and as long as these conditions prevail the prosperity of the other branches of the electrical industry will be limited."

After considering the advisability of having discounts readjusted, the association passed a resolution urging manufacturers to pay dealers a definite percentage for local newspaper advertising when the dealers expend an equal amount to advertise the manufacturers' products. This advertising allowance is to be in excess of the regularly recognized trade discount.

A. B. Harris of Gary was re-elected chairman and executive committeeman for the northern division. Thomas Hatfield, Indianapolis, and A. L. Swanson, Evansville, were elected to represent the central and southern divisions respectively on the representative committee. A. I. Clifford of Indianapolis is secretary.

Work on Skagit River Project May Be Entirely Suspended

UNLESS the city of Seattle, Wash., is able to dispose of its bond issue voted for the Skagit River power project work on the nine-million-dollar hydro-electric enterprise may be entirely suspended. The work has been reduced 75 per cent at this time. Several millions in bonds remain available but are useless until sold, and the condition of the bond market, according to city officials, is such that 6 per cent utility bonds are not as attractive as other forms of investment. The experiment of selling the bonds to the public over the counter did not result in a sufficiently rapid movement to keep pace with construction work.

More money has been spent in construction than has been received from sale of bonds, according to report of City Comptroller Harry W. Carroll, who places the deficit at $45,756.55. Thus far $1,698,769.01 has been spent. Suspension of operations next month, as threatened, would entail an expense of $100,000 due to the scattering of the present organization and reassembling of another crew. City Engineer Dimock has been notified to limit his work. However, C. F. Uhden, chief engineer in charge of the work, says that he will continue tunnel boring operations at least until mid December.

Bonds totaling $5,500,000 have been voted for the Skagit project, but this issue will not be nearly enough to cover the contemplated development. City Engineer Dimock states that the soundest plans involve an expenditure of $9,000,000 to develop 34,500 kw. Further development of the Gorge unit, entailing a great dam costing several more millions, would increase the plant rating to 54,000 kw.

The work thus far accomplished has been preliminary, including construction of a railroad to the Gorge Creek power site, which is 80 per cent completed; equipment, right-of-way, cottages, bunk houses, warehouse, hospital, sawmill, timber cutting and similar incidentals, as well as a 2,720-ft. tunnel for the Newhalen power unit, which will supply power for the construction machinery that will then take up the Gorge work, involving a 10,000-ft. tunnel. Work on this tunnel has proceeded 1,200 ft. and the plant is to be in operation next July, according to present plans.

Electrical Power Production in Soviet Russia

THE generation and distribution of electric power in Russia is under the control of the soviet department for electricity. This department manages ten nationalized power plants, forty-five nationalized factories for electrical machinery, telephones and telegraphs and nineteen works not yet nationalized. The aims of the soviet government are to build new power plants and to supply electricity to farmers, sawmills, mines and to all larger foodstuff producers.

A statement issued by the soviet government regarding the future of the electrical industry in Russia is full of optimism and goes so far as to say that all the resources of the country will be utilized by electric power, bringing the country to a state of prosperity unparalleled in its history. The figures of the power production of the Moscow and Petrograd plants from January to April, 1920, show, however, that practical conditions are very far behind these aims of the soviet government. In Moscow only three of the existing five power plants were running in January, the other two having been put to work later on with insgnificant results. Only 8,000,000 kw.-hr. are produced in Moscow per month. In Petrograd the power production is still less and was in March at its highest point, with 6,800,000 kw.-hr. Nine of the ten nationalized power plants are situated in these two cities. The electrical works in the provinces that still exist are in private hands, but most of these plants have shut down for want of fuel.

New England N. E. L. A. to Award Prizes

PRIZES for the best letters setting forth the personal benefits actually realized by membership in the National Electric Light Association will be awarded by the New England Geographic Division, and the papers will be read at a special dinner and meeting on Dec. 17 at the General Service Buildings of the Edison Electric Illuminating Company of Boston in connection with a movement recently inaugurated to bring home the advantages of membership to employees of operating companies and others. M. H. Aylesworth, executive manager N. E. L. A., will speak at the meeting. The competitive letters will be classified according to section, under accounting, commercial, technical and public relations divisions, the letters being sent respectively to G. M. Guilford, V. M. F. Tallman, L. L. Elden and H. T. Sands, chairmen of these sections of the New England Geographic Division. Full publicity will be given the prize papers.

Electric Versus Diesel-Engine Drive for Cargo Ships

COMPARATIVE tests on electric and Diesel-engine drive for ship propulsion are being made by the United States Shipping Board for the purpose of determining the more economical and efficient motive power for use with cargo ships.

The William Penn, which is the first vessel to be allocated to the United American Line, has been equipped with Diesel oil-burning engines geared direct to the propellers. The Eclipse, which is on a voyage to the East Indies, is provided with electric generators. Records giving in detail the performance of the two vessels on their present voyages are being kept and will be placed before the Shipping Board as soon as the home ports are reached again. The cargo ships will be converted to the form of motive power found most economical and efficient, said Admiral Benson, chairman of the board.

Hydro-Electric Power Plants for the Rhine

PLANS for the development of the water power of the Rhine have been submitted to the French government by the economic regional committee of the eastern district and have been approved. These plans include the construction of seven dams and ten power plants between Huningen and Strasbourg. The plants will be rated at 80,000 hp. each, and a possible total development of 1,000,000 hp. at high water and one-half that amount at low water is expected. From four to five years will be required to carry out the project, and the cost is estimated at 350,000,000 francs, though it will probably be much higher, some authorities putting it at a billion francs.

As Switzerland has ancient rights for the navigation of the Rhine, the power plants will be erected some distance from the banks and will be fed by a canal running parallel to the river. The power will supply the mining district of eastern France, especially the Briey mines. The Versailles peace treaty provides that the water power of the Rhine along the German-French frontier shall be the common property of both countries. In the case of new power plants the country building them will have to recompense the other country up to half of the value of the produced power either in energy delivered or in the money equivalent.

Electrical Credit Association of Chicago Reaches Its Twenty-fifth Anniversary

FOR the purpose of holding its annual convention and celebrating the twenty-fifth anniversary of the formation of the association the Electrical Credit Association of Chicago will meet at the Congress Hotel in that city on Dec. 9 and 10, at which time the trend of business conditions and practices will be discussed. The program follows:

Thursday, Dec. 9.—"The Trend of the Times," by H. A. Lewis, advertising director McGraw-Hill electrical publications; "Credit Insurance," by John E. Gregory, New York; "Better Letters," by Charles Henry Mackintosh, Chicago; "Oriental Trade Representation," by F. K. Pinckney, MacBeth-Evans Company, Chicago; "C. O. D. Refusals," by H. L. White, Detroit; "Uniform Trade Terms," by A. L. Cohen, Detroit, and J. H. Morgenson, Chicago.

Friday, Dec. 10.—"Trade-Acceptance Experiences and Results," by E. W. Shepard, general credit manager Western Electric Company, New York; "Contractors' Standard Accounting System," by T. K. Quinn, Cleveland.

At the banquet on Thursday evening the principal speakers will be Judge K. M. Landis, Gen. Charles G. Dawes and W. M. Carpenter, who was the first president of the association.

Stockholm-Gothenburg Railroad to Be Electrified

THE Swedish Government has decided to electrify the Stockholm-Gothenburg division of the State Railroad and has appropriated about $5,000,000 for the work to be done during 1921. The division is about 300 miles long and its electrification will require a total expenditure of about $25,000,000. Although the Riksgränsen division, which is already electrified, operates at 16,000 volts, single-phase, it has not been definitely decided whether the new electrification will use alternating or direct current. In order to determine this and other factors which are unsettled a royal commission is now studying the railroad electrifications in the United States.

Research Information Bureau Established

THE Research Information Service has been established by the National Research Council as a general clearing house and bureau of information for scientific and industrial research. Information is supplied on request concerning research problems, progress, laboratories, equipment, methods, publications, personnel, funds, and similar matters. Except where unusual difficulty in obtaining the desired information makes it impossible inquiries will be answered without charge. Requests should be addressed to Research Information Service, 1701 Massachusetts Avenue, Washington, D. C.

Incoming and Retiring Presidents of Southeastern Section N. E. L. A.



At the left S. B. Ireland, vice-president and general manager Montgomery (Ala.) Light & Power Company, who was elected president of the Southeastern Section of the N. E. L. A. at the convention at Miami, Fla. Beside him stand P. A. Tillery, vice-president and general manager Carolina Power & Light Company, and "Bill" Goodwin, the well-known advocate of better organization within the industry, whose presence at the Miami convention is one indication of the breadth of the program planned and successfully executed by Mr. Tillery, who now retires as president of the Southeastern Section.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Platinum Find in South Africa.—Reports of the discovery of a rich platinum mine in the Cala district of Cape Colony are noticed in the British papers as entitled to credence. The ore body is said to extend 13 miles and the values to be extraordinarily high. An assay plant is being sent to the mine to make thorough tests.

Utility Securities as Investment for Soldiers' Bonuses.—A special drive to enlist the soldiers' bonus granted by the state in the upbuilding of the company system through security purchases is to be launched by the Central Maine Power Company, which sees in these securities an excellent investment for those former service men who want to save their bonuses.

Hydro-Electric Development in Russia.—The Russian government, it is reported, is considering plans for the development of three hydro-electric plants, the first to be located on the Svir River, which connects Lake Ladoga and Lake Onega; the second on the Vollshov River, and the third on the Dnieper River north of the Black Sea, between Ekaterinburg and Alexandrovsk.

Water-Power Valuations.—A "Memorandum Concerning Principles and Methods of Water-Power Valuations Approved and Practiced by Various Courts and Commissions" has been prepared by Edward J. Cheney, an engineer of New York City. This pamphlet, which is not controversial but in which collected facts are set forth in an impartial manner, is especially recommended by its sponsors to public utility men.

Eight Years' Issues of California Public Utility Securities More than a Billion Dollars.—In the eight years since the public utilities act became effective the Railroad Commission of California has authorized the issue by public utilities of securities totaling $1,001,500,000, besides dismissing or denying applications for $130,000,000 more. Gas and electric companies ranked first in amount of securities issued, with $398,000 000, against the steam railroads' $324,000,000.

Rotterdam Expanding Electrically.—Dr. A. Ter Frock, of the city engineer's department, Rotterdam, Holland, has been on a visit to Canada for the purpose of studying the Ontario Hydro-Electric system. Dr. Ter Frock says that the city of Rotterdam is expanding so fast on account of the annexation of suburbs that the electric system is wholly inadequate to meet the demand. The city uses garbage to develop power for industries and for civic transportation. It is now going to utilize the water from the River Meuse, flowing by the city, and expects to adopt a system similar to the Ontario Hydro-Electric.

Renting of Electrical Equipment in Germany.—A recent issue of *Elektrische Kraftbetriebe und Bahnen* contained a report of a power system in Germany supplying energy to farms and small villages. For this service transformers are loaned on a rental basis. The rent on a transformer of 50-kw. rating is 35 marks per month. If this transformer must be exchanged for a new one of the same rating the customer is required to pay 355 marks, owing to the increase in the first cost of the transformers. The present cost of transformers in sizes up to 100 kva. is twenty-two times the cost in 1914.

Buckeye Power Company's New Transmission Line.—The 66,000-volt tower line recently constructed for the Buckeye Power Company between Steubenville and Wellsville, Ohio, covers 22 miles, much of the distance presenting an extremely rough and rugged profile. The maximum span on the line is 2,100 ft., and there are twenty-two spans exceeding 1,000 ft. Many interesting engineering problems presented themselves in building this line, the *A-G-E Bulletin* says, at points where it was necessary to deviate from the original survey owing to right-of-way difficulties and other causes. The Wellsville substation has an initial installed capacity of 6,000 kva., 66,000/13,200 volts, three-phase. Two of the secondary circuits extend north to East Liverpool, Ohio, where a new substation is being built. The old 13,200-volt line to this place will soon be replaced with a line of modern construction, forming the last link in the new system between East Liverpool, Wellsville and the Windsor power plant.

Legal Aspects of Water-Power Development in Utah.—The constitutionality of the Utah law giving the State Engineer, with the consent of the Governor, power to withdraw from entry the waters of any particular river or other source of supply is to be tested in a suit brought by Caleb Tanner against State Engineer George F. McGonagle. Mr. Tanner has filed application for permission to divert 33.47 second-feet of water from the Provo River, with which to develop about 250 hp. of electrical energy, and to return the water to the West Union Canal. Mr. McGonagle refused to accept the application, apparently on the ground that the waters of the Provo River have been withdrawn from entry for the present. This action was taken on the organization of the Utah Water Storage Association, representing eight counties watered by the Provo and Weber Rivers and by waters from Utah Lake, which has employed engineers to determine the ultimate possibilities of the development of the water supply in these counties. The association requested the withdrawal of the two rivers and the Utah Lake waters during investigation.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Cleveland Section, A. I. and S. E. E.—Before this section on Dec. 13 L. F. Adams of the General Electric Company's power and mining department will discuss "Continuous-Rated or 50-Deg. Rise Motors?"

Chicago Section, A. I. and S. E. E.—The Chicago Section of the Iron and Steel association plans to hold its next meeting on Dec. 11, when G. P. Wilson, switchboard engineer of the Westinghouse Electric & Manufacturing Company, is to read a paper on switching equipment for steel-mill power houses and substations. The meeting will be held at the Morrison Hotel.

Joint Meeting of Meter Committees.—A joint meeting of the meter committees of the N. E. L. A. and the Empire State Gas and Electric Association will be held at the Iroquois Hotel, Buffalo, on Dec. 8. In the morning a paper on "Maximum-Demand Metering" will be presented by Perry A. Borden of the Ontario Hydro-Electric Commission, and in the afternoon B. W. St. Clair of the General Electric Company will read a paper on "Measuring Instruments Used in Connection with Service Tests."

N. E. L. A. Committee Meetings.—Meetings of Technical Section committees of the N. E. L. A. are scheduled as follows: Dec. 7, 8 and 9, meter committee, Buffalo; Jan. 17, hydraulic power committee and underground systems committee; Jan. 18, inductive interference committee and prime movers committee; Jan. 18 and 19, meter committee; Jan. 19, 20 and 21, electrical apparatus committee, and Jan. 19 and 20, overhead systems committee, all in New York.

Coming Meetings of Electrical and Other Technical Societies

Association of Iron and Steel Electrical Engineers, Philadelphia Section, Dec. 7; Chicago Section, Dec. 11; Cleveland Section, Dec. 13.

Rivers and Harbors Congress—Washington, Dec. 8-10.

Illinois State Electric Association—Chicago, [illegible] Nov. 6, Jan. 9, 1921.

Electrical Credit Association—Chicago, Dec. 9 and 10.

A. I. E. E. and A. S. M. E. [illegible] Section, [illegible], Dec. 13.

A. I. E. E. and A. S. M. E. [illegible] Section, [illegible], Jan. 11.

American Physical Society—Annual meeting, Chicago, Dec. 28-Jan. 1.

American Institute of Electrical Engineers—Chicago, Jan. 14.

Western Association of Electrical Inspectors, [illegible], Jan. 25-28.

Association of Municipal Electrical Utilities of Ontario, Toronto, Jan. 27 and 28.

A. I. E. E. (New York Section) and A. S. M. E. (Metropolitan Section) joint meeting, New York, Jan. 28.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Rates Which Commission Cannot Change Cannot Affect Other Rates.—In determining the reasonableness of electric rates for private consumers no weight can be given to the question whether or not a contract entered into by the utility for street lighting is profitable to the company, the New York Public Service Commission, Second District, has asserted, because the commission has no jurisdiction to change such rates and they must be considered as voluntary rates of the company.

Apportioning Cost of Rural Service Extensions.—Residents of rural districts within reach of electric plants and in territory covered by franchises of the central-station company should, the Public Service Commission of New York for the Second District found in determining a complaint against the Orange County Public Service Corporation, be supplied with service if it can be done in a safe and practicable manner and without prohibitive expense. However, an unusual installation in order to afford rural service should not be made entirely at the expense of the company. To do so would either require special and high rates for such rural consumers or would unduly burden urban consumers. In this case the consumers were required to contribute to the expense of installation the difference between that expense and the average cost to the corporation per customer on the distribution system, including transformers, service drops and meters.

Going Value and Other Factors Entering Valuation Proceedings.—In approving proposed rates for the Brookfield Electric Light Company, a utility valued at $145,000, which would yield less than 4 per cent for depreciation and 7 per cent for return, the Missouri Public Service Commission asserted a number of principles governing it in valuation proceedings. Going value, it held, is not to be estimated on the theory of the "cost of establishing the business" where such costs, charged to operating expenses, have been recouped to the utility. The actual cost of property is, in its opinion, the proper basis upon which to compute depreciation, since the purpose of a depreciation reserve is to retire property, and when it is retired the plant account should be credited and the depreciation reserve charged with its cost. Rates for electric service are based upon both fixed costs—determined by the investment and its maintenance—and variable costs—determined by the quantity of energy consumed—inasmuch as income from operation should meet investment or fixed costs and production or variable costs.

Temporary Discontinuance of Service May Be Authorized.—Declaring that it has no power to award damages against a utility for breach of contract to render continuous service, the New York Public Service Commission, Second District, maintains also that it was the duty of the commission to authorize an electric company to discontinue service for short periods of time for several successive days in order to improve its plant so as to serve other patrons, although it had recently ordered the utility to render continuous service to a certain customer and the utility had therefore entered into a contract so to do.

Combination Contract Not Affected by Change in Rates for One of the Commodities Furnished.—The Jefferson Deposit Company having complained to the Illinois Public Utilities Commission that it had been overcharged for steam and electric service in contravention of a contract whereby it refrained from equipping its office building in Peoria with heating and lighting apparatus and gave to the utility the exclusive right of service to its tenants and occupants, the commission declared that such a contract was not one involving a transfer of real estate or property—which, under the Illinois statute, would remove it from the commission's jurisdiction—and also that a patron of a utility receiving gas, electric and heating service under a combination contract recognized in the field schedules of the utility is not affected in any way by proceedings brought by the utility for a change in heating rates upon published notice to steam users only. The commission therefore sustained the complaint and ordered the excess charges refunded.

Property Not Used or Useful in Particular Service Not Considered in Rate Fixing.—In determining the rate for hydro-electric service furnished the United Railways Company of St. Louis by the Union Electric Light & Power Company the Missouri Public Service Commission held that a street railway purchasing energy under contract from an outside distributing company, later acquired by a local electric utility formerly also purchasing from said distributing company, is not chargeable in proceedings adjusting rates for power so purchased with investments of the local utility in tie lines and transformer stations not in fact used and useful in furnishing energy received under said contract by the street railway, where no contract obligation requires the local utility to deliver energy to the street railway, where the improvements were made for the requirements of the local electric utility and not those of the original distributing utility, and where both the local utility and the street railway were instrumental in bringing water power to the locality served.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Court Order for Definite Complaint Not Appealable.—A circuit court having granted an application in City of Milwaukee vs. Railroad Commission of Wisconsin for an order requiring the plaintiff to make its complaint more definite, and the plaintiff having appealed, the Supreme Court of the state has declared the order of the lower court not appealable. (179 N. W. 511.)*

When Utility Abandons Property Operation at a Loss Cannot Be Compelled.—A decision of the California Supreme Court, in Lyon & Hoag vs. Railroad Commission, declares that the state cannot, through the public service commission or otherwise, compel the continued operation of a public utility at a loss in a case where the owner has abandoned all of its property devoted to the public use, because such action would violate the Fourteenth Amendment to the United States Constitution, forbidding the taking of property without compensation. (190 Pac. 795.)

Commission Cannot Fix Rates in Territory Exempted from Its Jurisdiction.—While disclaiming power under the statutes of Colorado to find itself what the rate paid to a public utility should be, the Supreme Court of that state, in Golden Cycle Mining & Reduction Company vs. Colorado Springs Light, Heat & Power Company, vacated the order of the Public Utilities Commission fixing rates, on the ground that part of the territory covered was within a city exempted from control of the commission under the home rule amendment to the constitution. (192 Pac. 493.)

City Operating Electric Light Plant Not a "Private Corporation."—It has been held by the Supreme Court of California that the term "private corporation" does not include municipal corporations so that a city engaged in operating an electric light plant to supply its inhabitants is not subject to regulation by the Railroad Commission of the state. The case was that of the city of Pasadena against the commission, the city contesting the power of the commission to require it to file a schedule of rates. Admitting that a city while engaged in the business of furnishing electric power and light to its inhabitants is liable for acts of its agents for which it is not liable while performing purely governmental functions, the court holds that the municipality does not for that reason lose its character. (192 Pac. 25.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

S. B. Irelan, who was elected president of the Southeastern Section of the N. E. L. A. at the Miami convention, Nov. 16-19, is vice-president and general manager of the Montgomery (Ala.) Light & Water Power Company and a popular executive of the H. L. Doherty organization. Mr. Irelan has been stationed in Montgomery since 1919, when he was transferred from Sedalia, Mo., where he was vice-president and general manager of the City Light & Water Company. Mr. Irelan was graduated from Purdue University in 1909 with the degree of E. E. After graduation he became associated with the Denver (Col.) Gas & Electric Light Company, and in 1910 he was made secretary and treasurer of the Fremont



S. B. IRELAN

(Neb.) Gas & Electric Light Company, both these companies being Doherty properties. He was then transferred to the New York office of H. L. Doherty & Company in 1912, working in the engineering department. In 1914 he was made vice-president and general manager of the Bartlesville (Okla.) Gas & Electric Company. Mr. Irelan is thirty-one years of age.

W. H. Glenn has resigned as vice-president of the Georgia Railway & Power Company, Atlanta, Ga., to take up the active duties of president of the Shippers' Compress Company, which operates cotton warehouses and compress plants in many cities of Georgia and Alabama. Mr. Glenn has been continuously connected with the Georgia Railway & Power Company and its predecessors for the last twenty-nine years. Shortly after his graduation from the Georgia Institute of Technology he entered the employ of one of the constituent companies as a rodman. He subsequently served for several years in the shops. Then came a promotion to purchasing agent. He was next appointed superintendent of track and roadway. In this position he had charge of most of the reconstruction work following the formation of the Georgia Railway & Electric Company and worked out many of the physical problems of the property. Twelve years ago Mr. Glenn was appointed general manager of the rail way department of the Georgia Railway & Electric Company. Later he was advanced to the position of vice-president and manager of railways. In 1904 he surrendered that title for that of vice-president and operating manager with widely increased duties. These included not only the management of the railways, but supervision over generating stations, transmission lines and the distribution systems.

Fritz J. Frank, vice-president of the Iron Age Publishing Company, has been elected president of that company, following the resignation of William H. Taylor, who has been president and general manager for more than ten years. Mr. Taylor has resigned because of ill health and has retired from active connection with the company. William H. Taylor joined the *Iron Age* as general manager after a group of publishers had acquired the ownership from David Williams. Previously Mr. Taylor had been connected with various trade and engineering publications over a period of fifteen years, having for a time been vice-president of the McGraw Publishing Company and later president of the Taylor Publishing Company of Chicago, which consolidated *Engineering* and *Steam Engineering*. He and his associates on acquiring the *Iron Age* separated from it what had long been the hardware department of this journal and established it as *Hardware Age*. Mr. Frank has been with the Iron Age Publishing Company since 1910, after an active association with other trade publications, among them *Colliery Engineering* and the *Mining and Scientific Press*. He has a wide acquaintance in the iron and steel and machinery trades, is experienced in business journalism, and is thoroughly committed to the traditions and standards of the *Iron Age*, which belongs in that progressive group of business publications that make editorial service to the reader the basis for substantial and sound publishing development.

Eugene B. Edwards, formerly cashier of the Northampton (Mass.) Electric Light Company, has been appointed assistant manager of the company.

L. D. Le Fevre, who has been made the general auditor of the General Electric Company, to succeed S. L. Whitestone, now the comptroller, became connected with the company in 1903. He was appointed traveling auditor in 1907 and in 1917 he was appointed assistant general auditor.

R. C. Starr, construction engineer for the San Joaquin Light & Power Corporation, Fresno, Cal., and F. M. Thebo, construction manager of W. A. Kraner, Inc., San Francisco, have formed the firm of Thebo & Starr, engineers and contractors, with headquarters in the Sharon Building, San Francisco, Cal. The firm will specialize in the design and construction of hydro-electric and irrigation plants and in appraisals and investigations. Both Mr. Starr and Mr. Thebo have been engaged on important hydro-electric construction work in the West for about ten years, including the development of more than 250,000 hp. west of the Rockies. The completion of the 60,000-hp. Kerckhoff project of the San Joaquin Light &



R. C. STARR

Power Corporation by R. C. Starr in fifteen months, at a cost of less than $6,000,000, has been the greatest achievement of the year in Western hydro-electric development. It was made possible by the adoption of entirely new methods in tunnel and dam construction. Mr. Starr will still retain his connection with the San Joaquin Light & Power Corporation.

Obituary

Alfred J. Babcock, who resigned early this year from the firm of Manning, Maxwell & Moore, manufacturers of electrical machinery, New York, died Oct. 30, in London, England. Mr. Babcock was associated with this firm for thirty years.

Arthur M. Waitt, consulting engineer and railroad specialist, died Nov. 10 at Sharon, Conn., as the result of an operation performed several months ago. After graduation in 1879 from the Massachusetts Institute of Technology Mr. Waitt spent many years with various railroads. While with the New York Central he was superintendent of motive power and rolling stock. In 1902 he was elected president of the American Railway Master Mechanics' Association.

Trade and Market Conditions

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

Steel Price Cut Expected to Help Stabilization

FOLLOWING the announcement on Nov. 26 by the Jones & Laughlin Steel Company that its prices on bars, plates and structural shapes had been revised downward to meet the prices quoted by the United States Steel Corporation, which prices were those suggested at the conference of steel interests with the Industrial Board in March, 1919, there has been in the steel trade a general feeling of satisfaction. It is felt that this action on the part of this independent steel company will exert a stabilizing influence on the steel market, and that a readjustment in the trade will follow.

Some action was necessary to overcome the low level of steel buying and to avoid complete suspension of work in many plants. At the time of this writing, however, there has been little noticeable revival of buying, but it is expected that few days will go by before this condition is overcome and buying is resumed. While not all independent producers have met the full drop in prices announced by the one producer above many mills have shown a recession to figures close to the bottom prices quoted.

The independent mills as a whole are working much below capacity, in some cases down to 60 per cent. It is probable that these mills will now receive some orders which had previously been given to the corporation but on which shipments were some distance off. This feature of prompt delivery is expected to have some effect on cancellations of orders placed with the leading steel producer.

Manufacturer Backs Recognition of Integrity of Contracts

IN COMMENTING on the custom prevailing in some quarters of canceling contracts, the president of a representative electrical manufacturing company is in thorough sympathy with the belief that there must be a greater recognition of the integrity of contracts, as shown in a letter to all his representatives:

"Where we are approached by a customer with whom we have a future delivery contract in the shape of anything from a simple accepted order to the most elaborate formal agreement," he says, "and a request is made that the contract be abrogated by cancellation, our first step is to ascertain the status of the work involved. The factory's resultant report to us shows, generally speaking, the materials on hand or contracted for, those which are special to the order in question, how far processing has advanced, and indicates what disturbance would be caused by instructions to hold. If the report shows that cancellation would involve no loss other than that of anticipated profit, we have just claim for that profit, but no more.

"Whether or not we urge the claim depends on circumstances, but as a rule we waive it, accept cancellation and receive as offset merely the customer's appreciation of our having lent a helping hand. If the factory's report shows that losses other than anticipated profit would ensue, we determine a suitable cancellation charge and advise the customer that this will be made if cancellation is insisted upon. We also propose, as an alternative, postponement of shipment schedules over the maximum period for which we feel we can afford to spread. A request to hold the order until the customer is ready for its release cannot be complied with."

This manufacturer goes on to show that he has sufficient confidence in human nature and the integrity of the average business concern to feel that the ability to make his customers appreciate the necessities of the case and the fairness of his stand will remain satisfactory, as they have in the past, but only as each individual concerned convinces himself after due reflection that only by adherence to business pledge can business prosper.

New York Jobbers Interchange Surplus Stocks

A FEATURE of the electrical supply market as practiced by the jobbers in the New York City territory is the interchange of surplus stocks and a falling off in buying from the manufacturers. This is not the first time this feature of interchange of stocks has been tried in New York, but it is working out to a better degree than it did previously, when there was a falling market.

Of course, the present is the right time to revert to this method of moving stocks, because manufacturers are making shipments on orders of long standing and there is a tendency toward a falling market. In some cases these incoming deliveries are making certain stocks a little top-heavy, and although there is quite a good volume of buying inventories are frequently a little higher than might be desired under the present conditions of credits.

The system of stock interchange among jobbers is working out through the medium of the New York Electrical Club, to which the jobbers send lists of their excess stocks.

Jobbers are buying, it seems, only as it is necessary and are keeping their inventories down to rock bottom as far as they are able. When they buy they want to know that the market is present and that they will sell before they have to pay for the article. This is particularly true of certain seasonable articles just reported. One jobber is ordering every three or four days a seasonable item on which he pays cartage rather than order a sufficient quantity to escape this charge but at the same time build a stock for which he has no orders at present.

Larger Discounts May Reward Modern Selling Methods

AT THE recent question-box conference of the New England Section of the National Electric Light Association at Boston a short discussion of discounts from manufacturers' list prices took place. From the manufacturer's standpoint the point was made that in a sense the manufacturers do not set the retail prices on their goods, these being developed over a long period of years by custom and by the profits which retailers desire to make. In a representative case the bulk of the goods goes to dealers at a discount of 30 and 7.5 per cent, which gives the dealer on his resale a little better than 50 per cent on his cost, or 30 and 7.5 per cent on his gross. It was maintained that there is a point in setting list prices by a manufacturer beyond which he cannot go. If he sets his list too high he then has an artificially high price which the trade as a whole will not hold to.

A heating-appliance maker has found that the limit in discount is 40 per cent. Department stores, which are clever merchandisers, would like to get 40 per cent, but they will take and do business presumably at a profit of

30 and 7.5. It is felt by electrical manufacturing interests that if 40 per cent off is given to all dealers and correspondingly longer discounts to jobbers the price will not be maintained as a list price. The dealers will find they can do business on a smaller margin of profit than the 40 per cent calls for and will not adhere to list prices. Another manufacturer's representative pointed out that the sooner the contractor-dealer and the central station give the manufacturer a greater amount of co-operation in the education which the retailer requires in merchandising the sooner there may be a possibility of obtaining larger discounts. The manufacturer will be able to give these as a result of being relieved of the cost of educating and assisting in sales. The industry is passing through a first stage in selling electrical products along merchandising lines.

Electric Sheet Prices Easier for 1921 Shipment

BUYING of electric sheets has dropped off in the last few weeks and there is reported plenty of capacity available so that shipments may be made after the first of the year. Larger electrical manufacturers, it seems, are still ordering in fairly good quantities, but not up to the amounts they have ordered in the past. Bookings are not for so far in the future either. Smaller electrical manufacturers appear to have reduced their buying in greater proportion because their orders are very small. The lighter demand for fractional motors is one reason given for this condition in the electric sheet market.

There is little material available for shipment this year. There has been a price recession during the month just passed ranging from about 10 to 20 per cent on the best grades of sheets. This has applied to any little capacity which has been looking for a buyer for 1920 delivery and is expected to hold for orders placed for early 1921 shipment.

Export demand is indeed light. Six months ago there was no electric sheet reported available for the orders which foreign buyers attempted to place. Today orders are lacking when deliveries could be promised early next year. One reason given for this applying to European demand especially is the return of German sheet producers in that market. It is reported that these producers are taking orders for steel on the basis of a considerably lower watt loss than that which American manufacturers are guaranteeing. If this is true it shows a serious handicap which must be overcome in the export trade, aside from the consideration of exchange and credit.

Strong Foreign Demand for Steel Transmission Towers

LARGELY as a result of adverse financial conditions which have made the floating of bonds for financing power extensions very difficult, domestic interest in steel transmission towers remains lacking. Foreign orders and inquiries, on the other hand, are extremely active. Even there a large producer who had a good volume of foreign business on hand three months ago reports that since then, with the exception of inquiries from wireless interests, demand has petered out. Several other producers report no slump in export business as yet, however.

Some of the most promising countries affording markets for transmission towers are Italy, France, Japan, South America and the Scandinavian peninsula, orders being reported both on behalf of power companies and electric railways. One important factor in the increase of this demand abroad is said to be the growing scarcity of fuel and oil in certain European countries, which has led to the more intensive development of natural water-power resources.

On the other hand, a great deal of export business is undoubtedly held in abeyance at present because the present level of foreign exchange works so strongly against foreign customers who buy in the United States. With any decided change for the better in that respect and an improvement in financial conditions at home as well, it is believed that the demand for transmission line equipment will mount to greater proportions than ever before. This view is based on the extent and number of hydro-electric power projects that are known to be on the boards, both at home and abroad.

Conditions of production are greatly improved. This is largely due to the relief from transportation congestion which delayed supplies of raw material for so long. Little difficulty is now experienced in obtaining all the steel that is needed, and both the supply and the efficiency of labor have improved. Deliveries are consequently much improved, but as the greater part of this product is fabricated to order, shipments vary according to the manufacturer, the size of order and the type of material—whether galvanized, etc. In general, delivery of about 1,000 steel towers in the slowest instance can be accomplished in six to seven months and in the quickest in about four to five months.

In spite of the view taken by one large producer that lower quotations will not prevail for a long time, several other manufacturers see a gradual softening of prices that will come about as a result of the lower levels quoted by independent steel producers.

The Metal Market Situation

COPPER prices at present are largely nominal as interest on the part of consumers is mostly confined to hand-to-mouth buying. Producers, on the other hand, are not anxious to enter the market as sellers at present prices. The present level at which producers will sell for near-by delivery has been established at 14 cents, though many of the latter remain entirely out of the market at that price.

The 14-cent level is reported as being shaded in the outside market and by some small producers. For shipment over the rest of the year copper can be obtained from second hands at 13.50 to 13.75 cents f.o.b. refinery, equivalent to 13.75 to 14 cents delivered. For delivery over the first quarter of 1921 there are sellers at 13.75 to 14 cents f.o.b. refinery.

Export demand remains very light. It is reported that export sales have been made as low as 13⅜ cents aside ship recently. A feature in the market is the additional mines that are cutting down their output and laying off employees in an effort to reduce the large surplus stocks of copper above ground. The latter are held to be largely responsible for the present weak condition of the market. Standard copper at London is weak and dull, spot falling off an additional £3 5s. in the last week.

The price of lead during the week was reduced another ½ cent by the leading interest. It is a buyers' market at present with very few buyers on hand. Stocks are not extra heavy, but are too large for the present condition of demand. Zinc, tin and antimony also declined. Consumers are showing better inquiry for zinc for delivery over the first quarter of 1921 and spot stocks are heavy.

NEW YORK METAL MARKET PRICES

	—November 22—	—November 30—
Copper	£ s. d.	£ s. d.
London, standard spot	78 10 0	77 5 0
	Cents per Pound	Cents per Pound
Prime Lake	Nominal 13 50	14 00
Electrolytic	14 25–14 75	14 00
Casting	13 00	13 87
Wire bars	17 00–17 50	17 00–17 50
Lead, spot price	6 50	6 00
Antimony	5 87½	5 75
Nominal spot	43 00	43 00
Shipment, Jan.–March	11 00	11 00
Zinc, spot	6 50	6 10
Tin	36 25	33 12
Aluminum, 98 to 99 per cent.	26 50–27 50	26 50–27 50

OLD METALS

	Cents per Pound	
Heavy copper and wire	12 00–12 50	11 00–11 50
Brass, heavy	6 00–6 50	5 00–5 50
Brass turnings	4 50–5 00	4 50–5 00
Lead, heavy	5 00–5 25	4 50–5 00
Zinc, old scrap	3 75–4 00	3.75–4.00

THE WEEK
IN TRADE

THE slightly improved tone to general condition in the electrical industry that has been previously noted continues. No material change such as a general increase in buying is reported, but the buoyant note from nearly all sections is evident. This is variously ascribed to a natural readjustment in the face of altered trade conditions, to a feeling of optimism over prospects for next year's business and to mere relief that things are not getting any worse.

The demoralization of the cotton market in the South and of the wool and grain markets in the Intermountain section has greatly unsettled trade in those districts. Collections at present seem to be about holding their own at the unfavorable average of sixty days. Little talk of shortages in any line is now heard, but, on the other hand, efforts are concentrated upon holding down inventory levels. Labor is in plentiful supply, and though hours of production in some instances have been shortened no general laying off of employees is reported.

Seasonal goods are moving well, the demand for lamps, heating appliances of all sorts and various holiday goods holding up strongly.

NEW YORK

Little change is evident in week-to-week trade conditions at present. Sales in most lines are not very heavy, but, on the other hand, jobbers as a whole are not complaining. Expectations are that the present period of quiescent waiting will continue for the next three or four months, but that starting next spring electrical business will boom. The trade seems to have accepted this outlook philosophically and to have adjusted itself to the altered conditions.

The epidemic of cancellations has now run its course. Few items are overstocked on jobbers' shelves, though this is a result of persistent efforts to keep down inventories. Electrical contractors are closing very little new business, though a good deal of work for the future is said to be in view. No decided change in collections is evident, some jobbers reporting the situation as good and others as bad. The average length of time in which bills are paid is probably about sixty days.

Demand for conduit, lamps, porcelain and certain appliances such as heaters holds up fairly well, and in many cases sales of these items offset the light demand on other lines. Reports on the present volume of consumer demand vary. Here and there jobbers say the retail Christmas trade will be very poor and consequently these houses are not trying to build up stocks of heaters, appliances, etc., which they have allowed to become low. This feeling is not general, however.

Porcelain.—Tubes are still generally short, but other items are coming through in better shape. In barrel lots 3-in. tubes are quoted at $11 to $12, "Nail-it knobs" at $32 to $35, and two-wire unglazed cleats at $21 per 1,000.

Lamp Cord.—Demand is small and the supply plentiful, though jobbers are able to hold down their stock to an average level. Prices have followed the slump in wire and cotton and cover too wide a range to give a representative quotation.

Heaters.—Although some jobbers report light sales the general season has been very good. Renewal orders from dealers are being received, and little or no complaint is heard regarding shipments. Stocks thus far have been ample.

Weatherproof Wire.—The market remains in a weak condition. Demand is poor and efforts are concentrated on holding down stocks to a fair level. Prices cover quite a wide range.

Flush Switches.—The delay occasioned by porcelain some time ago has disappeared and stocks are plentiful. Demand is light, owing to the little construction work under way.

Lamps.—Excellent sales are reported and shipments are coming through regularly. Here and there sizes are reported short, but in general full stocks are the rule.

Conduit.—Jobbers who report complete supplies are the exception as stocks continue very spotty in all sizes of both black and white conduit. Demand holds up well, but shipments are poor. One-half-inch black is generally quoted at from $81 to $85 and ¾-in. black from $108 to $115 per 1,000 ft. in 2,500-lb. lots or over.

Locknuts, Washers and Bushings.—The subnormal supply reported a month ago has been remedied as good stocks are on hand while demand is only average.

CHICAGO

Local conditions in the electrical trade remain unchanged. Retailers assert that trade on Christmas specialties is not up to expectations and that interest in the higher-priced articles is lagging, compared to that shown in the past two years. This is entirely in line with the attitude of the buying public in general. In every phase of retail business here the amount of sales seems to be directly proportionate to the sales effort that is expended.

Jobbers' business in electrical lines is fair only. A large amount of stuff is still going forward on back orders, but new orders placed do not amount to much. Stocks are accumulating and reluctance of dealers in buying indicates constantly growing inventories in jobbers' hands. One thing that will be a benefit to the industry is that next spring sufficient stocks should be in the hands of all factors to assure supplies when the construction season opens up.

Radiant Heaters.—The weather for the past ten days has been particularly favorable for this line and retailers' sales have been quite up to expectations. The most popular size is the single-unit heater and prices are held firm on all sides. Retailers are placing orders with jobbers just sufficient to replace sales, while plentiful stocks are in jobbers' hands.

Floor Lamps.—Manufacturers report a lessened demand for the Christmas season. This seems to come from lessened sales expectations on the part of dealers rather than lowered current sales to the public, as the past two weeks have seen lively retail trade. Considerable price shading is being done on this line.

Silk and Cotton Cord.—All orders for reasonable quantities can be filled from stock, and demand from manufacturers of appliances is falling off. Jobbers will continue to buy for some time in order to get stocks up to where they should be. Prices are firm.

Electric Phonograph.—Renewed sales efforts are being made by retailers and results have been gratifying.

Washing Machines.—Sales efforts are causing holiday demand for washing machines to make itself felt. Confidence in the permanence of present prices seems to be growing and steadily increasing sales are reported. Surrounding territory also reports increased sales wherever effort is being made.

Percolators.—Retailers report some complaint on the part of the public because there have been no price reductions, but in spite of this sales are on the increase as Christmas demand is awakening. The smaller sizes are the most popular, but little demand is being felt for the high-priced sets.

Sewing Machines.—Sales are reported as light, probably because greater effort is being put on other lines. Prices have been unchanged for some months, and well-planned selling campaigns in the rural districts are producing satisfactory results.

BOSTON

Despite widespread curtailment in general business the electrical trade is displaying healthy activity. A large volume of non-spectacular business is being handled by jobbers and retailers. The wiring of old houses is continuing to absorb much material, and during the present slack period industrial-plant engineers are putting through a large amount of minor improvement work. Considerable optimism exists as to the outlook for next year's electrical sales. At the Fore River shipyard in Quincy naval construction that will total about $75,000,000 is under way, including the building of electrically driven superdreadnought and battle-cruiser craft. Jobbers' stocks are being built up all along the line, and as the year draws toward its end manufacturers are making the utmost effort to fulfill deliveries. Recent low stocks are largely a thing of the past and jobbers are trying to avoid overstocking. Some New England manufacturing plants in the electrical field are shortening their hours of production, but no general laying off of employees has yet been noted. Prices are weak in wire quotations. Collections are slightly improved of late.

Schedule Material.—A fair demand exists. Manufacturers are still busy and one large house is adding to its employees' roll. An active demand for electric range switches is seen at present.

Metallic Flexible Conduit.—Small orders are being handled often 500 ft. at a time. No scarcity of this material is reported and prices are steady.

Crossarms.—Business is rather spasmodic. Stocks are fair and deliveries prompt. Fir arms, 3¼ in. x 4¼ in., are quoted as follows: Two-pin, $77.37 per 100; four-pin, $154.74, and six-pin, $206.33.

Motors.—Small stocks are beginning to be heard of even in sizes from 1 hp. to 10 hp. Immediate requirements are being well handled, especially where jobbers deal with established customers. The demand is varied and healthy, with little weakness in prices as yet.

Meters.—Stocks are rapidly improving, at least in some houses. One large jobber declared Monday that for the time being an overstock of meters exists in Boston, recent shipments having come through in a volume too large for immediate absorption.

Flexible Armored Conductor.—The market is overstocked and demand is light. Prices are steady around $85 per 1,000 ft. on No. 14 single-strip in 5,000-ft. lots.

Rigid Conduit.—Recent shipments have greatly improved local stocks. Some difficulty is noted in obtaining the larger sizes of pipe.

Porcelain.—Tubes are a little hard to get, the 3-in. size being quoted at $11.35 per 1,000 in barrel lots. "Nail-it" knobs are plentiful at $34 per 1,000. Two-wire cleats are somewhat scarce. A new porcelain factory with two sections, each 140 ft. x 800 ft., has been started into production by the General Electric Company at its Pittsfield works.

Appliances.—Jobbers' stocks are larger than it was hoped would be the case and retailers are buying in small quantities for the holiday trade. Cut-price retail sales continue here and there, chiefly on old designs.

ATLANTA

A returning spirit of cheer and optimism is to be noted in all lines of business. Since cotton has fallen off to practically the price on which loans were based it leaves the merchant holding the bag, and he in turn cannot remit to his creditors. Electrical jobbers report all lines of building material very slow and stocks heavy, but holiday goods, socket appliances and so forth are moving with sufficient celerity to encourage the trade in the belief that conditions have taken a turn for the better. In fact, jobbers report the business as a whole somewhat better this week than for several weeks past. Bank clearings in the cities in the Sixth Federal Reserve District show a shrinkage of approximately 33⅓ per cent and few permits for new construction are reported this month.

Dry Batteries.—Contrary to the usual rule dry batteries are reported as moving very slowly. This is in a measure accounted for by the lessening number of battery-ignition cars in the rural districts. Stocks are reported fair by all jobbers and shipments are coming through satisfactorily. Price, barrel lots, $40.15 per 100.

Flashlights.—The movement of flashlight batteries continues steady, as is customary at this period of the year, while flashlight cases are reported as going exceptionally well. Stocks of all sizes and assortments are on hand and shipments coming through promptly.

Toys.—Christmas toys in retail lines have begun to move earlier this year than usual and prospects point to an exceptional season in this line. Jobbers have about completed shipments of orders on hand, but from present indications dealers will have to reorder to take care of the Christmas trade. Stocks as a whole are in good condition.

Porcelain.—Porcelain still continues to be somewhat scarce, though a great improvement is noted over the past month. Knobs, tubes and cleats are in the market in fair quantities, but back orders have not as yet been completely filled and therefore no stocks can be accumulated. All lines of porcelain are moving satisfactorily but shipments are slow. Prices: Tubes, ⅝-in. x 4 in., standard packages, $1.90 per 100; "Nail-it" knobs, lots of 500 to 4,000, $5.22 per 100; cleats, two-wire, unglazed, lots of 300 to 1,850, $2.75 per 100.

Heating Devices.—The heavy holiday demand has prevented the accumulation of very large stocks of heating devices. Stocks of hollow ware are particularly spotty. Jobbers do not think they will be able to accumulate satisfactory stocks, flatirons excepted, until after the holiday season.

Lamps.—The demand for lamps continues on the increase and while some jobbers report stocks low on 40-watt and 100-watt sizes, with the prospect of an acute shortage in sight, other jobbers report good stocks of all sizes on hand.

ST. LOUIS

Jobbers report that the past week has been dull, measured even by the standard set by the last two months' business. Some jobbers say that their volume of business for the week will be close to that of their low week in September. This is ascribed to the presence of a holiday in the week's schedule. In spite of this low volume for the week practically all jobbers report that their volume for November will be ahead of that for November of last year and October of this year in orders billed, though not in new business. This is due to the building up of stocks and the consequent ability to rid the books of back orders.

November has seen a steadily decreasing demand for supplies of all kinds with the exception of small appliances, lamps, Christmas goods and other seasonable items, and stocks have in some cases become much larger than normal.

Collection conditions have not changed materially, an average of sixty days being maintained. Credit departments, nevertheless, are looking very conservatively upon the activities of sales departments.

Lead-Covered Wire.—Some jobbers report large stocks, others stocks only slightly over normal. There is little demand for it, but prices have held up well during the last two weeks and inquiry disclosed no instances of cutting from the 23-cent base. A representative quotation is $48 per 1,000 ft., in 5,000-ft. lots, for No. 14 duplex.

Switches.—The demand for safety switches is making serious inroads upon the sale of knife switches.

Meters.—Stocks are becoming better and most jobbers have caught up with their back orders. There is a good rural demand at present, one jobber reporting the sale of 750 meters to a rural central station.

Percolators, Etc.—Percolator stocks are spotty and deliveries are poor. Christmas demand on this item may not be taken care of. There are normal stocks of flatirons, toasters, grills, water heaters, etc., and sales continue good without pushing.

Flexible Armored Conductor.—Stocks are large, but demand is fair and jobbers are not worried. There is considerable old work being done and jobbers are getting numbers of small orders for this purpose. No. 14 two-wire is quoted around $90 per 1,000 ft. in lots of 2,500 ft.

Fuse Plugs.—There are normal stocks to take care of a normal demand.

Instruments.—Instruments of all sorts are still difficult to get. The best delivery quoted is from three to four months. Demand has dropped considerably, but jobbers still have back orders on their books.

Flashlights.—Jobbers have good stocks and are moving them well. The demand is increasing with the approach of winter.

Batteries.—Stocks are fair and demand is only a little below normal. It is coming mainly from the railroads for signal work.

SAN FRANCISCO

Recent building permit figures indicate that all California cities with the exception of Los Angeles are below the corresponding figures for 1919. The rainy season, which is unusually early and heavy this year, accounts for a certain part of the decrease. But the present high cost of material and labor is also a predominant factor. Several large motion-picture companies are building plants a few miles south of San Francisco, and this, it is hoped, will be the nucleus of a large business. The government is still undecided upon the exact location of its proposed huge plant in San Francisco Bay. The various governmental navy yards are busy to an almost unprecedented degree.

Collections in the electrical trade are fair and are being vigorously followed. For the present at least there has been a decrease in the retail trade improvement noted several months ago among the contractor-dealers. The labor situation is easier, and although there is no great amount of non-employment yet it is noted that labor is far more plentiful. Salesmen, however, are noteworthy exceptions, and several jobbers report that there are hardly any experienced salesmen to be had.

Christmas displays are being made early this year. A widespread feeling of retrenchment is evident, though the holiday trade will postpone the effects of it into 1921. Dealers are advised to fall in with this feeling by especially pushing the sale of useful electrical gifts and of the larger household appliances by the low-first-payment plan.

Illuminating Lines.—The California Co-operative Electrical Campaign is carrying on an educational illumination show in San Francisco. The exhibit is commercial in character, but it is proposed to follow it by a display of portable lamps and fixtures for private dwellings.

Lamps.—Stocks are well maintained through quick deliveries. A marked decrease in white "Mazda" sales is reported in some sections.

Christmas Novelties.—Many electrical dealers have added well-assorted stocks of electrical toys and trains to their line of goods. This is especially noticeable in the interior cities. Christmas-tree lighting outfits have been widely purchased and deliveries are good.

Radiators.—Jobbers and dealers are well stocked. An advance of about 10 per cent is predicted after the first of the year. A feature of this year's display is the variety of styles and sizes stocked by dealers.

SEATTLE—PORTLAND

Although a spirit of confidence prevails in Seattle and the Puget Sound District present conditions do not justify this confidence. Sales volumes are low, generally speaking, and are showing noticeable decreases from week to week. True, domestic appliances, including percolators, toaster stoves, flatirons, heaters, etc., for the Christmas trade are moving well, thought they are not nearly in such heavy demand as was originally expected. This movement, however, does not compensate for dullness in heavy power apparatus, industrial equipment, schedule material, housewiring devices, etc.

Stocks as a whole are in fine condition; back orders have been met, and there is apparently plenty of everything on hand to meet immediate needs. Freight is coming through satisfactorily. Long anticipated price decreases are not materializing, but there are many who believe that the downward trend will surely begin after the first of the year. Collections are slow and tighter and are causing jobbers considerable uneasiness. New credits placed are negligible.

In the Portland district manufacturers report that business is quiet, running 25 per cent less than a year ago. There are no price changes. Shipments are improving, but stocks are about the same because of the large number of back orders still unfilled. Motor stocks are improving but meters remain very scarce, central stations having to install service without meters in many cases. Galvanized conduit is still very hard to obtain.

Portland jobbers report a slight reduction in the price of weatherproof wire and a drop of 6 to 7 per cent in lead-covered cable. To offset this fuse-wire prices have increased and there has been an advance of more than 10 per cent on glass insulators. Crops are moved to a considerable extent, and collections are improving materially with industrials and dealers, though not with lumber organizations. Contractors report good work ahead, with labor plentiful.

Washing Machines.—In Seattle sales are stimulated considerably by liberal time-payment terms. Sales hold up well; in fact, the past week showed an appreciable increase. In Portland, however, a recent advance of $10 to $20 per machine on two or three lines is seriously affecting sales.

Lamps.—In Seattle and Sound cities sales of residence types are dropping off gradually, although the volume, considering the prevailing quietness in building lines, is fairly satisfactory. In Portland sales are good, but the percentage of cash sales is decreasing.

SALT LAKE CITY—DENVER

Jobbers and merchants are watching with keen interest the efforts of the National Wool Growers' Association, with headquarters in Salt Lake City, to further federal legislation that will protect and give immediate relief to the wool growers and live-stock men. A delegation has been sent to Washington to urge an embargo on wool and a protective tariff on imported meats. These two industries, together with agriculture and mining, constitute the chief sources of wealth in the Intermountain section. Unless aid is granted it is conceded that business will be in a bad way for many months to come.

Ninety per cent of the wool crop is still in the hands of the original producers without a market. Certain live-stock loan companies, owing to the uncertain future prospects, have forced their clients to excessive liquidation, and the heavy shipments have smashed the markets. The credit situation is bad and it is difficult to make collections. A recent survey shows that not more than 30 per cent of the wheat crop has been marketed. Farmers are holding out for better prices.

In spite of these handicaps electrical jobbers are going ahead with big plans for 1921. After careful surveys budgets are being made up that contemplate a volume of business greater than any for several years past. Dealers, however, are in an attitude of waiting. Distributors are still sitting tight in the matter of price recessions determined that whatever readjustment comes shall be brought about gradually. There is only slight improvement in the credit situation. It is still difficult to make collections.

Hollow Ware.—With the approach of the holiday season consumer demand for grills, percolators, toasters and urns is better. Jobbers are able to fill needs as they arise.

Porcelain.—Contractor-dealers are now in a position to obtain all the material needed for building jobs. The previous shortage has now been eliminated as factories are in a position to catch up with the demand.

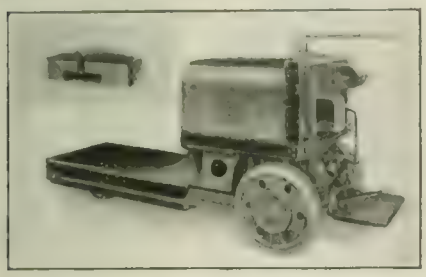
Heaters.—The weather is such that furnaces are going full blast in private homes, and as a result the market for electric heaters has declined in the past two weeks.

NEW APPARATUS & APPLIANCES

A Record of Latest Developments
and Improvements in Manufacturers' Products
Used in the Electrical Field

Self-Loading Electric Truck

The industrial self-loading truck of improved design recently placed on the market by the Industrial Truck Company, division of Cowan Truck Company, Holyoke, Mass., is all-steel and guaranteed for 5,000 lb. capacity. Its elevating mechanism elevates in five seconds when equipped with twenty-eight cells and six seconds with twenty-one cells. The lifting mechanism is operated by an independent, heavy-duty motor and worm-gear reduction. The platform lifts vertically 4½ in. The length is 102 in. over all and the width 36 in.



SEPARATE MOTOR LIFTS PLATFORM

Switching Equipment for Farm-Line Service

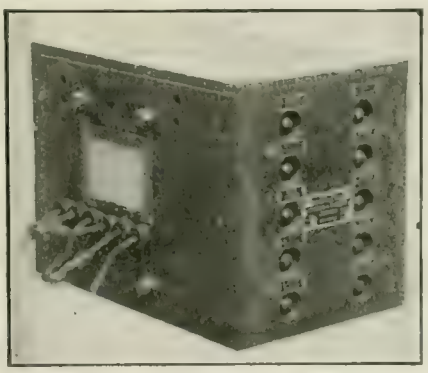
For the control and protection of small outdoor distributing transformer outfits which supply energy to farm extension lines and similar installations the Westinghouse Electric & Manufacturing Company has placed upon the market the type FL switch, which consists of a combined fuse, lightning arrester and disconnecting switch. The equipment may be mounted near the top of a line pole so that it is operated from the ground by means of an operating handle. This combination switching equipment is of rugged construction and all metal parts exposed to the weather have a durable galvanized finish. The fuse is of the expulsion type and is mounted in the hollow center of the large pillar-type porcelain insulator. These switches are made in both single-phase and three-phase sizes for 2,500, 6,600 and 13,200-volt service and are intended for applications up to approximately 50 kva. rating.



COMPACT ARRANGEMENT OF UNITS FOR SMALL INSTALLATIONS

A 100-Lb. Welding Machine

A welding machine weighing complete 100 lb., which is intended with reasonable care to accomplish any work in or around a garage, plumbing shop, etc., has been developed by the Electric Arc Cutting & Welding Company, 222 Halsey Street, Newark, N. J. The machine uses electrodes from $\frac{1}{16}$ in. to $\frac{5}{32}$ in. in diameter and will operate continuously with the medium and small sizes and intermittently on the large size. The standard machine is for 110 or 220 volts and any frequency specified. The power supply must be of at least 5 kva.



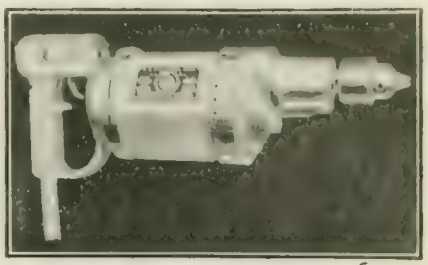
WELDER WEIGHS ONLY 100 LB.

Cabinet Cylinder Clothes Washer

A feature of the new cabinet cylinder clothes washer developed by Haag Brothers Company, Peoria, Ill., is that the mechanism is all on one side, altogether in one unit, easy to get at and at the same time out of sight behind the hinged door. The wringer shaft, crank shaft, drive shaft and cylinder shaft are all contained in one unit or housing. The tub of the washer is of Armco rust-proof steel, the cylinder is of zinc, but the washer will be made with either wood or metal cylinders.

Portable Drill for Automobile Body Building

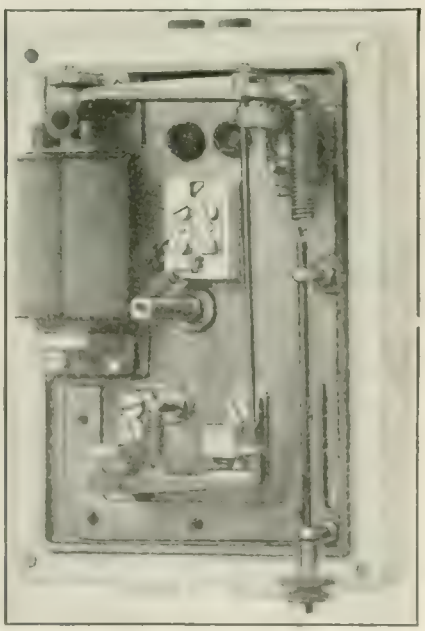
For the manufacture of automobile bodies, which calls for a drill with speed and endurance and easily handled, the Black & Decker Manufacturing Company, Baltimore, Md., has designed a $\frac{5}{16}$-in. drill. The gears are made of steel hardened by a special heat-treated process and mounted in shafts ground to size. The light weight of the drill is obtained by having the housing made of aluminum alloy. The motor is air-cooled, develops ¼ hp. and gives the drill a no-load speed of 1,480 r.p.m. Control is by means of the pistol grip and trigger switch, and the drill runs on either alternating or direct-current, 110, 220 or 32 volts.



LIGHT DRILL FOR THREE VOLTAGE RANGES

Device for Regulating Voltage

A regulator for controlling line voltage, motor-starting current, arc-furnace current, etc., has been developed by the American Galco, Inc., Grand Central Palace, New York. The action is controlled by the varying pressure in a stream of water constantly flowing through a pipe. The pressure in the pipe is varied by obstructing the openings more or less by means of a lever moved by a solenoid connected, for instance, across the line on which voltage is to be kept constant.



REGULATING DEVICE FOR HOLDING CONSTANT VOLTAGE, CURRENT, ETC.

Utility Motor on Tripod Base

For use on farms and other places supplied with 32-volt energy the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has just placed upon the market a ¼-hp. portable electric power stand. A



TAKES POWER FROM 32-VOLT CIRCUIT

telescopic rod is provided to brace the motor and to obtain the proper tension for the belt. The main shaft speed is 2,100 r.p.m. and the back-geared shaft turns at 250 r.p.m. There are two pulleys on each shaft, a 6⅝-in. flat pulley and a 2¾-in. grooved pulley being permanently attached to the low-speed shaft. A 1½-in. flat pulley and a 2-in. grooved pulley are supplied for the high-speed shaft.

Rust Remover

Peter H. Frasse & Company, 417 Canal St., New York City, are distributing a preparation under the trade name of "Meno" for removing rust, corrosion, etc., from machines, tools, parts and metal surfaces in general. The preparation is a blending of chemical ingredients, which, says the manufacturer, in combination produce an electrochemical action that loosens and dissolves rust, corrosion, grease, paint and other foreign substances adhering to the metal irrespective of its age or hardness.

Insulated Fixture Stems

The Electrical Dealers' Supply House, 162 West Randolph Street, Chicago, has developed the E D S H insulator chain hanger and stem for attaching ceiling fixtures to existing gas pipe. It is at the same time an insulating joint. The sizes come in ⅜-in. and ½-in. couplings with lengths 5½ in. to 8 in. and adjustable stems.

Six-in-One Lighting Unit for Factories and Public Buildings

A lighting unit the various parts of which may be rearranged to form six separate and distinct designs has been developed by the Duquesne Electric & Manufacturing Company, Pittsburgh, Pa., and will be known as the "Six-in-One" unit. The parts are made of heavy solid-spun copper, and there is an interchangeable fitter for either 3¼-in. or 6-in. glass or metal reflector. Thus the one design can be carried out with six different changes to fit various locations. The unit is designed to be dust-proof and insect-proof without sacrificing good ventilation.

Artificial Commutator Stones

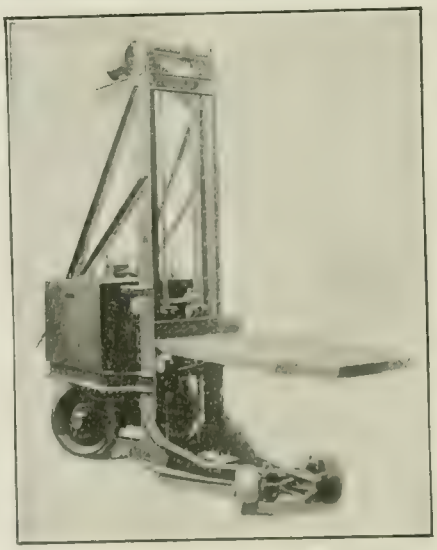
A line of artificial stones for grinding commutators and slip rings has been put on the market by the Martindale Electric Company, 11,737 Detroit Avenue, Cleveland, Ohio. These stones are made in five grades from "rough" to "polishing" in several sizes and come with handles or without them. The stones are sold under the trade name "Imperial."

Complete Outfit for a Radio Station

A complete radio station outfit, including material for an aërial, high-frequency buzzer test with battery, 2,000-ohm telephone receivers, a cabinet receiving set and a set of instructions, is being offered by the Eastern Radio Laboratory, West Fort Lee, N. J. The instruments and controls are mounted on a bakelite panel placed in a mahogany finished cabinet 6 in. x 8 in. x 7 in. All exposed metal parts are nickel-plated.

Tier-Lifting Trucks with 96-In. Lift

Two new designs have been added to the line of tier-lift trucks built by the Lakewood Engineering Company, Cleveland, Ohio. One of these is a machine with a 96-in. lift, which will handle a 4,000-lb. load. The other model has been designed for users han-

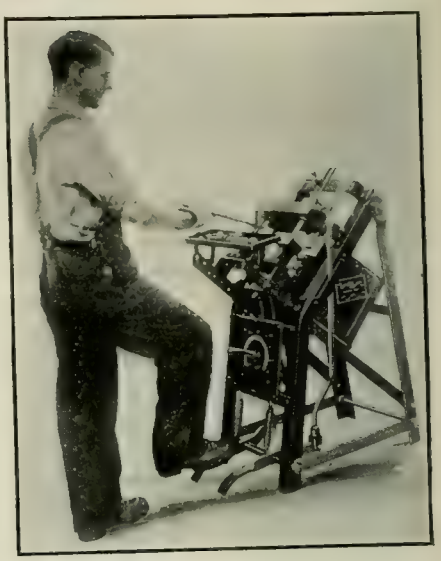


HAS HIGH-SPEED LIFT FOR LIGHT BULKY LOADS

dling light bulky packages and has twice the lifting speed of the regular models. This model, 703-A, handles a load of 2,000 lb.

Electric Rivet Heater

The Taylor Welder Company, Warren, Ohio, is marketing an electric rivet heater, built in sizes to heat two rivets at a time or multiples of two. The



BUILT FOR TWO RIVETS AND MULTIPLES OF TWO

time required for heating is said to be about thirty seconds for a ¾-in. x 4-in. rivet. Equipment consists of a 15-kw. transformer and a five-step self-contained regulator for controlling heat and rivet adjustment. The complete outfit weighs about 400 lb., occupies 31 in. x 18 in. space and is 40 in. high.

Notes on Recent Appliances

Attachment Plug

The Peerless Light Company, Chicago, has made a new "Stuart 900" attachment plug.

Socket Extension

Betts & Betts, 515 West Forty-second Street, New York City, is producing an extension for Edison-base sockets.

Refrigerator

A household refrigerator is being manufactured by the Clothel Refrigerator Company, 61 Broadway, New York City.

Pendent Switches

Porcelain-shell and brass-shell pendent switches are being produced by the Beaver Machine & Tool Company, Newark, N. J.

Demagnetizer

The William Brewster Company, Inc., 30 Church Street, New York City, has developed "Demagnetool" No. 2, a type of demagnetizer suitable for production work.

Alternating-Current Welder

For welding cast iron and repair work the Electric Welding Machine Company, Detroit, Mich., has put out an alternating-current "Weldrite" arc welder.

MANUFACTURERS' ACTIVITIES

Record of Changes Affecting Sales and Distribution
Together with Trade Personals and Notes on Foreign Trade,
Jobbers' News and New Trade Literature

THE BLACK & DECKER MANUFACTURING COMPANY, Towson Heights, Md., has recently increased its capitalization by $2,000,000. Of this amount $568,500 was subscribed by the employees. Since closing the books on the above issue so many more requests for subscriptions have been received that the company has decided to open up immediately another block of $150,000 for the benefit of the employees of the organization.

THE TECHNICAL PUBLICITY COMPANY has changed its address in Pittsburgh, Pa., to Apollo Building, 238 Fourth Avenue.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, 95 Orange Street, Newark, N. J., is having plans prepared for the erection of a three-story addition at its local works, brick and concrete, about 40 ft. x 115 ft.

THE CUTLER-HAMMER MANUFACTURING COMPANY, Milwaukee, Wis., has recently acquired the property at 137th Street and Southern Boulevard in New York City, as an additional plant for the manufacture of "Thermoplax and Fyroplax" molded insulation. The five-story building on this property has been completely equipped with presses for this work. The new plant, when working at capacity, will have an output equal to the company's insulation plant in Milwaukee, which has been running two shifts for the past three years. The New York plant will take care of the Eastern business of the company in this line. F. J. Boller, formerly of the Milwaukee insulation department, is in charge of the new plant.

THE ERIE ELECTRICAL EQUIPMENT COMPANY is seeking a location in Johnstown, Pa., to erect a foundry and factory for the manufacture of electrical and mechanical products, fittings to support high-tension and low-tension cables, busbars, insular supports, switchboard panel fittings, etc. The company has opened an office at 620 Elder Street, Johnstown. F. S. Proudfort is chief engineer.

THE BORDEN COMPANY, Warren, Ohio, manufacturer of pipe-threading cutters and die stocks, has just completed a new building which will add a space 50 ft. x 120 ft. to its manufacturing capacity and a second office addition amounting to 30 ft. x 120 ft.

THE MORSE CHAIN COMPANY, Ithaca, N. Y., has established a Detroit branch factory which will be devoted exclusively to the manufacture of silent-chain sprockets and the Morse adjustment. The Morse Chain Company will continue to manufacture chains and power transmission at the main plant at Ithaca. The Detroit branch, corner of Eighth and Abbott Streets, will be under the general management of F. E. Thompson.

THE AMERICAN BLOWER COMPANY, which recently bought the foundry of the Lane & Bodley Company on Tennessee Avenue, Cincinnati, Ohio, contemplates alterations, including new equipment, to cost about $100,000.

THE JOHN H. McGOWAN COMPANY, Cincinnati, Ohio, manufacturer of steam and power pumps, has purchased property adjacent to its plant on Central Avenue, on which it proposes to erect a three-story building, 100 ft. x 100 ft., to cost about $100,000. The company has abandoned temporarily its plans for a new factory in the Oakley district.

THE WADSWORTH ELECTRIC COMPANY, Covington, Ky., has filed notice of increase in capital stock from $150,000 to $500,000 for expansion purposes.

THE BOWER & BARTLETT COMPANY has leased property at 1201 South Sharp Street, Baltimore, Md., for a manufacturing plant. The company manufactures washing machines.

THE WALSTRUM ARMATURE WORKS, Birmingham, Ala., have filed notice of increase in capital stock from $10,000 to $25,000.

THE YATES & JOHNSON MANUFACTURING COMPANY, Chippewa Falls, Wis., has increased its capital stock from $25,000 to $100,000 and has also changed its name to the Northlite Manufacturing Company. The company is building a new machine shop. It manufactures electro-generating units.

SHAPIRO & ARONSON, 20 Warren Street, New York City, have completed plans for an addition, 100 ft. x 200 ft., to their plant on Glenmore Avenue, Brooklyn, N. Y., to cost about $50,000.

BETTS & BETTS, INC., 511 West Forty-second Street, New York City, has filed notice of increase in capital stock from $50,000 to $100,000. The company manufactures electrical specialties.

THE MILBURN WAGON COMPANY, Toledo, Ohio, is planning to erect a new plant on the site of its former works on Monroe Street for the manufacture of electric automobiles. This plant, it is said, will more than treble the present capacity of the company for manufacturing electric cars.

THE HYGRADE LAMP COMPANY, Salem, Mass., on Nov. 10 held a visiting day to give the people of Salem and vicinity an opportunity to go through the factory and see how the Hygrade lamps are made. The trip was so arranged that it took only about thirty minutes to see an empty gas bulb transformed into a complete incandescent lamp.

THE MANISTEE IRON WORKS COMPANY, Manistee, Mich., manufacturers of Roturbo centrifugal pumps, vacuum pumps, rotary jet condensers, etc., has established a Pacific Coast office in the Rialto Building, San Francisco, Cal., in charge of L. M. Page, formerly sales manager of the company for the past five years. The company expects to open branches also at Los Angeles, Portland, Ore., and Seattle, Wash., which will be under the supervision of Mr. Page.

THE NEW YORK ELECTRICAL CREDIT ASSOCIATION'S twenty-fifth anniversary meeting and dinner will be held on Dec. 14 at the Hotel McAlpin.

THE ELECTRICAL CREDIT ASSOCIATION OF CHICAGO will hold its twenty-fifth annual meeting Dec. 9 and 10 at Congress Hotel, Chicago. At the annual dinner, to be held Dec. 9, an address will be given by Gen. Charles G. Dawes, president of the Central Trust Company of Illinois, on "Taxation and Reduction of Governmental Expenses."

BIRTHDAY CELEBRATION AT INDUSTRIAL PLANT.—The birthday anniversary of James Clark, Jr., president of the James Clark, Jr., Electric Company, Louisville, Ky., was recently celebrated in an unusual manner. All the shop employes and their wives and friends took part in the celebration. The electrical workers returned to their work at 7:30 p.m., and for an hour all machines were operated the same as during the day. The guests of the company's employes were given an insight into the character of work done in the plant. Later in the evening an entertainment was given with addresses by Mr. and Mrs. Clark and factory officials.

THE GOYER COMPANY, INC., manufacturer of electrical hardware, has removed its works from Hartford, Conn., to Willimantic, Conn., where it has leased the old Turner silk mill on Valley and Bank Streets. Nearly 200 men will be employed when full capacity is reached.

THE VATTER COMPANY, Louisville, Ky., manufacturer of lead batteries, has filed notice of increase in capital stock from $20,000 to $40,000.

ALFRED VESTER SONS, INC., Providence, R. I., manufacturers of brass goods and specialties, in August made some changes in management, the business at that time having been purchased by J. William Schulze, president and general manager, and W. P. Young, secretary and treasurer. A number of changes are being made to the plant.

THE ATLAS ENGINEERING COMPANY, 3009-21 Lisbon Avenue, Milwaukee, Wis., manufacturer of concrete mixers, wagon loaders and other mechanical devices, is planning to erect a machine shop, 60 ft. x 120 ft., with a two-story wing, 30 ft. x 36 ft., at Thirtieth Street and Auer Avenue.

THE CAPITAL LAMPAGRAPH COMPANY, St. Louis, Mo., manufacturer of a combination electric lamp and phonograph, electrically operated, will move its main offices to Chicago, and locate its plant at Indiana Harbor, Ind.

THE SPLITDORF ELECTRICAL COMPANY, Newark, N. J., plans to erect a six-story factory, 120 ft. x 300 ft., on Twenty-second Street, near Fifty-fourth Avenue, Cicero, Ill., to cost about $700,000.

THE LUTHY STORAGE BATTERY CORPORATION, 215 Emmett Street, Newark, N. J., has recently filed articles of incorporation under the laws of the State of New Jersey.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, 95 Orange Street, Newark, N. J., is contemplating the erection of a three-story addition, 40 ft. x 115 ft., to its plant.

THE NATIONAL LAMP WORKS of the General Electric Company, Ferry Street and Fillmore Avenue, Buffalo, has awarded contract for the erection of a two-story machine shop, 110 ft. x 320 ft., at 757 East Ferry Street, to cost with equipment about $125,000.

THE AMERICAN INSULATOR COMPANY, New Freedom, Pa., has acquired a site at Norwalk, Conn., on which it proposes to erect a two-story building. The proposed plant will give employment to about 500 people.

THE BRYANT ELECTRIC COMPANY, Bridgeport, Conn., is constructing a four-story, 60 ft. x 159-ft. addition with wing 60 ft. x 66 ft., to its plant on Organ Street, and a four-story and basement building, 60 ft. x 128 ft., to its works on State Street.

Supply Jobbers' Notes

THE ROBERTSON-CATARACT ELECTRIC COMPANY, 151 West Mohawk Street, Buffalo, N. Y., is contemplating increasing its capital stock from $1,500,000 to $3,000,000.

THE JONATHAN WOODHOUSE WHOLESALE ELECTRIC GOODS COMPANY, 150 Bank Street, Norfolk, Va., is erecting a new storehouse, 50 ft. x 56 ft., two stories, to cost about $13,000.

Foreign Trade Notes

THE EQUATOR MANUFACTURING COMPANY, Bay Street, Hamilton, Ontario, Canada, manufacturer of electrical equipment, suffered a loss of $25,000 recently owing to its plant being damaged by fire. The plant of the Hamilton Lamp Company, 146 York Street, was also damaged at the same time.

HANDBOOK ON NORWAY.—The Department of Commerce offers Special Agent Series No. 196 on "Norway, a Commercial and Industrial Handbook," showing Norway as a market for American goods.

ELECTRICALLY DRIVEN AGRICULTURAL MACHINERY IN FRANCE.—The demonstration of the use of electrically driven agricultural machinery is being carried out in different sections of France. A motor-culture week, organized by the Chambre Syndicat de Motor-Culture de France, was held from Oct. 1 to 6, near Chartres, in which fifty French and foreign firms took part, demonstration being carried out with over 150 machines and apparatus of various kinds. A similar demonstration was held the latter part of October on the borders of the departments of the Eure-et-Loir and the Seine-et-Oise.

WASHING MACHINES TO BE MANUFACTURED IN ENGLAND.—The sole rights for the manufacture of the American Coffield electric washer in England have been purchased by Sam Jackson of Shipley. Steps have been taken to have the newly-acquired machine manufactured in Keighley, which has been one of the foremost towns in making laundry machinery.

THE CANADA WIRE & CABLE COMPANY, Leaside, Ontario, has purchased the buildings erected by the United States government for a munition factory at Leaside, which, it is understood, will be used as an addition to its present plant.

THE CANADIAN METAL PRODUCTS COMPANY, Guelph, Ontario, has made arrangements with the Federal Electric Company of Chicago, for the manufacture of its washing machines.

Trade Publications

CAR LIGHTING.—"Control of Motor Car Lighting" is the title of publication 861, now being issued by the Cutler-Hammer Manufacturing Company.

ELECTRIC FURNACE. — The Electric Furnace Company, Alliance, Ohio, is distributing booklet 9-B, a new catalog describing Baily electric furnaces for melting, annealing and heat-treating non-ferrous metals.

ELEVATORS AND CONVEYORS.—The Dodge Sales & Engineering Company, Mishawaka, Ind. has published a 160-page catalog describing the Dodge standardized elevators and conveyors.

COPPER-CLAD STEEL.—"Putting the Strength of Steel Into Your Wires" is the title of a two-page leaflet issued by the Copper-Clad Steel Company, Rankin, Pa. (Braddock, Pa., post office).

ELECTRIC ROCK DRILLS.—The General Electric Company, rock drill department, Fort Wayne, Ind., has issued bulletin 48,902, covering its Fort Wayne electric rock drills, type A.

LINOTYPE MOTORS.—The Cushman Electric Comapny, Concord, N. H., is circulating a booklet describing the Cushman patented offset linotype motor.

COMMUTATING-POLE MOTORS.—The Marble-Card Electric Company, Gladstone, Mich., has issued bulletin 200, describing its direct-current commutating-pole ballbearing motors, which are built in sizes from ½ hp. to 60 hp.

CONDENSERS. — The Elliott Company, Jeannette, Pa., has issued bulletin "C," covering its Elliott-Ehrhart condensers.

BALLBEARINGS.—"Langhaar Self-Adjusting Ballbearings" is the title of a thirty-two-page booklet issued by the Langhaar Ballbearing Company, Aurora, Ind., describing the "L-S-A" self-adjusting ballbearings.

HEADLIGHTS—"Mine Locomotive Headlights" is the subject of bulletin 7-A-C-1, which describes the new mine locomotive headlights for 23-watt to 94-watt lamps recently placed upon the market by the Westinghouse Electric & Manufacturing Company, George Cutter Works, South Bend, Ind.

New Incorporations

THE FIBER GAS MANTLE COMPANY, 108 Diamond Street, Pittsburgh, has applied for a charter for the purpose of manufacturing electric and gas fixtures, reflectors, etc. Ernest Goff, C. O. Emerick and S. E. Tilbrook are interested in the company.

THE BATTERY SPECIALTY COMPANY, 6117 Sheridan Road, Chicago, has been incorporated with a capital stock of $5,000 by Carl Eben, Jr., John and Cora McGlashan. The company proposes to manufacture batteries, motor accessories, machinery, etc.

THE PARDEEVILLE ELECTRIC COMPANY, Pardeeville, Wis., has been incorporated by Joseph Chandler, H. V. Eggar and John J. Wright. The company is capitalized at $5,000 and proposes to construct and operate an electric light and power plant.

THE PACIFIC LIGHTING FIXTURE COMPANY, 1321 South Main Street, Los Angeles, has been organized to manufacture electric and gas fixtures. William F. Brunder, 3025 West Pico Street, Los Angeles, is interested in the company.

THE AJAX BATTERY COMPANY, Passaic, N. J., has been incorporated by Delos C. Gibson, Joseph H. Lefferts and Richard Baker, all of Garfield, N. J. The company is capitalized at $200,000 and proposes to manufacture electric storage batteries.

THE AUTO FARM LIGHT COMPANY, Indianapolis, has been incorporated by Jack D. Oldham, 130 North Gladstone Avenue; Ora L. Kestie and Vane B. Korner. The company is capitalized at $150,000 and proposes to manufacture farm lighting machinery.

THE RHY-BON ELECTRIC COMPANY, 538 West Madison Street, Chicago, has been incorporated by F. L. Rhyndress. I. J. Clusman and Tillman Bond. The company is capitalized at $5,000 and proposes to manufacture electrical supplies.

THE IDEAL MOTOR APPLIANCE COMPANY, Woodhaven, N. J., has been incorporated with a capital stock of $300,000 to manufacture electrical apparatus. The incorporators are: Julius Buinlet and William J. Ellison, Woodhaven, and Fred J. Van Dohren, Weehawken, N. J.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

BAR HARBOR, ME. — The Bureau of Yards and Docks, Navy Department, Washington, D. C., contemplates the installation of an electrical distribution system at the Naval Radio Station, Otter Cliff. (Specification 4341.)

BOSTON, MASS.—The Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will receive bids until Dec. 7 for furnishing transformers. (Specification 7131.)

LAWRENCE, MASS.—Estimates submitted to the city officials show that the establishment of an ornamental street-lighting system on Essex Street will cost $75,000.

NEW HAVEN, CONN.—The United Illuminating Company, 84 Temple Street, has plans under way for the erection of an extension (40 ft. x 60 ft.) to its lighting plant. Westcott & Mapes, Inc., 207 Orange Street, are engineers.

Middle Atlantic States

AMSTERDAM, N. Y.—The Adirondack Power & Light Company has made arrangements for the issue of $2,500,000 in bonds, the proceeds to be used for the construction of its proposed new hydro-electric power plant, to be operated in connection with the present generating stations on the Hudson and Hoosic Rivers and the East Canada Creek. J. L. Hees is president.

JAMAICA, N. Y.—The Board of Trade has petitioned for a boulevard lighting system on Jamaica Avenue from Sutphin Road to Cana Street.

SMYRNA, N. Y.—The Smyrna Electric Light Company has petitioned the State Public Service Commission for authority to erect and operate an electric lighting system.

WATERTOWN, N. Y.—The Northern New York Utilities, Inc., has been authorized by the Public Service Commission, Second District, to issue bonds and capital stock, the proceeds to be used for the construction of a hydro-electric development at Flat Rock on the Oswegatchie River, to cost about $730,182, and for extending the present electric development of the company at Brown's Falls, cost about $1,782,726.

BLOOMFIELD, N. J.—The Board of Education of the Essex County Vocational Schools, 316 Essex Building, Newark, will receive bids until Dec. 8 for supplying electrical equipment for the Girls' Vocational School at this place.

JERSEY CITY, N. J.—The Delaware, Lackawanna & Western Railroad, Hoboken, has plans under way for the construction of a power house at the foot of Eighteenth Street, Jersey City, to cost about $20,000. G. J. Ray is chief engineer.

JERSEY CITY, N. J.—The Public Service Company has filed plans for the erection of an addition to its plant on Duffield Street.

THREE BRIDGES, N. J.—The Board of Public Utility Commissioners has granted permission to the Raritan Valley Hydro-Electric Company, Inc., to issue bonds to the amount of $18,000, the proceeds to be used for betterments to the plant and system.

ABINGTON, PA.—The Abington Memorial Hospital, York Road, contemplates the erection of a power house and administration building. Tilden & Register, 1525 Locust Street, Philadelphia, are architects.

PHILADELPHIA, PA.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Dec. 15 for furnishing a generator set, and also for turbo-generators. (Specification 7119.)

WHITE HAVEN, PA.—The Lehigh Coal & Navigation Company has plans under way for the erection of a dam in the Tobyanna River for the purpose of impounding waters for the generation of electric power at Hauto, near Lansford.

North Central States

WARREN, OHIO.—The Trumbull Steel Company contemplates the erection of a power house. Freyn, Bassert & Company, 122 South Michigan Avenue, Chicago, Ill., are structural engineers.

VIRGIE, KY.—The J. B. Elkhorn Coal Company contemplates the construction of a power house, miners' houses, etc.

HOPE, IND.—An election will be held on Dec. 16 for the purpose of submitting to the voters a proposition to erect and operate a lighting plant.

LINTON, IND.—The city officials have plans under way for the erection of a 1,500-kw. light plant and contemplate the purchase of complete power-plant equipment. The cost is estimated at $100,000. Shrouds Stoner Company, Tribune Building, Terre Haute are engineers.

CHICAGO, ILL.—The Illinois Malleable Iron Company, 1801 Diversey Boulevard, plans to install a twelve-panel electric switchboard. Cahill & Dougalas, 217 West Water Street, Milwaukee, Wis., are engineers.

MILWAUKEE, WIS. — The Milwaukee Children's Hospital, 219 Tenth Street, have had preliminary plans prepared for the erection of a hospital, including a steam-power plant to cost about $450,000. Scott & Mayer Colby-Abbot Building are architects and engineers.

WEST ALLIS, WIS.—The city officials contemplate improvements to the waterworks, including the erection of a new pumping station to be equipped with two electrically driven pumps. The cost is estimated at about $30,000.

HOPKINGTON, IOWA.—The Hopkington Electric Light & Power Company is receiving bids for hydro-electric machinery. The company contemplates the installation of one 225-kw. unit in spring and two hydro-electric units later. Holland, Ackerman & Holland, Monadnock Building, Chicago, Ill., are engineers.

KEOKUK IOWA.—The Mississippi River Power Company contemplates the erection of another line, to be operated at 30,000 volts, from this place to Fort Madison, a distance of 21 miles.

BLAIRSTOWN, MO.—An issue of bonds will be submitted to the voters for the purpose of establishing an electric light plant.

PINEVILLE, MO.—The Ozark Electric & Manufacturing Company has been organized for the purpose of developing the water power of the Rosserman mill and dam.

Southern States

RALEIGH, N. C. — The Raleigh Ice & Cold Storage Company, care of J. L. Dorminy, contemplates the erection of an electrically equipped and operated ice manufacturing plant and cold-storage house to cost about $100,000.

LAGRANGE, GA.—An election will be held on Dec. 16 for the purpose of submitting to the voters an issue of $20,000 in bonds for an extension to the electric light system.

CARTHAGE, TENN. The Smith County Electric Company, plans to extend its transmission lines to Cookeville and several agricultural communities in that vicinity.

FLORENCE, ALA.—Bids will be received at the office of the United States Engineer, Florence, until Dec. 15 for furnishing one 1,000-hp. hydraulic turbine with governor. Further information may be had on application.

WINONA, MISS. — An election will be held on Dec. 29 for the purpose of submitting an issue of $60,000 in bonds for the establishment of an electric light plant.

NOWATA, OKLA. —The Gunther City Coke & Coal Mining Company is interested in an electric light plant. C. B. Circles is purchasing agent

FORT WORTH, TEX.—The proposition and plans for the erection of a power plant at Lake Worth with a water turbine so located as to impound waters of the spillway for generation of electric power has been placed before Mayor W. D. Davis for consideration.

Pacific and Mountain States

HOQUIAM, WASH.—The City Council has rejected the only bid received for the installation of a boulevard lighting system in the business section. New bids will be called at once.

PUGET SOUND, WASH.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Dec. 21 for furnishing turbo-generators. (Specification 7128.)

BAKER, ORE.—The Eastern Oregon Light & Power Company, Masonic Building, does not intend extending its service to the White Swan Mine, as was incorrectly noted in these columns on Nov. 6.

PORTLAND, ORE.—The Portland Vegetable Oil Mills Company, capitalized at $1,000,000, will soon have work started on the erection of an electrically operated factory for crushing dried cocoanut.

SAMS VALLEY, ORE.—The Sams Valley Power Company has been recently incorporated and contemplates the distribution of electric energy. Metla Pelton is president

ARCADIA, CAL.—The local substation, it is reported, has been destroyed by fire, causing a loss of about $150,000.

EL CENTRO, CAL.—The city clerk has been instructed to advertise for bids for the installation of a fire-alarm system to cost about $15,000.

OROVILLE, CAL.—Work will soon be started on the construction of a hydro-electric project near this place by the Great Western Power Company, 11 Sansome Street, San Francisco, to cost about $6,000,000.

PASADENA, CAL.—The City Water Department is planning to replace the steam plant at the Copelin wells with electric equipment.

SACRAMENTO, CAL.—Bids will be received by the State Reclamation Board, Forum Building, until Jan. 11 for low-lift centrifugal pumps and induction motors for the pumping stations at Chandler, Tisdale and Wadsworth.

GARFIELD, UTAH.—Application has been made by the Utah Power & Light Company, Salt Lake City, to the Public Utilities Commissioner for a certificate of convenience and necessity to extend its lines from Garfield to the new mill of the Utah Consolidated Mining Company in Tooele County.

BOISE, IDAHO.—The Acequia Mutual Electric Company has been organized for the purpose of distributing electric energy, which will be purchased from the United States Reclamation Service.

ROSWELL, N. M.—The installation of new equipment to cost about $50,000 is contemplated by the Roswell Gas & Electric Company.

Canada

EDMONTON, ALTA.—The City Council has decided to submit a bylaw to the electors for an extension to the existing municipal power plant.

BRANTFORD, ONT.—The Lake Erie & Northern power plant has been recently destroyed by fire, and it is understood that the building will be reconstructed and equipment purchased at a cost of about $110,000.

RICHMOND HILL, ONT.—The city officials have plans under way for the development of a water-works system to include the installation of electrically driven centrifugal pumps. The total cost is estimated at $95,000. E. A. James Company, 36 Toronto Street, Toronto, is engineer.

SHELBURNE, ONT.—The town officials contemplate extensions to the existing water-works system, including the erection of a pumphouse, installation of three-stage, 1,000-g.p.m., electrically driven centrifugal pumps, etc., to cost about $100,000. E. A. James Co., 36 Toronto Street, Toronto, are engineers.

Miscellaneous

SONORA, MEXICO.—The state officials are promoting an irrigation and a hydro-electric project. A number of engineers, headed by Nicolas Durno, City of Mexico, and A. C. Caballero, Nogales, Ariz., are now locating sites for two dams and reservoirs. No estimate of the cost of the proposed work has been made.

Record of Electrical Patents

Notes on United States Patents

(Issued Nov. 23, 1920)

1,359,182. SEMI-MECHANICAL TELEPHONE SYSTEM; William G. Blauvelt, New York, N. Y. App. filed April 11, 1917. Semi-automatic.

1,359,191. STORAGE BATTERY. Dead W. Davis, Fort Wayne, Ind. App. filed June 2, 1919. Improved cell construction.

1,359,194. METHOD OF RECOVERING TIN FROM STANNIFEROUS WASTE PRODUCTS. Torguy A. Eklund, Stockholm, Sweden. App. filed Feb. 5, 1920. Electrolytic.

1,359,503. TROLLEY; George W. Hamilton, Chicago, Ill. App. filed March 26, 1919. Mine locomotive.

1,359,516. HOLDING CIRCUITS FOR TOLL-SWITCHING TRUNKS; Owen H. Loynes, Woodbridge, N. J. App. filed Dec. 23, 1918. Long-distance toll connections.

1,359,552. WHEEL RIM AND PROCESS OF MANUFACTURING THE SAME; George Warwick, Seven Kings, England. App. filed March 24, 1920. Electric welding.

1,359,565. TELEGRAPH SYSTEM; John H. Bell, South Orange, N. J. App. filed Oct. 11, 1917. For submarine cables, etc.

1,359,567. ELECTRICAL PLUG; James G. Benton, Maisonneuve, Quebec, Canada. App. filed July 28, 1917. For flatirons, toasters, etc.

1,359,581. LIGHTING SYSTEM; Ethan I. Dodds, Pittsburgh, Pa. App. filed July 25, 1917. For activating lamps containing light-absorbing material.

1,359,585. COUPLING PLATE FOR STORAGE BATTERIES; John W. Fitzgerald, Detroit, Mich. App. filed Nov. 24, 1919. Spring connector.

1,359,589. TRANSFORMER COIL; William N. Furthmann, Chicago, Ill. App. filed Oct. 8, 1919. For intensifying sparking.

1,359,600. MOTOR SUPPORT; Robert A. Ilg, Chicago, Ill. App. filed Feb. 24, 1920. Base mounted at any angle.

1,359,616. POWER TRANSMISSION; Howard J. Murray, New York, N. Y. App. filed July 11, 1916. For selectively securing different speeds.

1,359,620. ELECTRIC WELDING TOOL; John C. Ritchey and Ferrell G. Williams, Bellevue, Pa. App. filed April 17, 1920. Electrode holder.

1,359,648. COMPRESSION RHEOSTAT; Albert J. Allen, New York, N. Y. App. filed April 26, 1920. For testing meters, etc.

1,359,653. PROCESS AND APPARATUS FOR THE ELECTROLYTIC DECOMPOSITION OF ANHYDROUS MAGNESIUM CHLORIDE AND THE PRODUCTION OF MAGNESIUM OR ALLOYS THEREOF AND CHLORINE; Edgar A. Ashcroft, London, England. App. filed Aug. 12, 1919. Twin-cell apparatus.

1,359,656. HEADLIGHT DIMMER; William C. Baker, Amesbury, Mass. App. filed Dec. 19, 1919. Automobile.

1,359,687. DYNAMO-ELECTRIC MACHINE. Valere A. Fynn, St. Louis, Mo. App. filed July 2, 1917. To vary the excitation automatically.

1,359,716. ELECTROLYTIC CELL; Ernest A. Le Sueur, Ottawa, Ontario, Canada. App. filed May 13, 1918. Improved carbon electrodes.

1,359,735. ELECTRIC FURNACE. Charles E. Parsons, Englewood, N. J. App. filed Feb. 19, 1920. Resistance type.

1,359,736. PROCESS OF TREATING CHARGE MATERIALS IN ELECTRIC FURNACES. Charles E. Parsons, Englewood, N. J. App. filed Feb. 19, 1920. For producing nitrogen, magnesium, etc.

1,359,745. IRONING MACHINE; Michael J. Reilly, Chicago, Ill. App. filed Sept. 23, 1918. Electrically heated.

1,359,751. GLASS CUTTER. John R. Seeby, Okmulgee, Okla. App. filed May 6, 1920. By electric arc.

1,359,757. ELECTRIC STOVE. Charles L. Skinner, Chicago, Ill. App. filed Dec. 8, 1919. Removable members.

1,359,789. ELECTRIC HEATER AND TROUBLE LAMP; Albert J. Barnes and Charles A. Fedder, West Haven, Conn. App. filed April 5, 1920. For automobiles.

1,359,846. FLOW METER; Lucian A. Sheldon, Schenectady, N. Y. App. filed July 18, 1918. U-tube type.

1,359,855. COMPENSATED SERIES ALTERNATING-CURRENT MOTORS; Willem C. Korthuis-Altes, Schenectady, N. Y. App. filed Dec. 22, 1917. Two parallel circuits, each having a set of brushes.

1,359,881. GAS BATTERY; Philip A. Emanuel, Aiken, S. C. App. filed May 15, 1920. Improvement on the Grove battery.

1,359,889. HEAT-CONTROL SYSTEM; Percy W. Gumaer, Pittsfield, Mass. App. filed May 19, 1917. For control depending on heat.

1,359,903. CONVERTER FOR TRANSFORMING CONTINUOUS ELECTRIC CURRENT INTO ISOCHRONOUS UNDULATORY CURRENT. Henri Magunna, Paris, France. App. filed May 7, 1913. By tuning forks.

1,359,913. MEASURED-SERVICE TELEPHONE SYSTEM; William W. Owen, Elgin, Ill. App. filed May 11, 1917. Subscriber's meter.

1,359,932. FURNACE FOR THE ELECTRICAL OXIDIZATION OF GASES; Bruno Thomas, Seattle, Wash. App. filed July 18, 1917. Nitrogen fixation, etc.

1,359,933. FURNACE FOR ELECTRICAL OXIDIZATION OF GASES; Bruno Thomas, Seattle, Wash. App. filed July 18, 1917. Electric arc.

1,359,940. AUTOMATIC TELEPHONE SYSTEM. Francis M. Ward, Leonard C. Bygrave, and Henry J. Herfink, London, England. App. filed Sept. 13, 1917. Trunk selector.

1,359,952. TELEGRAPH SYSTEM; John H. Bell, South Orange, N. J. App. filed Dec. 28, 1918. Means for controlling the balance.

1,359,960. ELECTRICAL RESISTANCE; Frank Buchanan, Syracuse, N. Y. App. filed June 10, 1919. Adjustable units.

1,359,971. LIGHTNING ARRESTER; George H. Dryden, Baltimore, Md. App. filed Sept. 10, 1914. Vacuum tube.

1,359,972. ELECTROPLATING; Thomas A. Edison, Llewellyn Park, West Orange, N. J. App. filed June 21, 1919. Metal readily stripped.

1,359,976. ELECTRODE FOR ARC WELDING; Joseph W. Fay, Milwaukee, Wis. App. filed Feb. 27, 1920. Insulated.

1,359,979. WIRELESS TRANSMISSION SYSTEM; Charles S. Franklin, London, England. App. filed Jan. 3, 1920. Multi-aërial.

1,359,983. FUEL-MIXTURE VAPORIZING AND HEATING DEVICE; William W. Grant, Brooklyn, N. Y. App. filed March 28, 1919. For internal-combustion engines.

1,360,012. DRIER FOR PRINTING PRESSES. Rudolf Nitch, Cleveland, Ohio. App. filed Oct. 27, 1919. Electrically heated.

1,360,017. ELECTRODE HOLDER; Frank A. Rappold and Charles R. Tremaine, Columbus, Ohio. App. filed Feb. 18, 1920. For arc welding.

1,360,034. CHAIN-WELDING MACHINE; John Senft, York, Pa. App. filed Oct. 30, 1919. Welding previously formed links.

1,360,054. MAGNETIC CHUCK; Howard J. Sweet, Lansing, Mich. App. filed July 22, 1920. Attachment for magnetic chucks.

1,360,055. ELECTROLYTIC CELL; George K. Thomas, Topeka, Kan. App. filed May 17, 1920. Means to limit voltage without reducing capacity.

1,360,113. CALLING DEVICE; William Kaisling, Chicago, Ill. App. filed June 23, 1913. Automatic telephone.

1,360,118. CONTACT SHOE FOR WELDING MACHINES; Peter W. Krall, Cleveland, Ohio. App. filed Dec. 6, 1918. For movable terminal of welding transformer.

1,360,126. HIGH-FREQUENCY GENERATING SYSTEM; Dav'd G. McCaa, Lancaster, Pa. App. filed May 26, 1917. To convert single-phase alternating current into continuous high-frequency oscillations.

1,360,133. PORTABLE CLAMP SOCKET; Roland C. Mitchell, Oakland, Cal. App. filed Feb. 15, 1918. For mining, trench and tunnel work.

1,360,152. METHOD OF BASING INCANDESCENT LAMPS; Alfred Swan, Montclair, N. J. App. filed June 20, 1917. Metal bases cemented to glass bulb.

1,360,166. COMMUTATOR; Charles C. Zenk, Westfield, N. J. App. filed Feb. 24, 1913. Held in place by molded insulating material.

1,360,167. ANTENNA. Ernst F. W. Alexanderson, Schenectady, N. Y. App. filed Sept. 13, 1917. Network.

Directory of Electrical Associations

Printed in the First Issue of Each Month

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Co-operation That Co-operates

CO-OPERATIVE trade movements, such as are in effect in California and have spread into the Northwest, the Mountain States and the East, require one principal condition to assure success. That condition is the gaining of the public's confidence by the electric utilities. In the public's mind the electric utility is largely the electrical industry. Since an important benefit from these co-operative campaigns is the creation of a favorable public attitude toward the industry, a most fruitful work can be done by the utilities. Correct, complete and thorough education of the public in all the business of the utilities will turn the trick. That is the essence of co-operation.

Recognizing the Industrial Electrical Engineer

IT WAS not long ago when the industrial employee in charge of electrical work was looked upon simply as an expert wireman. At that time also the management took a rather dictatorial attitude in the buying of electrical equipment and based its decisions on superficial economies or immediate needs. Little faith was placed in the opinions of the "electrician." How changed are present conditions! Interview the industrial electrical engineer of today in any one of the newer and more modern of industrial plants and you will discover a professional man in a real business office—the same man in the same general organization, but transformed through a well-merited recognition. Buying conditions have also changed. Today the industrial electrical engineer is exerting a powerful influence in plant layout and operation and in the adoption of new production methods. In a recent issue we presented a study of a plant distribution system that is indicative of this new status. The judgment of the industrial engineer is now accepted by the management with full recognition of the results that are possible in production economies as well as in reduction of installation and operating costs.

Itinerant Committee Meetings

GEOGRAPHIC divisional committee work in the National Electric Light Association is benefiting in lasting ways those who attend. The value of informal conferences and discussions among the men who are identified with an industry advancing with rapid strides is almost beyond computation. It costs a lot of time and money to attend committee meetings, especially where these are held first in one place and then in another, but the "close-ups" of local problems and the direct interchange of ideas which go with these occasions when well planned and managed are of immense value. The practice of holding such meetings here and there instead of in a single district center makes for breadth of interest and new enthusiasm. No central-station executive should maintain a policy of too great economy in relation to the attendance of his leading department heads when they are selected to represent the company in the discussions that come up on such occasions.

Automatic Rate Adjustments Help Public Relations

UNTIL the war-time upheaval in prices turned the plane of central-station rate development end on end, many companies took pride in the fact that their revisions had always been downward. The introduction of the coal clause and later of the oil clause into many power contracts solved the rate problem temporarily for not a few utilities and offered the industry an automatic means of adjustment in the face of changing costs. If rate revisions could have continued downward, their announcement would have continued to please the public as a matter of course. An upward movement of rates is "a horse of another color," and the job of establishing such a change is generally one which the central-station manager completes with a huge sigh of relief. In times like the present it should be far simpler and less costly from every point of view to revise rates automatically upon a cost basis than to put into effect at more or less irregular periods sharp and perhaps sweeping changes which resound from the housetops and tend to draw the fire of customers from all over the system. It is really too bad to have to go through the burdens of a rate hearing or of a rate change justification more than once or twice in a decade.

Strength Must Not Be Sacrificed in Rural Lines

RURAL transmission lines should be low in cost without being cheap in construction. By cheap is meant slipshod, careless work that may be low in first expenditure but will be high in maintenance costs. In too much of the discussion of the past year or two the assumption that there is a radical difference between rural and city construction has been made. The only difference is that in city construction lines are built to carry much heavier mechanical loads than those originally imposed, because it is known in advance that growth will require constant addition of circuits. In rural construction the original mechanical loads are small with little or no chance of increase; therefore rural lines should be constructed to carry only these loads, which means that lighter poles, hardware and other equipment can be used with no sacrifice in relative strength and consequently

no sacrifice in life and no imposition of heavy maintenance charges.

When construction that reduces the relative strength of rural lines compared with city lines is adopted, the probability of heavy maintenance charges and poor service is at once created, bringing an ultimate severe penalty in excessive operating costs and loss of public confidence that cannot be measured in dollars and cents. This has been fully realized in the Western sections of the United States, and types of construction, light yet sturdy, low in first cost and also low in maintenance costs and as long in life as city lines, have been developed for rural and irrigation service. There is a growing realization of the fact in other parts of the country, but a much keener appreciation is needed if future trouble is to be avoided. Not the development of entirely new specifications but an intelligent application of those now in use will produce the result.

Interconnection Possibilities in Philadelphia District

AN AWAKENING of interest in interconnection projects has resulted from the various suggestions for super-power stations connected to existing sources of supply, and many investigations of such possibilities in various localities have been made. A review of one of these, by R. B. Mateer, regarding the situation in the general vicinity of Philadelphia, is published this week. The field here considered is that covering a radius of perhaps 125 miles (200 km.) from the city, and the details specially considered are the economies of interconnection and of unification in the operation of existing utilities. According to this investigation, which includes twenty-five available generating stations with a total yearly output of more than 200,000,000 kw.-hr., interconnection and the shutting down of the inefficient stations, except as they might be needed to carry peaks, would result in a fuel saving equivalent to nearly $350,000 a year. Such a saving would justify an expenditure of $3,000,000. An expenditure of a little more than $5,000,000, which would be approximately the amount necessary for taking in the full radius already mentioned, will assure a spare capacity of more than 200,000 kva., a reserve capacity of more than 50,000 kva. and a fuel saving of nearly $680,000, in the opinion of Mr. Mateer, who concludes that the expenditure for 60,000-volt tie lines would be justified. Working on a still larger scale, he adds, and perhaps including a big mouth-of-the-mine plant and a 220,000-volt trunk line, an investment of about $50,000,000 would seem to be justified by the saving.

Assuming that all conditions and benefits have been taken into account, the figures look favorable for a development on a large scale in this region. Of course, through co-operation between the managements of neighboring utilities, unification of frequencies and voltages and a gradual building up of regional centers over perhaps a radius of 200 miles (320 km.) are necessary. Many details would have to be worked out concerning the financing of the proposition and the co-operation of the interests involved; but, on the whole, the region dealt with by Mr. Mateer appears to be a very favorable one for trying out the plan on a large scale, particularly because its full development would render possible the utilization of relatively low-grade coals and afford vast relief in the transportation difficulty now so keenly felt in the distribution of fuel.

Continuous Campaign for Local Investment Is Advisable

IN THE second installment of W. H. Hodge's discussion of the public utility financial problem, elsewhere in this issue, useful suggestions are given to those undertaking to solve it. The desirability of local consumers owning company securities is self-evident. There is every reason why a public utility should encourage such investment by those whom it serves. Experience has shown that nothing is more irritating to a community than the feeling that its electrical supply is being administered by a group of outsiders for their sole benefit. It creates an impression, true or false, that the community is being exploited, and this impression acts unfavorably in all the relations with the public. When, however, a supply company has a large group of stockholders who become personally interested in its success, every individual concerned becomes a power for good in maintaining proper public relations. He feels a direct interest in the continuing prosperity of the enterprise and comes to understand more and more fully its true relations with those whom it serves.

As Mr. Hodge very properly indicates, there is no universal road to success in the local distribution of securities. Every company needs at times fresh funds to take care of its growing necessities, and if the securities can be handled locally the money can generally be obtained on better terms than when the bonds are underwritten by distant bankers and sold in the general market. Whether a hard drive for the quick raising of capital in the local market is good policy seems open to some question. A strenuous effort to raise money at any time is troublesome, whatever be the proposed source of supply. Where a little foresight can be exercised it would seem that a continuous selling program is the more desirable method of taking the public into partnership. The mere understanding that the utility is desirous of local support and of making its consumers sharers in its fortunes has a wholesome moral effect.

Usually it is found desirable to carry out a program of this sort with a systematic arrangement for partial payments, so that not only the ordinary investor but those who would otherwise be stowing away cash in savings banks at 4 per cent may be directly benefited. A well-managed electrical supply company in a community which makes any pretensions to prosperity is almost universally a good investment to one who can thus get in, so to speak, on the ground floor. A stock or bond yielding 7 per cent is momentarily not in great demand, since sound investments on slightly better terms are temporarily available, yet this figure is one which by and large is a good one, and a safe stock issued by a local utility of good standing becomes a very sound investment. Of course, there has been a period of somewhat reckless aggregation which has damaged the reputation of some electrical securities. The facts, however, are generally locally known, and nobody can detect the symptoms of overcapitalization more quickly than the company's immediate neighbors.

A company which seeks local support must seek it with clean hands, and in the vast majority of cases it can do so. In such case a well-planned continuous campaign for local investment would seem to be a very sound policy, quite certain to lead to better public appreciation and the continued prosperity which this kind of relationship implies.

Localized General Illumination for Specialized Industries

THERE are certain fundamental principles of good lighting which must be observed regardless of the particular application involved. For instance, glare should be prevented in all lighting designs, because its effect on acuity of vision is very nearly the same without reference to the specialized illuminating problem. Each industry, however, has its special problems. This is illustrated on another page in the discussion by A. D. Bell of the proper illumination of a printing plant. Here is found a need for local high-intensity lighting for such work as typesetting and for the use of daylight lamps or color-matching units for color-press work. Unfortunately, it has been rather a slow process in this somewhat conservative industry to get away from the individual drop lamp for the high-intensity local lighting. However, it is obviously impracticable as well as inefficient to carry general lighting for a composing room to the high intensities required for such exacting work. Therefore, a somewhat new application has been worked out—localized general illumination. Each rack where typesetting is done by hand is illuminated by two standard-dome reflectors hung about eight feet above the rack. The intensity obtained on the work where 100-volt type C lamps are used is 12 foot-candles. In this way the old-style drop lamp, with its attendant loss of time through adjustment, has been eliminated. Thus it has been possible all through the printing plant to combine the elements of good lighting and yet meet the specialized needs of a particular industry.

Is Grading System Insulation Effective?

ONE very interesting feature of the protection of the Swedish state lines, as brought out in this issue, is the use of graded insulation not only with the idea of distributing the electrostatic stresses over the insulator string but of providing something akin to a fusible plug in a boiler by intentionally having the weakest points of the line at switching stations and similar places easily accessible and under watch. Horn-gap protection is not used in connection with these safety points, since in order to make it effective it has to be set so closely that the gaps are apt to spill over and cause trouble on provocation far less than that required actually to jump an insulator, hence causing interruptions from relatively trivial causes. In a similar way special attention is paid to the insulating of the bushings and series apparatus and to the transformer windings, all of which present much larger factors of safety than do the switching-station insulators. Finally, the line insulation is made as strong as economical construction permits. The result of this general grading system has been to minimize transformer and other faults which might cause protracted interruption of service. It certainly would seem, however, that a better and more convenient safety valve might have been provided than a busbar insulator without running into the faults found with the horn gaps.

The generator equipment has had a most remarkable record since in the whole group of installations running back over six or seven years there have been but three failures in the windings—one in a stator and two in rotors, due directly to moisture during the period of construction. Among the bigger transformer units there has been singularly little trouble, but transformer equipment purchased during the war proved decidedly poor, a good deal of trouble having been experienced with 20,000-volt transformers of moderate output. Faults developed even to the extent of forty per hundred transformers in a single year, the disastrous results of war substitutes in the construction being thus made evident.

Dissipating Heat Generated Inside of Machines

ONE of the limitations to the output available from a given dynamo-electric machine lies in the internal heat insulation. The heat which is liberated within the machine, by reason of its energy losses, becomes partially bottled up within the structure and raises its temperature to the limiting value. If the internally generated heat could escape without any impediment, the temperature elevation of the machine would become negligibly small and would not set a limit to the output. Great advances have been made during recent years in methods for dissipating the internally generated heat, as, for example, by more thorough ventilation; but there is still much room for improvement.

Heat generated in the laminated mass of steel forming the core body of a machine can escape both along the laminations and across them from one to another. The thermal conductivity is naturally much greater along the sheets than transversely. The electric insulation which has to be inserted between the laminations is, moreover, thermal insulation, or substance of low thermal conductivity, as compared with metal, and hence the transverse thermal conductivity is relatively very small. It would help the general dissipation of heat, and the lowering of the temperature in the steel, if the transverse thermal conductivity could be improved without at the same time improving the transverse electric conductivity.

The tests described in this issue by T. S. Taylor go to show how the transverse thermal conductivity may be materially improved by mechanical pressure. If the laminations are pressed tightly together, the air contained in the crevices between them will be more or less squeezed out, the insulating films will be rendered more homogeneous in composition, and they will be thinner, all of which tends to improve the thermal conduction. The laminations should, of course, be in good mechanical shape and free from sharp burrs or projections, as otherwise the same mechanical pressure laterally applied will tend to break down the electrical insulation and increase materially the eddy-current losses.

The method and details of apparatus used in the test are very interesting, involving a combination of thermal, electrical, mechanical and mathematical principles. They are well worth careful consideration. Some of the units employed, such as the watts per inch and per degree centigrade, sound somewhat incongruous; but the facts are of more importance than the units.

It is by such studies as these that dynamo-electric machines become capable of improvement in design, construction and service from year to year, instead of remaining in a perpetual rut. The fact that manufacturers make such investigations is an asset to them, because they inspire their customers with confidence.



William Charles Lawson Eglin

Who effected the establishment of N. E. L. A. company sections and under whose direction the electric system of Philadelphia was unified and standardized

PHILADELPHIA, like many other large cities, in its early years grew up as did Topsy. There were many electric systems, and these gradually became consolidated into what is now known as the Philadelphia Electric Company. To harmonize all of these elements electrically involved virtually the rebuilding and rearranging of the entire service. This unification and standardization was designed and successfully accomplished under the direction of W. C. L. Eglin. Such work has more than local interest. It reaches out nationally. Without such unified systems the entire principle of interconnection would probably fail. Furthermore, it is doubtful whether American electrical manufacturers could have gone ahead so rapidly had they had to deal with non-unified systems in our large communities.

For many years Mr. Eglin has been prominently identified with the safety work. For a long time he headed the safety committee of the N. E. L. A. He was also a member of the national commission of physicians and engineers that formulated the now generally accepted rules for resuscitation from electric shock.

Mr. Eglin has given considerable thought and attention to the training and the general welfare of the employees of the industry, and the establishment of company sections of the N. E. L. A. for this purpose was successfully effected during his administration as president of the association. He has made an intimate study of the relations that should prevail between the employees of the industry and their employing companies, and in a paper, "The Personnel of the Industry," presented before the 1919 convention of the Association of Edison Illuminating Companies, he offered, as the logical and rational solution of this problem, a carefully designed plan of education and advancement that would be applicable to all grades of men in the industry. He has contributed to the technical press and to the proceedings of various associations engineering papers and reports, notably on the steam turbine.

Glasgow, Scotland, is Mr. Eglin's birthplace. After graduation from the West of Scotland Technological College he assisted Rankin Kennedy in his early experimental work on alternating-current generators and transformers. In 1889, at the age of twenty, he came to the United States, where he joined the Edison Electric Light Company of Philadelphia. There, under Prof. William D. Marks, the head of the company, he had charge of the electrical construction of the first modern central-station plant in that city. As consolidations were effected he continued in charge of the electrical engineering, and today he is chief engineer of the Philadelphia Electric Company.

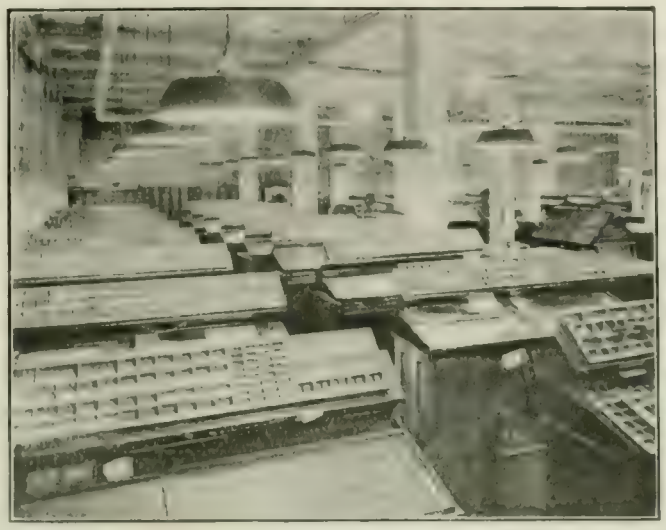
Besides being a past-president of the N. E. L. A., Mr. Eglin is a fellow of the American Institute of Electrical Engineers and a past-vice-president, a member of the board of managers of the Franklin Institute and a vice-president of the Engineers' Club of Philadelphia. His administrative ability has strengthened those associations which he has guided, which in turn has naturally had its favorable reaction on the industry.

Effective Printing-Plant Illumination

General Requirements for Good Lighting in Publishing Establishments Special Layout for Composing Room, Pressroom, Engraving Department and Bindery With Regard to Their Respective Requirements

By A. D. BELL
Edison Lamp Works, Harrison, N. J.

TO MAINTAIN the high standards of operation and efficiency which characterize the printing industry today one would expect to find in most plants a good lighting system. However, in many of the plants the systems are poor and in the smaller plants a too great variety of units is found. Nearly every worker, whether he be an engraver, a compositor, a press operator or a binder, has a unit which furnishes him with light adjusted to suit his own fancy. The drop cords are often adjusted by means of strings tied to them, a practice entirely contrary to the Underwriters' lighting code. Often the lamps have paper fastened to them to give a more shaded effect. Such a layout is inefficient and costly. Individual drop lamps mean a large number of outlets, and outlets are expensive.



LOCALIZED HIGH INTENSITY ILLUMINATION IS REQUIRED IN THE COMPOSING ROOM

An adjustable unit for each workman means that he is frequently going to spend a few minutes in making adjustments. Frequent handling also causes unnecessary breakage and wear of equipment.

The different processes in the printing industry will obviously have special requirements. Typesetting, for instance, requires a higher intensity of illumination than the mechanical operation of a press. For color work "daylight type of lamps or color-matching units should be used. Each different process has to have its requirements handled separately. While specific recommendations cannot be laid down so as to cover all cases, consideration should be taken of the following points:

1. Abundant and uniform illumination should be provided to prevent eye strain.

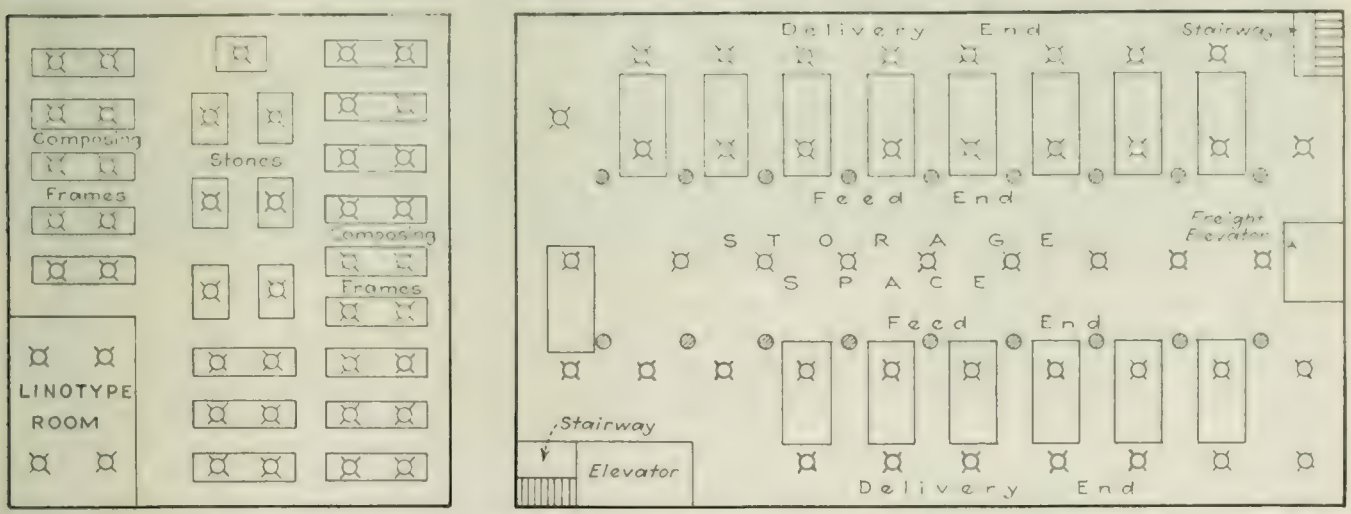
2. Glare should be prevented—usually by means of bowl-enameled gas-filled lamps with suitable reflecting equipment. Lighting units must be of such a character that glare from glazed surfaces or paper will be prevented.

3. Workmen should not cast shadows on their work.

4. The system installed should be simple in arrangement and as low in cost as possible. However, good lighting should not be sacrificed for the sake of a small saving.

5. As few sizes of lamps as possible should be used because the lamps may become interchanged or it is possible that some one size may not be easily obtained when it is needed, and hence uniform intensity of illumination will not result.

In printing establishments with large pressrooms and



PLANNING LIGHTING FOR EACH SPECIALIZED DEPARTMENT TO MEET PARTICULAR NEEDS

On the left is a recommendation for a typical composing room. The linotype room also requires local lighting for the machines besides the general illumination. The pressroom, shown on the right, also presents a special problem which requires a localized general lighting scheme. The units are located with respect to the presses and are necessarily hung high to clear the machine.

large high-speed presses the ceilings of the rooms directly below the presses vibrate considerably. Lighting units hung from such ceilings should be suspended by flexible drop cords rather than by rigid tubular piping. Units suspended on flexible cords are also especially convenient over high presses, for they can be temporarily fastened to one side instead of being taken down in case it is necessary to move or repair the upper portion of the press.

It is the universal practice to illuminate linotype and monotype machines by means of local lamps. These are usually placed in half shades which throw the light on the printer's copy and the keyboard. This does well enough, but the rest of the room as a whole should be illuminated by a general system so as to provide an even intensity of from 5 to 7 foot-candles. An evenly lighted room is more cheerful to work in and can be kept cleaner and in better order than one where there are dark areas. Moreover, a bad condition for the eye is produced where one works in a small area of bright illumination surrounded by darkness.

In the diagrammatic layout of the linotype room shown general illumination is provided by 100-watt bowl-enameled "type C" lamps in R.L.M. standard-dome reflectors in centers 11 ft. by 8 ft. (3.3 m. by 2.4 m.) and hung about 10 ft. (3 m.) above the floor. A similar layout should be provided in rooms of other dimensions than the one shown.

In the main composing room where all the work is done by hand a system of localized general lighting should be employed. The work requires a very fine discrimination of detail, especially where the smaller varieties of type are used. Good lighting here is a special asset, for with it errors will be fewer, decreasing the necessity for changes in the proof, a costly and delaying process.

As the racks are usually symmetrically spaced, an even distribution of illumination will be provided even though the localized general lighting scheme is followed. In the plan of a composing room two units comprising R.L.M. standard-dome reflectors with 100-watt bowl-enameled "type C" lamps, hung approximately 8 ft. from the top of the frames, are used to light each rack. Such an installation will produce an intensity of about 12 foot-candles.

The imposing stones must also be properly lighted in order that the forms may be accurately "made up," and corrected. One similar unit with a 100-watt bowl-enameled "type C" lamp in a R.L.M. standard-dome reflector is recommended for each stone. It should be suspended over the center about 10 ft. from the floor.

The illustrations used in most publications are printed from plates which are in general made by a process known as photo-engraving. In brief, this consists of reproducing on sensitized metal plates by photographic and chemical means a sketch or drawing of which the reproduction is known as a line cut, or a photograph of which the reproduction is known as a halftone. The photographic work requires a very high intensity of evenly distributed actinic light. High-current open-arc lamps with specially impregnated electrodes are used for this purpose.

After development work in a typical dark room the plates are etched or chemically treated. This work is usually carried on in the open and is not exacting in nature. A moderate intensity of from 3 to 5 foot-candles is adequate. General illumination, employing fixtures which are not affected by chemical fumes, should be supplied. Porcelain rather than brass-shell sockets are to be preferred for such conditions as these.

When the plates are inspected defects are routed out or touched up with an engraver's tool and the plates are mounted on wooden blocks. This work is carried on at tables or benches usually placed in a row near the windows. It is very important here that a light of a high intensity be provided on account of the minuteness of detail which must be observed. The work is usually planned so that most of it is done during the hours when natural light is adequate, yet on many occasions dependence must be had on the artificial illumination system.

The methods of bench lighting which have become standardized are applicable here. Bowl-enameled "type C" lamps rated at 100 watts, in bowl-shaped steel or mirrored-glass reflectors, should be installed on centers approximately 6 ft. (1.8 m.) apart, from 6 in. to 12 in. (15 cm. to 30 cm.) from the front edge of the bench, and approximately 5 ft. (1.5 m.) above the bench.

Laying Out the Pressroom Lighting

The next process after the forms have been made up is that of the actual printing itself. Most printing is done on one of the two main classes of presses—rotary and flat-bed. In either case the paper is introduced into the feed end of the press, and from there it is mechanically passed over the inked type and finally comes out at the delivery end in the desired printed form. It is important that the paper be properly fed into the press, and the necessity for good lighting for this operation is obvious. It is likewise essential to have sufficient light at the delivery end to enable the operator there to watch the printed matter as it comes out to see whether the work of the press is satisfactory.

A suitable lighting unit placed over the ends of each press will provide the desired illumination. An example of such a layout is indicated in the diagrammatic plan. Standard-dome reflectors of the R.L.M. type with bowl-enameled "type C" lamps are especially suitable for this because they give just where it is needed a fairly wide distribution of light without glare. As the presses are generally about 10 ft. high, it is necessary to hang the units high, and by using one unit over each end of the press the feed and delivery operations receive maximum light, while there is sufficient spread of light to illuminate the remainder of the press and aisles, allowing any repairs or adjustments to be made there. The effect of such a system of illumination will be seen in the night photographs.

Both types of presses are generally arranged in rows, and this allows a symmetrical system of illumination to be laid out, which should consist of two rows of lighting units along each row of presses. Thus uniform intensity of illumination will be produced in the vicinity of the presses. It is advisable also to provide both kinds of presses with an inspection lamp in a wire guard on an extension cord. This permits the necessary inspection or repairs within the interior in places where light from overhead sources would not penetrate.

In the case of small job presses, such as those of the Gordon type, an intensity of at least 8 foot-candles is recommended, using a system of general illumination with R.L.M. standard-dome reflectors and bowl-enameled "type C" lamps. This would be obtained from the following arrangement, provided that the surroundings are light in color: With ceilings under 12 ft. (3.6 m.), 100-watt or 150-watt "type C" lamps on 9-ft. or 11-ft.

(2.7-m. or 3.3-m.) centers respectively; ceilings 12 ft. to 16 ft. (3.6 m. to 4.8 m.), 200-watt "type C" lamps on 13-ft. centers; ceilings above 16 ft. (4.8 m.), 300-watt or 500-watt "type C" lamps on 16 or 20 ft. (4.8-m. or 6.1-m.) centers respectively.

Color-press work is becoming an important branch of the printing industry. It varies from the simple two-color work to the rather more complicated multiple printing in common lithography. The proper alignment of plates and accurate press work is a most important element in successful color printing. In view of the huge production required on many jobs in a short time it is important to employ every possible aid to insure accurate printing. While good lighting is an essential element to maximum production for any sort of printing, this is especially true in color-press work, where color accuracy is required and hence more careful inspection must be made.

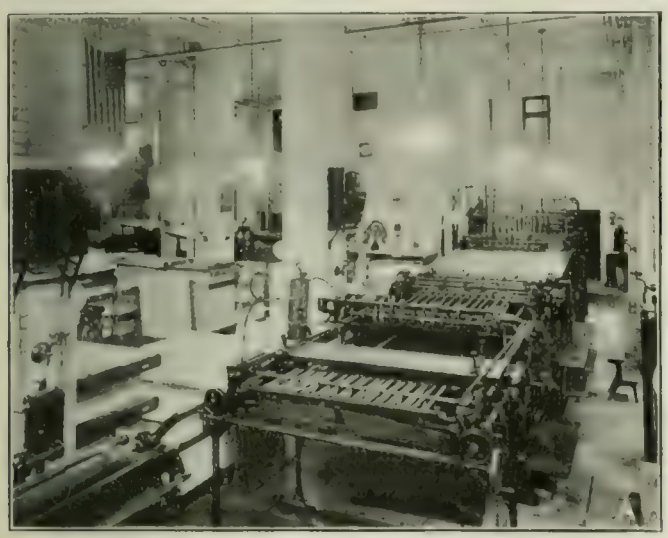
The general schemes outlined for the pressroom apply for color work, except that it is desirable to employ "daylight type" lamps. It is readily recognized that it is difficult to distinguish a yellow halftone from the white background when illuminated with the regular tungsten lamps. It is also particularly hard to detect blues and blacks, and other colors are not shown in their true relation.

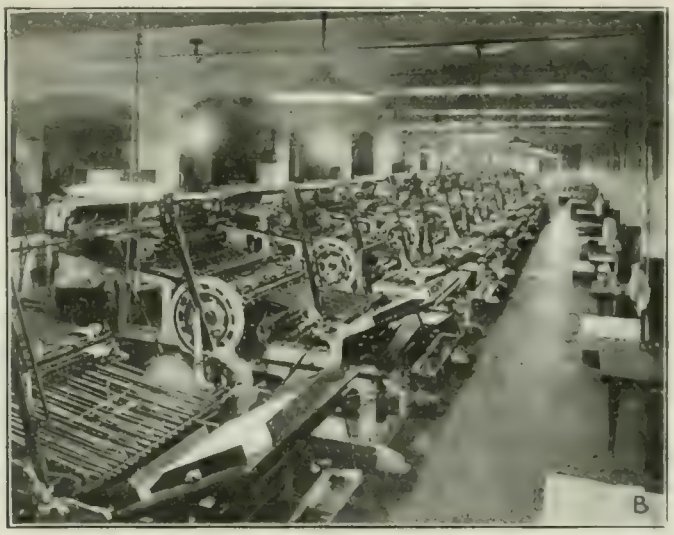
There are accurate types of color-matching units which employ clear "Mazda C" lamps in a suitable reflector and filter the light through a very carefully determined blue-glass plate. This type of unit produces unvarying light of north-skylight quality. Its total output, however, is not sufficient to warrant its use for general illumination. This accurate type of color-matching unit is particularly adaptable to the final inspection and for the absolute assurance of high-quality work at night.

The preparation of the stones and plates for lithography and photogravure demands lighting similar to that suggested for the hand work and retouching on photo-engraved plates. The localized general system of illumination employing R.L.M. standard-dome reflectors and bowl-enameled "daylight type" lamps gives excellent results, and a minimization of shadow effects is obtained. By the use of diffusing semi-inclosing globes with clear "daylight type" lamps a high intensity of well-diffused light is produced which will assist materially in maintaining the standard of production.

In the bindery the printed matter is collected and prepared for distribution. Magazine and book material is usually printed in large sheets, and these have first to be cut and trimmed to the size of the publications for which they are intended. The other operations of folding, punching, stitching, covering and so forth follow, the operations varying according to the variety of work being done. Although these operations are largely done by machines which are supervised and controlled by hand, it is essential that accuracy be maintained, for irregularly cut, punched or stitched sheets cause a very inferior product. Safe operation of the cutting and trimming machines demands proper lighting. With glaring or inadequate lighting here an operator can easily be seriously maimed. A system of general illumination will be satisfactory, provided that an average lighting intensity of at least 5 foot-candles is furnished.

In the gathering machines it is often advisable to install local "type B" lamps with wire guards around them in order that adjustments and repairs may be easily made. Such lamps should be of the mill type to withstand the vibration. They are available in 25-watt and 50-watt sizes. R.L.M. standard-dome reflectors with bowl-enameled "type C" lamps are satisfactory equipment to produce the desired general illumination. To produce an approximate average of 5 foot-candles intensity the following specifications are given: Ceiling below 12 ft. (3.6 m.), 100-watt "type C" bowl-enameled lamps on 12-ft. centers; ceiling 12 ft. to 16 ft. (3.6 m. to 4.8 m.), 150-watt "type C" bowl-enameled lamps on 12-ft. or 13-ft. (3.6-m. to 3.9-m.) centers; ceilings above 16 ft. (4.8 m.), 200-watt "type C" bowl-enameled lamps on 14-ft. or 15-ft. (4.2 m. or 4.5 m.) centers.





WITH HIGH-SPEED PRODUCTION AT A PREMIUM GOOD LIGHTING IS ESSENTIAL IN THE MODERN PRINTING PLANT

A. General illumination is provided in this pressroom by 300-watt "type C" lamps in diffusing opalescent-glass inclosing fixtures. These are 16 ft. above the floor on 15-ft. centers. The white-tiled side walls and the white ceiling make possible a high intensity of illumination throughout the room and such a remarkable degree of diffusion that the necessity for local or trouble lamps in adjusting or repairing the presses is minimized.

B. The pressroom of a large publishing concern as it appears by night lighted with 150-watt bowl-frosted "type C" lamps in porcelain-enamel-dome steel reflectors. These lamps are hung 11 ft. above the floor on centers 10 ft. by 18 ft. The localized general system recommended is followed out. It is interesting to note the application of white enamel paint to the presses, creating excellent diffusion which tends to eliminate shadows

Methods of Selling Securities Locally*

Continuous Efforts Result in Well-Placed Securities Held for Their Income-Bringing Value — Resale Market Must Be Provided — Campaign Method May Raise Stated Amount in Short Time, but Failure May Be Harmful

By WILLIAM H. HODGE
H. M. Byllesby & Company, Chicago, Ill.

SINCE the possibilities of distributing a utility company's securities in small holdings among a considerable number of the company's service customers have been demonstrated (ELECTRICAL WORLD, page 1018, Nov. 20), there has been a keen demand for information about selling plans and methods. Not much literature is obtainable on this subject. The only printed document containing anything approaching a compilation of available information is a report made to the National Electric Light Association in 1919.

No Uniform Method

The methods employed in customer-ownership work vary a great deal. Some are designed evidently to make the practice a continuous and permanent policy, others to raise money in the shortest possible time at the smallest cost. Certain plans appear to be shaped with the object of improved public relations ever in mind and to make every step taken and every piece of literature issued of definite value toward causing the people to know the organization better and to think well of it.

It is clear that each situation has problems peculiarly its own. Factors within the company and its financial structure, contemporary investment market and rates of interest, public sentiment, physical environment and many other circumstances, all inhibit uniform methods for making customer ownership a success. It is believed, however, that there is no situation, large or small, where a company is able fairly to assure investors a satisfactory rate of return for which a satisfactory plan cannot be devised.

Rate of Return

During the present year, the demand for investment capital being far in excess of the supply, the extraordinarily high returns paid to investors on securities of the highest class have increased the difficulty of marketing among service customers a preferred stock paying 7 per cent annual dividends. There are some instances where utility companies are succeeding in distributing at a price of $100 a share a fairly satisfactory quantity of 7 per cent preferred stock with certain tax-exemption features, but the tendency is to change the security offered to one yielding 8 per cent to 8½ per cent to the investor, or to reduce the price of the preferred stock to enable the investment to pay such returns on the cash invested.

The supply of capital and its cost will always fluctuate. Utility companies must adjust themselves to the prevailing conditions. If they can obtain money for construction purposes at all, they have to pay the going rate for it, and sometimes more. Customer ownership provides them with a means of raising part of their capital at least as cheaply, and frequently far more easily, than any other way. Certain companies are selling 8 per cent short-term notes at par in their home towns, these notes being convertible into preferred stock at a certain price, and also callable by the company at a small premium. Expedients such as this are sound and take into account the day when old-fashioned interest rates will return and a 7 per cent dividend will again be attractive.

Let it be assumed that a management has selected and made available a sound security paying the investor a return equal or nearly equal to what he is able to obtain from other sound investments in his community. Whether the security to be offered is a bond, a coupon note or a dividend-paying stock is immaterial. The essential points are that the security be safe both as to principal and regular returns and yield sufficient to rank within hailing distance of competing investments of the same degree of security. The selling methods which will distribute bonds or notes are just as efficacious in handling preferred stock and vice versa.

The selling method to be chosen has to be one of two, either the campaign method or the continuous-selling method. Every continuous-selling plan is made up of minor drives or campaigns, but it means also keeping everlastingly at it all the time.

Campaign Method

The campaign method has several points in its favor. It usually, but not always, succeeds in raising a stated amount of capital in a comparatively short time. If it is successful, the selling costs per share are low. It avoids the formation and expense of a permanent special sales organization. Nearly the entire force of employees can be put to work on it effectively, and they are soon back giving their regular jobs full time and attention.

The disadvantages of the campaign method are equally obvious. It starts with a flare, concentrates public attention for a short time, is concluded and soon forgotten. The full amount of the security offered is not always disposed of within the time set. When this happens the time usually is extended and there is more advertising and effort. Thus a harmful effect is produced on the public, which concludes that "the company must have an awful hard time selling its stock. Wonder if there is anything wrong with it?"

Continuous Selling Method

The continuous-selling method undertakes nothing sensational. It starts slowly and gathers momentum as it proceeds. It works steadily on the consciousness of the public, not only in impressions as to the merit of the investment and the desirability of owning it, but in creating new and favorable opinions concerning the organization, properties and service. Facts about the business which the company wishes known are presented and absorbed. Citizens are not allowed to forget that the company invites them to become profit-sharing

*The first article in this series will be found on page 1018 of the Nov. 20 issue of ELECTRICAL WORLD and dealt with the general subject of customer ownership and what it means to the locality and to the utility.

partners. Office holders take notice of the increasing number of shareholders as they are reported from time to time. The popular appeal of the idea itself grows steadily. The people come to regard the company as one of themselves.

There is nothing to be gained by placing a few shares of stock with an individual who sells them the first time he needs a little ready money. Campaign drives invariably make a certain number of short-time investors. They buy but they do not retain. Continuous-selling methods avoid this evil. As a rule the securities sold are well sold and placed where they are kept for their income-bringing value. The appeal which has interested their owners has not been emotional, and the investor has bought after cool calculation, not in a burst of short-lived enthusiasm.

To Provide Construction Capital

Inasmuch as every growing utility company requires new capital for construction purposes continuously, why not build up capital-providing machinery to meet the requirements? The public can be educated to a realization that as long as the community and company grow new capital must be obtained, and that therefore stock or bonds will be purchasable while improvements and extensions are necessary. Experience has shown that a great many more securities can be sold by telling investors that the company will have securities for sale just as long as it undertakes new construction than by setting a date whereon all subscriptions must be on file before the books close.

An example to support these statements is found in the experience of a group of companies employing the continuous-selling method which marketed $6,000,000 of preferred stock in three and one-half years and more than $6,000,000 additional in the next eighteen months. No campaign drives have equaled this record.

Customer ownership to be really successful must reach all classes of people. It must offer something attractive to the rich, the well-to-do and the wage earner, but particularly to the well-to-do and to the manual and professional worker. All can be reached and all can be induced to buy. The capitalist invests because the citizen-voter is a shareholder and this means that the company will be justly treated by the public authorities. The well-to-do place their money in the customer-ownership offering because it meets their investment requirements, pays substantial returns at frequent intervals, is readily marketable and is accepted as bank collateral. The wage earner comes in because he finds he can buy on small monthly payments and thus utilize the company for saving and investing on a better basis than he can usually obtain elsewhere.

The short offering with a date limit is not in harmony with the effort to build up a large list of shareholders from among all classes of people. It is decidedly impracticable in small communities, and it fails everywhere to give scope to the sustained educational effort whch achieves benefits to the utility companies of the most substantial kind.

Partial Payments

The partial-payment plan is a necessary adjunct to any genuine customer-ownership endeavor. It is the only medium through which a company can say, "Any one may become a profit-sharing stockholder, or investor, in this enterprise." The words "any one" in this connection of course means any one who can earn money and save a few dollars a month. In actual experience over a period of years from 20 to 25 per cent of home shareholders are made by operation of the partial-payment plan. Not to exceed 10 per cent of the securities sold, however, are handled in this way, 90 per cent being disposed of for cash. The advertising and political advantages of the partial-payment plan are so great that in themselves they are worth a great deal if they added but a few shareholders a month. For every worker who invests there are a hundred who say, "There's a corporation that's got the right idea," and who realize that this particular corporation grants recognition to them. There is nothing formidable about the details of the partial-payment plan. Any executive can work out the terms and conditions to suit himself. The simpler the plan and the less of forms and red tape the better.

Customer-ownership efforts directed at selling solely on the partial-payment plan, although prosecuted with initial success, can hardly be classed with the selling plans which produce a large number of paid-up shareholders and a large volume of capital in hand within a reasonable time. Such efforts are in a measure makeshifts and do not replace the far sounder and broader practices necessary to secure cash investors, with the partial-payment plan merely as a convenience for those not possessing the requisite funds. Most partial-payment plans are based on the payment of about 5 per cent of the purchase price monthly. This requires a period of about two years to complete the payments. During a two-year period many things may happen to the partial-payment investor. Sickness, lack of employment, increased living expenses, loss of interest, change of heart regarding the company, desire to invest in something else—these and other motives may cause the partial-payment investor to drop out. If he wishes to cancel his subscription and withdraw his funds, the company practically has to meet his wishes, irrespective of any contract or agreement which he has signed. It must do this as a good business and public-relations policy. It cannot afford to permit its customer-ownership plan to become an engine for generating dissatisfaction and ill will.

Resale Market

Every company undertaking customer ownership will find that it must maintain a buying as well as a selling market for its securities. After a considerable number of local investors have been acquired, the vicissitudes of life and prosperity and personal desires cause a certain number to wish to convert their securities into cash. If the investment is hawked about for a buyer, price recession is apt to occur. The company itself must provide a means of handling the securities offered for resale, and if it succeeds in maintaining a good selling market, it has no difficulty in transferring the resold securities to new owners. The price paid to the former security holders should be sufficiently lower than the selling price to cover the expenses of selling—that is at least the salesman's commission. It is far better for a company to advertise the marketability of its securities and to provide the market than to hold aloof and permit an outside market to organize itself—and that is usually what will happen.

Offering to handle resales for investors at the prevailing market price, less selling expenses, must not be confused with an agreement on the part of the company to buy back the security or to repurchase at a stated

price. No securities-selling organization or agency should ever make offers or agreements of this kind or permit its salesmen to leave any such impression with the investor.

The question "Can I sell my stock if I want to realize money and how much can I get for it?" is one of the most frequent ones asked by prospective investors. To reply that the company will repurchase the stock at any time is to promise something that the company may or may not be able to perform and something that it never should be called upon or expected to perform. But to answer that the company maintains a market for the security and will handle resales to other investors at the prevailing market price, whatever it may be, is a commitment of the company merely to do the best it can for the security holder at such time as he may wish to sell. It undertakes nothing impossible and does not attempt to transact business in the future sight unseen.

People as a rule are perfectly content not to sell their investment securities as long as they feel assured that they can sell them at a satisfactory price if they should care to. The offer of the company to place its selling mechanism at their disposal and the actual operation of this agency is sufficient to cover this question.

Advertising

In the most thorough-going customer-ownership endeavors infinite pains have been taken to inform the public of the objects of the company, great stress being laid upon the advantages to citizens and company of creating a large number of profit-sharing partners or investors in the community. The twin objects of improved public relation and construction financing have been carefully explained. Advertising and publicity have been frank and direct. The greatest of care has been taken to discuss in a serious way the economic advantage to the community and the personal benefits to individuals—a procedure not calculated to secure sensational results quickly, but almost certain to achieve splendid returns within six months to a year if faithfully persisted in.

No customer-ownership campaign can succeed without skillful and adequate advertising. The very nature of the undertaking makes it necessary to address the whole public and to carry the message to every person in the community who can be induced to receive it. Upward of one-half of the whole equipment needed for customer-ownership effort consists of advertising—newspaper, direct-by-mail, follow-up literature, etc. The advertising necessarily covers the whole basis of approach to the public. If the advertising is out of line with public acceptance, if it presents the innovation in a bungling manner, or if it is overdone or underdone in quantity, success cannot be expected.

Any basis of approach other than that founded upon the intrinsic, income-producing and capital-conserving features of the investment itself is shortsighted and dangerous. The public grants franchises to utility companies because the companies agree to build plants and distributing lines and to provide service. To construct these things the potential ability of the company to obtain capital is essential. No city would grant franchise rights to a corporation confessing itself unable to finance its construction.

The public rightly expects a public utility organization to possess the power of obtaining capital. The company that is unable to finance the construction necessary to render adequate service simply falls down on its job. It may have valid excuses, such as the conditions caused by wars and various other calamities, refusal of authorities to grant adequate rates, etc., but whenever the company confesses inability to raise capital it makes an admission of weakness more or less damaging which does anything but recommend the investment offered to the public.

Whether a company chooses to raise capital in New York, Chicago, home territory or Hong Kong is merely a question of selection, containing no plaint of impotency. It may decide to finance through bankers or directly with the public, or both, with no loss of strength or prestige and without sacrifice of public confidence. In any event it should offer its securities on their merit as securities and not because it happens to be a utility company and utility service is vitally needed in every community to advance the welfare of every individual in it.

There is no good reason why the financial necessities of the utilities should not be described in customer-ownership advertising, along with the vital character of the service rendered and the bearing of adequate service upon individual and community prosperity. All sound customer-ownership advertising does this, but never to the exclusion of the fundamental appeal to the citizen made by the desirability of the investment from the standpoint of his individual wealth and income.

The pioneers of really democratic and successful customer ownership looked far ahead in shaping their plans. They looked upon the subject seriously and they gave it and still give it the closest attention. Their hope was to lay a foundation upon which a larger and more permanent structure would stand as the years advanced. They meant to identify the personal financial interests of a large body of citizens with the fortunes of the utility corporation, and they have followed this determination with an unswerving perseverance handsomely rewarded.

One of the advertising and selling methods used with unfailing results is the simple process of advertising in newspapers and direct by mail to produce inquiries; next placing literature in the hands of inquirers and following it up by personal salesmanship. Every step in this chain is decidedly important. Careful record must be kept of all inquiries—mail, telephone and personal. The literature should be fully descriptive of the company and the security offered and illustrated.

Copy

Newspaper advertising and circular letters that tell the whole story to the reader do not produce nearly so many inquiries as copy that leaves questions such as the price of the security and the yield to the investor open for further inquiry. The person who is informed of all the main points of an investment offering may be favorably impressed, but too often he lays aside the advertisement and fails to act. The only way in which he can satisfy himself of the desirability of an advertised suit of clothes or a piece of furniture is to go and look at it or have it sent to him, and he is thus brought to the market. But he can judge an investment without inspecting a lithographed sheet of paper called a stock certificate fully as well as though he held the certificate in his hand. The advertising that tries to sell investment securities usually attempts too much and actually keeps many prospective purchasers from coming within the reach of personal sales effort.

Here is the approximate record of the recent inauguration of customer ownership in a city of about 225,000 population under conditions peculiarly disadvantageous. Newspaper advertisements and circular letters produced something more than 2,000 inquiries, the great majority within the first thirty days. During the ensuing six months sales were made to upward of 1,100 people, who purchased in round figures $500,000 of 7 per cent preferred stock at par plus accrued dividends. Under normal conditions these results easily would have been doubled.

SALESMANSHIP

It requires good personal salesmanship to make the best records in customer ownership, just as it requires good advertising. Every central-station man knows that salesmanship and advertising were necessary to develop the electrical energy business, despite the manifest value of the service to people and industry. It is the same with the distribution of securities.

Whether or not a special securities-selling department should be organized depends entirely upon the company, the size and character of its territory, the ability and disposition of its executive personnel and various general conditions. In many cases, with proper direction and education the regular force of executives and employees have scored excellent selling records. They have done this both in campaigns and by continuous selling, some stimulated by special prizes and emoluments, others securing only the customary commission of $2 a share, and still others drawing only their customary salaries. In all cases, however, there has been a directing personality who has studied the problems and mastered the essentials of the sales necessities—who has understood the security marketed and has provided the facts and selling talks and answered the questions asked by employee-salesmen.

The fact is that, if preceded by good advertising, almost any kind of an intelligent force of personal salesmen or saleswomen properly directed can dispose of utility securities direct to the local public, provided that they have confidence in their company, enthusiasm in its progress and are studious and industrious. Faith and energy are often worth more than knowledge indifferently exercised.

The total cost of customer-ownership selling should be kept within a maximum of $5 a share, of which advertising expenses ought not to exceed 75 cents to $1.50 per share.

All successful salesmanship comes from a few bold strokes and utilizing the momentum of a multitude of small things, circumstances and events. To get anywhere with anything calls for good faith, concentration and hard work. These are the prime requisites of successful customer-ownership selling and advertising methods.

Reducing Temperature of Laminated Cores

Experiments Show That the Transverse Thermal Conductivity of Sheet Steel Is Increased by the Application of Pressure and by Means of Varnishing the Laminations - An Important Consideration in the Design of Electrical Machinery

By T. S. TAYLOR
Research Laboratory, Westinghouse Electric & Manufacturing Company

IT IS well known that the transverse thermal conductivity of sheet material depends upon the intimacy of contact between the individual sheets as well as upon the nature and compactness of the material in the sheets. By the addition of some fluid or wax between the surfaces the thermal resistance of the imperfect contact can be considerably reduced. This is particularly the case where the thermal conductivity of the wax or whatever is used is of the same order of magnitude as that of the material constituting the sheets. This is of great importance in the design of electrical machinery, transformers and all apparatus

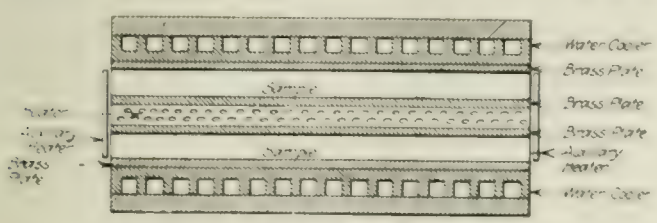


FIG. 1—ASSEMBLY OF IRON STAMPINGS FOR TEST

in which iron laminations are used, since the more readily the heat generated by eddy currents and hysteresis can escape, the lower the internal temperature or the greater the rating of the apparatus.

Another method of improving the transverse thermal conductivity of sheet material is to apply pressure. In all the work done on this subject by the writer both methods were used simultaneouly. The report of this is to be found in a paper presented before the American Society of Mechanical Engineers on Dec. 5, 1919. In these experiments, however, the pressure was applied by means of bolts around the edge of the measuring apparatus. This method gave no means of calculating the total pressure applied, and it also had the disadvantage that as the bolts were tightened up there was a great tendency for the pressure to be applied chiefly at the edges owing to slight buckling of the plates between which the bolts extended. This method was used merely because no means of measuring the pressure applied was at the time available. Recently, however, a Riehle testing machine of 10,000 lb. (4,500 kg.)

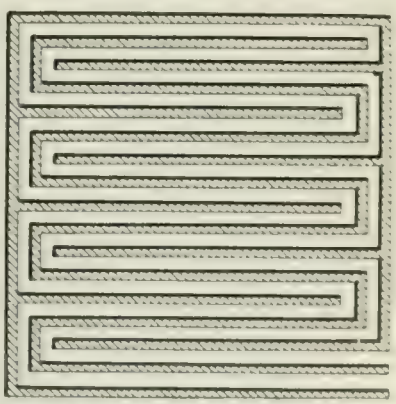


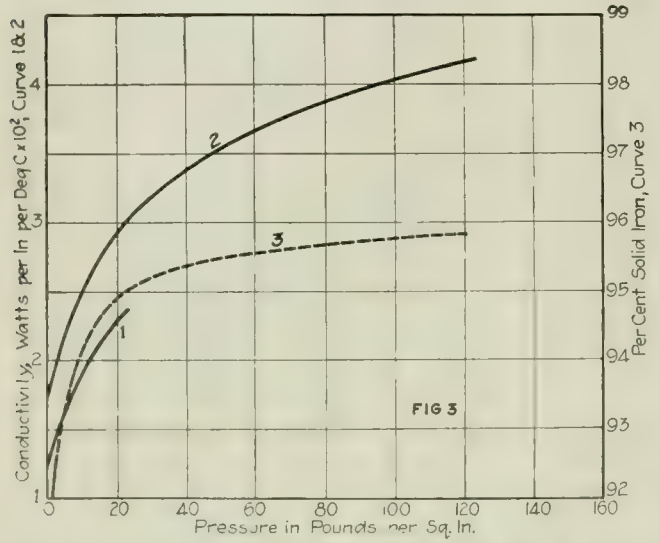
FIG. 2 — SCHEME FOR CIRCULATING COOLING WATER ABOUT SAMPLES

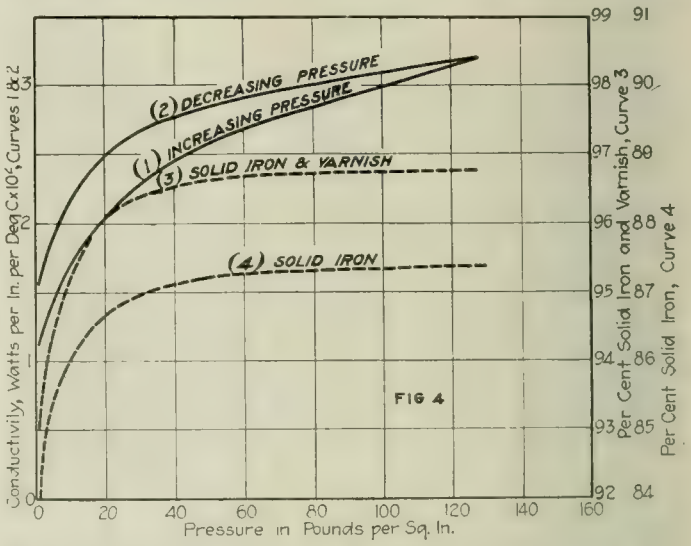
capacity has been obtained, and the work herein reported was done under definite, known pressures.

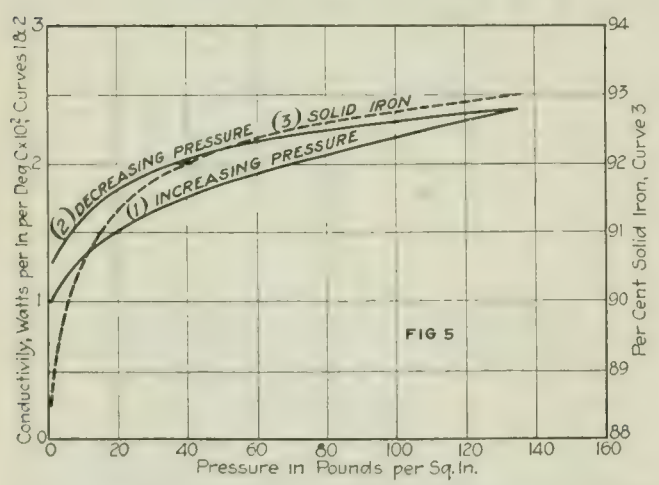
The transverse thermal conductivity of iron stampings, 0.0172 in. (0.437 mm.) for ordinary sheet steel and 0.014 in. (0.356 mm.) for silicon steel, has been determined under definite conditions of pressure. Both varnished and unvarnished were tested for each kind of steel under pressures up to 135 lb. per square inch (9.45 kg. per sq.cm.). There is considerable difference between the curves showing the relation between conductivity and pressure for increasing values of pressure and for decreasing values after the maximum pressure has been applied.

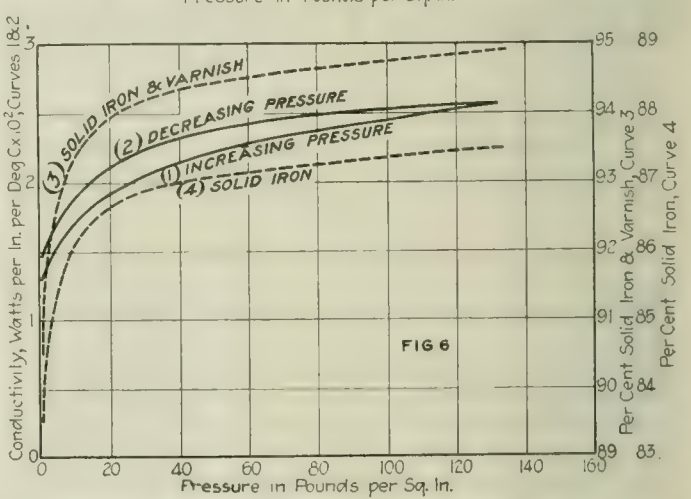
From the thickness of the samples as measured during the experiment curves were derived showing how the percentage of solid iron varied with the pressure. From the same data and the values of the conductivity the curves were drawn showing how the thermal conductivity varied with the percentage solid for cases tested.

The flat-plate method of measuring thermal conductivities was used. The sketches in Figs. 1 and 2 represent the main features of the apparatus. The heater was made by winding No. 21 constantan wire uniformly spaced, about $\frac{1}{16}$ in. (4.8 mm.) apart, over a $\frac{1}{16}$-in. (1.6-mm.) sheet of plate mica. Two more layers of plate mica, $\frac{1}{16}$ in. x $8\frac{3}{4}$ in. x $8\frac{3}{4}$ in. (0.16 cm. x 22.2 cm. x 22.2 cm.), the same size as the first, were then pressed tightly on the one about which the wire was wrapped, one being placed on each side. This heater was then placed between two brass plates $\frac{1}{4}$ in. x $8\frac{3}{4}$ in. x $8\frac{3}{4}$ in. (0.63 cm. x 22.2 cm. x 22.2 cm.) and held securely by means of brass strips fastened to the edges of the brass plates by means of machine screws. The samples to be tested, consisting of thirty sheets each of sheet iron, were placed adjacent to the heater as indicated in Fig. 1, one sample on each side of the heater. Small thermocouples made from 0.005 in. (0.13 mm.) copper and constantan wire were placed on each side of the samples. This was made possible by cutting the outside sheets of each sample into two parts and allowing the couple wire to pass out between the two parts. The cooling plates were so made that water could be readily circulated through them. A groove $\frac{1}{16}$ in. x $\frac{1}{16}$ in. (1.11 cm.) was milled in the face of each of two heavy brass plates as is shown in Fig. 2. A second brass plate was then soldered to each of the ones containing the grooves. As can be seen by reference to Fig. 2, this permitted the water to be circulated from one side to the other and return along the advancing current. Such a plate makes a very effective constant temperature cooling surface. Auxiliary heaters were placed securely on each side of the apparatus as shown in Fig. 1. They were made by winding nichrome ribbon over strips of $\frac{1}{16}$-in. (1.6 mm.) mica plate. These









FIGS. 3, 4, 5 AND 6 — EFFECT OF PRESSURE ON THERMAL CONDUCTIVITY OF BOTH ORDINARY AND SILICON STEEL

(3) Ordinary sheet steel (0.0172-in.), unvarnished; specific gravity, 7.79. (4) Ordinary sheet steel (0.0172-in.), varnished; specific gravity, including varnish, 7.51. (5) Silicon sheet steel (0.014-in.), oxide-coated; specific gravity, 7.54. (6) Silicon sheets (0.014-in.), varnished; specific gravity including varnish, 7.36. All samples tested at 85 deg. C.

heaters thus formed extended over the edges of the samples and prevented loss of heat from the edges of the samples when proper current was sent through them.

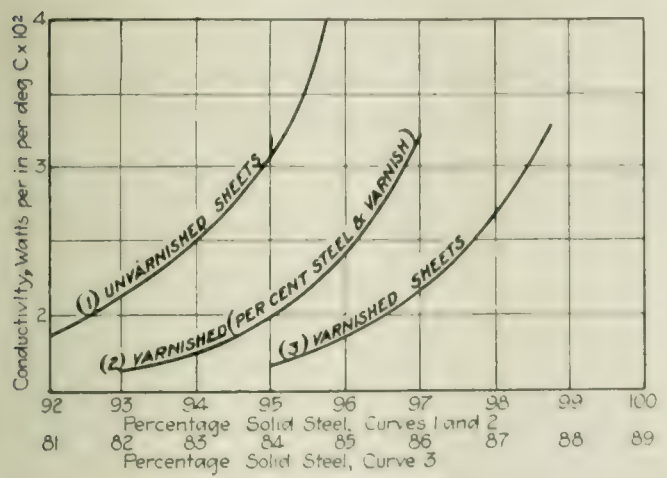
A sheet of a poor conducting material such as ⅛-in. (3.2-mm.) fullerboard or cardboard was placed adjacent the water cooler on each side so that a wider range of mean average temperatures of the sample could be obtained. In order to prevent further loss of heat from the outer edges of the total apparatus thus assembled, as shown in Fig. 1, wool felt was placed snugly around all sides. The current in the auxiliary heaters along the edges was always adjusted so that the temperatures as indicated by the thermocouples at the center of the sample and at the edges of the sample, just under the auxiliary heaters, were the same or differed by a very small amount. This condition insured a uniform transverse flow of heat from the heater through the samples to the cooling reservoirs. The amount of heat developed in the main heater per unit area was calculated from the value of the current flowing through the heater. The current was measured both by ammeter and by the potential drop through a standard resistance. This potential drop was measured by means of a potentiometer. The voltage was measured by determining the potential drop across a definite small fraction of an auxiliary high resistance circuit, 10,000 ohms, placed in parallel with the heater circuit. The temperatures as indicated by the various thermocouples on each side of the samples were measured by means of a special thermocouple potentiometer. The apparatus as described was thus assembled (see Fig. 1) in position in a Riehle testing machine. This made it possible to maintain any desired total pressure less than 11,000 lb. (5,000 kg.) on the samples. This maximum total pressure was equivalent to about 130 lb. per square inch (9.1 kg. per sq.cm.). Small extensions were left on each of the corners of all the brass plates which were placed adjacent to each side of the samples tested. The thickness of the sample for various pressures was thus readily determined by measuring the distance between these extensions by means of a pair of calipers. From these measurements the thermal conductivity was calculated by the usual formula

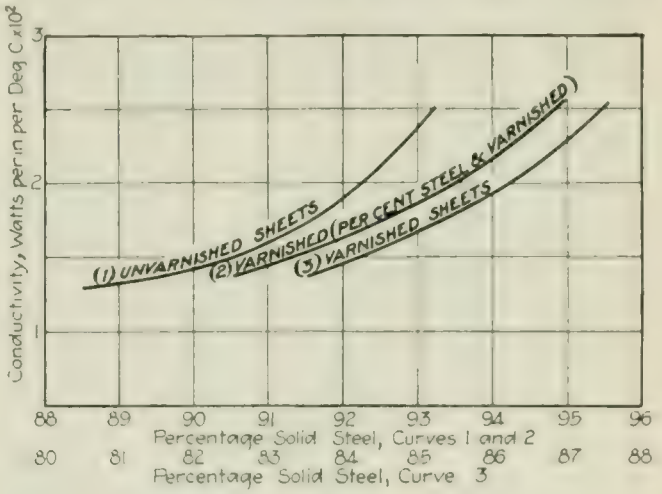
$$Q = \frac{kA(t_2 - t_1)}{d}$$

Sufficient time was always allowed between consecutive readings to allow the steady state to be reached. This varied from four to eight hours, depending upon the changes made.

In this manner transverse thermal conductivity measurements were made for 0.0172 in. (0.437 mm.) ordinary sheet steel, both varnished and unvarnished, and for 0.014 in. (0.356 mm.) silicon steel, both oxide-coated and varnished, for all pressures from slightly less than 1 lb. per square inch to 130 lb. per square inch (0.07 kg. to 9.1 kg. per sq.cm.). The average temperature of the sample was maintained at approximately 85 deg. C. for all pressures.

The results obtained for the unvarnished 0.0172-in. (0.437-mm.) ordinary sheet steel are represented in Fig. 3. The value of the conductivity was initially quite low, about 0.01260 watt per in. per deg. C., and as the pressure increased it followed the course indicated by the lower curve 1. The pressure at the point where the curve stops was accidentally increased to the full capacity of the testing machine, and when reduced to the next value above 22.5 lb. per square inch (1.5 kg. per sq.cm.), which was about 47 lb. per square inch (3.3 kg. per sq.cm.), the conductivity had increased to 0.0350 watt per inch per deg. C. Curve 2 was then traced as the pressure was increased up to 125 lb. per square inch. Upon lowering the pressure below 47 lb. per square inch (3.3 kg. per sq.cm.) the lower part of curve 2 was observed. In the light of what will follow from the results of the succeeding samples, the high pressure accidentally applied must have been beyond the capacity of the machine, or else upon decreasing the pressure the curve found would have been only slightly above curve 1.





FIGS. 7 AND 8—VARIATION OF THERMAL CONDUCTIVITY WITH SOLID IRON
(7) Ordinary steel. (8) Silicon steel. All tests made at 85 deg. C.

From the average thickness of the two samples, one on each side, and the specific gravity of the iron, the percentage solid iron was determined for each pressure. Curve 3 (Fig. 3) shows how this per cent of solid iron increases with the pressure applied. It is rather striking that even at a pressure of 125 lb. per square inch (8.7 kg. per sq.cm.) a little more than 4 per cent of the space occupied by the iron stampings is air space.

In a similar manner the results which are represented in Fig. 4 were determined for 0.0172 in. (0.437 mm.) ordinary sheet steel varnished. Curve 1 shows how the transverse conductivity increases with increasing pressure, and curve 2 how it varies as the pressure is then diminished to zero. Curve 3 shows the percentage of solid, including both iron and varnish, while curve 4 is for iron alone. These curves show that the varnish

occupies about 9½ per cent of total space and that there is still an air space due to roughness of the surface of over 3 per cent. For the unenameled this was about 4¼ per cent at the maximum pressure of 125 lb. per square inch (8.7 kg. per sq.cm.).

The curves in Fig. 7 show how the thermal conductivity varies with the per cent of solid for both the enameled and unenameled ordinary sheet steel. The conductivity of the unenameled appears to be rising much more rapidly than the enameled at the maximum pressure or maximum per cent solid. This shows that making more intimate contact between the surfaces of good conductors has a greater influence upon increasing the thermal conductivity than is the case with surfaces which are poor conductors.

Fig. 5 shows graphically the results for 0.014 in. (0.356 mm.) silicon steel, oxide-coated. Here also the thermal conductivity is seen to have higher values upon diminishing the pressure than it had when first applying the pressure. The pressure available, 135 lb. per square inch (9.4 kg. per sq.cm.), here is seen to be quite insufficient to cause the per cent solid curve to reach anything like a maximum. For the ordinary steel the per cent of solid curve was becoming quite flat, but for silicon steel it is still rising quite rapidly. This is entirely in agreement with the nature of the two materials. For the maximum pressure there is still 7 per cent air space.

The curves in Fig. 6 show the behavior of the 0.014-in. (0.356-mm.) varnished silicon steel. Curve 1 shows how the thermal conductivity increases with the pressure upon first applying it, and curve 2 is the same relationship as the pressure is then diminished after having been at the maximum value attainable in the particular apparatus. Curve 3 shows the variation of the per cent of solid iron, including varnish, with the pressure applied, and curve 4 is for the per cent of solid iron alone. Here also the per cent of solid curves is still rising quite rapidly at the maximum pressure. For varnished silicon steel, at a pressure of 130 lb. per square inch (9.1 kg. per sq.cm.) there is 87½ per cent of the space occupied by the steel, about 7.4 per cent by the varnish and 3 per cent air space.

VALUES OF TRANSVERSE THERMAL CONDUCTIVITY OF IRON STAMPINGS

Material	Average Temperature, Deg. C.	Transverse Thermal Conductivity, Watts/In./Deg. C.	Temperature Coefficient of Thermal Conductivity
Ordinary 0.0172-in. sheet steel, unenameled	85	0.0416	0.0010
Ordinary 0.0172-in. sheet steel, enameled	85	0.0319	0.0053
0.014-in. silicon sheet steel, unenameled	85	0.0240	0.0012
0.014-in. silicon sheet steel enameled	85	0.0270	0.0060

The curves in Fig. 8 show the way in which the conductivity varies with the per cent solid for both varnished and unvarnished but oxide-coated 0.014-in. (0.356-mm.) silicon steel. The oxide-coated or unvarnished is here seen to be increasing more rapidly than the others, just the same as was true for the ordinary sheet steel.

The values of the transverse thermal conductivity of iron stampings as found at a definite pressure of 125 lb. per square inch (8.7 kg. per sq.cm.) are recorded in the accompanying table.

Further tests being made on new samples indicate that the same sort of results hold for different samples. In the new tests each sample is taken several times around the cycle of increasing and decreasing the pressure from zero to the maximum to see whether the curve such as is shown in the various figures here will keep getting higher and higher. There is every reason to believe it will somewhat increase, especially for the lower curves, but should after several cycles settle down to a more or less definite course.

The values of the transverse thermal conductivity given here are considerably larger than were given in the earlier experiments. The transverse conductivity of ordinary sheet steel is considerably larger than it is for silicon sheet steel. The relative difference, however, is not quite so great as it is for the longitudinal conductivities.

The results which are here described indicate that in the earlier experiments (*loc. cit.*) there was considerable buckling of the heavy plates when they were bolted down tightly and hence most of the pressure was applied on the edges of the sample. In conclusion I wish to express my indebtedness to C. E. Nolan for his assistance in carrying on this investigation.

Another Opportunity for Interconnection

A Study of the Systems in the Vicinity of Philadelphia Indicates That 62,000 Tons of Coal Could Be Saved by Holding in Reserve Inefficient Stations

BY ROSS B. MATEER

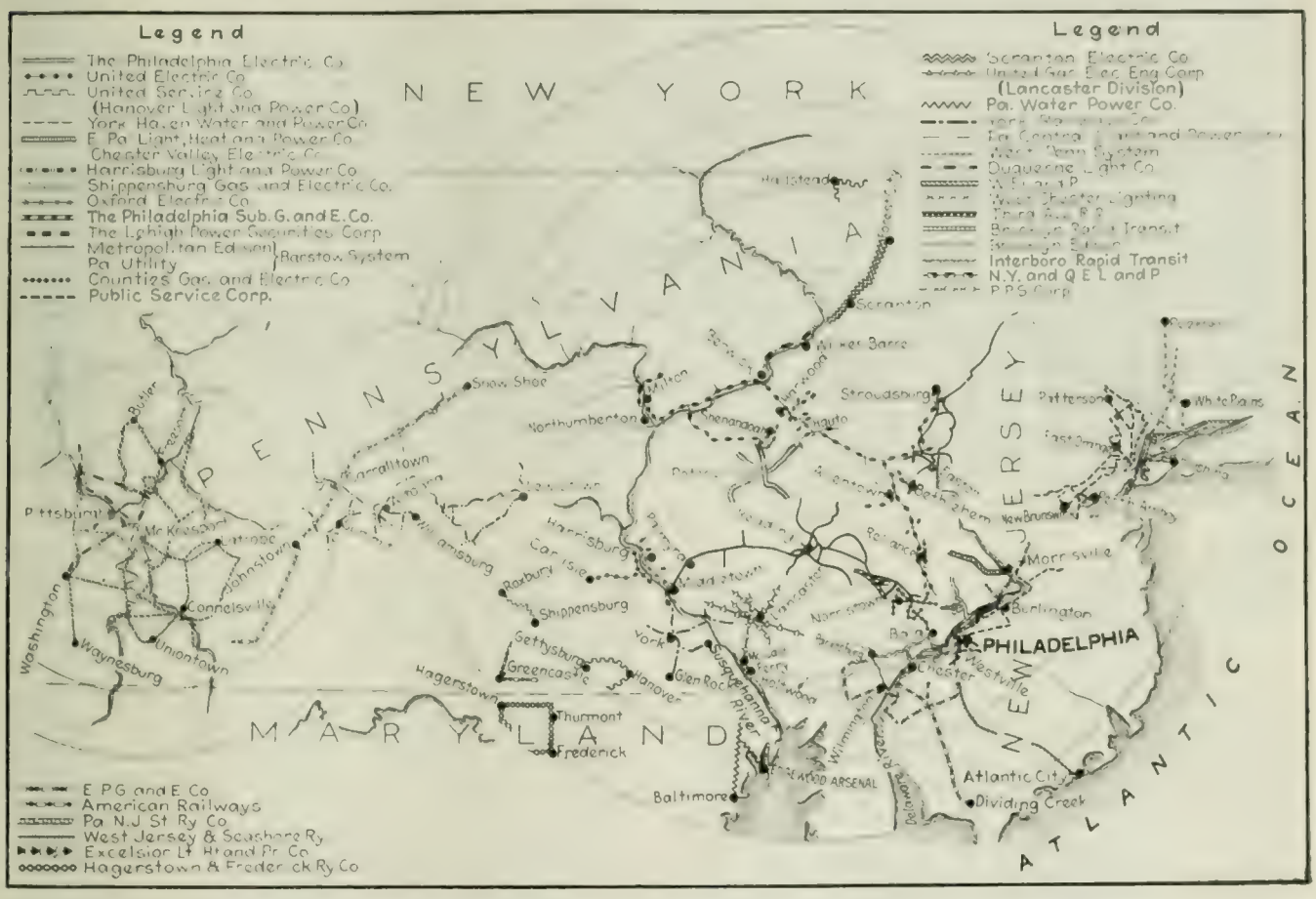
WHILE the advantages of interconnecting central-station systems with different load characteristics have been rather fully set forth, the study of any specific instance where such interconnection is especially advantageous is both timely and logical. An analysis of the operation of systems in the vicinity of Philadelphia shows that by using the most efficient stations in the group and holding the others for peak load service 62,000 tons of coal can be saved yearly, which, at $5.50 per ton, amounts to $344,771, justifying an expenditure of $3,000,000 for interconnecting lines.

Interconnection of adjacent electrical properties is such an essential part of the development program inaugurated in the Pacific Coast States that today exchange of energy is practicable in California from the California-Oregon line on the north to San Diego in the south. Greater utilization of hydro-electric energy, a more effective combination of steam standby, improvement in daily and annual load and power factor, better utilization of plants and transmission capacities of the system, and an insurance feature which reduces the capital charge of the individual companies, were a few of the reasons presented (1) for the capital outlay in transmission tie lines and frequency changers, (2) for the impressive hydro-electric development on the Kern and Pitt Rivers, and (3) for the operation of the linked system under the direction of one power administration. Believed to be a necessity where "white coal" is the one potential fuel, interconnection is of equal importance in the Middle Atlantic States.

Concurrent with the development in the West is the progress of the East. In New York, New Jersey and Pennsylvania huge tidewater power stations have been erected. Super-power generating stations are now not

only under construction in Philadelphia but are projected for erection at the mouth of the mine. With their completion and the supply base established, it is but the achievement of the transmission engineer to link up at adequate potentials distributing centers within a radius of 125 miles (200 km.) of the Quaker City. Problems to be solved are, then, (1) the economies of interconnection and (2) co-ordination and unification in the operation of existing utilities.

The larger the number of operating properties the greater are the benefits to be derived by interconnection. An analysis of twenty-five generating stations in this vicinity with an installed capacity of 113,074 kw., a simultaneous peak of 69,928 kw., a yearly output of



TRANSMISSION NETWORKS IN THE VICINITY OF PHILADELPHIA, SHOWING GAPS BETWEEN SYSTEMS

201,039,754 kw.-hr. and an average coal consumption of 2.62 lb. (1.19 kg.) per kilowatt-hour indicated (1) that these stations had 43,146 kw. in combined spare or reserve capacity; (2) that by shutting down all the inefficient stations, except for short period of peak load, a fuel consumption of only 2 lb. (0.91 kg.) of coal per kilowatt-hour was feasible under skillful operation; (3) that, applying the fuel saving, 0.62 lb. (0.28 kg.) of coal, to the combined output of the systems as interconnected, the yearly saving in fuel approximates 62,322 tons; (4) that, at a unit price of $5.50 per ton, the sum of $344,771 annual saving to the utilities justified, apart from saving in labor and supplies, the expenditure of $3,000,000 for tie lines.

Considering this group of properties in connection with other aggressive corporations within a radius of 125 miles of Philadelphia, it has been estimated, by reference to an analysis of their operating characteristics, that the expenditure of $5,100,000 for 185 miles (300 km.) of 66,000-volt transmission lines, exclusive of step-up and step-down transformers, will assure (1) an immediate spare capacity of 215,546 kva., (2) a reserve capacity of 53,092 kva., based on a minimum diversity factor of only 10 per cent; (3) a fuel economy of not more than 2 lb. (0.9 kg.) of coal per kilowatt-hour, except at periods of extraordinary demand; (4) an annual saving of 123,368 tons of coal, based upon the generation only of the energy supplied the Counties Gas & Electric Company, the American Railways-Wilmington property, and the Camden division of the Public Service Corporation in the larger and more efficient Philadelphia regional generating stations, and (5), at a unit price of $5.50 per ton, an annual saving of $678,524, justifying the expenditure for interconnecting 66,000-volt lines.

Again considering only the properties receiving energy from the isolated generating stations at Camden, N. J.; Norristown, Pa.; Wilmington, Del., and Westville, N. J., it is apparent from the transmission graph that the immediate construction of a 66,000-volt steel-tower transmission line from the Chester station of the Philadelphia Electric Company to a main switching station in the vicinity of Bala, Pa.; the extension of the steel-tower 66,000-volt line from the switching station to the principal substation of the Counties Gas & Electric Company at Norristown, Pa.; the tying in of the principal system substations of the Wilmington & Philadelphia Traction Company at Wilmington with the Chester generating station, and the spanning of the Delaware River with a 66,000-volt line, over which energy will be supplied from the Schuylkill generating station to the Camden property of the Public Service

Corporation of New Jersey and to the West Jersey & Seashore Railroad for traction purposes, will permit (a) of the abandonment of the Camden, Norristown, Wilmington and Westville generating stations except for emergency purposes; (b) of the installation of a transmission system of standard potential and supplied with energy from tidewater stations of 100,000 kva. and excess; (c) of the installation of efficient 30,000-kva. units in the large generating stations at Chester and

LOAD CHARACTERISTICS OF SYSTEMS IN THE VICINITY OF PHILADELPHIA

Corporation	Installed Kva.	System Peak	Present Transmission Potentials	Annual Kw.-hr. Output
Counties Gas & Electric Co.	18,000	10,000	13,200	54,000,000
American Railways Co.	25,900	15,000	13,200	60,000,000
Metropolitan Edison Co.	47,500	27,000	13,200 33,000	100,000,000
Lehigh Power Securities Corporation	113,074	69,928	110,000	201,000,000
Public Service Corp.	277,000	200,000	26,400	30,000,000 740,000,000
Philadelphia Electric Co.	250,000	199,000	66,000	727,000,000
West Jersey & Seashore R.R.	15,000	10,000	35,000	30,000,000
	746,474	530,928		1,942,000,000

PROPOSED TIE LINES*

Corporation	From	To	Mileage	Estimated Cost of Line	Proposed Lines Right-of Way
Counties Gas & Electric Co.	Norristown	Bala	10	$300,000	Private and Railroad
American Railways Co.	Chester	Wilmington	20	500,000	Railroad
Metropolitan Edison Co.	Norristown	Reading	30	700,000	Traction
Lehigh Power Securities Corp.	Reading	Allentown	30	700,000	Railroad
Public Service Corp.	Philadelphia	Camden	15	500,000	Railroad
Public Service Corp.	Philadelphia	Trenton	40	1,000,000	Railroad
Philadelphia Electric Co.	Chester	Bala	10	350,000	Highway
Philadelphia Electric Co.	Philadelphia	Bala	10	350,000	Highway
West Jersey and Seashore R. R.	Camden	Westville	20	700,000	Highway
			185	$5,100,000	

* These lines, operated at 66,000 volts would have 40,000 kva. capacity.

Philadelphia, Pa., and as industrial demands for central-station energy increases; (d) of the development of a regional generating and distributing center at Philadelphia, in harmony with the comprehensive plans of the Super-Power Survey; (e) of the conservation of an estimated minimum tonnage of 123,368 tons of coal annually; (f) of a substantial improvement in load factor at the super-generating stations by the gain in diversity.

Again, consider the 66,000-volt lines linking the regional generating center at Philadelphia with the distributing corporations at Camden, Norristown and Wilmington to be in operation and additional capacity at the distributing centers to be required. The installation of new transformers or the changing of taps of existing transformers, if designed and installed for such an emergency, to operate at 114,000 volts star instead of 66,000 volts delta will increase the carrying capacity of the net work from 40,000 kva. to 70,000 kva., or approximately 75 per cent, which is adequate for the normal growth or demands for power in the Philadelphia region until (a) the ultimate development of the super-power station at the mine already under consideration and (b) the construction of a 220,000-volt trunk to provide flexibility and assure interchange of energy between regional generating centers.

Co-ordination and unification in the operation of existing utilities is the answer to the present and future requirements, based upon an immediate call for 100,000 kva., a demand for 80,000 kva. additional by 1923 and another call for 100,000 kva. by 1925, in the region embracing Delaware, New Jersey and eastern Pennsylvania. Such an emergency may be met by (a) the development of the Chester and Delaware generating stations to their ultimate capacity of 120,000 kva. and 180,000 kva. by 1923, and (b) the rebuilding and expansion of the Harwood or Hauto generating station of the Lehigh Power Securities Corporation, or (c) the construction of the first unit of a power plant at the mine rated at 250,000 kva. to 500,000 kva., and (d) the construction by 1926 of a double-circuit No. 4/0 aluminum-steel-cable 220,000-volt tower line from the Hauto, Harwood or super-plant at the mine to the switching station at Bala, Pa., tying in at this point with the 66,000-114,000-volt network.

The program as outlined involves certain capital investment, (a) for the ultimate development of the tidewater generating station and (b) for the plant at the mine and its transmission trunk. The investment, however, is more than justified when consideration is given to the comprehensive data compiled by R. J. McClelland,* in which he compared the relative economy of a 250,000-kva. plant at the mine and the necessary transmission system with an equivalent 410,000 kva. in local central stations. The former entailed an estimated investment of $45,500,000 against $56,500,000 for the latter, and an annual expense of 10,000,000 and a cost per kilowatt-hour of 5.4 mills for the plant at the mine compared with $13,900,000 and 7.5 mills per kilowatt-hour for the several local stations.

An analysis of these figures points to advantages mutual to the operator and to the financial supporter of aggressive utilities and of essential economic value to the nation. The facts assuring the carrying out of the plan for the centralization of power generation in existing tidewater stations (with future demands to be cared for by transmission over high-potential buses to distributing centers) are (1) the saving; that is, the difference between the expense incident to the construction of a 250,000-kva. plant at the mine and its essential transmission system and the sum necessary to provide an equal capacity of 410,000 kva. in local central stations; (2) the decrease in the unit generating cost per kilowatt-hour, approximately 39 per cent; (3) the gain in spare and reserve capacity by interconnection; (4) the saving in transportation of some 1,300,000 tons of coal, and (5) the sum available for interest charges upon capital investment, a direct result of the elimination of $2 860,000 of transportation charges.

The evidence as stated, when considered with reference to the present and proposed transmission network, should be adequate (1) effectually to restrain the financing and erecting of isolated tidewater steam generating stations remote from the mine other than those now under construction in Philadelphia; (2) to require such co-operation between the managements of neighboring and regional utilities; (3) to call for unification of operation of the utilities here considered; (4) to require the creation of regional generating centers; (5) to demand unification of frequencies as well as transmission and distribution potentials, and (6) to permit the burning of such fuels as will make possible the marketing of coal of high calorific value for domestic purposes until the period comes when the construction of additional 250,000-kva. generating units shall require the utilization of the annual output of the mine.

*See ELECTRICAL WORLD, July 20, 1918, page 104.

Electrical Features of Springdale Plant

Balanced Relay Protection Is Applied to Generators, Whereas Line Switches Open on Overload
Precautions Taken to Prevent Spread of Trouble from Any Switch or Bus-
Station Load Indicators Used in Various Parts of Station

By GEORGE S. HUMPHREY
Electrical Engineer West Penn Power Company



SPECIAL TWIN TOWERS RECEIVING LINES FROM SPRINGDALE POWER STATION ACROSS THE ALLEGHENY RIVER

UNIT layout and operation of the station, the working of the plant at high power factor in combination with stations on the system and a particularly careful arrangement of the energy supply for auxiliary drives and excitation are exemplified in the design of the Springdale plant of the West Penn Power Company, an account of which was given in ELECTRICAL WORLD last week. This account of the electrical layout of the station is now completed with a discussion showing how the units function in case of trouble originating within the station or outside of the plant, the description of measures taken to prevent the spread of trouble which may be developed in any switch or compartment and other unique devices designed especially for this plant, such as a large station load indicator which is installed in the boiler room and at other important points about the station and system.

PHYSICAL ARRANGEMENT OF EQUIPMENT

Energy is carried* from the main generators under the turbine-room floor up compartments in the fire wall between the turbine room and boiler room and under the main switch floor to the 11,000-volt generator switches by open bare busbar construction. From the 11,000-volt transformer switches, which are on the same floor, single-conductor varnished-cambric-insulated cables run through fiber conduits down the river wall of the turbine room and through a self-supporting reinforced-concrete conduit line to outdoor transformers. The 25,000-volt leads are stretched from the transformer structure to the building wall, where they pass through wall bushings and are carried across the main switch room to the 25,000-volt switch compartments. From the 25,000-volt oil switches the circuits pass up and through the walls of the monitor to the lightning arresters on the roof. From here part of the circuits go across the Allegheny River, with a span of 1,450 ft. (442 m.), using silicon bronze conductors, and the others pass between the smokestacks, from which they are supported, to the transmission lines which run along the public highway at a distance of 1,000 ft. (305 m.) from the power house.

The 2,300-volt cables extend from the transformers back through the concrete conduit structure and under the turbine-room floor to the 2,300-volt concrete bus structure between the turbine room and boiler room.

The water circulated through the cooling coils is first filtered and treated by a water-treating plant, which is installed under the transformer platform.

The reactance of the main transformers is approximately 5 per cent, and that of the house transformers 6 per cent.

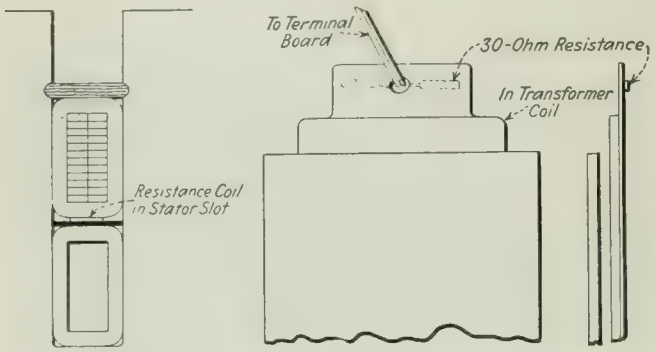
BALANCED RELAYS PROTECT GENERATORS AND TRANSFORMERS

The main generators, house generator, main exciter motor, main transformers and house transformers are protected by balanced relays and are therefore automatically disconnected in case of internal failure. The current transformers are installed so that as much as possible of the wiring is protected by these relays. However, the generators and transformers are not protected against overload. In case more current flows from one terminal of the generator than from the other terminal of the same winding a multi-circuit relay operates to disconnect the generator from the bus, from

*See cross-section of station, ELECTRICAL WORLD, Sept. 25, 1920, page 627.

the transformers and from the neutral, stop the ventilating fan, and then to open the generator field. Unbalanced current in the main transformers will open the two 25,000-volt, the two 11,000-volt and the neutral circuit breakers of the transformers in trouble. The balanced relays are set for 1.5 amp., so they will operate on a comparatively small unbalance and thus disconnect defective apparatus with as little damage as possible.

The 25,000-volt transmission lines are protected by means of Westinghouse type CO inverse time-limit



LOCATION OF RESISTANCE COILS FOR DETECTING INTERNAL TEMPERATURES IN GENERATORS AND TRANSFORMERS

The resistance forms one element in a Wheatstone bridge scheme, and temperatures are read on switchboard ammeters graduated to read temperature directly.

overload relays, as are also the 2,300-volt circuits. The 25,000-volt circuit breaker which connects each transformer bank to the transfer bus also has an overload relay to protect a transmission line when it is being supplied from the transfer bus.

The 25,000-volt lightning arresters are Westinghouse impulse-gap, four-tank, electrolytic arresters with choke coils, and a "dip" in the leads to the arresters. Experience on the West Penn system indicates that there is considerable benefit in bringing a line conductor straight to an arrester and then taking it straight back on itself for a few feet, and this is referred to as a "dip." The lightning seems to follow a straight path through the arrester rather than suddenly reverse its path around the 360-deg. turn.

Each section of the 11,000-volt bus has an electrolytic arrester to protect the generators against surges.

Grounding Device for Protecting Workmen

A new type of grounding device has been developed for grounding the 25,000-volt lines when it is desired to work on them. This device consists, for each circuit, of three knife switches mounted on top of the bus structure and controlled from a single handle mounted in the corresponding switch cell. This switch is electrically locked in the open position when the line is alive by means of current supplied by a 25,000-volt potential transformer connected on the line side of the circuit breaker. When the handle is in the closed position it opens the closing circuit for the corresponding circuit breaker. Thus it is impossible to ground the line unless the circuit breaker is open, and it is impossible to close the circuit breaker when the line is grounded. Each of these line-potential transformers also lights a lamp on the switchboard, so that the operator can tell whether or not the line is charged from the other end when the station line circuit breaker is open.

One set of busbar reactors rated at 6 per cent at 2,000 amp. with 75 deg. C. temperature rise is installed in the 11,000-volt bus between the two main generators, and it is intended to place reactors in this bus between units as the station grows.

The operating room is on the main-switch floor, which is two floors above the turbine room. The operator can see none of the apparatus which is controlled by him and must depend on signals and the telephone for communication with the turbine room and other points about the plant.

The switchboards in the operating room are arranged in five groups. One group contains four generator panels, which are of the benchboard type with indicating instruments on the front vertical section and relays and curve-drawing meters on the back of vertical panels placed 4 ft. (1.2 m.) back of the front panels. Another group contains the 25,000-volt line and transformer panels and a 25,000-volt neutral panel; a third, the 2,300-volt auxiliary panels; a fourth group, the exciter panels and voltage regulators, and the fifth group, the panels for distributing the control and lighting circuits.

The switch control circuits are so arranged that the automatic tripping of any switch will ring a bell, which will keep ringing until the operator has turned the corresponding control handle to the trip position. Should a number of switches open automatically at the same time the bell will keep ringing until the operator has cleared the last switch. Thus there is no chance for him to believe he has entirely taken care of the trouble by attending to only one switch, although this would stop the ringing of the bell unless special provision were made against it as was done in this case. In this station a green light indicates that a switch is closed and a red light that the switch is open, which is opposite to practice in most power plants. The West Penn system has always been operated on the theory that the normal condition for a switch is closed and the abnormal position is open, and the red light is to call the operator's attention to the abnormal condition. When a switch opens automatically the green light is extinguished, while the red lamp is lighted and remains lighted until the switch is again closed or the control handle is turned to the trip position, when it also is extinguished and the alarm bell simultaneously stops ringing.

Indicators of Total Station Load

A device has been provided which is actuated by the totalizing wattmeter and operates instruments having 36-in. (90-cm.) dials to indicate the total station load, such instruments being installed in the system operator's office and at several points in the turbine room and boiler room, those in the boiler room being arranged so that they can, in addition, be adjusted by the system operator to show contemplated increase or decrease in load.

In the basement are railway machines and a railway board consisting of twelve panels. Clocks of recording instruments wherever possible are synchronized and controlled from a Warren master clock placed in the operating room. Tracing the sequence of various operations recorded by these instrumnts in case of trouble is greatly facilitated by thus having all clocks continuously synchronized.

All the main generators and the house generator are provided with Westinghouse automatic voltage regulators.

The emergency lighting circuits, which supply energy to the lamps most vitally needed in case of trouble, are ordinarily supplied from alternating current, and an

automatic throw-over switch is provided which throws them over to a storage battery if there is an interruption of two seconds in the alternating-current supply. The battery, which consists of 120 type E-17 "Exide" cells, also operates the circuit breakers.

The 25,000-volt conductors are all open wiring without insulation except that micarta tubes are placed over the leads between the disconnecting switches and buses to prevent arcs from traveling from the disconnecting switches to the bus. The conductors indoors are of copper tubing, and the busbars consist of two ¼-in. x 2-in. (0.6-cm. x 5-cm.) bars. All indoor insulators are porcelain posts, which have a dry flash-over of 135,000 volts and will withstand a cantilever pull of 1,500 lb. (680 kg.). There are barriers placed between the individual 25,000-volt circuits but not between individual phases, the spacing between which is 32 in. (81 cm.). The 25,000-volt bus structure is of reinforced concrete, weighs 2,400 lb. per foot (3,568 kg. per meter) of length, is 130 ft. (39.6 m.) long, and is supported at intervals of 21 ft. 9 in. (6.4 m.), over which distance it is self-supporting as a beam.

The 11,000-volt conductors consist of flat bars mounted on porcelain insulators with concrete or brick barriers between individual phases at all points, with the exception of the leads to the transformers, which are single-conductor varnished-cambric cables with $\frac{3}{8}$-in. (96-mm.) insulation and a double braid. The 11,000-volt bus and switch structure is of concrete. The 2,300-volt wiring consists of single-conductor, varnished-cambric braided cables in fiber conduits laid in floors and walls. The control wiring consists of multiple-conductor rubber-covered cables in iron conduits.

A double-circuit steel tower transmission line 21 miles (33 km.) long, using No. 4/0 copper conductors and insulated for 130,000 volts, has been constructed from Springdale to a point near Greensburg. This line is now operated at 25,000 volts.

When further extensions shall be made to the station, it is the intention to distribute the additional power at 130,000 volts. The step-up substation will be entirely out of doors and will be between the turbine room and the river. A step-down substation will then be constructed, and the voltage of the steel-tower line will be increased to 130,000. Another 130,000-volt double-circuit transmission line will be run northward from Springdale to supply the territory served by the West Penn on both sides of the Allegheny River. It is probable that the present number of 25,000-volt circuits will take care of the power that can economically be served from the station at this voltage. It is the intention eventually to interconnect the stations of the company by means of 130,000-volt transmission lines.

The station proper was designed by Sanderson & Porter, consulting engineers, of New York, and was built by the West Penn Power Company under the supervision of the consulting engineers. The 25,000-volt installation and the transmission lines were designed and constructed by the engineers of the West Penn Power Company.

Utilizing Hydro-Electric Energy in Sweden

Interesting Experience with Extensive High-Tension System of the Swedish Government — The Method of Grading Station Insulation and Studies of Lightning Trouble Are Features — Plans for 200,000-Volt Transmission Lines

THE utilization of Sweden's natural resources of hydraulic power is a matter of immediate national importance owing to the almost complete lack of hard coal within the country's borders. The management of all state-controlled water rights therefore has been intrusted to a national board, which, under the name of the Royal Board of Waterfalls (Kungl. Vattenfallsstyrelsen), reports directly to the Minister of Communication. At present the Board of Waterfalls controls some 250,000 kw. of installed generating capacity and distributes yearly some eight or nine hundred million kilowatt-hours of electric energy to almost every industry, city, village and farm within a large area in middle southern Sweden and also to the mining districts in the far north. The map shows the extension of the present high-tension transmission system and also a system of extra-high tension trunk lines now under construction.

Experience in the operation of this system shows that only four faults have developed in 135 generator-years, and little trouble has occurred in transformers, excepting during the war, when faults increased to 40 per cent of the number of certain transformers in service for one year, owing to substitute material used in construction. From 3 to 5 per cent trouble is said to represent normal operation of transformers. Grading of suspension insulators for 50-kv. and 70-kv. lines has been adopted, and six units per string are used for the latter voltage. The general method of insulation dispenses with horn gaps, and a scheme of so grading the insulation has been adopted that the most accessible insulators, at the station, will break down first. Thus the line insulators have a high factor of safety. This method is said to have proved highly satisfactory.

The Swedish state of old held certain important water rights in the Göta Alv, the outlet of Lake Vänern into Kattegat, a part of the North Sea. It is expected that after complete development between 250,000 kw. and 300,000 kw. will be utilized in this stream. Plans had already been laid down in the earlier years of the century for a wholesale development of the falls of Trollhättan, in Göta Alv, and early in 1910 the first generating unit was put into service. At Trollhättan there are now in operation thirteen hydro-electric units of 9,000 kw., representing a total of about 115,000 kw. installed capacity. The next task of the Board of Waterfalls was to build a hydraulic station in the wilderness north of the Arctic Circle. In connection with the electrification, in 1913-15, of the important ore-hauling state railroad between Kiruna and Riksgränsen, at the Norwegian border, the interesting subterranean power station at Porjus was constructed. Porjus now puts some 20,000 kw. single-phase power at the disposal of this railroad, and supplies the large iron mines at Gellivara and

Kiruna and the electrochemical industries at Porjus with about 35,000 kw. over a three-phase system. The next development was the Alvkarleby station, on the river Dalälven, about 90 miles (140 km.) due north of Stockholm, with 55,000 kw. generating capacity, and among recent acquisitions is the Motala plant, which is not yet completed. The latter station has a rather small all-day capacity, but because of its advantageous situation between Lake Boren and Lake Vättern it is intended as a peak-load station with synchronous capacity of 30,000 kva. There is also a 30,000-kw. steam-driven reserve station at Västeràs, intended to supplement the Trollhättan and Alvkarleby systems during periods of water shortage.

At the congress of electrical engineers and physicists gathered in Copenhagen Aug. 31-Sept. 3 to commemorate Oersted's electromagnetic discoveries Waldemar Borgquist, head of the electrical construction and plant of the Royal Swedish Board of Waterfalls, gave an interesting résumé of operating results during the ten

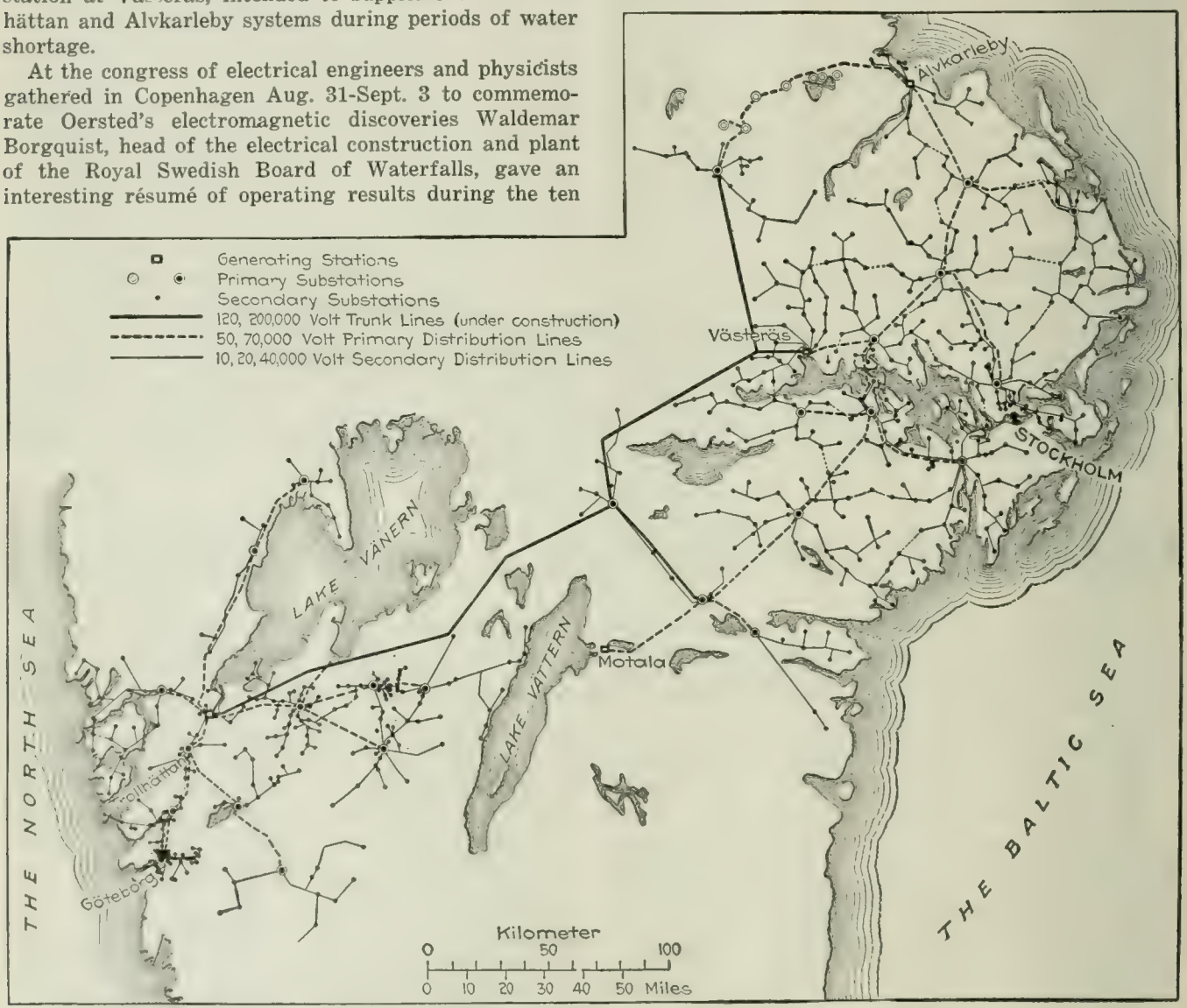


FIG. 1—ELECTRICAL SUPPLY FOR RAILWAYS AND INDUSTRIES IN MIDDLE SOUTHERN SWEDEN
This system has been designed, built and operated by the Royal Board of Waterfalls for the Swedish government.

or more years of operation of the board's vast power distribution systems. He also touched upon some far-reaching plans for the future.

At present there are about 5,000 km. (3,100 miles) of high-tension lines, the speaker said—namely, 1,100 km. (680 miles) for a tension of 70,000 to 80,000 volts, 800 km. (500 miles) for 40,000 to 50,000 volts, and 3,100 km. (1,920 miles) fo. 10,000 to 20,000 volts. There are installed thirty large generating units and 300 transformers of 100 kva. to 5,000 kva.

Most of this equipment has been in service uninterruptedly for six or seven years, but in a total of 135 generator years only one stator and two rotor winding faults and one mechanical fault have been noted, the two rotor faults in fact being caused by accidental exposure to moisture during the period of construction. In the beginning ice expansion caused some trouble in winter time, but thanks to special equipment, including ice deflectors and electrically heated gratings, hydraulic reliability now is practically 100 per cent.

In 250 transformer-years, counting only the bigger units, there has been only one mechanical fault, but cooling-water coils sometimes showed a tendency to leak and had to be looked after. In certain large lots of smaller and medium-sized 20,000-volt transformers bought during the war, however, the fault frequency has been much higher, emphasizing the detrimental effects of the use of war substitutes. In such transformers the fault frequency ranged all the way from 15 per cent (that is, 15 faults per 100 transformers in a year) up to 40 per cent, while in pre-war installations on similar duty the fault frequency had been only 2 to 3 per cent, or even lower. As a standard for good transformers the speaker suggested a fault frequency of less than 3 to 5 per 100 transformers per year during the first ten years of service for each transformer. Medium-quality transformers should give from 5 to 10 per cent fault

frequency, while transformers giving more than ten faults per 100 transformer years must be considered as not up to trade requirements.

All the newer 70,000-volt lines in the system and most of the 50,000-volt lines are provided with suspension insulators, with six and five units per string respectively. The units are of a special design, developed after extensive researches in the board's high-tension laboratory at Alvkarleby, and are graded so as to give a reasonably even distribution of voltage over the string. On the high-tension lines of the Eastern system the fault frequency has been kept down to one fault per year for 500 km. (310 miles). In spite of the severe climatological conditions of northern Sweden, only one fault per year for 100 km. (62 miles) has been reported from the Porjus 70,000-volt lines. However, on certain older 50,000-volt stretches, insulated with two or three units per string and running close to the western coast line, the fault frequency has been enormously larger, possibly owing to the salt winds from the sea, and up to one fault per year for 6 km. (3.7 miles) has been observed on the line from Trollhättan to Gothenburg, necessitating reinsulation with five-unit strings. Lines operated at 40,000 volts and below and some 50,000-volt divisions are provided with pin-type insulators and naturally show a somewhat higher fault frequency than modern suspension-insulator lines. On wood-pole lines there has been on an average one fault per year for 40 km. (25 miles)—half of the number, however, having been due to falling trees—but certain 50,000-volt steel-tower lines have shown up to one electrical fault per year for 20 km. (12.5 miles).

The Board of Waterfalls has equipped all newer plants according to a rule which may be called the principle of graded insulation. It is part of the system not to use any horn gaps or other lightning arresters. The insulation is not uniform over the entire plant, but systematically tapered. The weakest points in the system are the switching-station insulators, which may easily be kept under continuous inspection and in case of a breakdown may be quickly replaced. All bushings and series apparatus are designed for considerably better insulation, since a failure here causes longer interruptions. The transformer windings are insulated so as to be able to stand brief overvoltages still better than the bushings, and the line insulators, finally, are made with as high a factor of safety as economy permits. Owing to this grading of the insulation electrical surges which occur in the neighborhood of a station will very seldom cause any transformer breakdowns, but the electrical faults have instead a tendency to appear in the switching station insulators, where the trouble may easily be found and remedied. Experience has shown that the system works very well and that the grading in no way causes any alarming increase in the total number of disturbances.

Horn Gaps Are Considered Hazardous

Mr. Borgquist remarked that he is as often asked just why he prefers to use the busbar insulators as electrical safety valves instead of horn gaps or similar devices. The reply, he said, is this: In order to make horn gaps effective at all, they must be adjusted to about 80 per cent of the breakdown voltage of the weakest insulation in the system, and the gaps then tend to pick up a great many disturbances which ordinarily would have been perfectly harmless. The effect thus virtually is a considerable decrease in the over-all electrical strength of the plant, which reacts very unfavorably upon reliability of service.

A survey of electrical faults on the Alvkarleby system during 1916-18 gave as a result the fault-frequency curve in Fig. 2. During the winter no other faults occurred than such as could be traced back to accidental shortcomings in manufacture of the equipment. Service interruptions of unknown origin, insulator failures and so on began to be prominent during the late spring, and in the summer there was a decided maximum of disturbance, while the fault frequency during the autumn gradually fell back to its low winter value. This periodicity of disturbance clearly indicates that the overwhelming majority of unexplainable faults are due to atmospheric disturbances of electrical nature. Much attention, therefore, has been devoted to a study of the inter-relation between atmospheric electricity and plant trouble, and in this connection investigations are being made of the electrical field in the neighborhood of the earth's surface, including continuous graphical registration of the potential drop in the air. During this work it at once became evident that the earth-field gradient may rise to enormous values, much larger, in fact, than heretofore has been assumed possible. In one case a drop of 275,000 volts per meter was registered, and gradients of the order of hundreds of volts per centimeter were common occurrences. It is clear, therefore, that a transmission line during a thunderstorm will take on tremendous electrical charges, if it is grounded at one end. A sudden lightning discharge will liberate the charge on the line, and the potential of the line conductors then may rise momentarily to millions of volts to ground. That any operation at all is possible under such conditions may be explained only by the assumption that the field changes take place not instantaneously but at such a rate that the charges have time partly to equalize themselves during the lightning. The main point, therefore, is the rate of change of the potential gradient, and just now a method is being tried for direct photographical registration of the time derivative of the air potential.

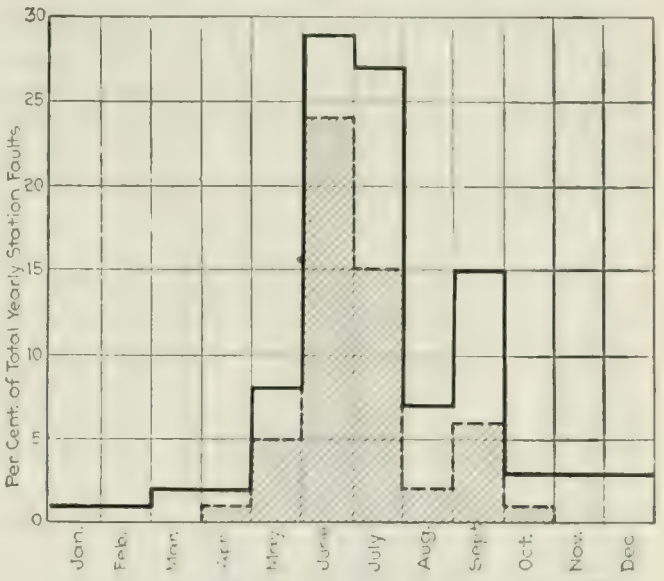


FIG. 2—MOST OF STATION TROUBLE OCCURS IN SUMMER

Average number of station disturbances during 1916-18 in the Alvkarleby system in Sweden. The shaded area indicates faults occurring during thunderstorms.

In concluding, the speaker stated that conditions during these past years of operation in no way have indicated any technical difficulties which could prevent the

rational working of such widespread and ever-expanding transmission systems as those in middle southern Sweden, nor could they make it impossible to maintain in such systems any degree of service reliability necessary for good economy.

The two big systems branching out from the Trollhättan and the Alvkarleby stations hitherto have been operated independently, but they will soon be very effectively linked up by a 200,000-volt tie line now under construction. This line will preliminarily be provided with 70-sq.mm. (1,380,000-circ.mil) copper and will be put in operation during 1921 at 120,000 volts. The poles, however, are designed so as to be able to carry four 300-sq.mm. (5,920,000-circ.mil) copper conductors, and room is provided for 200,000-volt insulation. As soon as the need for greater flexibility arises the present conductors will be replaced by the heavier material and the full voltage applied.

This trunk line, shown on the map by heavy dash lines, is intended to form the first link in a widespread system of super-high tension lines to span Sweden from east to west and from north to south. The Board of Waterfalls, the speaker said, even considers the possibility of an economical transmission of energy from the tremendous hydraulic resources of the vast wilderness in the far north down to the densely populated industrial districts in southern Sweden, over a distance of more than 1,000 km. (620 miles).

Communal Electric Heating System

THE city of Bergen, on the west coast of Norway, in January, 1916, suffered very heavily from a fire which totally destroyed 369 houses. The city authorities now have made arrangements for the rebuilding of the destroyed districts and the question was raised as to the economical possibility of electric surplus-power heating on a large scale. An interesting plan for an electric hot-water system was outlined by a Norwegian engineer, Mohr, and after some modifications this plan has been favorably reported by the authorities.

The city owns undeveloped water power amounting to about 100,000 hp., which is to be utilized in the new scheme, it being shown that with a successive development of power plants the surplus power should be amply sufficient to provide all heating energy needed for many years to come. Each city block is to have its own water-heating system, consisting of a large hot-water tank, placed under the yard, with resistance heaters supplied from a 7,500-volt three-phase transformer of suitable size. The plan also calls for special mixing tanks, where the cool return water from the radiator system can be mixed with just the necessary amount of hot water from the heater tank. By this means a constant temperature can be maintained in the supply water, thus eliminating any inconveniences due to temperature fluctuations in the main tank. While the power may be entirely shut off during daytime, or at least during peak hours, the surplus energy stored in the big tank during the night may be utilized for heating in daytime.

Each tenant will have to pay for his heat according to heat meters inserted in the hot-water supply pipes.

A detailed description of the planned electric heating system was given by Mr. Mohr in *Elektroteknisk Tidskrift*, Nos. 6, 7, 14-17, and 32, 1919, and in *Teknisk Tidskrift, Mekanik*, April 14, 1920, H. Theorell took up the whole matter of economical electric heating for a thorough discussion.

Readers' Views and Comments

The Radio Compass and the Guiding Cable

To the Editor of the ELECTRICAL WORLD:

SIR: In your issue of Sept. 4, page 492, an item was printed on "Ships Successfully Guided Into Harbor by Radio Detectors." The guiding cable mentioned is not a radio device, though the term has been mistakenly applied by a number of publications. It operates at an audio, not radio, frequency, namely, 500 cycles, and the signal is picked up by induction purely. The guiding cable is, however, auxiliary to a purely radio device, the radio compass, which guides the vessel to the mouth of the channel, at which point the audio cable is found and followed into the harbor. S. KRUSE.

Washington, D. C.

Curricula of California Institute of Technology

To the Editor of the ELECTRICAL WORLD:

SIR: My attention has been called to a statement in your issue of Oct. 23, page 833, to the effect that in order to devote more time to technical matters the faculty of the California Institute of Technology had eliminated modern languages from the required curricula of the engineering classes. I should like to correct what, from our point of view, is a rather serious error in this statement. The action of the faculty in eliminating modern languages from the various curricula was not taken in order to devote more time to technical matters. In fact, it was made quite definite by resolution at the time the action was taken that the proportionate number of hours in the curriculum previously given to humanitarian and general studies should not be reduced by the elimination of modern languages. It was the thought of the faculty, however, that the time that had been given to modern languages might more profitably be used in other humanitarian subjects and subjects of general information; and in the new schedules, accordingly, a larger amount of time than before is devoted to English, history, current topics and economic subjects. A rather thorough general geology course has been added, and it is hoped later to provide general informational courses in astronomy and biology. EDWARD C. BARRETT.

California Institute of Technology,

Pasadena, Cal.

Electricity, Too, Has Its Columbuses

To the Editor of the ELECTRICAL WORLD:

SIR: Why should not the successful celebration of the Oersted-Ampère centenary which has just culminated at Ampere, N. J., lead to a revival of interest in electrical biography and history all along the line and be the forerunner of many similar commemorations as occasions arise? The human element which interests men so strongly in geographical discovery and exploration is present, too, in the new worlds first revealed by devoted and intrepid scientists and has too long suffered neglect. W. C. F.

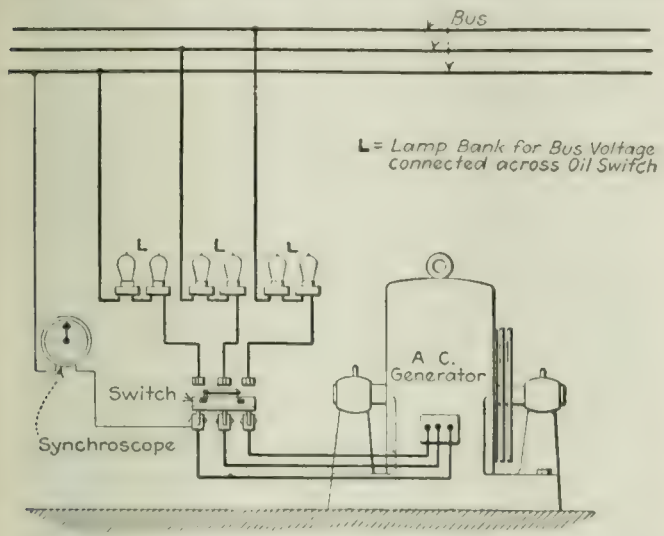
Brooklyn, N. Y.

Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Checking Connections for Parallel Operation

BEFORE putting two alternators in parallel for the first time three important points should be checked. These are the engine-speed regulation, the generator phase rotation and the reliability of the synchroscope employed. The engines should be tried out to determine that they have the same speed at no load, at partial load (say one-half load) and at full load. If this is not true,



CONNECTIONS FOR CHECKING PHASE ROTATION AND SYNCHROSCOPE INSTALLATION

adjustments to secure the same speed regulation in the two units must be made.

Checking phase rotation is called "phasing out" and can be done in several ways, as follows: (a) Connect a polyphase induction motor to the bus and run it first on one generator and then on the other. If it runs in the same direction on each generator, their phase rotations are the same. (b) Connect one generator directly to the bus and connect the other to the bus through a bank of lamps across each break of its main switch. Use enough lamps in each bank to stand the full bus voltage (see drawing). If the machines are of high voltage (over 550 volts), use a step-down transformer suited to the generator voltage in place of each lamp bank and put a lamp across the low side of each transformer. These will then work the same as the lamp banks. Run both machines at full speed and voltage. If the phase rotation is correct, the banks of lamps will go up and down in brightness together. If it is wrong, they will alternate with one another. (c) Run both machines up to full speed but at only one-third voltage or less. Extra resistance in the fields may be necessary for this. Then close both main switches to the dead bus and note the action of the ammeters on each machine. To make this test it is necessary to have at least two ammeters for each generator. If all the ammeter needles swing together, the phase rotation is correct, but if they swing alternately it is wrong.

If the phase rotation is found to be wrong by any of these tests, change it by reversing the leads of one phase of one machine. Then check the rotation again to be sure it is right.

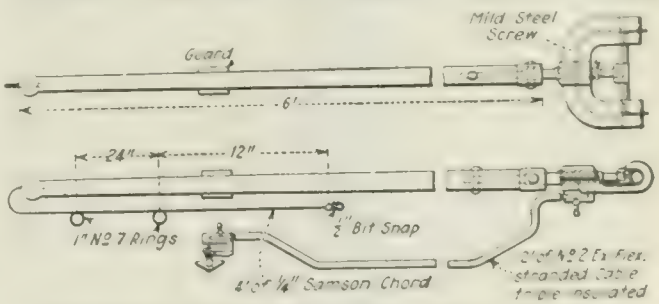
To check the synchroscope, connect one machine to the bus and connect lamp banks or transformers across all breaks of the main switch of the other, as in (b) of the foregoing paragraph. Run both machines at about full speed and voltage. Watch the lamps and the synchroscope. If the synchroscope shows the machines in phase when the lamps are dark, it is connected correctly. If not, its connections must be changed.

Small plants often use synchronizing lamps only, without any synchroscope, both light and dark methods of synchronizing having their advocates. As the phase rotation must be made right by permanently connecting the generator leads to the oil switch, it is sufficient to have the lamps in the permanent indicator connected to one phase only of each machine and not to all phases.

Reliance Engineering Company. JAMES DIXON.
Cleveland, Ohio.

Arrangement for Grounding Lines Before Working on Them

FOR grounding lines on which work is to be done the device shown in the accompanying drawing has been designed for use in place of chains by the Utah Power & Light Company, Salt Lake City. This appliance consists of a pole 6 ft. (1.8 m.) long to one end of which is attached a clamp which may be tightened on the wire by turning the pole. To this clamp is attached 12 ft. (3.6 m.) of No. 2 extra-flexible stranded cable which is triple-insulated. The other end of the cable terminates in another clamp which is fastened by means of a wing



GROUNDING CLAMP IS SECURED ON WIRE BY TURNING WOODEN HANDLE

nut to one of the members of a steel tower. The clamp which holds the wire is made of a double hook in the shape of a U. This hook revolves on a screw spindle which is fastened permanently in the end of the pole. On the outer end of this spindle a bar is pivoted which fits into the two branches of the hook. In using the

device the two branches of the hook are placed over the wire and the pole is turned to the right. This forces the arm up into the two branches of the hook, clamping the wire tight. The pole is of ash treated with paraffin and two coats of varnish. To the handle end of the pole is attached 4 ft. (1.2 m.) of ¼-in. (6.4-mm.) sampson cord with a ½-in. (13-mm.) bit snap on the end and two 1-in. (25-mm.) iron rings taped to the cord at distances of 1 ft. (0.3 m.) and 3 ft. (0.9 m.) from the snap so that the pole may be hung up on crossarms, etc. When grounding a line the tower clamp should be attached to the tower before hook is placed on wire; likewise it should be removed after hook is removed.

Utah Power & Light Co., Salt Lake City, Utah. — P. P. ASHWORTH, Distribution Engineer.

Power Factor Quickly Read from Table Supplied to Metermen

TO ASSIST metermen in calculating the power factor of a balanced three-phase load by comparing the speeds of the two elements of a watt-hour meter when run separately, the Northern Virginia Power Company supplies them with a card such as is reproduced here. To make use of the table the speed of the slower element is determined in per cent of the speed of the faster element. Opposite this figure in the table will be found the corresponding power factor. When one element runs backward the right hand column is used.

POWER FACTOR DETERMINED BY CONNECTING WATT-HOUR METER ELEMENTS ONE AT A TIME

ELEMENTS ROTATING IN SAME DIRECTION		ELEMENTS ROTATING IN OPPOSITE DIRECTIONS	
Speed of Slower in Per Cent of Speed of Faster	Power Factor, Per Cent	Speed of Slower in Per Cent of Speed of Faster	Power Factor, Per Cent
100.0	100.0	0.0	50.0
84.7	99.0	1.3	49.0
79.0	98.0	3.0	48.0
74.7	97.0	4.1	47.0
71.2	96.0	5.4	46.0
68.4	95.0	6.8	45.0
65.4	94.0	8.2	44.0
62.8	93.0	9.6	43.0
60.6	92.0	11.0	42.0
58.4	91.0	12.5	41.0
56.3	90.0	13.9	40.0
54.4	89.0	15.4	39.0
52.5	88.0	16.9	38.0
50.7	87.0	18.3	37.0
49.0	86.0	19.9	36.0
47.3	85.0	21.4	35.0
45.7	84.0	23.0	34.0
44.1	83.0	24.6	33.0
42.5	82.0	26.2	32.0
41.0	81.0	27.9	31.0
39.6	80.0	29.5	30.0
38.1	79.0	31.2	29.0
36.7	78.0	32.9	28.0
35.3	77.0	34.6	27.0
33.9	76.0	36.4	26.0
32.5	75.0	38.2	25.0
31.2	74.0	40.0	24.0
29.8	73.0	41.9	23.0
28.5	72.0	43.8	22.0
27.2	71.0	45.8	21.0
25.9	70.0	47.8	20.0
24.6	69.0	49.8	19.0
23.3	68.0	51.9	18.0
21.9	67.0	54.0	17.0
20.7	66.0	56.2	16.0
19.3	65.0	58.4	15.0
18.1	64.0	60.6	14.0
16.8	63.0	63.0	13.0
15.6	62.0	65.4	12.0
14.3	61.0	67.8	11.0
13.0	60.0	70.2	10.0
11.7	59.0	72.7	9.0
10.4	58.0	75.6	8.0
9.2	57.0	78.4	7.0
7.9	56.0	81.1	6.0
6.6	55.0	84.3	5.0
5.3	54.0	87.0	4.0
3.9	53.0	90.1	3.0
2.6	52.0	93.3	2.0
1.3	51.0	96.7	1.0
		100.0	0.0

Northern Virginia Power Co., Winchester, Va. — C. C. MOLER, Superintendent.

Treating Cross-Arms with Old Transformer Oil

TO LENGTHEN the useful life of cross-arms an Ohio company has developed a plan for impregnating them with discarded transil oil and then painting them. This plan seems to be economical and effective. In 1918 the company had just bought some cross-arms and was investigating preservative treatments. It happened that five fifty-light constant-current transformers had just been junked and their oil was not considered desirable for use elsewhere. It was decided to experiment with this oil as a preservative. Accordingly some of the oil was poured into a sheet-iron tank having a capacity of several barrels of oil and twenty-five to thirty cross-arms. The oil was maintained at 150 deg. to 175 deg. Fahr., and the arms received an immersion of thirty minutes or more. None of the arms showed a penetration of less than 1 in. (2.5 cm.) on any surface. The first batch of arms in the morning was allowed to heat up with the oil and the last batch at night was left in overnight, the result being complete impregnation of the entire cross-sectional area of a large number. All arms were Washington fir, standard N. E. L. A. specifications. Some 12,000 locust pins were also treated in the same way, and the arms and pins were allowed to stand several days in the open air until all traces of surface oil had disappeared.

COST OF TREATING CROSS-ARMS WITH OLD TRANSIL OIL AND PAINT IN 1918

Per 100 Arms, Six-Pin, 8-ft., 3½-in. x 4½-in. Section

Impregnation:	
25 gal. oil	$5.00
Nine hours' common labor	3.75
Total	$8.75
Painting:	
25 lb. white lead	$3.63
1¼ gal. linseed oil	1.69
18 hours' common labor	7.50
Total	$12.82

First cost of arm, $1.08; average life, eleven years; cost, 9.8 cents per year.
Oiling and painting, 8.75 cents + 12.82 cents = 21.57 cents.
Cost of treated arm, $1.08 + $0.216 = $1.296; estimated life, fifteen years; cost, 8.6 cents per year.

When setting the pins they were first smeared around the top of the shank with a heavy mixture of white lead and linseed oil to seal thoroughly the top of the arm against the admission of water. Ill-fitting or imperfect pins were discarded. After setting the pins the entire arm received a coat of white lead and linseed oil of ordinary consistency and was allowed to dry a week.

A hard, flinty, wear-resisting surface resulted, and after more than two years' service for some of the arms there is no evidence of peeling of the paint. Probably the entire absence of surface oil when painting helped to obtain this result. It is thought also that this treatment imparted a certain degree of flameproofing to the arms. For example, a defective fused cut-out recently started a 6,900-volt arc across the face of an arm. The arc hung for a number of seconds and destroyed the cut-out, but the arm did not catch fire and except for a slight surface charring was not damaged.

The cost of impregnation and painting in 1918 is shown approximately in the accompanying table. Although a value of 20 cents per gallon was arbitrarily assigned to the oil, it really cost nothing as it would have been discarded. The tabulation shows a cost of 8.6 cents per cross-arm per year, allowing a fifteen-year life.

Columbus, Ohio. — L. C. PETERMAN.

Industrial Applications

The Economical Utilization of Electrical Energy
in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

Starting Switch Mounted Directly on Grinder Frame

INSTEAD of placing the starting switch shown in the accompanying photograph on an adjacent column it was mounted directly on the frame of the Norton grinder in the East Springfield factory of the Westinghouse Electric & Manufacturing Company. Advantages of this method of mounting are that the switch is very close to the operator, thus saving time in stopping the machine or starting it. The circuit which feeds the motor is entirely out of the way and is protected by the conduit from the ceiling and the flexible conduit leading down from the starting box.



MOUNTED WITHIN EASY REACH OF OPERATOR

Advantage of Motor-Driven Exciters for Synchronous Motors

LOSS of excitation voltage on a synchronous motor where a direct-connected exciter is not installed is minimized by exciting from a motor-generator set of which the motor is connected without fuses to the motor side of the synchronous-motor oil switch. This insures a continuous supply of exciting current whenever the synchronous motor is operating, provided that the motor-generator set is kept in a serviceable condition. This scheme was evolved by a large industrial concern after losing a synchronous motor installed between the two cylinders of an air compressor and excited from a belt-driven generator. The belt came off the exciter pulley and the synchronous motor winding was burned out in consequence. After losing this motor the concern solved the difficulty by exciting the synchronous motor from a motor-generator set as described. By means of a throw-over switch excitation can be obtained from another source of direct-current supply if it is necessary to take the exciting motor-generator set out of service for repairs.

H. L. BURNS,
Chief Electrician.

The Dayton Engineering Laboratories Company,
Dayton, Ohio.

Simple Grid Connections to Give Wide Range of Resistance

BY USE of single-pole, double-throw switches connected as shown in the accompanying diagram a wide range of resistance is obtained in the portable and stationary resistance units employed in an Eastern industrial shop. The principle of this method of connecting is shown in Fig. 1, where *a*, *b*, *c* and *d* are

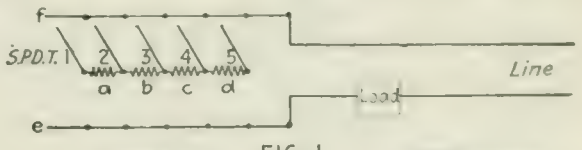


FIG. 1

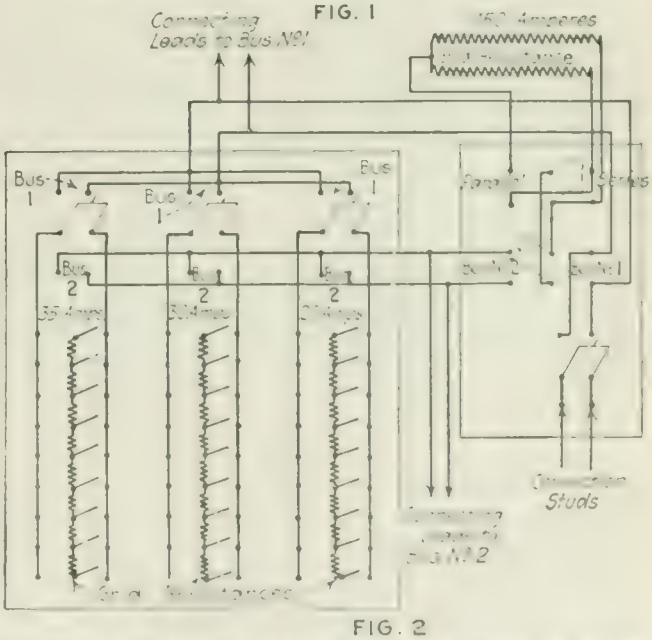
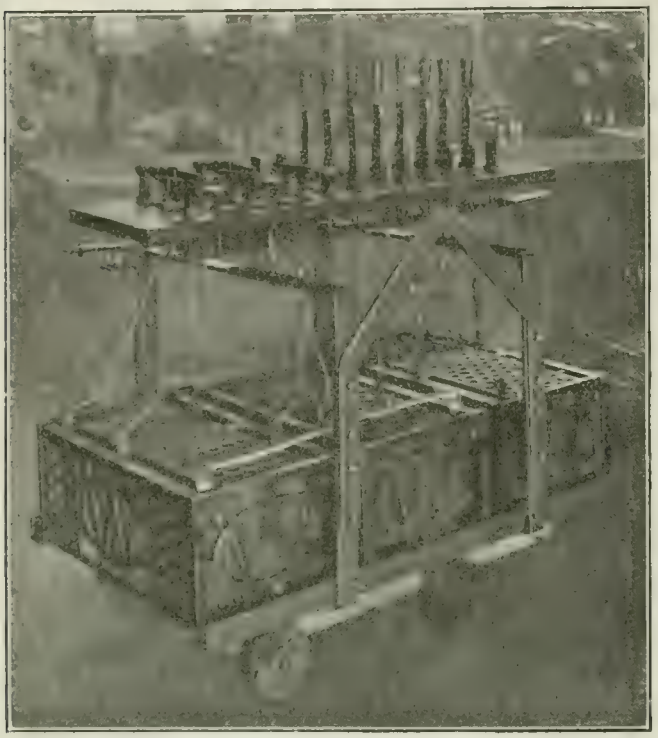


FIG. 2

ADJUSTABLE RHEOSTATS WHICH GIVE WIDE RANGE OF RESISTANCE FOR THE NUMBER OF RESISTANCE UNITS EMPLOYED

resistance units connected by single-pole, double-throw switches to either *e* or *f*. The maximum resistance obtainable is the sum of *a*, *b*, *c*, *d*, the current being limited to that allowable for one of the sections. To obtain this maximum resistance switch No. 1 is thrown

over to *e*, switch No. 5 is thrown to *f*, and the other switches are left open. The minimum resistance will be one-quarter of the resistance of any section (provided they are all equal), and with this condition the maximum



THIS RHEOSTAT MAY BE ROLLED ABOUT THE LABORATORY

current will be four times the maximum current allowable for any one section. This condition is obtained by throwing switches 1, 3 and 5 to the left, 2 and 4 to the right. Various steps can be obtained between the maximum and minimum values.

Three resistance tables connected in this manner have been mounted on wheels so that they can be conveniently moved from one place to another. Each of these tables is made up of twelve resistance sections, the resistance of each section being 0.5 ohm, 0.75 ohm and 1 ohm, and the carrying capacity of each section being 35 amp., 25 amp. and 15 amp. respectively for the three cables.

A permanently mounted set of grids using the same method of connection has been made up as shown in Fig. 2, which gives a range of 2.5 amp. to 830 amp. at 230 volts. This method of switching is not confined to large resistances; it has been found very useful also in making up smaller rheostats.

EUSTACE C. SOARES.

Ampere, N. J.

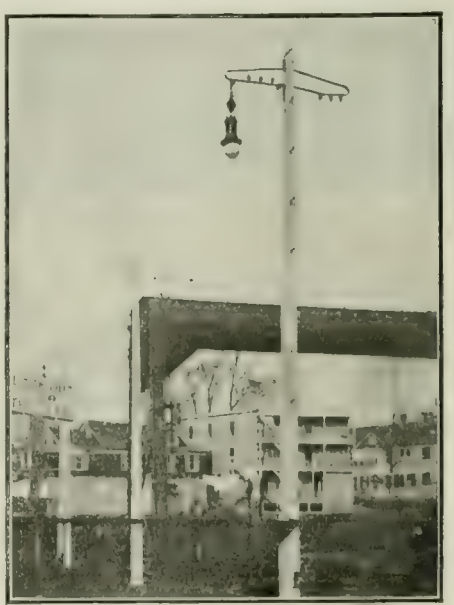
Simple Tests for Welds

GREAT improvement in the quality of welds has been brought about in the Rochester (N. Y.) Welding Works by applying simple tests and carefully instructing welders until their work can pass these tests. The best test to determine quickly the general character of a weld is to grind it off level with the surface of the pieces and clamp it on an anvil, with the center of the weld level with the top of the anvil, so that the top of the weld is stretched when the projecting end is struck with a sledge. The blow should not be too heavy and the number of blows required and the angle to which the piece bends before cracking are a good index of the value of the weld. If sample welds made in ½-in. x 2-in. (1.2 cm. x 5 cm.) bar steel, with a 90-deg. single V, bend to a right angle cold without cracking on the outside, a welder may feel well satisfied with his work. It is true in this test that the quality of the material being welded has a great influence on the results. Stiff material throws more of the strain into the weld, while soft ductile material will itself take considerable of the bend. In the case of defective welds—that is, those not fused along the V or which contain slag or other inclusions—this test will at once develop the defects. If a welded piece is for use in a place where it might become red hot, as, for instance, in a locomotive fire-box crown sheet, it might be better to heat the sample to a bright orange with a torch before bending with the sledge.

In many cases the defects in welds are easily visible to the naked eye when tested, but in other cases they are not. A method for testing rails for these hidden defects recently devised by A. M. Waring consists of deeply etching a polished surface of the material under test. For instance, a section of a weld is cut out with a hack saw, machined or filed to a true surface and polished on various grades of emery paper, ending up with No. 00 Manning. It is then placed in a warm solution of 25 per cent hydrochloric acid and water for half an hour to an hour. The acid will eat away the defects, making the edge of the material taper, so that rather large grooves and pits will be visible where the defects prior to the etching were only microscopic. A small bending machine that can be placed on the microscope stage is very useful.

S. W. MILLER,
Rochester (N. Y.) Welding Works. Proprietor.

Crane Wires and Lamps on Same Concrete Poles



NEAT APPEARANCE OF CRANE WIRES AND LAMPS ON SAME CONCRETE POLES

CRANE trolley wires and local lighting circuits and lamps are carried on the same concrete poles in the transformer tank yard of the General Electric Company's Pittsfield (Mass.) works. The wires are carried on insulators fastened to bow-shaped strap-iron holders as illustrated, the holders being bolted to the reinforced-concrete poles. The holders are sufficiently strong to carry a pendent lamp at the outer end and to maintain proper spacing and elevation of the crane trolley wiring. The lamps are fed by a three-wire system and the crane supply is three-phase. An unusually neat and accessible arrangement results from this construction.

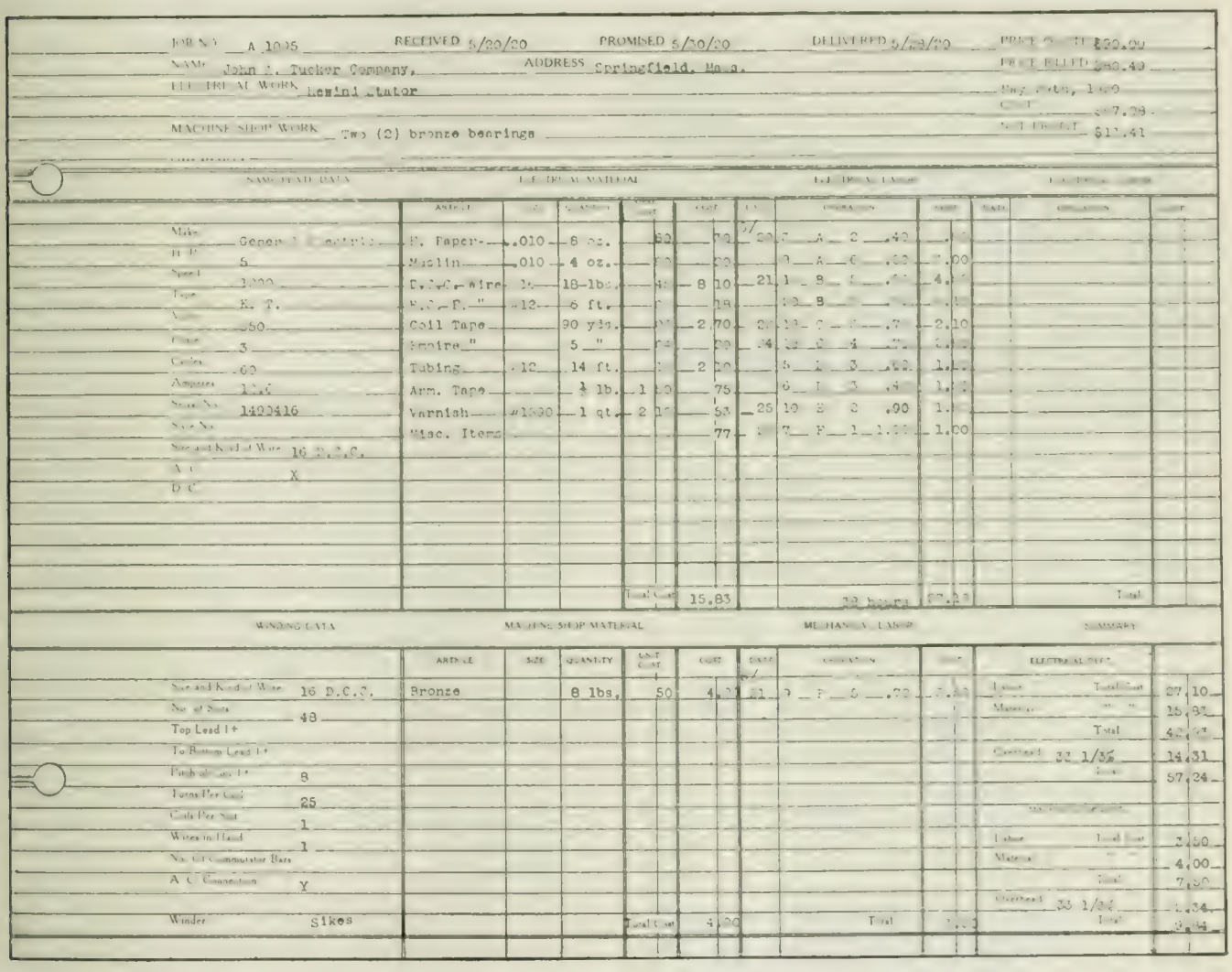
H. S. KNOWLES.

Boston, Mass.

Cost Records of Motor Repair Shop Used to Classify Expenses

A SYSTEM for keeping costs of motor repair work which makes for accurate records, low office expense and satisfaction to customers is in use by the Electric Motor Repair Company, Springfield, Mass. On receipt of an order it is entered in an order book and a job number is given to it. Then the man who is to handle the job receives a card on which are all data necessary for him to proceed. On the back of the card he keeps a record of all material used. The foreman has "O.K." the bookkeeper makes out the bill and enters the figures in the sales journal.

If a price is quoted when the job is taken, it is entered on this sheet in the upper right-hand corner. This eliminates any chance of its being overlooked. It is the practice of this company to bill out each job for the exact amount it comes to, including overhead expense and profit, provided that it is less than the price originally quoted. The price quoted is usually higher than the job is expected to cost. In billing the customer the original quotation is mentioned together with the price actually charged. After a customer has learned that he is not being held strictly to the original



JOB NO. A 1005 RECEIVED 5/20/20 PROMISED 5/30/20 DELIVERED 5/23/20 PRICE QUOTED $20.00
NAME John L. Tucker Company. ADDRESS Springfield, Mass. PRICE BILLED $20.49
ELECTRICAL WORK Rewind Stator Pay Rate, 1.00
MACHINE SHOP WORK Two (2) bronze bearings COST $7.28
NET PROFIT $13.41

NAME PLATE DATA — ELECTRICAL MATERIAL — ELECTRICAL LABOR — MACHINE SHOP LABOR

ARTICLE	SIZE	QUANTITY	UNIT COST	COST
F. Paper	.010	8 oz.	.02	.72
Muslin	.010	4 oz.	.02	.08
Copper Wire	16	18 lbs.	.48	8.10
"S-P"	12	6 ft.	.01	.18
Coil Tape		90 yds.	.03	2.70
Empire "		5 "	.04	.20
Tubing	12	14 ft.	.01	.20
Arm. Tape		½ lb.	1.50	.75
Varnish	#1000	1 qt.	2.10	.53
Misc. Items				.77
			Total Cost	15.83

Make General Electric
H. P. 5
Speed 1200
Type K. T.
Volts 550
Phase 3
Cycles 60
Amperes 5.5
Serial No. 1429416
Slot No.
Size and Kind of Wire 16 D.C.C.
Y
D C X

OPERATION	COST
1 A 2 .42	.42
2 A 6 .60	1.00
3 A 6 .60	1.00
4 B 6 .70	2.10
5 A 3 .52	1.56
6 A 3 .48	1.44
7 F 1 1.00	1.00
32 hours	$7.28

MACHINE SHOP MATERIAL — MECHANICAL LABOR — SUMMARY

ARTICLE	SIZE	QUANTITY	UNIT COST	COST
Bronze		8 lbs.	.50	4.00
			Total Cost	4.00

OPERATION	COST
1 F 6 .72	.72
	Total

Size and Kind of Wire 16 D.C.C.
No. of Slots 48
Top Lead To
To Bottom Lead To
Pitch of Coil
Turns Per Coil 25
Coils Per Slot 1
Wires in Hand 1
No. of Commutator Bars
A C Connection Y
Winder Sikes

ELECTRICAL LABOR
Labor Total Cost 27.10
Material 15.97
Total 43.07
Overhead 33 1/3% 14.31
Total 57.24

MECHANICAL LABOR
Labor Total Cost 2.50
Material 4.00
Total 7.50
Overhead 33 1/3% 2.84
Total 9.84

ITEMIZED COST CARD OF MOTOR REWINDING JOB SHOWING MATERIAL AND LABOR EXPENSES

a card (see ELECTRICAL WORLD for Nov. 20, page 1026) with duplicate information, and the total amount of material is entered on this card on completion of the job, after which it is turned in to be posted on the cost sheet.

On this sheet, under the headings "Electrical Labor" and "Mechanical Labor," are entered, reading from left to right, the date, the workman's number, the operation, the number of hours worked and the rate to be paid. Each workman knows that his name is shown on each job sheet and that he will be held accountable if the job should fail to give satisfaction. As soon as the bookkeeper has filled in and extended the figures this sheet is turned over to the official in the company who is responsible for the prices. After it has received his quotation, but is being billed according to the cost of the job, he usually does not ask for a quotation on any other work he wants done.

Classified data as to the cost of different jobs on different types of machines are kept in the following manner: At least once every month a card is filled out giving material and labor costs and the number of hours of labor. This card, for example, would be filled in "G. E., 5 hp., 1,200 r.p.m., K. T. motor." At the end of a year if fifty motors that fall under this classification have been rewound, the average cost is estimated and a memorandum of this is put on the index card.

J. B. TUFTS,
General Manager.
Electric Motor Repair Company,
Springfield, Mass.

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

Measured Demands of Power Loads Found Most Satisfactory

IN ORDER to place its power customers on a definite demand basis the Binghamton (N. Y.) Light, Heat & Power Company is installing indicating instruments on all power installations of 5 hp. and over. The instruments are set to measure the average fifteen-minute peak. The company has found that the demand charges have been materially increased after installing these meters, and with the demand thus accurately determined customers are more satisfied than in the past, when it was estimated or taken only at irregular intervals.

Central-Station Income per Kilowatt

BY KASSANDRA

CENTRAL-STATION commercial men are all the time searching for a term or expression which will indicate in a simple way whether or not a particular kind of business is profitable and to what degree. The following are some of the terms that have been used: (1) Income per kilowatt-hour; (2) income per kilowatt of connected load; (3) income per kilowatt of customer demand; (4) income per kilowatt of busbar demand, and (5) income per customer.

It is obvious that no one of these gives all that it is desirable to know because no one of them shows by itself whether the business is really profitable. A business may pay a very high figure as expressed in any of these ways, and yet the cost of serving it may be so high that it is very undesirable business to solicit. The only real figure is a high percentage of return on the necessary investment, that is, on the investment which would not have been made if the business in question had not been taken.

This goes back to the old statement of the principles of accounting: "There is only one real figure to show profits, and that is the difference between what comes in and what goes out. The difference is the profit, and that is all there is to it." However, there is much to be added to this basic principle in order that accounts may picture the real condition. Likewise there is much to be added to the "net income per dollar of new investment" to show whether or not business is profitable.

In the first case this principle would indicate that when a station or line is built it is unprofitable at first, because it is always built larger than necessary at the time. Therefore it is at first unprofitable. Then more customers are added, and from these later customers a good profit is realized with but little new investment. Hence on the principle stated these customers are exceedingly profitable, but when the station or line is fully loaded it is necessary to build again, and then the next customers are an apparent loss. All this means is that if profits or losses are computed for a short period of time it must be remembered that the new station or new line is not built for the first customers but for all. and then the interest or fixed charges on the proportion of the line put in for future customers is an investment for future profit, which should not be charged against the present business if that business were considered by itself.

Profit cannot be computed for a single customer. For example, in the telephone business a conversation between New York and San Francisco is charged for at, say, $25 and involves the use of, say, $1,000,000 of investment or fixed charges of $80,000. One conversation per year is a loss, but 6,000 conversations per year give $150,000 income, which would be a profit. Again, the packers buy a steer at, say, 20 cents a pound, pay for killing and preparing it and then sell the beef for the same price or nearly so. This would be a loss except for the hide, glue, bones, hair, etc.; but the price obtained for these by-products enables the packers to sell the beef at an apparent loss and yet make a good profit. Supposing, however, some one invents substitutes for leather, glue, etc., so that the price of the by-product goes down. Does this increase the cost of the beef? Or vice versa, if the price of leather goes up?

CENTRAL STATION CANNOT SELL ENERGY AS BY-PRODUCT

The electric central station has many customers and classes of customers, and its profits depend on the diversity factor, which is merely the same idea as by-products. One customer or class may be called the main product and the rest by-products, but by-product is really a relative term. A gas company makes coke, tar, chemicals and gas. In some cases, as in big cities, gas is the main product and the others are by-products; but many companies pay more regard to their coke and chemicals and regard gas a by-product. In the same way electricity for power is no more a by-product than electricity for light. A company starting as a power company, selling power only, cannot afford (as a permanent matter) to sell light at a price different from what the price would have been if it had started as a lighting company and then developed a power business.

The final profit depends not on the power business or light business or on any part of the work, but on the skill with which the company balances one against the other, just as a farmer's success depends not on one crop, but on the skill with which he rotates his crops and the skill with which he uses his crops to feed his cattle or poultry and the skill with which he uses the manure to fertilize the crops.

Therefore income per kilowatt or per kilowatt-hour or per customer is, alone, of little meaning. For instance, we may think of income per customer and perhaps look forward to an income of $100 per year per residence as against the $20 to $30 a year we now get. This is in my opinion probable, but also it is in my opinion of little use to think of this figure alone. An income of

$100 a year from a small residence will involve not only appliances but also cooking, possibly refrigerating, and probably other uses not yet thought of or at least not yet developed. Each of these must be considered first by itself and each must be considered also in relation to the others. Advance can be made only one step at a time, or rather only a little at a time, even if we can (and should) look as far ahead as possible. A youth may hope to build a beautiful mansion before he dies, but there is no use in designing it when he begins his work. The Woolworth company made its success by reducing rates per customer, and the early gas companies kept on steadily reducing the price of gas per 1,000 cu.ft. and their income per customer and yet increased their profits.

An income of $100 per kilowatt of busbar demand looks good, but if it costs $95 to get it, leaving only $5 per kilowatt for fixed charges, is it worth going after? A gross income of $20 per kilowatt if it gave a net of $10 would be much better.

It is interesting to take successful or unsuccessful companies and compute various figures. Often these figures are suggestive, but they must be used carefully. A high income per mile of main often accompanies a high net return to the investor, and so does a high income per kilowatt, a high income per customer, and so forth. In each case, however, it is necessary to go deeper. It is often possible to increase net profits by reducing prices as well as by increasing them. It may be possible to increase net profits by taking on business that when conditions were different would have been unprofitable. A very good instance is income per kilowatt of connected load. At first sight it looks as though it would pay to keep this figure high. A demand charge per kilowatt of connected load accomplishes this, but discourages thousands of lamps—like closet lamps—which are decidedly profitable even if they give an income of only a few cents per kilowatt per year. The same thing applies (as a possibility) to the use of any single figure of income per kilowatt of demand or station demand or customer or mile of main. Even a group of figures may give bad results unless all conditions are considered.

The answer is to choose a suitable figure as a guidepost, sometimes as a guidepost showing where to go, sometimes as a guidepost showing where not to go, but before moving—*i.e.*, before making any decision—consider all the possibilities and then move in the direction of the biggest net profit all things considered. Even when considering net profit, remember that 8 per cent on $10,000,000 will probably be better than 10 per cent on $1,000,000.

Puget Sound Company Offers Second Million of Securities to Customers

BEGINNING Nov. 30 the Puget Sound Power & Light Company offered for sale to its customers and the investing public another million of its 8 per cent five-year gold coupon notes. This is the second million dollars of an authorized issue of $2,000,000 of these securities. The first million dollars' worth, as reported in the ELECTRICAL WORLD of Oct. 23, was sold in September of this year in eleven working days. The issue was oversubscribed several hundred thousand dollars.

More than a thousand employees of the corporation became purchasers of these notes, taking among them more than $400,000 of the first issue.

The Puget Sound Power & Light Company, with its subsidiary companies, serves 147 communities in the Puget Sound district. Participation by the public in the ownership of the utilities operated by the company, officials say, will broaden the public's interest in and understanding of the company's purpose and problems.

Publicity with a Double Objective

PUBLICITY with a twofold purpose was used recently by the Central Connecticut Power & Light Company, East Hampton, Conn., to impress upon customers the fact that it had not advanced its rates for domestic service or street lighting, and at the same time customers were invited to become stockholders of the company on the easy-payment plan. The postcard reproduced here shows one of the company's hydro-electric plants on the Salmon River. In the space allowed on the face of the card the following message was printed:



POST CARD SHOWING CENTRAL CONNECTICUT COMPANY'S HYDRO-ELECTRIC PLANT

EAST HAMPTON, CONN., Nov. 1, 1920.

On the other side is one reason why this company has not advanced its rates for house lighting, street lighting or electric cooking; and has earned and paid fourteen consecutive quarterly dividends to its 6 per cent preferred stock holders.

If you are in sympathy with what this company has done, especially in furnishing your village and many other villages which were formerly in darkness with good electric service, you should acquire an interest in the company and *share in its success.*

We wish every electric customer could be and were a stockholder. You *now* have this opportunity.

Send $15 now and $10 on the first of every month until June 1, 1921, when a total of $85 has been paid and you will receive one share of the Central Connecticut Power & Light Company's 6 per cent cumulative preferred stock, earning for you 7 per cent on the $85 invested. If more convenient, payment may be made to our collectors with the monthly lighting bill.

Owing to limited supply, subscriptions are subject to allotment.

Save systematically and invest wisely.

CENTRAL CONNECTICUT POWER & LIGHT COMPANY,
L. P. PERRY, Treasurer.

The Central Connecticut Power & Light Company serves twelve towns and villages in the state, and one of the cards was sent to each of its customers. Upward of 400 shares of stock have been sold to customers.

To extend further the scope of this publicity the company had the cards printed in quantities and sold them practically at cost to news dealers. These cards carried no printing on the side for the address.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generation, Transmission and Distribution

Alternating Current Propagation—On the Effect of a Variation in One of the Line Constants.—POMEY.—The following problem is treated in this article: If the current and voltage distribution along an alternating current line is computed, the physical line constants being assumed to have certain values, then how big an error will result if one of them is entered with an incorrect value? The case of a mistake in estimating the leakage conductance per kilometer is worked out in detail. In this case the resulting error may be estimated according to very simple rules. If the total leakance G increases by the amount δG mhos, then the increase in leakage current (leakage current = the difference between the sending-end and the receiving-end currents) is equal to the current which would flow in a conductance equal to δG under the influence of an electromotive force of $\frac{1}{2}(V_1 + V_2)$ volts, where V_1 and V_2 are the voltages at the sending and receiving ends respectively. Similar rules apply to the change in voltage distribution which will occur if the leakance is varied.—*Revue Générale de l'Electricité*, Sept. 25, 1920.

Interconnection of Power Systems.—HAROLD W. SMITH.—The most important considerations in planning for interconnection of power systems are here given as follows: (1) The selection of switching equipment with adequate rupturing capacity; (2) the use of tie lines having ample synchronizing power to hold the systems in parallel; (3) relay protective systems arranged so that a defective section is quickly disconnected; (4) voltage conditions studied with regard to the flow of wattless currents, under both maximum and minimum load conditions, and with power flowing in both directions.—*Electric Journal*, November, 1920.

Electrical Characteristics of Transmission Circuits—XIII.—WILLIAM NESBIT.—In concluding the series on electrical characteristics of transmission circuits the author makes a comparison of the various methods which have been discussed in detail, giving practical examples to show their applications.—*Electric Journal*, November, 1920.

Traction

Multiple-Unit Control Equipment for the Cleveland Interurban Railway Company.—H. R. MEYER.—This type of control equipment, the author says, was selected after an analysis of the conditions surrounding the maintenance of equipment, first cost and reliability of operation, together with the multiple-car operating features, and he explains how the system adopted meets these requirements. Details of the control scheme are described in full.—*Electric Journal*, October, 1920.

Electrification in Italy.—In the midst of political turmoil in Italy the question of railroad electrification has again risen to the surface and has been made an issue. A recent enactment represents an important step toward a rational electrification of the state-controlled railroads in Italy by bringing into contact with the railway administration men all the authorities which handle water power and other matters bearing upon the electrification problem. The act also provides for financial aid from the state to new hydro-electric plants, an amount of 40 lire per developed horsepower being given as a premium to counteract the abnormally high cost of construction and the threatened slow-down of all new developments. In connection with the activities of the Superior Council of Water Power a special bureau has been organized for investigating the possibility of utilizing domestic lignite for steam generating plants in connection with railway electrification. A preliminary program has been made up, according to which the electrification work on 1,332 km. (828 miles) of mountainous stretches is to begin at once, while a later period of electrification will bring the electrified total up to 2,000 km. (1,242 miles). The electrification of a third group of lines is to be left entirely to private initiative. An attempt to reach agreement on the question of supply system appears to have met with difficulties, and several different systems are to be tried. Following earlier successful experiments with three-phase electrification in upper Italy, the roads in the north and down to the Pisa-Florence line are to be provided with double aërial and locomotives for low-frequency three-phase supply. In southern Italy direct current is to be used, while on certain stretches near Rome a three-phase supply of a higher frequency than that used in the north is to be tried.—*Elektrotechnische Zeitschrift*, Sept. 9, 1920.

Installations, Systems and Appliances

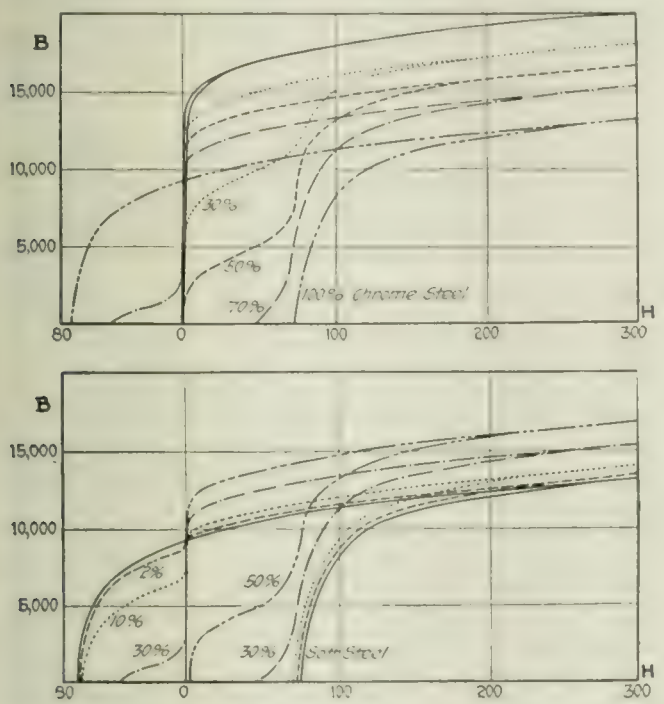
Switches for Interruption of Alternating Current Without Arcing.—W. HÖPP.—The author presents analytical and graphical methods for determining the heaviest current which can be interrupted by a pair of switch contacts without the formation of an arc. This limiting current depends on phase displacement as well as on voltage, and a study of different alternating-current circuits shows that if the load circuit contains resistance and self-inductance in parallel a greater current can be interrupted without arc than if the circuit contains resistance and inductance in series. A three-phase, 500-volt, 200-amp. switch is described which was designed by the author to operate without arcing.—*Elektrotechnische Zeitschrift*, Sept. 23, 1920.

Improved Graves-Etchells Electric Furnace Installation.—EDWARD T. MOORE.—A description of the Graves-Etchells electric furnace and of the arrangement of the electrical equipment as installed at the plant of the Halcomb Steel Company. An oscillographic study of the operation of the furnace in the manufacture of alloy and high-speed steel gives the furnace characteristics during the melting of the charge and other information regarding electrical operation.—*Chemical and Metallurgical Engineering*, Oct. 27, 1920.

Testing Insulators in Factory and Field.—LESLIE N. CRICHTON.—A résumé of modern methods of testing insulators, including the "buzz-stick" method developed for live circuits, the spark-coil method for testing insulators with the power shut off, and the use of wireless-telephone receivers in which a peculiar scratching noise is heard when the insulator is defective.—*Electric Journal*, November, 1920.

Electrophysics and Magnetism

Magnetic Properties of Inhomogeneous Material.—GUMLICH.—Some time ago the author observed, in magnetic tests on certain materials, that the hysteresis curve showed a very typical deformation, namely, a broadening of the loop in the region where the descending branch intersects the B axis. Subsequent researches have proved this phenomenon to be due to inhomogeneities in the tested material, and it has even been possible to construct laminated samples which show the same



MAGNETIZATION CURVES OF SAMPLES OF ALTERNATING HARD AND SOFT LAMINATIONS

characteristics in an artificially exaggerated form. Some curves for such inhomogeneous samples, made up of alternate laminas of extremely soft low carbon steel and of extra hard chrome steel, are shown here. The full-drawn curve in the upper figure is the magnetization curve of a sample of 100 per cent soft-steel laminas; the curve marked "30 per cent" relates to a sample with a 30 per cent chrome-steel section, and so on. In the lower figure curves are given for samples with from 50 to 0 per cent soft-steel laminas, the figures, however, indicating percentage of chrome steel. The full-drawn curve in the lower group and the dash-dot-dot-dash curve in the upper one show the characteristics of pure chrome-steel laminas. The upper 30 and 50 per cent curves give a clear although very much exaggerated illustration of the observed broadening effect, while the lower 10 and 30 per cent curves exhibit most astonishing distortions of a type which so far has not been observed in naturally inhomogeneous material. A number of peculiarly deformed curves for different samples of plate and wire with magnetically harder or softer surface layers are given, together with microphotographs showing the inhomogeneities. In certain cases two maximas were observed in the permeability curve, corresponding to the two magnetically different components. All these phenomena are characteristic for samples where two magnetically different materials are connected in *parallel* in the magnetic circuit. On samples with different layers in *series* connections, made up so that the magnetic lines of force cut through the surfaces of discontinuity at right angles, no deformations whatever can be observed in the magnetization curves. The author attempts to deal with the mixture phenomena on a numerical basis and shows that in certain cases the resulting coercive force of a sample may be determined from the values of coercive force of the components.—*Archiv für Elektrotechnik*, Aug. 8, 1920.

Units, Measurements and Instruments

The Directional Hot-Wire Anemometer: Its Sensitivity and Range of Application.—J. S. G. THOMAS.—A description of a hot-wire anemometer, which, in addition to affording a ready indication of the direction of flow of gas in a pipe, is applicable to the determination of the velocity of a slow-moving current of gas. The directional hot-wire anemometer consists of two fine platinum wires mounted in parallel, one behind the other, in close juxtaposition, transversely to the direction of flow of gas in the pipe or channel. The velocity of the gas stream to which the heated wires are exposed is gradually increased from zero, and by means of a Wheatstone-bridge scheme the velocity of the gas may be determined. The deflection of the galvanometer is reversed upon reversal of the flow of gas.—*Philosophical Magazine*, November, 1920.

Miscellaneous

On Water-Flow Characteristics of Rivers.—COUTAGNE.—In planning and designing a water-power plant it is important to know the hydraulic characteristics of the river to be developed, and therefore statistics concerning drainage, run-off, etc., must be carefully studied beforehand. A mere water-flow curve, however, giving the approximate number of cubic feet of water per day of the year, does not give a very good conception of the hydraulic conditions, since it is hard to analyze directly with the eye. A better representation is a rearranged curve, sometimes called the symbolic curve, which is formed, as it were, by cutting out all ordinates from the day-to-day curve and pasting them in order of size, beginning with the smallest one at 0 day and ending with the maximum value at the 365-day point on the *X*-axis. In this curve the abscissa will tell at once during how many days of the year the water flow was low. Such curves very clearly show what the river is worth for power development and usually lend themselves to rather accurate analytical representation—in fact, by simple equations of the second degree. Problems of water flow thus may be brought within reach of ordinary calculus. The author has employed this type of statistical device in the study of water-flow conditions in several rivers in France. Data for many years, obtained at three or more points along the path of the river, have been analyzed, and the effects of climatological and other conditions upon the symbolic equation constants are discussed.—*Revue Générale de l'Electricité*, Aug. 28, 1920.

SENATOR JONES will introduce in the upper house of Congress a resolution to amend the water-power act in such a way as to protect the national parks from possible injury through its operation. This action will be in accordance with a promise made to the Secretary of the Interior when he withdrew his eleventh-hour opposition to the bill. The parks by this resolution will be exempted from the authority vested in the Federal Power Commission.

WITH the acquisition on Dec. 4 of the MacKenzie power interests in Toronto and the Canadian Niagara district the Ontario Hydro-Electric Power Commission now has the largest single electrical generating and distribution system in the world.

TACOMA'S right to condemn property in connection with the development of the city's power site at Lake Cushman is being contested on the ground that the additional energy is wanted for sale to power customers.

FOR THE first five months' operation of the water-power act the horsepower covered by the applications equals the total developed water power in the entire country.

CONGRESS has been asked by the Federal Power Commission for appropriations aggregating $482,065. The Signal Corps requests $10,697,000 and the Bureau of Standards $2,179,440. An additional $25,000 to wind up the work of the Super-Power Survey during the next fiscal year is wanted by the United States Geological Survey.

STORAGE of coal by the coal companies is advocated by J. W. Lieb as a remedy for the fuel situation.

SECURITY sales to customers and power-factor correction were leading topics at the convention of the Illinois State Electric Association.

ENTIRE optimism concerning the outlook for prosperity of electric light and power companies is expressed by H. M. Byllesby.

PROVISIONS for indeterminate permits, certificates of convenience and necessity and regulation of municipal utilities were urged for incorporation in the act governing the Kansas Industrial Court by Executive Manager Aylesworth of the N. E. L. A., addressing the Kansas Public Utilities Association at Topeka.

RATHER than nationalize the German coal mines, Herr Stinnes, the "coal king," favors their operation by groups of large consumers which could gradually buy control.

RETURNS from forty-five states report industrial depression widespread and non-employment slowly increasing. Nevertheless, a fairly satisfactory amount of business is being done in the supply field, mainly in rewiring and reconstruction, with the quietest conditions reported in the West. Christmas buying continues good. Sufficient stocks of wire, cable, loom, outlet boxes and porcelain are on hand. Pipe stocks are short.

News in Brief

Summary of Market Conditions and of Recent and Approaching Happenings of Importance to the Industry

A. A. STEVENSON, representing the American Society for Testing Materials, has been re-elected chairman of the American Engineering Standards Committee for 1921.

AT THE annual convention of the American Society of Mechanical Engineers plans to conserve fuel were discussed. It is intended that the A. S. M. E. shall take an active part in this movement.

THE VALIDITY of a demand charge has apparently been called into question by a judicial decision of the New York Supreme Court in an action brought by the city of Oswego against the People's Gas & Electric Company.

THE AMPERE centenary was celebrated before a distinguished assemblage at the Crocker-Wheeler Company's plant at Ampere, N. J., last Saturday.

DAYLIGHT-SAVING bills are already being introduced into Congress.

AN ISSUE of $5,000,000 in 7 per cent twenty-year bonds has been made by the Brooklyn Edison Company at 97⅜, to yield about 7¼ per cent.

REORGANIZATION of the American Bureau of Welding as a joint advisory board of the engineering division of the National Research Council and the American Welding Society has been effected.

A SYNDICATE of paper manufacturers has purchased a controlling interest in the Northern New York Utilities, Inc., of Watertown, N. Y.

A HYDRO-ELECTRIC construction program involving the development and distribution of nearly 600,000 kw. is announced by the Southern California Edison Company. The program covers fifteen years and involves the expenditure of $200,000,000.

MEETINGS in Seattle and Spokane have served to launch the Northwest Electrical Service League, designed to bind together all branches of the industry.

A FUND of $50,000 has been raised in Cleveland for an electrical promotion campaign designed to interest both those engaged in electrical activities and the general public.

AN ASSOCIATION composed of public utility commissioners in the Intermountain States is likely to be formed as the result of a recent conference between such commissioners at Salt Lake City.

"CONTRACTING with one's self" through identical control or common officership or interlocking agency is condemned by the Massachusetts Department of Public Utilities in a recommendation for legislation against this practice. Increased regulatory powers over utility rates are also sought by the commission.

A POWER-FACTOR penalty clause has been filed by the Cumberland County Power & Light Company of Portland, Me., with the Maine Public Service Commission.

CREDIT continues to tighten in the Northwestern States, the farmers holding their grain and the lumber and woolen mills operating on part time or being shut down.

RECENT reports of German success in obtaining foreign contracts for electrical goods include orders from the Chilean, Dutch and Swiss governments for cranes and cables, from British and Chinese firms for electrical machinery and from the Russian soviet government for incandescent lamps.

ACTIVITY in brass and copper production has declined greatly. Electrical manufacturers, however, continue to purchase in fair volume.

OCTOBER electrical exports, amounting to $9,988,215, set a record for 1920. For the first ten months of this year electrical exports exceeded $78,000,000, indicating that last year's twelve-month figure, $90,000,000, will be exceeded.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Daylight Saving for Eastern Zone Again Being Urged

COMMERCIAL organizations throughout the Eastern time zone are being urged by the Merchants' Association of New York City to join in an effort to secure the passage by Congress of a daylight-saving bill for that zone for the five months from the end of April to the end of September. There are now pending before Congress three daylight-saving bills—the Edge bill before the Senate, an identical bill introduced by Representative Ackerman in the House and a similar bill in the House introduced by Representative Dallinger.

Electric Light and Power Outlook Good, Says Colonel Byllesby

COLONEL H. M. BYLLESBY in speaking to a representative of the ELECTRICAL WORLD in Chicago Wednesday expressed himself as greatly pleased with the outlook in the electric light and power industry. He said:

"The general situation with reference to electric light and power companies and the public utilities generally is most encouraging. We are thoroughly optimistic. The demands for additional service at the Byllesby properties normally would call for a large construction program in 1921 approximating $18,000,000. If the prices of material and labor recede to reasonable levels, we shall, of course, proceed to build the plants, additions and extensions required. The present tendency is toward the lowering of construction costs, and it would not be surprising if next spring should see the beginning of the greatest construction period in central-station history. Copper is now lower than the ten-year average preceding the war.

"To build it is necessary to finance. Apparently the raising of money for public utilities is becoming easier. It is recognized that these industries are in an exceptionally strong position, they having gone through the past few years without incurring the evils of inflation and overextension affecting many industrial enterprises. Many utilities like the Byllesby properties have raised large amounts of new capital in the territories they serve by the customer-ownership method. Local sales of the preferred stocks of the Byllesby companies are now running from $500,000 to $600,000 a month and are a great aid in financing the improvements that cannot be postponed.

"We find everywhere that the public has a far better understanding of utility problems and a much keener realization of their necessities than before the war. State utility commissioners now have public sentiment behind them in endeavoring to give the utilities a square deal and thereby enable the latter to contribute their full share toward industrial and community development.

"The Byllesby properties have not experienced any falling off of industrial power demands. On the contrary their business continues to increase steadily. All things considered, the outlook for the utilities is distinctly good, and we do not see how their future can be anything but successful."

National Park Amendments to Water-Power Bill Introduced in Congress

IN ACCORDANCE with the promise made Secretary Payne when he removed his objection to the water-power bill, amendments to that act prohibiting the Federal Power Commission from granting licenses for power in national parks have been introduced in the Senate and in the House of Representatives. The resolution reads:

That hereafter no permit, license, lease or authorization for dams, conduits, reservoirs, power houses, transmission lines or other works for storage or carriage of water, or for the development, transmission or utilization of power within the limits of any national park or national monument, shall be granted or made without specific authority of Congress, and so much of the act of Congress approved June 10, 1920, entitled "An act to create a Federal Power Commission, to provide for the improvement of navigation, the development of water power, the use of the public lands in relation thereto, and to repeal Section 18 of the river and harbor appropriation act approved Aug. 8, 1917, and for other purposes," as authorizes licensing such uses of national parks and national monuments by the Federal Power Commission is hereby repealed.

Commenting on the amendment, Senator Jones of Washington, the chairman of the committee on commerce, said:

"The water-power act was not signed before Congress adjourned last session. It was found that an objection had been made to it by the Interior Department because it embraced national parks within its jurisdiction.

"When we came to the conclusion that the president had authority to sign the bill within ten days from the time it was presented to him, notwithstanding the adjournment of Congress, I conferred with the Secretary of the Interior and agreed with him that if his objection to the signing of the bill would be withdrawn I would introduce an amendment to the water-power act exempting national parks from its jurisdiction and do what I could to secure its passage. Upon that assurance he withdrew his objection and the President signed the act.

"I am glad to introduce this measure, not only in pursuance to this agreement and understanding, but because upon the merits of the question I am inclined to believe that no permit for the construction of a dam for any purpose within a national park should be left to the will or discretion of any single man or board and that no such permit should be granted until specific consideration shall have been given to the matter by Congress and legislation dealing with the particular proposition enacted."

Cleveland Electrical Promotion Campaign Ready to Go Ahead

CLEVELAND'S campaign for the educational development of those now engaged in the electric industry to render greater service to the public and for the enlightenment of the public on the uses and advantages of electric service is ready to be pushed, the fund of $50,000 required having been raised. Seven important activities have been outlined. Open educational meetings will be held on the fourth Wednesday of each month at which men of high standing will discuss the commercial problems of the manufacturer, the jobber, the central station and the dealer. A contest for the best story concerning electricity in the home will be conducted. High-school students and those connected with the industry will have an opportunity to study practical lessons on electricity and take final examinations on the course. An active publicity campaign and a movement for the betterment of industrial lighting will be carried out. Three modern homes electrically equipped, representing values of $10,000 to $70,000, will be utilized to educate architects, builders, contractors and the general public in the better equipment of homes electrically. The school for salesmen started Nov. 1.

Tacoma's Condemnation Right Opposed on Account of Large Power Sales

THE city of Tacoma recently began in the Superior Court at Shelton its fight to secure the right to condemn property in Mason County for the development of the Lake Cushman power site, which the city has a contract to purchase. A lively fight by rival power-site claimants is promised before the case is concluded.

The opposition is centering its attack by enlarging on the amount of energy the city now sells for power purposes, in an effort to show that this sale of commercial power is what is running the city short and that it is to secure a large amount of additional commercial power business that it wants the Lake Cushman site. The reply of the city is to the effect that the sale of power is incidental to the sale of energy for lighting.

Commission Would Make "Contracting with Oneself" Legal Offence

IMPORTANT recommendations for legislation increasing the regulatory powers of the Massachusetts Department of Public Utilities have been prepared by the board for consideration at the 1921 session of the General Court. These include larger authority over rates and depreciation provisions, the issue of coupon notes, the sale of stock at auction, power to summon witnesses, and a proposed act prohibiting officers and agents of public utilities entering into contracts with themselves or corporations of which they are officers or agents except as a result of competitive bidding. In a statement filed with the Secretary of State, the commission sets forth the reasons for its recommendations and outlines the proposed enactments. As to rates, the commission points out that what is needed is not a requirement that all increases of rates shall be approved before going into effect, but provision for notice of any proposed changes and power given to the board to revise rates initiated by the company where justice to the public so requires. The commission seeks the power to enforce such specific requirements as to depreciation as it may deem necessary from time to time after proper proceedings. The board desires the same authority over the issue of coupon notes and other evidences of indebtedness payable at periods of more than twelve months after the date thereof as it has with bonds.

Good Service and Finance Discussed at Illinois Convention

HOW best to serve the public and how to get the money to do so were the leading subjects discussed by the Illinois State Electric Association at its convention in Chicago on Thursday. The sale of utility securities to customers and employees was covered in a paper by F. H. Scheel, manager of the investment department of the Insull properties. He elaborated on the methods which he had found productive of the best results in communities of different size.

Various methods which have been used to measure the power factor of customers' loads were discussed at length by E. T. Anderson of the People's Power Company, Moline, Ill., who concluded that the best scheme so far suggested was that described by Willard S. Wilder in the Aug. 2, 1919, issue of the ELECTRICAL WORLD and by C. E. Brown in the ELECTRICAL WORLD of March 27, 1920. M. H. Aylesworth, executive secretary of the National Electric Light Association, told of the affairs of the national body.

A. S. M. E. Crystallizing Coal Conservation Plans

AN ATTEMPT to formulate plans whereby the American Society of Mechanical Engineers shall take an active part in preventing the waste of fuel is growing out of activities of the fuel section of that society. At the annual convention held this week in New York City several important papers were presented dealing with this subject. One, by Prof. L. P. Breckenridge of Yale University, summarized the present fuel resources in all of their available forms, and another, by D. M. Meyers of New York City, pointed out where fuel is being wasted and offered suggestions for stopping the waste. The discussion of these papers had to be spread over three days so great was the interest of the membership. Out of the discussion, which indicated wide variation in individual opinion, the hope was expressed of developing some formula to which the A. S. M. E. can subscribe and which may be used as a basis for effort to relieve the coal crisis.

Coal Operators Should Stock Their Commodity, Says J. W. Lieb

THAT much of the difficulty in getting coal experienced by central stations and all other users could be removed if the coal companies would, like other industries, store a limited amount of the commodity was the assertion of John W. Lieb, vice-president of the New York Edison Company, in discussing the coal crisis before the A. S. M. E. convention in New York City this week. Mr. Lieb stated that coal companies could arrange for bin storage without rehandling the coal, and that it should not be necessary to suspend mining operations every time cars are not immediately available.

Mr. Lieb said he did not know of another industry which would shut down its plants with so little excuse as the coal companies.

Appropriation of $482,065 Asked by Federal Power Commission

CONGRESS has been asked by the Federal Power Commission for appropriations aggregating $482,065. Of that amount $100,000 is required to reimburse other executive departments for the expenses of investigations requested by the commission. General expenses for conducting the authorized work of the Federal Power Commission, exclusive of compensation to those employed, are fixed at $137,000. The greater part of that sum is intended for field investigations.

Brooklyn Edison Bonds Sell on 7¼ per Cent Basis

A NEW issue of $5,000,000 general mortgage, Series D, 7 per cent gold bonds, due Dec. 1, 1940, has just come on the market at a price of 97½, yielding the investor about 7¼ per cent. The proceeds of the issue are to be used further to reimburse the company for expenditures made on additions, extensions and improvements and to provide funds for additional similar expenditures.

Recommended Principles for Inclusion in Kansas Utility Act

THE Kansas Public Utilities Association met in annual convention at Topeka, Kan., on Monday and Tuesday of this week. Unusual interest was manifested in the meeting owing to the presence of Judge Huggins and Judge Reed of the Kansas Industrial Court, which has jurisdiction over the public utilities of the state, and also because M. H. Aylesworth, executive manager of the N. E. L. A., journeyed from New York to lay before the association some of the more important questions now confronting the electric light and power industry. The general utility situation in the state was reviewed by Judge Huggins, and Judge Reed delivered a forceful address on ways and means of winning the public and explained the Kansas Industrial Court.

In view of the effort being made in Kansas to amend the Industrial Court act so as to create a separate commission and give it jurisdiction over the public utilities of the state, Mr. Aylesworth spoke on the desirability of incorporating provisions for the indeterminate permit, the certificate of convenience and necessity, and also for the regulation of municipally owned utilities.

C. E. Groesbeck of the Electric Bond & Share Company touched on the difficulty of raising money for public utilities in communities where unfair treatment is meted out to the utilities. It was decided to carry on more active work in promoting public information and to engage a secretary for that purpose.

Launching Northwest Electrical Service League

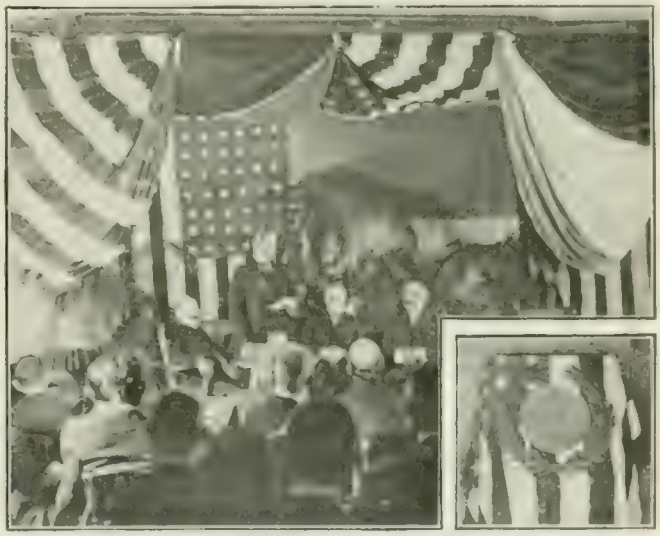
THE Northwest Electrical Service League, representing central stations, manufacturers, jobbers and contractor-dealers, was formally launched in Seattle, Wash., Nov. 29. The launching was preceded by a banquet attended by upward of 150 men.

The league, as outlined by R. W. Clark, chairman of the advisory committee, will have for its aim the promotion of the electrical industry in all of its branches, through the co-ordination of effort in the rendering of better service to the public, based on the conviction that more efficient electrical service as a whole will elevate the industry to the plane that its merit and usefulness deserve. Further, according to Mr. Clark, the league's activities will be directed along constructive lines within the industry in the way of encouraging sound, ethical and progressive business methods.

When the league was being organized it was originally intended to spread its activities over the entire Northwest, covering the States of Washington, Oregon, Idaho, Montana and Utah. As plans progressed it became apparent that the league was perhaps taking in too much territory—that is, if the best interests of all were to be served. Finally it was decided that it would be better first to interest, organize and educate the various divisions of the industry in Oregon and Washington, and when the organization was perfected to extend it to the other states.

Ampere Centenary Cements French-American Relations

MORE good feeling was engendered between the United States and France by the formal celebration on Dec. 4 of the Ampère centenary at Ampere, N. J., under the auspices of the Crocker-Wheeler Company. In 1908 a tablet was erected at Ampere in honor of the founder of the science of electrodynamics, and at the celebration last week the Prince de Béarn, Chargé d'Affaires and Councilor of the French Embassy of Washington, unveiled a bronze wreath with a suitable



PRINCE DE BEARN, WHO UNVEILED THE WREATH IN THE CORNER SPEAKING OF AMPERE'S ACCOMPLISHMENTS

inscription to be placed above the tablet in commemoration of this centenary. At the invitation of the Crocker-Wheeler Company a hundred or more men prominent in the electrical industry journeyed to Ampere, where a formal program was carried out. Dr. Schuyler S. Wheeler, president of the company, who acted as chairman, in opening the meeting characterized Ampère as the author of the electrical law of gravitation.

Prince de Béarn, who traced the life of Ampère and spoke feelingly of his accomplishments, was followed by Dr. M. I. Pupin, who gave a very interesting account of the intimate and more personal story of Ampère's life, which had its great joys and great sorrows. The program was concluded by Dr. C. O. Mailloux, who on this occasion represented the French Académie de Science, with a carefully prepared paper, in which was traced the inter-relationship of fundamental electrical research.

Bureau of Standards Wants More Money for Utility Investigation

THE Bureau of Standards has asked Congress for $2,179,440 for its expenses during the next fiscal year. Among the items are the following:

For investigation of the standards of practice and methods of measurements of public utilities, such as gas, electric light, electric power, water, telephone, central-station heating and electric railway service, and the solution of the problems which arise in connection with standards in such service, $125,000, an increase of $45,000 over the current appropriation; to maintain the standards and otherwise investigate radio work.

An additional $25,000 has been asked of Congress by the United States Geological Survey to wind up the work of the Super-Power Survey during the next fiscal year largely for the preparation of reports.

Bulk Energy Supply in Competitive Territory Not Allowed

THROUGH a misreading of the decision of the Massachusetts Department of Public Utilities in the appeal of the Webster & Southbridge Gas & Electric Company against the entrance of the New England Power Company into the field of energy supply at Webster, Mass., it was wrongly stated in the news department of the ELECTRICAL WORLD for Nov. 27, page 1087, that the New England Power Company had been authorized to supply energy to the Slater Mills against the protest of the Webster & Southbridge company. These mills are supplied with energy by the Webster & Southbridge company, and by the decision the New England Power Company is merely authorized to transmit energy through the town and to supply only the Webster & Southbridge company, should the latter company so contract with the former. No other customer can be supplied by the New England Power Company in this town without obtaining the consent of the commission, and the Webster & Southbridge company maintained throughout the hearing and still maintains that it is meeting adequately the power requirements of the community and that there is no necessity for the commercial entrance of another company into its territory.

Exceptionally Large Demand for Christmas Sales Service Material

ORDERS for its Christmas sales service material are still being received by the Society for Electrical Development at the rate of thirty to forty a day. The demand for the Christmas material this year, it was stated by General Manager James M. Wakeman, has been greater than that for three previous years put together.

To increase the use of "electrical pages" in local newspapers the society is calling the attention of its members to this service. A list of all newspapers in the United States and Canada now receiving the news service has been sent to all members for additional names.

Unusual Court Action Appears to Question Demand Charge

AN UNUSUAL proceeding which for the first time apparently questions the equity of the demand charge in a power rate was the action of the Supreme Court of the State of New York in the case of the City of Oswego vs. the People's Gas & Electric Company. Recently a temporary injunction was granted by the court restraining the company from collecting a service charge on its gas and electric rates.

The case was heard at Syracuse on Nov. 26 before Judge L. C. Crouch, who on Dec. 3 vacated the injunction, permitting the company to apply the service charge on its gas and electric rates. However, he retained jurisdiction over the demand charge included in the power rate. There will be a further hearing.

Purchase of MacKenzie Interests Makes Ontario Hydro-Electric World's Largest System



BY THE acquisition on Dec. 4 of the MacKenzie power interests in the Toronto and Canadian Niagara district the Ontario Hydro-Electric Power Commission now has the largest single generating and distribution system in the world. The total capacity of plants now owned and under construction will be more than 1,000,000 hp. One of the plants thus acquired, namely, that of the Electrical Development Company here shown, was built in 1906 with an installed capacity of 125,000 hp., at that time the largest water-power plant in North America.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Late Figures on Hydro-Electric Development in Spain. Recent statistics prepared by the Union Eléctrica Española put the existing hydro-electric development in Spain at about 620,000 hp., compared with 348,297 hp. in 1917 and 281,480 hp. in 1914. The present development is said to represent only about 10 per cent of the available water power of the country.

Electrical Progress in Utah.—A significant fact in connection with the road-paving work just completed or still under way between Salt Lake City, Utah, and Ogden, on the north, and between Salt Lake City and Provo, to the south, is that almost all of the contractors are using electric power for pumping purposes and for their rock crushers, elevating machinery and mixing plants. Many contractors who formerly used steam or gasoline have concluded that electric power is more practical and more economical.

Rates Continue to Advance.—Permission has been granted by the Indiana Public Service Company to the Hawks Electric Company to increase its rates for electrical energy in Goshen, and the city has been ordered to increase the rates for municipal-plant service to correspond. The contract of the Hawks company with the city remains for the present undisturbed, however, and the city is thus enabled to buy energy at the old rate and sell at the new. Other places where recent rate increases have been granted are Winona, Minn.; Galena, Ill.; Green Bay, Manitowoc, Kaukauna and other places served by the Wisconsin Public Service Company; St. Helena, Cal., and Vale, Ore.

Power Possibilities of the St. John River.—The drainage area of the St. John River, which forms part of the boundary between the State of Maine and the Province of New Brunswick, comprises 26,000 square miles, and the river with its tributaries offers opportunities for power development which have been inquired into by an international commission. The results of this investigation, as reported by A. Langlois of the Ottawa Department of Public Works in the *Canadian Engineer*, show that the best power sites are found upon the Allagash and Fish Rivers, the uniform fall of the main stream making the economical development of much power on it a rather doubtful scheme. In the conclusions arrived at full allowance was made for continuing the use of water for log driving, which is carried on extensively for a distance of 300 miles. At Grand Falls, on the Allagash, the most promising site for development, where there is a fall of 120 ft. in a mile, it is estimated that from 45,000 hp. to 76,000 hp. could be made available.

"Push-the-Button" Farms. — Under this title Harry R. O'Brien contributes an illustrated article to the *Country Gentleman* in which he describes the fast-spreading movement for electric light and power in the rural communities and warns against the danger of wrong methods of promotion if central-station companies do not rise to the opportunity. Iowa, Mr. O'Brien finds, is the banner state in farm service, at least 4,000 farmers receiving electrical energy from distribution lines of city companies and estimates being made that from 8,000 to 10,000 more will be served within another year. Ohio, Wisconsin and Illinois are other states in which the movement has gained increasing momentum. The author of the article figures that two months' wages of a farm hand this year would pay for all the energy that an average farm in the corn belt could possibly use. In comparison with the cost of electricity the farm hand would be worth 10 cents a day at turning a grindstone or 5 cents at shelling corn or shoveling it into a crib, while in the latter case he would need a five-hundred-dollar team and a hundred-dollar wagon to help him earn it. Nor does Mr. O'Brien forget that electricity is a real bonanza to the farmer's wife.

Great Water-Power Development Planned for England. — A cable dispatch to the New York *Times* announces that a vast and complete scheme for supplying electricity to the great industrial centers of England has been made public by the Ministry of Transport. It embraces construction of a concrete dam across the River Severn, with sluices and turbines, an energy storage plant with a high-level lake and tunnel in combination with an immense pumping and turbine power house on the tidal part of the River Wye. The assertion is made that electricity could be produced and distributed over a wide area to the extent of 500,000 hp. during a ten-hour day at a cost of little more than 1 cent per kilowatt-hour. The scheme which has been worked out by the civil engineering department of the Ministry of Transport would take five to seven years to carry out. Parliamentary consent must first be obtained. The cost has not been determined in detail but the total would amount to many millions sterling. It is claimed that the utilizing of the enormous electric power generated would effect a saving of about three to four million tons of coal yearly, which would thus be available for export. A gigantic locked basin for shipping purposes on the Upper Severn more than 27 square miles in extent, a very large portion of which would be suitable for the accommodation of vessels of the largest size and which would be usable, at all stages of the tide, forms part of the scheme.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Association of Municipal Electrical Utilities of Ontario.—The semi-annual convention of this body will be held at Toronto on Jan. 27 and 28, 1921.

Boston Section, A. I. E. E.—This section of the Institute will hold its next meeting on Friday, Dec. 17, when the subject will be "Water Powers of New England" and the speaker H. K. Barrows, civil engineer. The mechanical engineers will meet with the Institute on this date.

Philadelphia Section, A. I. and S. E. E.—"Power-Factor Correction and Its Relation to Plant Operation" will be the title of a paper to be presented by P. T. Vanderwaart before this section of the Iron and Steel association on Jan. 8. Mr. Vanderwaart is electrical engineer of the New Jersey Zinc Company of Pennsylvania, Palmerton, Pa.

W. S. Murray to Address Philadelphia Engineers.—"The Super-Power System as a Proposed National Power Policy" will be the subject of the address to be made by William S. Murray before a joint meeting of the Philadelphia Section of the A. I. E. E. and A. S. M. E. on Monday, Dec. 13, at 8 p.m., at the Bellevue-Stratford Hotel. The meeting will be preceded by an informal dinner.

Milwaukee Section, A. I. E. E.—The Milwaukee Section of the American Institute of Electrical Engineers has elected the following officers and committee chairmen to serve for the season 1920-1921: Chairman, W. H. Cheney, Allis-Chalmers Manufacturing Company; secretary, W. H. Costello, Cutler-Hammer Manufacturing Company; chairman of program committee, Fraser Jeffrey, Allis-Chalmers Manufacturing Company; chairman of membership committee, R. L. Dodd, Milwaukee Electric Railway & Light Company.

Coming Meetings of Electrical and Other Technical Societies

Association of Iron and Steel Electrical Engineers—Chicago Section, Dec. 11, Cleveland Section Dec. [illegible] Section, Dec. 18, Philadelphia Section, Jan. 8; Birmingham Section, Jan. 27.

A. I. E. E. and A. S. M. E. (joint meetings)—Philadelphia Sections, Philadelphia, Dec. 13; Boston Section [illegible] 17; New York and Metropolitan Sections, New York, Jan. 28.

American Physical Society (annual meeting)—Chicago, Dec. 28-Jan. 1.

American Institute of Electrical Engineers—Chicago, Jan. 14.

Wisconsin State Association of Electrical Contractors and Dealers—Milwaukee, Jan. 19 [illegible].

Western Association of Electrical Inspectors—Detroit, Jan. 25-27.

Association of Municipal Electrical Utilities of Ontario—Toronto, Jan. 27 and 28.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Directed Verdict Where Defense Charged Contributory Negligence.—The Supreme Judicial Court of Maine, in Kidney vs. Aroostook Valley Railroad, has sustained the lower court in granting a directed verdict to the defendant in a case where the testimony of the only witness in a suit for damages for accidental death showed clearly the contributory negligence of the individual killed. (111 At. 334.)*

Electric Companies May Use Highway Crossing Railroad Tracks.—A railroad company chartered by the state, subject to reserved power to alter or suspend the charter, cannot complain, the New York Supreme Court, Appellate Division, has held, in New York Central Railroad Company vs. Middleport Gas & Electric Light Company, that an electric light and power company, pursuant to a franchise granted by a municipality and approved by the Public Service Commission, has occupied with its poles and wires a highway crossing the railroad's tracks, none of the electric company's poles being on the railroad's right-of-way and the wires being 30 ft. above its rails. (184 N. Y. S. 221.)

Operation May Be Discontinued Where Utility Can Be Run Only at a Loss.—In the case of public service corporations where there is no specified contract upon the point the public is not authorized, according to the finding of the United States District Court for the Eastern District of South Carolina, in Charleston-Isle of Palms Traction Company vs. Shealy, to require the continued operation by the public service corporation of its property and franchises under rates which would afford not only no adequate return for the capital invested but a large continuing loss and the eventual exhaustion of the entire capital invested. The company was therefore authorized to abandon its charter, franchises and privileges and cease operation. (266 Fed. 406.)

Erroneous Instruction on Reasonable Care Upsets Verdict.—The Supreme Court of Appeals of Virginia has remanded for retrial the case of Jeffress vs. Virginia Railway & Power Company, in which a verdict for the defendant was found in the trial court. Jeffress, having lost his house through fire, sought for damages from the power company, which he charged with negligence in repairing a transformer that had been damaged in a storm. The company, denying that the cause attributed for the fire was the true one, asserted that it had used the ordinary test to insure the safety of the transformer. It also denied any obligation to provide a ground wire as a safety measure. The Supreme Court found that the trial court had erred in instructing the jury that it was the company's duty only to use ordinary care, as exemplified by common usage, having regard to the nature of electricity. The jury should have been informed that the care must be measured by the danger and evidence tending to discredit the transformer test should not have been barred out. It is the duty of those engaged in the production and distribution of electricity, the court held, to avail themselves of the best materials, contrivances and inventions in use to prevent injury to persons or property. (104 S. E. 393.)

Appellate Courts Must Exercise Independent Judgment in Proceedings Charging Confiscation.—The United States Supreme Court, in reversing the action of the Pennsylvania Supreme Court in Ohio Valley Water Company vs. Ben Avon Borough, and thus supporting the decree of the inferior state court which reversed a rate order of the Public Service Commission on the ground that its valuation of the plaintiff's property was so low as to constitute confiscation, has taken issue with the Pennsylvania Supreme Court's contention that "in the items wherein the Superior Court differed from the commission upon the question of values there was merely the substitution of the former's judgment for that of the commission in determining that the order of the latter was unreasonable." (See 103 At. 744.) "Looking at the entire opinion," the United States Supreme Court says, "we are compelled to conclude that the [Pennsylvania] Supreme Court interpreted the statute as withholding from the courts power to determine the question of confiscation according to their own independent judgment when the action of the commission comes to be considered on appeal. The order here invloved prescribed a complete schedule of maximum future rates and was legislative in character. In all such cases, if the owner claims confiscation of his property will result, the state must provide a fair opportunity for submitting that issue to a judicial tribunal for determination upon its own independent judgment as to both law and facts; otherwise the order is void because in conflict with the due process clause. Here the insistence is that the public service company law, as construed and applied by the [Pennsylvania] Supreme Court, has deprived plaintiff in error of the right to be so heard; and this is true if the appeal therein specifically provided is the only clearly authorized proceeding where the commission's order may be challenged because confiscatory." (40 S. C. R. 527.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Where Bill Is Disputed Electricity Must Not Be Cut Off.—The Tayabas Light & Power Company has been informed by the Public Utility Commission of the Philippine Islands that, while a public service company has the right to discontinue service to a defaulting company, it cannot do so in order to force the payment of a disputed bill and that it must inspect meters when their accuracy is disputed and must remedy defects. Court procedure can be taken to recover payment in cases of dispute where an adjustment cannot be reached between the company and the customer.

Consumption of Keokuk Energy Limited.—Under a ruling of the Missouri State Public Service Commission in response to an application filed by the Union Electric Light & Power Company of St. Louis, twenty of St. Louis' largest industrial establishments, which have been using unlimited quantities of power generated at the hydro-electric plant of the Mississippi River Power Company at Keokuk, Ia., and distributed through the Union Electric company, will in the future be limited in their consumption of energy from this source. Each of the companies will receive less energy than it wants, the exact quantities differing. The total number of kilowatt-hours a month to be allowed the twenty companies is limited by the commission to 6,183,293. These companies, it was contended, made contracts with the Union Electric Light & Power Company soon after the Mississippi River Power Company was ready to supply hydro-electricity on large contracts and under such easy terms as to render the service much cheaper than any other that could be supplied. In its application the Union company stated that with the growth of these twenty companies all the power it could obtain from the Keokuk Dam plant would be consumed by them. It also appeared that the Union Electric company could earn approximately $175,000 more by supplying Keokuk power to consumers other than these companies and that it could supply shortages from its steam plants. The commission ruled that to give to the twenty customers concerned hydro-electric power in unlimited quantities would deprive the general customer of his right to benefit in the water-power service and that as long as hydro-electric energy is delivered to the Union Electric company it must permit all of its customers to participate in its benefits.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

G. E. Watts, who is one of the best known sales engineers in the South through fifteen years of association with electric utilities, was elected a vice-president of the Southeastern Section of the N. E. L. A. at its recent convention in Miami, Fla. The honor bestowed on Mr. Watts is a signal one, permitted by a change in constitution which added a third vice-president to the list of officers and merited by a constant devotion to the work of the Southeastern Section since the time it was organized. Mr. Watts is an Englishman by birth, having been born at Bristol, England, April 4, 1864. While in the British naval service for nine years he visited nearly all the ports of the world on the old Madagascar and Northumberland. At the age of



G. E. WATTS

twenty-nine years he came to the United States, and he has since been identified with the electrical industry. For many years he was connected with the Columbia Incandescent Lamp Company, St. Louis, Mo. Later he took up the electric railway supply business as a member of the Watts & Uthoff Supply Company of St. Louis. For the past fifteen years, however, he has been established at Atlanta as sales engineer interested in hydro-electric construction work and street railways. Mr. Watts is Southern sales manager of the Locke Insulator Manufacturing Company.

L. T. Merwin, who recently was promoted from general superintendent to assistant general manager of the Northwestern Electric Company, Portland, Ore., has just been appointed vice-president and general manager of that company. A biography and photograph of Mr. Merwin appeared in these columns for Sept. 25.

W. G. Schmauder, formerly superintendent of power for the Texas Power & Light Company, Dallas, Tex., has been appointed assistant general manager. Mr. Schmauder is chairman of the safety committee of the Southwest Geographic Division of the National Electric Light Association.

S. L. Whitestone, since 1911 general auditor of the General Electric Company, has been elected comptroller of the company to succeed C. E. Patterson, recently elevated to the vice-presidency in charge of accounting. Mr. Whitestone, who has been employed by the General Electric Company since its inception, thirty-three years ago, became general auditor in 1911, having previously filled the position of assistant general auditor and traveling auditor. Before the present company was organized he was connected with the Sprague Railway & Motor Company and with the Edison General Electric Company.

Walter L. Upson of Union College, Schenectady, N. Y., has been appointed head of the engineering department of Washington University, St. Louis, Mo., with the title of professor of electrical engineering. Professor Upson has been teaching since 1904. He was instructor in electrical engineering and physics at Princeton University for two years, was professor of electrical engineering at Ohio State University for the same length of time, taught for two years in the University of Vermont, and since 1912 he has been associate professor of electrical engineering at Union College. Before taking up teaching Professor Upson was associated with Elmer A. Sperry in the development of the electric automobile, and in 1903-1904 he went through the General Electric Company's testing course at Schenectady. During the war he worked in the engineering department of the American Shipbuilding Company and in the consulting research department of the General Electric Company in addition to his regular college work. Professor Upson was born in Cleveland, Ohio, on July 3, 1877, and graduated from Princeton University with the degree of B.S. in 1899. He took a post-graduate course at his Alma Mater in electrical engineering and received the degrees of E.E. and M.S. He also studied at University College, London, and at Harvard, where he received the first degree of M.E.E. ever granted by that institution. Professor Upson has written a number of papers on engineering, scientific and educational subjects and is joint author with Dr. E. J. Berg of a textbook on electrical engineering. He is a member of the American Institute of Electrical Engineers, fellow of the American Association for the Advancement of Science, member of the Association of University Professors and of many other organizations.

Roy A. Weagant, winner of the Leibmann memorial prize for the best work of the year—progressive discovery tending toward the advancement of the radio art—is consulting engineer of the Radio Corporation of America. This prize, founded a year ago by a friend of the late Lieutenant-Colonel Leibmann, consists of the interest for one year on $10,000. Mr. Weagant is a native of Morrisburg, Ontario, Canada. He was educated at Stanstead College and McGill University. He studied physics under Sir Ernest Brotherford and first became interested in wireless through witnessing some of his experiments in Hertzian waves. He took up commercial wireless work in 1908 and in 1912 entered the employ of the Marconi Wireless Telegraph Company of



ROY A. WEAGANT

America. He soon rose to the position of chief engineer, and when the Radio Corporation of America absorbed the Marconi company he was retained as consulting engineer. Mr. Weagant is a fellow of the Institute of Radio Engineers and a former member of the board of directors of that body. He has also been a member of its standardization committee.

Clifton B. Day, for the last ten years superintendent Northampton (Mass.) Electric Light Company, has resigned that post.

E. T. Keck has been appointed superintendent of power for the Texas Power & Light Company, Dallas, Tex., to succeed W. G. Schmauder, who has been appointed assistant general manager of the company.

Obituary

Carl K. Badger, assistant production manager of the Pittsfield works, General Electric Company, died at Pittsfield, Mass., on Nov. 25. He was thirty-eight years of age, a native of Schenectady, N. Y., and had been about twenty-two years in the employ of the General Electric Company.

Trade and Market Conditions

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

Reduced Labor Helping to Lower Factory Costs

IN ORDER to lower their production costs it is known that manufacturers in the electrical field have been reducing their labor costs by diminishing their forces. This is true not only in certain sections of the country but also in pretty generally scattered centers. The percentage of labor cost to raw-material cost has been increasing to such an extent that the manufacturers have taken this means to reduce it, at least to some extent, in spite of the fact that they may have sufficient orders on their books to keep them working for some time.

Recent advices from the Middle West show that small reductions in working forces are being made by the smaller motor manufacturers. At the same time there is an ample supply of skilled workmen reported in that section. Other manufacturers are changing workers from one department to another and reducing hours.

How Should Glassware Packing Charges Be Handled?

WHEN the cost of packing illuminating glassware was a comparatively negligible item the American manufacturers established the practice of selling glassware plus a charge for packing. This was done because it was claimed that illuminating glassware was not a staple line, that the finished product varied from the size of an egg up to about 28 in. in diameter, and that the package quantity varied from one unit to about one hundred dozen. Now, however, conditions have changed. The package charge has increased from about 35 cents to $1.75 per barrel, and representative electrical jobbers and fixture manufacturers in the Middle West feel that illuminating glassware has become enough of a staple for manufacturers to include the cost of standard packages in the unit price of standard-package lots. Buyers claim that the number of pieces of glassware in a given standard package does not vary and that the glassware manufacturer should therefore experience no difficulty in adding the cost of the packing to the price of any given glassware.

The charge for packing the cheaper grades of glassware now amounts to about one-third of the wholesale price of the glass, and if the jobber adds this charge to the cost of the glassware, the dealer thinks the jobber is making an unduly large profit. If, on the other hand, the jobber simply bases his mark-up on the cost of glassware alone and passes on the packing charge to his dealer, it means that the jobber is getting neither profit nor even his overhead expense on 25 per cent of his capital invested in glassware.

The same trouble is not experienced with glassware purchased from abroad, because there the cost of packing is only about 3 per cent of the value of the glassware and importers make a price to cover this item when selling the glassware in this country.

High as the American package charge seems in comparison, the cost of lumber, cooperage, corrugated paper and all sorts of packing materials has been so high that the charges are said to yield no appreciable profit to the American glass manufacturers. Numerous buyers of glassware have complained to the manufacturers against the separate charge for packing, but inasmuch as the uniform packing charges have been the fixed policy of an organization known as the American Association of Flint and Lime Glass Manufacturers, it may take some little time and effort to get the policy changed. However, manufacturers have assured the ELECTRICAL WORLD that the question will be taken up for discussion at an early meeting of the newly formed Illuminating Glassware Guild.

Northwest Credit Situation Is Slightly Tighter

THE credit situation in the Northwest seems to be tightening a little more all the time. The farmers are holding their grain rather than sell at the present low price, many of the lumber mills are shut down or working at only a fraction of their output, and the woolen mills are in the same situation. Money, therefore, is not so free as it should be. Consequently collections are poor. They are averaging probably less than fifty days, but this is partly due to large commercial accounts which are promptly paid and are therefore very effective in keeping the average time down.

Another important factor is the activity of the collection departments and the fact that this condition has been anticipated for some time and the weak accounts have been closed out. At the same time many small accounts are running from sixty to ninety days. Dealers' business is reported fair, but not what was expected, and a larger percentage of sales than is desirable is represented by credit business.

Long Deliveries of High-Tension Porcelain Insulators

ALTHOUGH some manufacturers of porcelain high-tension insulators report that the volume of new business being placed is sufficient to absorb present production several other producers have noted a distinct falling off of domestic orders recently. Difficulty in floating bond issues to finance power extensions is said to be a contributing factor. On the other hand, the foreign market apparently remains as active as ever, a strong demand coming from Italy, France, Spain, Switzerland, the Scandinavian peninsula and South America especially. Foreign orders would undoubtedly be even heavier were it not for the prevailing exchange rates, which operate against them.

Excellent prospects for business are seen next year provided that financial conditions break favorably. This view is based on the immense hydro-electric power developments that are contemplated and the probability of a larger demand from electric railways which have not entered this market heavily since the war. As a matter of fact the railways are just beginning to make inquiries for insulators. Competition from foreign insulator manufacturers, while starting to make itself felt, is not feared as yet, for they are mostly concentrating upon the low-voltage material.

Stocks of finished insulators in this country are practically non-existent. Manufacturers still have such a large number of back orders unfilled that little progress has been made in improving deliveries. On the very high-voltage pin types from six to eight months is quoted. On the medium-voltage sizes large orders are filled in from three to five months.

In some cases suspension type insulators are in worse shape and in others in better as regards delivery.

The item of steel is not now occasioning especial trouble in turning out suspension insulators.

Labor conditions at insulator plants have improved, but the supply of raw material has been seriously impeding production. A slight easing up in the clay situation is now reported, but to offset this the fuel supply, both of coal and of natural gas, has been embarrassing manufacturers. Prices have undergone no change and a reduction is generally said to be impossible in the near future. Eventually, however, several manufacturers look for lower prices to come about, the advent depending upon the trend of labor, fuel and raw material costs.

Low Brass Prices Should Offer Favorable Market

ACTIVITY in the brass and copper mills, as far as can be learned, has fallen off to a great extent, probably in the neighborhood of 50 per cent. At the same time, under the present business conditions, electrical manufacturers apparently are buying as much as can be expected of them. It is generally known that bookings of electrical manufacturers using great quantities of brass and copper bars, sheets, tubes, wire, etc., have shown a large decrease in the past three months or so, and this condition of necessity must be reflected in the buying of the copper products.

Mills are running below their capacity, and there is little doubt that orders for brass can be handled for rather quick shipment. This condition, combined with the upward turn that the copper market has just taken, would seem to pave the way for a pretty favorable market for brass goods. Up to the past week copper has been quoted in the outside market as low as 13.5 cents for end-of-the-year delivery, with producers holding to 14 cents. At this writing there is little available in the outside market at under 14 cents delivered, with first quarter for both markets at 14 cents to 14.25 cents.

Compared with prices about two months ago copper wire, net, at the mill is quoted 4 cents lower now, at 17 cents. Copper sheets are off 6 cents, bottoms 6 cents and rods 5 cents. High-brass rods, wire and sheets are 4 cents lower, while low-brass sheets and wire are off 4.25 cents and rods 3.5 cents. Seamless copper tubing and high-brass tubing are quoted 4 cents lower, while low-brass tubing is off 4.5 cents. Early in October the outside market was quoting 17.25 cents for copper, delivered, while the producers' prices were nominal in a quiet market. In the past two weeks some good copper buying has been recorded. It is probable too that buying will be better after the first of the year.

October Electrical Exports Set Record for Year

ELECTRICAL exports for the first ten months of 1920 total $78,317,629, compared with $75,695,023 for the same period in 1919, or at a present annual rate of slightly under $95,000,000. The record export figure for this year of $9,988,215, reached in the month of October, gives promise of placing the year's electrical exports well beyond the approximate total of $90,000,000 recorded in 1919.

The excess of electrical exports thus far this year over last, amounting to more than $2,600,000, is well distributed over eleven of the nineteen items on the list. Those items which show the largest excess include more than a million each on motors, dynamos and miscellaneous items, nearly four-fifths of a million on interior-wiring supplies and rheostats, and not quite half a million excess on magnetos, spark plugs, etc., and on transformers. The only items on which 1919 leads by any considerable total are almost two million on insulated wire and cable and about one million on metal-filament lamps.

The export total of $9,988,215 for October, 1920, leading October, 1919, by more than $2,700,000, is not only a new record for this year but stands second to the previous high mark of nearly $11,000,000 that was hung up in June, 1919. Included in October's figures are new records on three items. The total of $970,840 on dynamos surpasses the previous high mark of $760,546 reached in June, 1919; $785,300 on transformers exceeds the previous best total of $721,507 in August, 1920, and the total exports of miscellaneous items, amounting to $3,516,873, displace the best previous mark of $3,039,569 recorded in June, 1919. A new record for this year was also made on exports of motors during October, the figures of $1,255,539 being second to those of $1,562,521 in June, 1919, however.

	October 1919	October 1920	Ten Months Ended October 1919	Ten Months Ended October 1920
Batteries	$507,704	$483,109	$5,114,399	$5,368,371
Carbons	121,621	137,760	1,228,848	1,225,491
Dynamos and generators	452,446	970,840	4,598,879	5,625,877
Fans	79,406	55,212	1,320,214	986,202
Heating and cooking apparatus	164,114	182,715	1,351,410	1,443,578
Insulated wire and cable	487,444	575,041	7,757,248	5,873,334
Interior wiring supplies	168,902	282,999	1,899,411	2,617,167
Arc lamps	2,239	1,548	14,599	18,924
Carbon filament lamps	6,075	16,871	144,418	87,826
Metal filament lamps	334,855	354,536	4,109,046	3,111,020
Magnetos, spark plugs, etc.	222,972	317,891	2,564,409	2,982,755
Meters and measuring instruments	237,077	254,876	2,506,697	2,123,176
Motors	1,007,930	1,255,539	8,853,573	10,154,662
Rheostats and controllers	63,153	64,251	438,269	1,225,855
Switches and accessories	347,152	425,615	3,118,811	3,473,439
Telegraph apparatus	44,366	24,751	751,973	506,185
Telephones	388,428	282,488	3,079,565	2,877,427
Transformers	218,789	785,300	3,332,601	3,765,756
All others	2,425,310	3,516,873	23,510,853	24,852,484
Total	$7,280,663	$9,988,215	$75,695,023	$78,317,629

Figures in the above table were compiled by the Bureau of Foreign and Domestic Commerce.

The Metal Market Situation

THOUGH a slightly firmer tone to the copper market was noted last week following reports of wage reductions and further curtailments of output the actual position remains the same. Sustained buying remains as largely absent as ever, although in part this is thought to be caused by the desire of consumers to keep their books free of obligations during the annual period of taking inventories. On the other hand, producing interests are no more anxious to sell.

Standard copper at London has checked its downward decline for the present at least, spot recovering £2 to £79 5s.

Zinc is stronger and more active in tone. Spot at New York advanced more than ½ cent per pound within the week, with a large and unsatisfied demand from consumers as offerings for first quarter delivery are small. Tin also moved upward more than 1 cent per pound but the "official" price of lead was further reduced 1 cent to 5 cents per pound by the leading interest. More inquiries are received and it is hoped that the new low level will stimulate the prevailing dull market.

The scrap metals market remains quiet. Consumers are manifesting more interest, however, as the reductions of the past weeks are believed to have brought prices to a level somewhere near a firm bottom.

NEW YORK METAL MARKET PRICES

	November 30	December 6
Copper	£ s d	£ s d
London, standard spot	77 5 0	79 5 0
	Cents per Pound	Cents per Pound
Prime Lake	14 00	Nominal 14 00
Electrolytic	14 00	14 00
Casting	13 37½	13 25
Wire bars	17 00 17 50	17 00
Lead, trust price	6 00	5 00
Antimony	5 75	5 70
Nickel, regular	43 00	43 00
Silver, New York, refinery	11 50	11 50
Zinc, spot	6 10	6 75
Tin	33 12½	34 37½
Aluminum, 98 to 99 per cent	26 50 27 50	26 00 27 00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	11 00 11 50	11 75 11 25
Brass, heavy	6 00 6 50	6 00 6 50
Brass, light	4 50 5 00	4 00 5 00
Lead, heavy	4 50 5 00	4 00 4 50
Zinc, new scrap	3.75 4 00	3.75 4.00

THE WEEK
IN TRADE

A FAIRLY satisfactory amount of business is being done in the supply field, mainly in rewiring and reconstruction. The Western territory, however, is more quiet than other places. Christmas buying is good in general, and it is expected that appliance stocks will be badly broken when inventories are taken. Hollow ware is in poorest supply in this line.

In the general supply line stocks of wire, flexible armored cable, loom, outlet boxes and porcelain are in sufficient supply to satisfy present demands, and these demands are not heavy. Pipe stocks still are short under a fair demand. Prices, it is noted, are holding at a given level with little tendency at cutting. Collections seem to average at sixty days in many sections reporting. Building is light.

As a whole, returns from forty-five states show that industrial depression, although not acute, is widespread and non-employment is slowly increasing. It has not, however, reached the point of a surplus of labor, according to the National Industrial Conference Board.

NEW YORK

Business in this territory in the past week has continued on an even keel. Sales, while not extra large, are fairly satisfactory, and the recent recession in demand now seems to have halted, for the time being at least. Stocks, on the whole, though perhaps a bit heavier than the trade would like to see, are by no means unwieldy. Jobbers have been quite generally and successfully interchanging stocks, with a very beneficial effect upon excessive inventories.

The building industry is badly off here, but optimism is generally expressed regarding its return, along with a general revival of business next spring. The Christmas trade, too, is turning out better than had been anticipated in many quarters.

Except for weakness on material directly affected by the cotton and copper markets prices on the whole show a steadier tendency. Collections range about sixty days, as previously reported, but many jobbers do not consider that a bad figure. Cancellations are not being received as the liquidation process has apparently run its course. Contractor-dealers are buying, though more closely to their requirements. While not rushed by any means they are keeping fairly busy on small jobs.

Non-Metallic Flexible Conduit.—Little demand exists and stocks are large, in some cases too much so. The current quotation on $\frac{7}{32}$-in. is $33 and on $\frac{1}{4}$-in. from $33 to $36 per 1,000 ft.

Outlet Boxes.—Steel is no longer holding up the supply and stocks are about normal. Demand varies from heavy to light.

Flexible Armored Conductor.—The first sign of a returning market on cable is seen. Several jobbers say their stocks are moving, and a representative house last week sold more than during the previous two months. No. 14 two-wire is still quoted from $80 to $85 per 1,000 ft.

Sockets.—Pull sockets are weak, but other types are moving fairly well, with stocks in good shape. In case lots pulls are worth about 50 cents, keys 28 cents and keyless 25 cents, net.

Fuses.—An average normal demand is felt with stocks at a favorable level.

Heating Appliances.—Consumer demand is apparently very active, and jobbers complain that their sales are limited by their ability to obtain supplies. Hollow-ware items remain in the worst shape, though a slight improvement in deliveries is reported. Christmas trade prospects in this line seem very good.

Tape.—Sales vary from fair to good, and stocks too are spotty, as some jobbers have too much tape, while the supply of others is low. In quantities of 100 lb. friction tape ranges from 45 to 55 cents per pound and rubber from 45 to 56 cents.

Wall Panels.—Jobbers are not stocking these, and very few inquiries or orders are received at present. Sheet steel is now plentiful and deliveries are good.

Rubber-Covered Wire.—No change in the weakness of the market is noted. No. 14 brings from $9.35 to $10.50 per 1,000 ft.

CHICAGO

No perceptible change in trade is noted, except possibly a vague feeling that things are better. Prices are holding firm, with the exception that in certain widely scattered instances jobbers are making small concessions on specialties and on goods in some way below standard. It is believed true that no widespread cutting is being indulged in by reputable dealers.

Construction remains at a low ebb and there is a widespread public demand for lowered building costs. Building permits in Chicago for October amounted to $3,800,000, about half the ten-year average. The same condition is reported throughout the Mid-West section. The Federal Reserve Bank review for November estimates $150,000,000 worth of construction withheld pending price stabilization.

Christmas business was slow in getting started this year, the week just passed being the first one that has felt any appreciable holiday buying. All retail stores are experiencing good business now, but not so good as in past years at this time.

Motors.—Inquiries from the railroads keep up, but few sales have resulted. The line in general is quiet with many prospective buyers apparently waiting for the price reduction that probably will not come. Motors between 1 hp. and 15 hp. are still hard to get, but the condition of all stocks is being gradually improved.

Wire.—In general prices are unchanged. Bare and weatherproof are sold on a list that closely follows the copper market, and sufficient supplies are available to satisfy all wants on short notice. Magnet wire, so long at a premium, is now more easily obtained.

Non-Metallic Flexible Conduit.—With the close of the season for repair and reconstruction stocks are again in good shape. Factories report a good volume of orders on books, and nothing has been heard here yet of lower prices.

Rigid Conduit.—Demand still prevents jobbers from accumulating any stock of the more popular sizes, but has recently fallen off to sufficient extent to promise better supplies in the immediate future.

Line Material.—As is usual for this time of year both inquiries and orders are being placed at a slow rate. Could the remarkably open season have been foreseen much better business would have been done.

Christmas Specialties.—Retail business is just being felt, but retailers are cautious in placing orders. A very heavy demand on jobbers is possible in the next ten days, for dealers' stocks seem abnormally low.

Washing Machines.—Sales continue in comfortable volume. Some price cuts are reported, these apparently being confined to shopworn or demonstrated pieces and having no effect on the market in general. Many sales campaigns are in progress, uniform success being reported where properly handled. Manufacturers report that jobbers show but little reduction in the volume of orders placed.

Cross-Arms.—As forecast some weeks ago in this review, prices of cross-arms were revised, effective Dec. 1. Current quotation on N. E. L. A. specification, 5-ft. x 3½-in. x 4½-in., five-pin arms, is, in less than 1,000 linear feet, $145.61 per 100; over 1,000, $139.43; 3-ft. x 3¼-in. x 4¼-in., two-pin arms are, in small quantities, $64.38 per 100, and in large lots $57.22.

BOSTON

Business during the past week was rather spotty. Prices in general remained firm, barring a tendency toward lower quotations on rubber-covered wire, and the retail trade is advertising many mark-downs. Pre-holiday business is not believed to be up to normal among jobbers, though a fair sale of hollow ware is reported. Building and engineering contracts in New England to Dec. 2 from Jan. 1 total $291,906,062, against $217,090,000 for the same period last year. Collections are fairly good among larger industrial concerns, but contractor-dealers and central stations are not paying their bills as promptly. Cautious buying continues among the jobbers, who are still working hard to keep their stocks from running into excess figures of value. Deliveries are excellent and no serious shortages were reported this week. Labor conditions are improving from the productive standpoint.

Lamps.—Lamps are now being stocked for sale in large quantities with little if any restriction as to size of orders. A leading distributer informed the ELECTRICAL WORLD on Monday that while the demand for lamps is somewhat below last year's a decided improvement in orders, taking the country as a whole, can be seen compared with a few weeks ago. One Boston warehouse had 1,500,000 lamps under its roof early in the week.

Flexible Armored Conductor.—A quiet market prevails, with some occasional 1,000-ft. orders and good stocks. Prices are soft, this week's quotation of $85 on single-strip No. 14 applying to 1,000-ft. lots and over.

Rubber-Covered Wire.—An undercurrent of price weakness exists, with fair demand and ample stocks. No. 14 in 5,000-ft. lots sells around $9 to $9.50.

Motors.—Stocks continue to increase among competing distributers. Well-rounded lines are not generally prevalent. Betterment work in industrial and mercantile establishments continues to absorb many motors. Considerable competition exists among motor agencies for the disposal of larger sizes.

Hollow Ware.—Healthy buying for the holiday trade is reported, toasters and percolators moving well.

"Nail-it" Knobs.—Heavy stocks are available in local warehouses. One of the smaller jobbers had 300 barrels on hand early in the week, it is reported, and in barrel lots these are selling for $28.50 per 1,000.

Loom.—So far prices do not reflect raw-material cost reductions. The market is dull and stocks are ample.

Schedule Material.—Prices are steady, stocks are complete as a rule and the demand is only moderate.

Washers and Cleaners.—Retail stocks are heavy, and the volume of business is insufficient to pull much on most jobbers. Cleaners are moving fairly well.

ATLANTA

Except for the activity in the holiday goods line business as a whole is reported rather dull, November business being slightly less than 30 per cent below that of October, and prospects indicate that December will show a still greater decrease. This is due to a great extent to the reluctance of the retail trade to place orders so near the inventory period on Jan. 1 and is in this respect a normal situation. Electrical supplies required in construction work are slow because of the falling off in building activities, little or no new construction being announced in the past few weeks. Building permits in Atlanta for the month of November number 174 and are valued at $365,000, this being less than one-half the value of permits for October. Construction companies report moderate activities in small additions and repair work and are receiving some inquiries regarding building operations to begin in the late spring, but the general opinion seems to be that there will not be a general resumption of heavy building before the first of March.

Owing to the low price of cotton the farmers are holding their crops and are not paying off their indebtedness as was contemplated, and this, of course, is causing a stringency in money matters all up and down the line and has tended to slow up mercantile business in general. Cotton mills, oil mills and gins, as a result of the holding of cotton, are being forced to curtail their hours of operation and in some instances to shut down entirely after having practically resumed normal operations ten days ago. How long this condition will continue to exist depends almost wholly upon how long the farmers continue to hold their product.

Vacuum Cleaners.—The past ten days have seen a renewed activity in this line. Stocks are somewhat low, but jobbers will hardly place heavy orders for replenishment of stocks before the first of the year. Prices show no change.

Non-Metallic Flexible Conduit.—It is freely predicted by jobbers that the present price of $33 per 1,000 ft. for ½-in. size will break in the near future, as the manufacturers and jobbers are both heavily stocked. Buying is slow.

Rectifiers.—The heavy slump in the automobile and garage trade is reflected in the falling off in demand for Tungar rectifiers, though the more firmly established companies are still purchasing as usual. Stocks are reported in fair condition and shipments are good, with price on the garage type steady at $117.

Distributing Transformers.—Continued improvement is noted and most central stations have succeeded in accumulating small stocks for their requirements. This, of course, has slowed down the movement somewhat, but the demand for the popular sizes continues to hold up quite well and some jobbers report shortages, particularly in 10-kw., 15-kw. and 25-kw. sizes. Shipments are improving.

Knife Switches.—The demand for knife switches is reported very light, the safety-switch type having contributed to the slow movement of this article. The smaller towns, however, continue to purchase the open-type switch, and the smaller sizes, particularly the two-pole type, are moving fairly well. Stocks are reported somewhat low because of jobbers' hesitation in placing orders at this time.

Wire.—Further base reduction in the price of wire is reported, effective as of Dec. 1. Stocks of both weatherproof and rubber-covered are in good shape and the popular sizes continue in fair demand.

ST. LOUIS

In comparison with the previous week last week's demand picked up appreciably, though it was still subnormal. The increase in activity is due mainly to last-minute orders for Christmas goods from dealers who put off buying any stock at all until they could estimate more closely just what they would need. Dealers report consumers looking over their stocks for suitable electrical gifts, but that there is a feeling that prices are high and not much buying has shaped up so far. St. Louis department stores are stressing more strongly than ever the desirability of electrical gifts.

Jobbers, in preparation for their inventories, are issuing numbers of hold orders to manufacturers in order to keep their totals as low as possible. Cancellations are becoming less frequent, however, and practically all jobbers report their stocks at favorable levels compared with other lines. Prices are remaining remarkably firm considering general business conditions. Collections are slightly easier but the sixty-day average has not been decreased. Building has taken a further drop.

Wire.—The situation has changed very little, but jobbers are encouraged by the fact that cancellations have dropped off considerably. Inquiries remain fair, but orders are low in size and number. No. 14 rubber-covered is held at $9.75 per 1,000 ft. in 5,000-ft. lots, and weatherproof is quoted on 23 cents base. Long deliveries are quoted on magnet wire with no weakening of prices.

Rigid Conduit.—Demand is still strong enough to prevent jobbers from accumulating complete stocks of smaller sizes of both black and galvanized. Stocks of the larger sizes are fairly normal. A light demand is being taken care of through the interchange agreement of St. Louis jobbers.

Heaters.—Demand has been fairly good until the past week, but has slowed up considerably owing to the unseasonably warm weather. Jobbers have good stocks on hand and they are looking forward to a particularly active season.

Christmas Goods.—These have been moving well, but jobbers are not expecting to equal the volume of last year. They have stocked up well, but their confidence has not been entirely re-echoed by many dealers who are just beginning to build up their stocks.

Motors.—Large quantities of fractional motors can be obtained on immediate delivery, but stocks of larger sizes are spotty and deliveries of several months are quoted. Prices are holding well but demand is light.

Outlet Boxes.—Stocks are spotty, some jobbers reporting that they can obtain enough to satisfy demand, which is comparatively light. Other jobbers report their stocks low and are finding it very difficult to get deliveries from manufacturers.

Knobs, Tubes and Cleats.—Practically all jobbers have very large stocks and are having quite a little difficulty in cutting them down for inventory purposes. Demand continues light.

Farm-Lighting Plants.—The demand predicted for November did not materialize, and dealers are not having a great deal of success with the deferred-payment plan, which, it had been hoped, would solve the problem. Declining prices for farm products have put the farmer in a non-buying mood. Demand is slightly better than it was in the beginning of November.

SAN FRANCISCO

The value of the building permits issued in the principal California cities during November, 1920, is as follows: San Francisco, $1,469,940; Los Angeles, $6,267,660; Oakland, $563,676; Fresno, $312,925. The value of the building permits for November, 1919, were as follows: San Francisco, $2,050,809; Los Angeles, $5,232,537; Oakland, $595,465; Fresno, $376,033. The figures indicate the universal decrease in electrical contracting, for the case of Los Angeles is unique in California. So far there has been little non-employment reported in California outside of the usual decrease in farm employment and the closing down of one or two shipyards.

Electrical Appliances.—Although dealers are anticipating a big Christmas business, yet during the past few weeks there have appeared indications that this business will be hurt by conditions such as the general public belief that electrical appliances will drop together with other commodities. It is true that several makes of washing machines have dropped in price, or are believed to be ready to drop, because of shut-down factories and accumulated stock; but, on the other hand, the manufacturers of standard makes believe that their prices cannot be lowered because of labor and material costs.

Heating Appliances.—A severe cold spell that followed the heavy rain has considerably increased the call for radiators and for heating pads. Stocks are good. Contrary to early impressions there are good local stocks obtainable on appliances of the better sort, such as percolators in a variety of models, and grills.

Line Material.—Business in line material has been unusually brisk during the past month. The San Joaquin Light & Power Corporation plans to spend $3,000,000 in the next few months, mainly upon its 11,000-volt distributing lines, for it has now a sufficiency of power but lacks distributing facilities in the newer districts. This work must be completed before the opening of the irrigation load in the early spring.

Alarm Systems.—A nice business is reported by jobbers and dealers who have made special efforts in this line. Eastern shipments are required.

Boxes and Covers.—There is no longer any shortage, in the northern part of this territory at least, of boxes, covers and other roughing-in material.

SEATTLE—PORTLAND

Sales volumes in Seattle and the Puget Sound district reported by both jobbers and dealers show that business is languishing and that the total for November and December will not nearly approximate original estimates. Jobbers and dealers as a whole agree that Christmas merchandise sales of electrical appliances will fall far short of last year's figure because of the attitude of the buying public in refusing to purchase anything that is not absolutely essential. Domestic appliances, such as toasters, flatirons, percolators, etc., are moving comparatively well, but other lines of more expensive merchandise are moving poorly at present.

Stocks in general are reported by both jobbers and dealers to be in very good condition with the exception of certain lines of hollow ware. Prices are holding, but a break downward would not be unexpected. An increasing number of lumber mills in both Oregon and Washington are being forced to cease operations because of inability to market their products without too great loss. Many still operating have cut wages approximately 50 cents per day and intimate that further cuts will be necessary to reduce costs of manufacturing. The non-employment problem in lumber is becoming serious both in Oregon and Washington. Wages in all lines will be greatly reduced.

In the Portland district jobbers report that business is continuing about the same as reported in the past few weeks' period. Demand for ranges, washing machines and flatwork ironing machines has decreased very noticeably, but heating devices are not moving so rapidly as they should at this time of year. Stocks in general are in very good condition with exceptions of certain lines of hollow ware.

There have been no price changes of any note recently.

Portland contractors report that business is slowing up and expect this condition to continue until after the first of the year. Electricians are very plentiful.

SALT LAKE CITY—DENVER

Several important salesmen's conventions are reported in session in the electrical jobbing centers. The keynote of these meetings is the imperative need of intensive selling methods to meet the contingency of a buyer's market, the importance of quick turnovers and the need of eliminating dead stock. Stocks are plentiful in practically all electrical lines. Dealers and jobbers alike are able to get what they want on immediate delivery, while factories seem to have caught up on nearly all back orders.

There is no apparent disposition to reduce retail prices. Opinion is divided among dealers as to whether a radical reduction would be ultimately good for the electrical trade. Some would welcome a materially reduced price schedule and be willing to take whatever loss is involved. It is generally admitted that high prices are the biggest factor in keeping the consumer out of the market. There is a noticeable pick-up in the volume of electrical buying for the holidays.

Christmas-Tree Sets.—Only the cheaper grades are in any considerable demand. Novelty lamps seem to rank highest in the favor of the buying public. Standard products are too high in price to be attractive to the shopping public.

Lamps.—Nearly every dealer is satisfied with his volume of lamp business. Buyers are choosing their lamps with more and more discrimination, looking especially to lighting efficiency. The frosted globe is in unusually good demand.

Fixtures.—The fixture business is at a low ebb. Building is virtually at a standstill. One dealer who specializes in fixtures reports his volume at 20 per cent normal.

Flatirons.—Irons are not going well. The prevailing retail price is around $8.25, representing a 20 per cent increase over the 1919 price. The investment is unattractive to the average buyer.

Rotary Sewing Machines.—The demand is almost negligible, the selling price being $80.

NEW APPARATUS & APPLIANCES

A Record of Latest Developments
and Improvements in Manufacturers' Products
Used in the Electrical Field

Plug Cap

A 20-amp. composition plug cap, polarized, has been placed on the market by Harvey Hubbell, Inc., Bridge-



HEAVY-DUTY PLUG FOR POLARIZED SERVICE

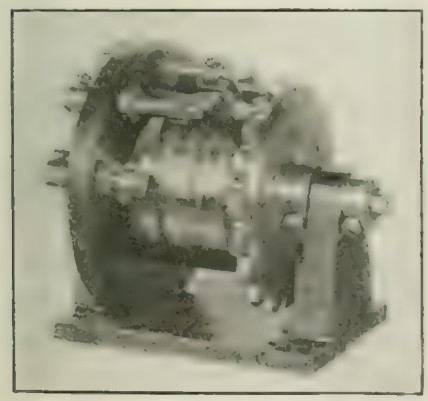
port, Conn. This No. 6720 cap is provided with a hole large enough to admit weatherproof or asbestos-covered wire, and has sufficient capacity, says the manufacturer, for 32-volt circuits.

Mirror and Lens Arrangement for Electric Signs

A device for use in electric display signs has been developed by the Golden Glow Sign Corporation, 45 West Thirty-fourth Street, New York City. By means of this device light from a centrally located incandescent bulb is reflected by mirrors behind a number of lenses which project the light. In an ordinary sign one bulb is used to illuminate an entire letter, averaging twelve lights, and in a box sign one lamp is used for both sides of the sign. It is claimed that each lens is as bright in appearance as if an individual lamp were behind it.

Water-Level Indicator

A long-distance indicator intended primarily for application in forebays



THE OPERATION OF INDICATOR IS INDEPENDENT OF VOLTAGE VARIATIONS

of hydro-electric plants has been placed on the market by D. W. Proebstel, Electric Building, Portland, Ore. The device consists of a direct-current motor whose field poles are changed in polarity as a result of changes in the water level. Five wires are required for connection with the control switch, which is placed at the measuring point and is actuated by a float. The device is usually built for operation at 120 volts direct-current.

Glue Warmer

The Ideal electric bench glue warmer has been developed by the Halverson Company, Portland, Ore., for users of hot glue. It is made entirely of copper and equipped with safety fuse and signal light. The upper compartment is divided to hold two quarts of glue in one side and water for the brush in the other. A three-heat switch is supplied. "Nichrome" ribbon is used for the new type of heating element.

Attachment Plug

Harvey Hubbell, Inc., Bridgeport, Conn., has placed on the market a com-



FOR BAYONET BASE

position attachment plug with bayonet base, No. 6712, for 250 volts and 6 amp.

Ironing Machine

An ironing machine with one open end, so that skirts and similar garments can be slipped over it instead of having to be ironed doubled, has been developed by the Utensils Company, 303 East Columbia Street, Fort Wayne, Ind. The ironer is motor driven and gas heated and finished in aluminum. For the convenience of the operator there is a pedal arrangement for working both from the front and from the side. The belt wheel is guarded and the feed roll becomes inoperative when goods are not passing through. Other specifications are as follows: Floor space occupied, 18 in. x 38 in.; height, 36 in.; steel-cut gears running in oil; heat-resisting roller bearings.

Note on Recent Appliances

Condulet Junctions

Accessible junctions for condulet work have been placed on the market by the Crouse-Hinds Company, Syracuse, N. Y.

Resistance Unit for Welding

The General Electric Company has developed an electric arc-welding equipment incorporating new features and especially adapted for welding rail bonds on street or industrial railways. It is also applicable to welding work in industrial plants where loss of electrical energy is not objectionable. The apparatus consists of a wire resistance unit mounted in a light metal frame. Switches provide a welding current with range of from 60 amp. to 200 amp. in 15-amp. steps.



ESPECIALLY ADAPTED TO RAILWAY AND INDUSTRIAL PLANT WORK

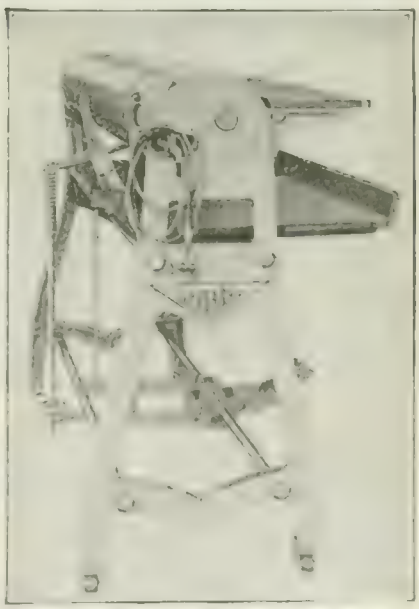
It is light, easily portable by two men and will not be injured by exposure to the weather. The circuit is controlled through a contactor operated by means of a push-button switch placed close to the electrode holder.

Paper Tape

An adhesive paper tape with high mechanical and dielectric strength, according to the manufacturer, has just been perfected by the Irvington Varnish & Insulator Company, Irvington, N. J. It has been made for taping coils and for general repair work.

Motor-Driven Gas-Heated Ironer

The new "Gainaday" ironer, recently placed on the market by the Pittsburgh Gage & Supply Company, Pittsburgh,



ALL GEARS COMPLETELY INCLOSED

Pa., is electrically operated and heated by gas. It is made in 42-in., 46-in. and 50-in. roll widths, has direct motor drive and is foot-controlled.

MANUFACTURERS' ACTIVITIES

Record of Changes Affecting Sales and Distribution Together with Trade Personals and Notes on Foreign Trade, Jobbers' News and New Trade Literature

THE WESTERN ELECTRIC COMPANY has established a factory at 1601 Glenwood Avenue, Philadelphia, to produce precision measuring instruments for radio and other work. The shop occupies a four-story building of 60,000 sq.ft. floor space, and its personnel will consist of about 900 employees. F. W. Willard is the plant superintendent, but he will be stationed at the Hawthorne works; D. A. Wallace, assistant superintendent, will be located in Philadelphia.

THE CHASE-SHAWMUT COMPANY, Newburyport, Mass., announces that approval by the Underwriters' Laboratories, Inc., has been given on the company's 600-volt line of renewable fuses to supplement approval of the 250-volt line.

THE ARROW ELECTRIC COMPANY, Hartford, Conn., has provided a pictorial trip through its plant through the medium of its new distributors' catalog, embracing fifty-nine photographs showing activities in and around the plant. The new three-story extension to the factory adds about 30,000 sq.ft. of floor area, with a restaurant on the top floor.



PLANT OF THE ARROW ELECTRIC COMPANY, HARTFORD, CONN.

THE M. B. AUSTIN COMPANY announces its removal on Dec. 1 to its own new building at 108-116 South Desplaines Street, Chicago.

THE INTERNATIONAL ELECTRIC COMPANY, manufacturer of electrical heating appliances, Indianapolis, Ind., announces removal of its office and factory from the Century Building to 211-15 South McCrea Street, where a five-story and basement building will make available about five times as much floor space as heretofore.

THE ECLIPSE ELECTRIC MACHINERY COMPANY, Louisville, Ky., is planning to erect a plant to cost about $30,000. Charles E. Weiss, Thirty-first and Madison Streets, Louisville, is president.

THE CHASE-SHAWMUT COMPANY, Newburyport, Mass., announces the appointment of H. C. Moran, Keystone Building, Pittsburgh, Pa., as district representative for the following territory: Western Pennsylvania, Ohio, Kentucky and West Virginia. The Engineering Equipment Company, 1011 Chestnut Street, Philadelphia, Pa., has also been appointed district representative for eastern Pennsylvania, New Jersey and Maryland.

THE SIMPLEX WIRE & CABLE COMPANY, 201 Devonshire Street, Boston, Mass., has announced that the E. S. Stickle Company, 305 Union Arcade Building, Pittsburgh, Pa., is representative of the company in Pittsburgh, succeeding the Stickle & Taylor Company (dissolved).

KLEIGL BROTHERS, 240 West Fiftieth Street, New York City, manufacturers of electrical stage equipment, have awarded contract for a four-story factory building, 60 ft. x 100 ft., to be erected at 321 West Fiftieth Street and to cost about $65,000.

THE ILLINOIS STOKER COMPANY, Alton, Ill., announces the appointment of the Ernest E. Lee Company, 115 South Dearborn Street, Chicago, as district representative for Iowa, Wisconsin, Michigan, northern Indiana and northern Illinois.

THE BOWLUS MANUFACTURING COMPANY, Springfield, Ohio, announces that it has more than trebled the facilities of its former manufacturing plant. The increased space will be used for the manufacture of its chain-drive boring machine. The company for several years has made nothing for the electrical trade but boring machines.

THE AMERICAN DI-ELECTRICS, LTD., 95 Liberty Street, New York City, announces the appointment of E. A. Thornwell, 1026 Atlanta Trust Company Building, Atlanta, Ga., as agent for the Southern States.

THE CHASE TURBINE MANUFACTURING COMPANY, Orange, Mass., has recently established a new sales office at Portland, Me., in charge of Albert M. Dexter, manager.

THE DRIVER-HARRIS COMPANY, Harrison, N. J., has offered for sale $750,000 of 7 per cent cumulative sinking-fund preferred stock at $98 per share. This issue is redeemable as a whole or in part at the option of the company at 110 and accrued dividend. The proceeds will be used for new equipment and working capital required by the rapid and constant growth of the company's business.

THE C. & G. COOPER COMPANY, Mount Vernon, Ohio, engine builder, has made a number of changes in its organization during the year. At the regular meeting held in June the following officers were elected: B. B. Williams, president and general manager; F. H. Thomas, vice-president in charge of sales; Mr. Taylor, secretary in charge of production and W. L. Daney, treasurer. The company reports an increasing volume of business.

THE STUART PRODUCTS CORPORATION, manufacturer of "Make-UR-Own" batteries, has recently removed from 116 South Green Street, Chicago, to 665 West Washington Boulevard, where it has much larger quarters. The company has organized a sales promotion department to co-operate with jobbers and dealers.

THE C. M. SORENSON COMPANY, 177 East Eighty-seventh Street, New York City, manufacturer of electrically driven air compressors, etc., has filed notice of increase in capital stock from $30,000 to $200,000.

HEYL & PATTERSON, INC., 51 Water Street, Pittsburgh, manufacturer of elevators, hoists, etc., has awarded contract for the construction of a two-story building to cost about $60,000.

THE F. S. PAYNE COMPANY, Cambridge, Mass., manufacturer of elevators, has within the last two years opened offices at 177 Church Street, New Haven, Conn., and at 13 Merrimack Square, Lowell, Mass., and has virtually doubled its factory floor space in that time.

J. W. MURPHY, former sales manager of the Esterline Company, has established a manufacturers' agency under the name of the J. W. Murphy Company at 108 South La Salle Street, Chicago. The company will handle Esterline and Duncan meters as well as some other parallel lines.

FAIR DEMAND FOR STARTING AND LIGHTING SETS.—Notwithstanding the present recession in general business and the falling off of work in many automobile factories, the demand for starting and lighting sets in the Massachusetts factories of the American Bosch Magneto Corporation continues active. At present about 2,500 starting and lighting sets are being turned out monthly at the Cambridge plant (formerly Gray & Davis factory), and the Amesbury lamp factory is being overhauled for increased production. New cost-accounting methods are being put into effect in these plants. An increase in net profits during the fall has been realized at the Cambridge factory.

J. E. SLIMP has been appointed sales manager in Chicago of the E. T. Chapin Company, manufacturer of Western red-cedar poles, piling and posts at Spokane, Wash. Mr. Slimp, who has been selling supplies and equipment to electric railway and transmission companies for the last twenty years, will have his offices at 127 North Dearborn Street. The district to be covered by the Chicago office of the company is everything in the United States east of the Dakotas and that part of Canada east of Winnipeg.

THE HANSEN STORE & FIXTURE COMPANY, Seattle, Wash., contemplates building a three-story addition, 50 ft. x 50 ft., to cost, exclusive of equipment, $15,000. Additional equipment will be installed.

Foreign Trade Notes

THE SIMPLEX WIRE & CABLE COMPANY, 201 Devonshire Street, Boston, Mass., has made arrangements with the Eastern Engineering Company, Tampico, Mexico, to handle its products in that territory. H. W. Page is manager and chief engineer of the Eastern company.

STANDARDS FOR ELECTRIC CABLES AND MACHINERY IN BELGIUM.—Official standards for electric cables and machinery adopted by the Chambre Syndicale des Electricien's of Belgium, it is reported, have been published. The general conditions of government contracts are also given.

Foreign Trade Opportunities

Following are listed opportunites to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A firm of manufacturers' agents in South Africa (No. 34,097) desires to secure an agency for the sale of electric pleasure and commercial automobiles.

A mercantile firm in Finland (No. 34,099) desires to secure an agency for the sale of

electric motors, accessories and appliances of every description.

The managing director of an engineering firm in India (No. 34,109) desires to be placed in communication with manufacturers of electric train-lighting systems, with a view to promoting their sale in that country.

A sales corporation in Canada (No. 34,112) desires to secure the representation of manufacturers for the sale on a commission basis of electric fixtures, etc.

A commercial agent in Spain (No. 34,086) desires to secure an agency for the sale of electric hotplates and stoves, wire, electrical wares, etc.

Trade Publications

ELECTRIC FURNACE.—The Booth Electric Furnace Company, New York City, is circulating an illustrated booklet on its rotating drum-type electric furnace.

BRUSH HOLDER EQUIPMENT.—The Baylis Company, Bloomfield, N. J., is distributing bulletin 516; entitled, "Commutation Troubles and Their Elimination," in which is described its reaction brush-holder equipment.

GAS ENGINES.—"Cooper Gas Engines" is the title of a forty-page catalog issued by the C. & G. Cooper Company, Mount Vernon, Ohio, in which it describes its different types of gas engines and accessories.

PANELBOARDS.—The Benjamin Electric Manufacturing Company, Chicago, is distributing catalog S-3, covering the Benjamin-Starrett panelboards and cabinets for lighting requirements.

CRANES AND HOISTS.—The Shepard Electric Crane & Hoist Company, Montour Falls, N. Y., has recently published a twenty-six-page booklet entitled, "Aërial Railway of Industry," describing and illustrating its cranes and hoists.

ELECTRIC FANS.—The Hunter Fan & Motor Company, Fulton, N. Y., has issued booklet 110, covering its different types of fans for direct and alternating-current.

ELECTRICAL DEVICES FOR SERVICE STATIONS.—The F. B. Electric & Manufacturing Company, Detroit, Mich., is distributing folders covering its products, including F. B. test sets, coil and magneto testers, battery testers, motor generator sets, battery-charging panels, discharge rheostats, etc.

New Incorporations

THE ROCKAWAY GAS & ELECTRIC APPLIANCE COMPANY, Inwood, N. Y., has been incorporated with a capital stock of $20,000 to manufacture electrical and gas appliances. The incorporators are J. E. and C. Smith and A. A. Wiley, Inwood.

THE B. W. ELECTRIC COMPANY has filed articles of incorporation under the laws of the state of Delaware with a capital stock of $500,000 to manufacture electrical products. The incorporators are T. L. Croteau, M. A. Bruce and S. E. Dill, Wilmington, Del.

THE DIXIE STORAGE BATTERY COMPANY, Charleston, W. Va., has been incorporated by Andrew Gardner, A. E. Hayes and Roy Pennywait. The company is capitalized at $100,000 and proposes to manufacture storage batteries

THE ACME LIGHTING FIXTURE COMPANY, New York City, has been incorporated by M. Ehrlich, S. S. Kogan and T. L. Sklamberg, 299 Broadway, New York City. The company is capitalized at $30,000 and proposes to manufacture metal electric and gas fixtures.

THE PLAZA ELECTRIC COMPANY, Bridgeport, Conn., has been incorporated with a capital stock of $50,000 to manufacture electrical specialties. The incorporators are Samuel Bernstein, A. A. Nelson and F. M. McCue, 56 Sherman Street, Bridgeport, Conn.

THE REVOLVING TRANSFORMER COMPANY, Cleveland, Ohio, has been incorporated by J. C. Lincoln, John C. Lincoln, James H. Griswold, John A. Hadden and David E. Green. The company is capitalized at $100,000 and proposes to manufacture electrical apparatus.

THE ELECTRIC REGULATOR MANUFACTURING CORPORATION, New York, N. Y., has been incorporated with a capital stock of $100,000 to manufacture electrical controlling devices. The incorporators are M. Samburg, J. G. Hochman and A. M. Levy, 195 Chrystie Street, New York City.

THE WINNSBORO (TEX.) ICE & LIGHT COMPANY has been incorporated with a capital stock of $60,000 by R. C. and K. A. Campbell and J. W. Rhone.

THE BILT-WELL LIGHTING FIXTURE COMPANY, New York City, has been chartered with a capital stock of $25,000 by J. and H. J. Glassberg, 87 Manhattan Street, New York City.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

PITTSFIELD, MASS.—The Pittsfield Electric Company, 92 Renne Avenue, contemplates the erection of an addition to its power plant at a cost of between $100,000 and $125,000.

WORCESTER, MASS.—The New England Power Company, 35 Harvard Street, has petitioned the Department of Public Utilities for approval of an issue of $250,000 stock and $550,000 bonds, the proceeds to be used for extensions to the generating plant, transmission lines and installations of service.

Middle Atlantic States

CADYVILLE, N. Y.—The International Paper Company, 30 Broad Street, New York City, has had plans prepared for the erection of a dam and hydro-electric plant on the Saranac River to cost about $250,000. A. H. White, care of the company, is engineer.

NEW YORK, N. Y.—The United Electric Light & Power Company, 130 East Fifteenth Street, it is understood, will soon take bids for the erection of a three-story plant on West Ninety-seventh Street, to cost about $150,000.

OWEGO, N. Y.—The Owego Light & Power Company has petitioned the State Public Service Commission for permission to construct extensions to its electric plant.

POTSDAM, N. Y.—The Racquette River Paper Company, Potsdam, has had survey made for the development of water power on the Racquette River at Sissonville. C. E. Eaton, Sherman Building, Watertown, is engineer.

JERSEY CITY, N. J.—The Hudson County Boulevard Commission will receive bids until Dec. 28 for furnishing two generators and steam turbine to cost $36,000 for the lighting plant. F. J. Ratigan is acting county engineer.

MEADVILLE, PA.—At a recent meeting of the City Council the proposition of erecting an electric light and power plant was discussed.

BUCKHANNON, W. VA.—The Buckhannon Light & Water Company has been reorganized and the erection of a 350-kw. power plant is contemplated. Enoch Bellis is president.

WASHINGTON, D. C.—Bids will be received at the office of Supervising Architect, Treasury Department, until Dec. 22 for permanent light and power feeders at the United States Auditor's Building.

WASHINGTON, D. C.—Bids will be received at the office of the Supervising Architect, Treasury Department, until Dec. 23 for extending outside light and power feeders and for electric and conduit wiring at the United States Public Health Service Hospital No. 32, 2650 Wisconsin Ave.

North Central States

PORT HURON, MICH.—C. Kern & Company contemplates the erection of an electrically operated ice plant to cost about $100,000.

CINCINNATI, OHIO.—The Cincinnati Gas & Electric Company, 114 West Sixth Street, has plans under consideration for the installation of a fourth generating unit. C. D. Jones is president.

COLUMBUS, OHIO.—It has been reported that the Northern Ohio Traction & Light Company, Akron, plans to construct an electric power plant along the Muskingum River, to generate an initial capacity of 100,000 kw. at a cost of about $15,000,000, including the erection of transmission lines, etc.

BLOOMFIELD, KY.—H. Peet, Jr., recently purchased the plant of the Bloomfield Utilities Company and contemplates the erection of a 14-mile transmission line at a cost of about $10,000, installation of alternators, transformers, etc.

CARROLLTON, KY.—Bids will be received about Dec. 20 for improvements to the electric power plant and water-works to cost about $12,000.

COVINGTON, KY.—Bids will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until Dec. 21 for conduit, wiring changes and lighting fixtures, etc., in the post office and court house.

PADUCAH, KY.—The city officials are considering the installation of a double system dynamo at the municipal light plant to cost about $20,000.

TAYLORVILLE, KY.—The city officials have had plans prepared for the erection of an electric light plant.

CROWN POINT, IND.—Bids will be received about Jan. 1 by J. Coleman, architect, 6257 St. Lawrence Avenue, Chicago, Ill., for the erection of several buildings, including a 50-ft. x 50-ft. power plant for the Crown Point Hospital, to cost about $350,000.

BEARDSTOWN, ILL.—Bids will be received by the Board of Commissioners, care of J. H. Bowman, about Feb. 15 for the construction of a drainage and power plant to cost about $175,000. Goodell & Millard are structural and mechanical engineers.

ASHLAND, WIS.—The L. E. Myers Company, Ashland, recently had under discussion the proposition to harness the Flambeau River between Park Falls and Ladysmith and erect numerous transmission lines for the purpose of serving light and power to the cities of northern Wisconsin. The cost of the development of such a project is estimated at about $3,500,000. L. E. Myers, Monadnock Building, Chicago, Ill., is president.

RUSH CITY, MINN.—J. D. Markham and A. Kelsey, Benson, Wis., contemplate the erection of a power plant, dam and a 7-mile transmission line across the St. Croix River at an estimated cost of about $2,000,000. Plans include the development of 20,000 kw. minimum capacity and a maximum of 60,000 kw. Druar & Millinowski, 512 Globe Building, St. Paul, Minn., are engineers.

SAUK CENTER, MINN.—An election will be held soon for the purpose of submitting to the voters a proposition to issue $15,000 for improvements to the lighting system. J. F. Cooper is city clerk.

ST. LOUIS, MO.—The Chester Iron & Foundry Company, E. A. Linnis, secretary, 7000 Vulcan Street, will receive bids about Jan. 1 for the erection of a foundry and power plant to cost about $30,000. L. Haeger is architect.

OLDHAM, S. D.—Bonds to the amount of $25,000 have been voted for the purpose of improving the electric light system.

MILFORD, NEB.—The Nebraska Corn Mills plans to remodel and enlarge its hydro-electric plant at a cost of about $20,000. Koenig, Hollister & Company, 401 Bankers' Life Building, Lincoln, are engineers.

Southern States

BIRMINGHAM, ALA.—The city officials contemplate the installation of a fire-alarm system to include 30 miles of underground work and 200 miles of overhead construction, forty additional boxes, etc. The cost is estimated at about $174,000.

JACKSON, MISS.—The Mississippi State Board of Health contemplates the erection of a power house at the sanatorium at this place to cost about $65,000. B. Price, 1420 Jefferson Bank, Birmingham, Ala., is architect.

MACON, MISS.—Bonds to the amount of $25,000 have been voted for the purpose of improving and repairing the light and water plants.

AMARILLO, TEX.—T. B. Slaughter contemplates the erection of a hydro-electric plant at Palo Duro Canyon to cost about $1,000,000, including equipment.

FORT WORTH, TEX.—It has been reported that the Fort Worth Power & Light Company plans to enlarge its plant.

Pacific and Mountain States

CENTRALIA, WASH. — The City Commission has passed a resolution creating an improvement district for the installation of an ornamental lighting system in the business section.

DEER PARK, WASH.—According to M. F. Mendenhall, president of the Mount Spokane Power Company, plans are under way for rebuilding and enlarging one of its plants and doubling the present capacity of 150,000 hp.

TACOMA, WASH.—The City Council has authorized the installation of electric power at the Green River purification plant and intake.

TACOMA, WASH. — The City Council passed ordinances authorizing the purchase of $15,000 worth of copper wire and transformers to cost about $20,000.

GEORGETOWN, CAL.—The city officials contemplate the installation of electric lights. G. G. DeVore is one of the committee in charge.

LOS ANGELES, CAL.—J. S. Dodge, chairman of the Board of Supervisors, recently discussed changing the plans for the Pacoima Dam which will bring the previously estimated cost of $2,500,000 down to $1,500,000. Plans include the erection of a hydro-electric plant for the use of the residents and ranchers of the San Fernando Valley. J. W. Reagan, Court House, is engineer.

LOS ANGELES, CAL.—Plans for a conservation and reclamation project in the San Gabriel Canyon have been announced by Chief Engineer Reagan of the Los Angeles County Flood Control District. According to Mr. Reagan, it is planned to erect a power plant to develop 11,455 hp., and the cost is estimated at $15,000,000.

SACRAMENTO, CAL. — F. Miller, city engineer, has been instructed to investigate sites for the proposed new power plant.

SAN BERNANDINO, CAL. — The city officials have retained C. F. Finkle, consulting engineer, I. W. Heilman Building, Los Angeles, to make report and prepare plans for water and power development in Cajon Basin. Plans include the development of 1,000 hp. and storage of 630 in. of water at the Mathew's Lake project to cost about $733,000, and the development of 770 hp. and storage of 590 in. of water at the Vincent Cienega project to cost about $767,000.

SANTA YNEZ, CAL.—Ranchers of Santa Ynez Valley are organizing for the purpose of negotiating with the San Joaquin Power Company to supply light and power in the valley and also in the Los Olives district. A. Hunt, Santa Ynez, is secretary.

HAILEY, IDAHO.—The Mascot Mining & Milling Company contemplates the installation of a 700-hp. hydro-electric unit next spring. C. Peters is president.

SHOSHONI, WYO.—Bids will be received by the Department of Interior, United States Reclamation Service, Denver, Col., until Dec. 23 for furnishing electrical apparatus for the power plant of the Shoshoni project. For information apply to the United States Reclamation Service, 412 Tramway Building, Denver, Col.

CEDAREDGE, COL.—W. L. and F. J. Parker have applied to the City Council for a franchise to erect and operate an electric plant.

QUESTA, N. M. The Molybdenum Corporation of America contemplates the construction of a hydro-electric plant on the Red River near this place.

Canada

TORONTO, ONT. Report of estimates for 1921 by R. C. Harris, city engineer, include: Installation of insulated negative feeder line on the Danforth Avenue Railway for prevention of electrolysis, $31,350; boilers and generators at the Riverdale pumping station, $100,000; generator and alterations at the Highland Station, $156,000.

PRINCE ALBERT, SASK. Bids will be received by E. F. Webb, city clerk, until Dec. 18 for pumping equipment as follows: One horizontal centrifugal pump, 1,400 Imperial g.p.m., 50-ft. head, direct-connected to alternating-current electric motor; one pump as above without electric motor (alternative); one horizontal centrifugal pump with capacity and head as above direct-connected to steam turbine; one horizontal centrifugal pump, 1,400 Imperial g.p.m., 190 ft. head, direct-connected to alternating-current electric motor; one horizontal centrifugal pump, 700 Imperial g.p.m., 190 ft. head, direct-connected to alternating-current motor; one horizontal centrifugal pump, 1,400 Imperial g.p.m., 190 ft. head, direct-connected to steam turbine; two vertical centrifugal pumps, 500 U. S. g.p.m., 40 ft. head, suitable for sewage, pumping, direct-connected to alternating-current motor. Information and specifications may be obtained on application to the office of the Electrical Superintendent, City Hall.

Miscellaneous

WRANGELL, ALASKA.—The Wrangell Mining, Pulp & Power Company has been incorporated for $1,000,000 by W. D. Grant and others for the purpose of supplying electric power for mining operations.

Record of Electrical Patents

Notes on United States Patents

1,360,168. ANTENNA; Ernst F. W. Alexanderson, Schenectady, N. Y. App. filed Feb. 15, 1918. Several ground connections.

1,360,169. RADIOSIGNALING SYSTEM; Ernst F. W. Alexanderson, Schenectady, N. Y. App. filed Dec. 24, 1918. Arc-generator sending system.

1,360,197. GAS LIGHTER; Johan O. Delen, Gothenburg, Sweden. App. filed May 4, 1920. Electric spark.

1,360,218. PULL SOCKET; David Hjorth, Bridgeport, Conn. App. filed March 18, 1919. Of sheet-metal parts.

1,360,231. PRINTING TELEGRAPH; Charles L. Krum and Howard L. Krum, Chicago, Ill. App. filed March 7, 1914. Rotatable transmitting and receiving switch mechanism.

1,360,235. ELECTRIC RELAY; Gustavus McAlpine, London, England. App. filed Dec. 10, 1919. Increased sensitiveness and small time lag.

1,360,246. AUTOMATIC ELECTRIC GENERATING SYSTEM; Edward B. Reese, Indianapolis, Ind. App. filed Aug. 14, 1916. For automatically cutting in or out source of energy.

(Issued Nov. 30, 1920)

1,360,069. LIQUID ELECTRIC RESISTANCE; John H. Wolliscroft, Great Crosny, near Liverpool, England. App. filed April 17, 1916. Electrolyte passes from one chamber to another.

1,360,257. MOTOR-CONTROL SYSTEM; John H. Albrecht, Pittsburgh, Pa. App. filed Dec. 20, 1916. For blooming mills.

1,360,266. LOCKING DEVICE FOR ELECTRIC LIGHT BULBS; James P. Cassidy, New Haven, Conn. App. filed April 7, 1919. Prevents theft.

1,360,267. ELECTRIC HEATING ELEMENT; Lewis W. Chubb, Pittsburgh, Pa. App. filed Sept. 5, 1916. For flatirons, percolators, etc.

1,360,273. IGNITION SYSTEM; Alfred C. De Lorme, East Orange, N. J. App. filed Oct. 29, 1917. For eight cylinder V-engine.

1,360,274. IGNITION SYSTEM; Alfred C. De Lorme, East Orange, N. J. App. filed April 15, 1919. For eight cylinder V-engine.

1,360,288. WELDING MECHANISM; James T. Griffin, Oak Park, Ill. App. filed April 29, 1920. For welding contact elements to studs.

1,360,293. PHASE CONVERTER; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed April 29, 1915. Self-starting for single-phase.

1,360,300. MOTOR-CONTROL SYSTEM; Reese T. Kintzing, Wilkinsburg, Pa. App. filed Jan. 30, 1920. For driving rubber calenders, etc.

1,360,326. PERMEAMETER; Joseph Slepian, Wilkinsburg, Pa. App. filed July 25, 1918. Eliminates losses of air-gap resistance.

1,360,331. TESTING AND ADJUSTING APPARATUS FOR CORD CIRCUITS; John F. Toomey, New York, N. Y. App. filed Sept. 1, 1917. Telephone.

1,360,332. TESTING CIRCUIT; John F. Toomey, New York, N. Y. App. filed June 21, 1919. Telephone.

1,360,352. INSULATOR; Arthur O. Austin, Barberton, Ohio. App. filed May 29, 1916. Cushion for pin insulator.

1,360,371. METERING PANEL; John Cuthbert, Chicago, Ill. App. filed Oct. 12, 1915. Quickly installed.

1,360,372. PANELBOARD; John Cuthbert, Chicago, Ill. App. filed Oct. 12, 1915. Plurality of like sections.

1,360,373. PANELBOARD; John Cuthbert, Chicago, Ill. App. filed Nov. 5, 1915. Plurality of like sections.

1,360,374. CABINET STRUCTURE FOR PANELBOARDS; John Cuthbert, Chicago, Ill. App. filed Nov. 5, 1915. Flush-type cabinet with detachable cover plate.

1,360,404. OIL-WELL HEATER; George S. Hollister, Boston, Mass. App. filed May 7, 1919. Lowered like a plummet.

1,360,420. ELECTRIC ELEVATOR; Nils O. Lindstrom, Nutley, N. J. App. filed July 15, 1918. Automatic or manual.

1,360,437. ELECTRIC WATER HEATER; Antonio Papini, Philadelphia, Pa. App. filed July 8, 1920. Carbon cylinder type.

1,360,447. APPARATUS FOR ELECTRICALLY TREATING LIQUIDS; Harry B. Rudd, Akron, Ohio. App. filed Sept. 22, 1919. Sterilizer.

1,360,452. ELECTRIC HEATER; William A. Sharpe, Detroit, Mich. App. filed Jan. 26, 1920. Heating element cut from rolled ribbon.

1,360,462. MEANS FOR REGULATING ALTERNATING CURRENTS; Erwin R. Stoekle, Milwaukee, Wis. App. filed Nov. 10, 1917. For polyphase currents.

1,360,482. DYNAMO-ELECTRIC MACHINE; John B. Wiard, Lynn, Mass. App. filed Sept. 15, 1919. Improvements in construction.

1,360,483. DYNAMO-ELECTRIC MACHINE; John B. Wiard, Lynn, Mass. App. filed Oct. 3, 1919. Provisions for dissipating heat.

1,360,510. ELECTRIC FLUID HEATER; Andrew B. Elliott, Toledo, Ohio. App. filed April 19, 1920. Prevents frozen radiator.

1,360,541. ELECTROLYTIC APPARATUS; Isaac H. Levin, New York, N. Y. App. filed Oct. 25, 1915. Filter-press type.

1,360,542. ELECTROLYTIC APPARATUS; Isaac H. Levin, New York, N. Y. App. filed May 25, 1917. Production of oxygen and hydrogen.

1,360,543. WATER-FEED ATTACHMENT FOR ELECTROLYTIC CELLS; Isaac H. Levin, New York, N. Y. App. filed April 21, 1919. Fill cup is safety valve.

1,360,544. ELECTROLYTIC CELL; Isaac H. Levin, New York, N. Y. App. filed April 21, 1919. Gas-tight insulating support.

1,360,545. ELECTRODE; Isaac H. Levin, New York, N. Y. App. filed April 21, 1919. For production of oxygen and hydrogen.

1,360,589. PRIMARY BATTERY; Charles B. Schoenmehl and Martin L. Martus, Waterbury, Conn. App. filed June 4, 1917. Cylindrical form.

1,360,592. CHARGING SYSTEM FOR STORAGE BATTERIES; William W. Sloane, Chicago, Ill. App. filed Feb. 20, 1920. For locomotives.

1,360,601. METHOD OF AND APPARATUS FOR SEPARATING MAGNETIC MATERIAL; George Ullrich, Magdeburg, Germany. App. filed Feb. 9, 1916. Drum type.

1,360,632. LISTENING-IN SIGNAL FOR TELEPHONE APPARATUS; George I. Galitzka, New York, N. Y. App. filed Feb. 20, 1917. Warns subscriber that operator is listening.

1,360,635. SIGNALING DEVICE; Clarence B. Harlow, Chicago, Ill. App. filed Nov. 21, 1917. Horn.

1,360,640. MAGNETO-ELECTRIC IGNITION MACHINE; Ernst Hurlimann, Zuchwill, Switzerland. App. filed Oct. 23, 1919. Method of mounting poles.

1,360,654. APPARATUS FOR ELECTRICALLY CHARGING FLUIDS; Edgar E. Littlefield, Seattle, Wash. App. filed March 10, 1919. For charging sprays.

1,360,677. COLLECTION BOX; Benjamin F. Perry, Pittsburgh, Pa. App. filed Sept. 10, 1919. Fare box.

1,360,686. MAGNET-WIRE RETRIEVER; Harry C. Robinson, Coatesville, Pa. App. filed Dec. 12, 1919. For lifting-magnets.

1,360,694. NAVIGATIONAL APPARATUS; Elmer A. Sperry, Brooklyn, N. Y. App. filed Nov. 13, 1914. Will automatically keep ship on its course.

Electrical World

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Educating Employees as to Company Activities

LUDICROUS errors on the part of an employee are often traced to ignorance of the things that his work requires him to handle. The most common mistake is made by clerks required to handle material records who attach to certain items unit prices whose incorrectness should be known at a glance, the clerk having no knowledge of the article or its use. Employees of the technical and operating departments make just as ridiculous errors when they attempt to deal with the work of the accounting department. The "information course" inaugurated by the Oklahoma Gas & Electric Company at Oklahoma City to correct such lack of knowledge is a praiseworthy move that can well be imitated elsewhere. Work along this line also helps to promote a spirit of co-operation between departments that can be assured only by a mutual understanding of one another's work and problems.

Water Powers Which Are Beautiful and Useful

BEAUTY is not always an attribute of nature, and if it were not for the ingenuity and skill of man, many of the priceless pearls of this world would still be shrouded in obscurity or plague the senses by their ugliness. There must be something radically wrong with the mind that is not moved by the grandeur of our mountain lakes, which resemble emeralds in settings outrivaling the skill of the goldsmith. To us it matters not whether the dam impounding the water be constructed by beavers or by an engineer, and yet we admit that there are in this world people to whom the first form of construction is sublime and to whom the latter form of construction is a desecration. Such is the perversity of man. A field of waving grain is a magnificent sight, and yet the farmer who would let it stand while people were clamoring for bread would be justly looked on as an enemy of mankind. A people that would go unhoused and unwarmed rather than cut down stately forests with which to build themselves habitations and fires would be fanatical. In the same category are those who would shut up from use the waters and timbers of our national parks when there is need for both and when their utilization will not detract from but rather add to the beauty of those reservations. Some one has discovered or imagined that our national parks are in imminent peril because it is possible to store the waters contained within their boundaries under the recently enacted water-power bill. This time the suggested legislation does not come in the guise of conservation, but the proponents consider themselves the champions of preservation of the natural beauty of our parks. We will admit that there may be cases where the erection of headworks might mar scenery, just as there may be cases where the creation of a lake from what was once a swamp might add to the attractiveness of the scene. Discretion in these matters may safely be left to the Federal Power Commission, and any attempt to limit the scope of the present water-power bill on that account is ill-advised.

Public Policy in Rate Increases

THAT rising costs, particularly in the case of coal, have weighed heavily on electric light and power companies is generally conceded. To reimburse the utilities for the excessive operating expense thereby occasioned commissions have as a rule permitted surcharges to be made temporarily. In a majority of cases these surcharges are made applicable to power contracts, residential consumers being specifically exempted. The reason for this seeming discrimination is that power customers can install isolated plants and generate their own energy if the rate is excessive, whereas with residential customers that is out of the question. We have yet to hear of any dissent from the reasonableness of such decisions. When, however, circumstances are such as to warrant the application of surcharges to all customers—and cases of this kind are not altogether rare—care should be taken not to offend public sensibility by the method of promulgation. It is not enough to abide by the letter of the law. That does not make for public good will, and as a matter of public policy it is better to have rate increases granted freely than to snatch them through technicalities. In the latter case the supposition is that the increase is not warranted. We view with alarm any action on the part of a utility which undermines public confidence in commission regulation. That bulwark should be strengthened and not weakened. Certain it is that the public will insist that commissions function properly or else it will do away with them for something more radical. It is better therefore to fortify commissions and endure them than to encourage some other form of regulation we know not of. The legislatures intended commissions to make rates, not merely to approve them.

France Rehabilitating Herself Electrically

A VIVID idea of the vital energy and recuperative power of war-stricken France is given in a short but striking illustrated paper by Major O. F. Allen this week. Within a year after the first invasion, before the grass had healed the shell holes in the battlefields of the Marne, the Chamber of Commerce of Paris was making preparations to furnish tools and equipment to

the devastated regions for repairing the wreckage of the war. One of the first important matters to be considered was the replacement of the wrecked and stolen electric plants and transmission lines, and a general system of tying together the power plants to exchange surplus energy was instituted, everything being at three-phase, 50 cycles, except the direct-current railway service. Thus the advantages of standardized systems was fully appreciated. The main transmissions ran from 5,000 volts to 120,000 volts. A standard rating of 5,000 kw. was selected for turbo-generators, and in 1917 units of this size were ordered from French builders to be available after the enemy had been driven out. By that year the extensive use of electric power along the western front had been inaugurated, and the war-time electric construction, carefully planned for peace-time purposes, is now being used for distribution.

In 1918 a 100,000-volt line from Switzerland was planned to serve the besieging armies gathering about Metz, and this line has now been completed by civilian activities. Even while the Germans were almost at the gates of Paris the electrical service and the engineers of the big electric companies were planning the high-tension network for the frontier over which the Germans were to be driven. This development had especially in mind the great industrial and mining areas along the western front, where the destruction of equipment by the Germans had been diabolically thorough. Part of the apparatus which was merely looted has been recovered, and the work of rehabilitation has gone on with a speed little short of astounding to those who have not full knowledge of French energy and devotion.

Intelligent First Attempt at Rural Service Regulation

RURAL distribution has reached an importance which has brought it definitely to the consideration of the Wisconsin Railroad Commission for actual regulation. The basis of three rulings recently made is given in this week's issue and is decidedly worth study as a very intelligent first attempt at formal regulation. Briefly, the commission recognizes the importance of developing rural business on a self-supporting basis, with proper provisions for carrying the necessarily large fixed charges and for insuring construction good enough not to involve hazards to other parts of the system, and with the probability of the same reasonable rate of return that is allowed on other kinds of electrical distribution. The commission evidently does not approve of the organization of local corporations among rural consumers, believing that it is an unnecessary complication and that the situation can be met more effectively by regulating the conditions under which existing utilities may take on the rural service.

The principles followed in the regulations are that when a sufficient call for rural service occurs the utility concerned shall investigate the situation as regards possible business, estimate a construction cost brought down to the lowest margin practicable, and shall then, when the work is undertaken, levy on the group of consumers the actual cost of construction and no more. A suitable connection charge, as in serving other customers, will be filed with the commission, and as business grows the original guarantors, so to speak, shall derive benefit from the gain in the form of refunds on the original payment of cost. All this is regulated much after the fashion taken by many utilities on their own initiative in cases where extensions to isolated groups of consumers have to be made. As to charges, the commission permits the regular rate for city service plus the actual amount by which fixed charges, energy losses and operating expense shall exceed the normal for city supply. Provision is made for annual adjustment in the rural charge, which must obviously vary as the business grows to the benefit of the consumer.

The various provisions of the commission sound somewhat complicated, but they seem to have been worked out on a sensible general basis. Experience will doubtless lead to some modifications; however, the main principles at least, if conscientiously applied, will insure a considerable extension of rural business on a basis that will not involve the supply company in speculative expense and will free the consumer from rates based in fact, if not in form, on the chances taken by the utility.

Conservation Which Does Not Save Is Futile

DISCUSSION of the conservation of fuel in a special session of the American Society of Mechanical Engineers at its annual meeting presented a curious complex of the practical and the visionary. That the nation is facing fuel shortage goes without saying, and the necessity for steps toward conservation is self-evident; but the discussion of the problem afforded an example of how far afield an engineer may go when once he escapes the boundaries of his own proper activities. In the discussion the central station, which is, by and large, the most efficient user of fuel, came in for rather sharp criticism as a waster of energy. Of course, if any plants are using old-fashioned and inefficient machinery or are careless in maintenance, they deserve criticism. However, those critics who blame the central station for not fully recovering the heat lost through condenser circulating water or the latent heat of vaporization by going into the heating business display singularly small practical knowledge of the economic problems involved.

We had thought that the timeworn scheme of constructing a bad power plant in order to obtain a somewhat efficient steam-heating plant had well-nigh passed into deserved oblivion, but it has bobbed serenely up again as if it had not been submerged over and over again by hard experience. In modern power plants practically no exhaust steam is returned to the atmosphere, and that which is condensed gives up a considerable amount of useful heat which is recovered. There is, of course, inevitable loss, and a large amount of capital has been from time to time sunk in experiments on auxiliary engines operated by working fluid of very low boiling point further to increase the final temperature range of the system. No broadly good results have followed, for it has generally turned out that the methods of conservation cost more than is saved, unfortunate as the circumstance may be.

So far as steam heating from central stations by use of the exhaust is concerned, that, too, has been tried by many a central station, and its possibilities have again and again been investigated. Nine times out of ten there is no available market at a price to justify the necessary expenditure. The tenth time the scheme succeeds only by reason of fortunate local conditions. But the sale of heat energy as steam or hot water from a central station is of necessity a forced sale, for the economic radius of action is small, and even central heating plants worked under far more advantageous

circumstances than are available at the central station have as a rule proved unsatisfactory save on a very limited scale. The central station's only safe policy is to save and utilize all possible waste heat, subject to the limitation that it must not impair the efficiency of its conversion into energy. A failure to accomplish more is chiefly due to the inexorable limitations of its temperature range.

Now and then there is opportunity for doing some of the things suggested in the discussion before us, like furnishing summer power to customers who need so much heat during the winter that they can then afford to operate a somewhat inefficient power plant. When a genuine case of this kind occurs the central station is ready with the goods. Industrial and building heating in connection with power production is, broadly, the will-o'-the-wisp of thermodynamics. In the somewhat rare cases when the scheme can be effectively employed no one is quicker to take advantage of it than the central-station operator, but he knows from experience how rarely it is sound policy.

Experience of San Joaquin Company Should Be Valuable to Others

THE maintenance problems of a distribution system with many plants, steam and electric, and several thousand miles of circuit are multifarious, involving equipment of very different kinds scattered over a large territory. Some of these problems are well set forth in a paper by E. A. Quinn and R. C. Denny regarding the practice of the San Joaquin Light & Power Corporation. Here is a case where the actual generating stations are thirteen in number, with more than forty substations and 3,700 miles (5,950 km.) of line. The apparatus therefore covers the widest possible range and the experience on this system should be of value on many another.

In the steam generating plants the turbo-generators form the principal equipment requiring close inspection. The advice is that turbines should be opened up and inspected as frequently as load conditions permit, especially in view of short circuits, which are more likely on transmission systems and which may impose severe stresses in the rotating parts. It may sometimes seem like unnecessary trouble, but if anything does go wrong owing to lack of inspection the damage is likely to be serious.

When generators fail it is likely to be due to lightning or other abnormal voltage, and the authors' suggestion that feeding the lines direct from a high-voltage generator increases trouble of this sort is worth noting. A transformer relieves the station equipment considerably. In this system, as generally elsewhere, the switching apparatus is the most considerable problem of maintenance. In the first place, oil switches are numerous, about 400 of them in this instance, and in the second place, when they are automatic and likely to open not infrequently, the chances of burning blades are considerable. Nothing except careful and frequent inspection and replacement of injured parts can overcome a source of trouble like this. For this a monthly inspection has here been found to be generally sufficient. Transformer troubles have been found here, as often elsewhere, to be most commonly due to broken bushings. It is interesting to learn that, although the average daily variation of temperature reaches 80 deg. F. during the summer, the effect on the insulators seems to be negligible, the most frequent cause of difficulty being malicious breakage by passers-by and grounding on the cross-arms by unlucky feathered trespassers.

Surface Creepage and Insulator Flash-Over

A SERIES of observations of the electrostatic charges appearing on the surfaces of insulating materials when subjected to high voltage are described by T. Nishi in the November issue of the *Journal* of the American Institute of Electrical Engineers. The observations, which were made with the proof plane and electrometer immediately after the removal of the voltage, show the presence of large values of charge and have many striking irregularities of shape. Such a method will indicate a residual polarization of the dielectric, and the combination of this with the copious ionization of the air surrounding the electrodes present in most of the experiments will account for all of the results. The interesting question is whether these charges are sufficient to affect materially the voltage gradient over an insulator. It is to be regretted that the author did not push his investigation into this field.

Most of the charges observed originated in corona or brush discharge. These discharges are not present around a transmission insulator under normal conditions of operation, and charges appearing on an insulator due to a transient corona would probably drift to ground rapidly under the normal voltage gradient over the surface. The continued presence of corona is always a danger signal, and the resulting spark-over may well be due to an accumulation of charges on the surfaces rather than to a direct stroke through the air. But if there is no corona present it appears doubtful whether these surface charges can exist in sufficient quantity to lower the flash-over voltage materially.

Mass Production Desirable in Industrial Heating Equipment

AT THIS stage of the industrial electric heating game development work occupies the head of the line. Practice is rapidly crystallizing into worth-while experience, but too little is yet known in the field of production about the possibilities of standardization through publicity and organized "missionary work" by manufacturers' representatives, jobbers' salesmen, retailers and central-station solicitors of new business. Any petty hiding of lights under bushels now to save future markets to patentees of this or that design may prove short-sighted in face of the world's need of comprehensive information about what is being accomplished with electricity in competition with other heating agencies. The more the gospel of industrial electric heating is spread abroad, supported by concrete examples of service results, the sooner executives and purchasing interests in industry will turn naturally to available apparatus for the solution of their problems. On the threshold of an advanced era thousands of installations will require special study and treatment, but just as standard motor designs have been fitted efficiently into varied machinery-driving situations, well-developed and stable designs of electric heating equipment can be applied with admirable economy if users and builders adopt and maintain a liberal policy in sharing their experience with the business world. Mass production, with its immense benefits to all, will follow.



Peter Junkersfeld

An electrical engineer with the ability to do big things to whom the government intrusted the problem of constructing the army's cantonments

A GOOD engineer must know how to get things done. He must be able to direct the energies of others. No matter how big the job, he must never quail, but pitch in and do it. In a measure these axioms characterize Peter Junkersfeld, now engineering manager for Stone & Webster. Although professionally rated as a central-station engineer in Chicago, he did not hesitate during the war to take on his shoulders the responsibility for the most extensive engineering project in this country, namely, the construction of the cantonments for the national army. Incidentally while doing this work he was in charge of other government construction which with the cantonments exceeded $600,000,000 in value. In no small measure was it due to his engineering ability that the United States was able to train 4,000,000 men in a year and a half after her entrance into the war. In fact, the government has recognized the services of this man who held a colonel's commission by awarding him the distinguished-service medal.

Colonel Junkersfeld's record with the Commonwealth Edison Company and its predecessor, the Chicago Edison Company, was sufficient recommendation to the government to warrant the responsibility placed on him. As assistant to Vice-President L. A. Ferguson, he shared in the supervision of the contract, operating and engineering departments of the electric light and power company carrying the world's largest load. He began as a helper the fall after he was graduated from the University of Illinois and quickly advanced through the electrical end of the business. He installed at Chicago the first engine-driven 25-cycle double-current units in America. He was for nine years in charge of the electrical construction and design of all the company's additions and new plants. Included in these is the Fisk Street plant of world-wide fame, which embodied many new features that have later come into extensive application.

He has acted many times in an advisory capacity to other electric light and power companies. Probably his most conspicuous work in this connection is his analysis and report of the St. Louis situation. His recommendations were accepted and resulted in the consolidation of the five existing distribution systems into a modern unified and comprehensive system. His executive ability was made plainly evident in his successful endeavors to increase the already cordial relations between the Commonwealth Edison Company and its employees. This he accomplished largely through the inauguration of a savings fund and annuity system and through his safety work.

Colonel Junkersfeld was born in Illinois Oct. 17, 1869, and except during the war lived there continuously until March of last year, when almost immediately after returning to civilian life he joined the Stone & Webster forces in Boston as engineering manager. He has always taken a keen interest in affairs of the industry. He is a past-president of the Association of Edison Illuminating Companies and a past-vice-president of the A. I. E. E., besides having served on numerous committees of various associations.

The Beauty of Use

Future Industrial and Agricultural Development of California, Nevada, Arizona and Idaho Are Limited by the Proposed Enlargement of the National Parks, Which Includes Water-Power Resources Essential to These States

At every waterfall two angels stay,
One clothed in rainbows, the other veiled in spray.
The first the beauty of the scene reveals,
The last revolves the mighty waterwheels,
And there those white-robed sisters ever stand,
Utility and beauty, hand in hand.

—Written in 1855.

WHEN Judge Payne, Secretary of the Interior, agreed last June to withdraw his objection to the water-power bill so that President Wilson could sign it within the lawful time he extracted a promise from Senators Walsh and Jones that at the next session an amendment would be brought in taking the waters of the national parks from under the Federal Power Commission's control. This amendment has been embodied in similar resolutions introduced in the Senate and the House. Innocent as the amendment appears on its face, its true meaning cannot be fully appreciated until it is considered in conjunction with the proposed plan for enlarging the national parks.

Development May Enhance Beauty

The school of thought represented by the American Civic Association would prohibit the storage of the water resources contained within the boundaries of the national parks, thus making impossible both the watering of the plains below for irrigation, agricultural and domestic purposes and the development of hydro-electric power to furnish light, power and heat to the people of neighboring states. Yet the greatest beauty in the world is the beauty of use.

It is possible in most instances to develop water powers without marring the natural beauty of nature. At Niagara Falls some of the power houses resemble Grecian temples of art and are surrounded by beautiful parks. The conduits and power machinery are hidden from view, and when one enters the power houses, looks upon those mighty hydro-electric appliances and ponders upon their diversified usefulness to man, he does not think of them as ugly, but remembers only the parks as fitting surroundings and the stately power-house structure as a proper housing for a still greater beauty, "the beauty of use." The imagination pictures the saving of coal effected, the hundred cities, towns and villages lighted, the factory wheels turned, the street cars operated, the agricultural communities served, and the thousand other facilities which these mightly engines of use provide for the comfort and well-being of man. Nearly always nature herself quickly repairs the scars necessitated by a hydro-electric installation. Within a year after the completion of the plant the rocks are covered with vines, and the only departure from primitive nature that can be seen is the red-tiled roof of the power plant nestling in a slight opening of the forest, or perhaps a beautiful lake, created for storage purposes, which adds to the beauty of the scene. In issuing licenses permitting development of water resources within national parks requirements can be made by government authorities which will permit of their utilization for the service of mankind and at the same time prevent defacement of the beauty of the natural surroundings.

While the present boundaries of the national parks in the Sierra Nevada mountain range inclose a comparatively small portion of the total area, yet the enlargement of the boundaries of the parks contemplated by bills now before Congress, and the creation of the proposed great Roosevelt National Park, would bring within their boundaries water resources the use of which is imperatively necessary to the future growth of the states of California, Nevada and Arizona.

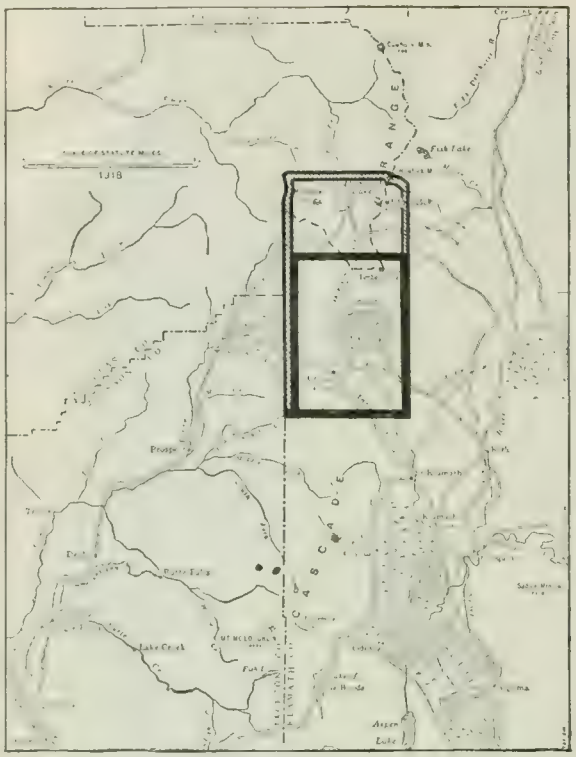
The American Civic Association is flooding the country with circulars headed "The National Parks in Imminent Peril." It is rather the great State of California which is in imminent peril, for if the area of the national parks should be enlarged as proposed and the right to utilize their water resources be denied, then the further agricultural development of California would be greatly impeded, because the state derives all its irrigation water from the Sierra Nevada Mountains.

California has no coal and her oil is becoming scarce and high. Coal can be obtained only by importation from such great distances as to make its cost prohibitive. The state depends absolutely upon the water powers of the mountains for its electric power, and if the boundaries of the national parks were enlarged, as proposed, so as to take in a large part of the mountain streams, and power development were prohibited, its future industrial growth would be seriously handicapped.

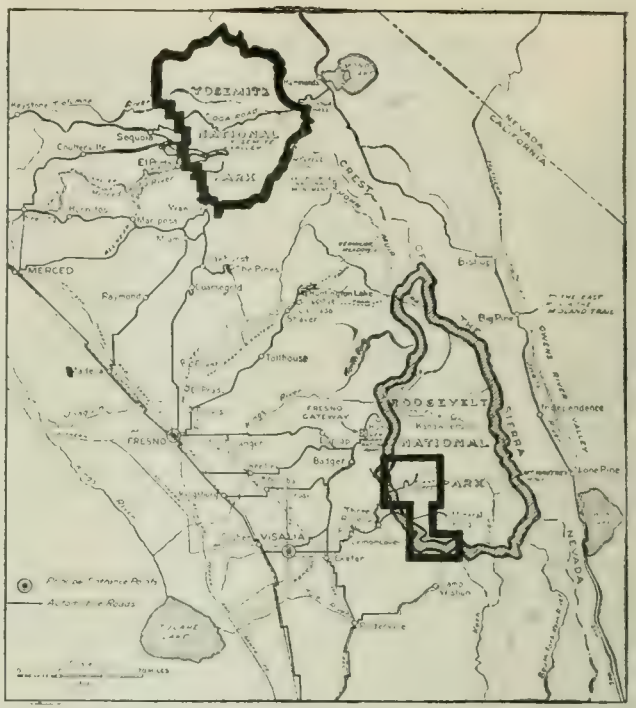
The menace to California would not come from the size of the area withdrawn but from the strategic location of the enlarged parks. This can be seen by the maps on the next page. A large portion of central and southern California is dependent for future growth upon the water resources of the Kings, Kern, Kaweah and San Joaquin Rivers and their tributary lakes and streams which find their source in the Sequoia and proposed Roosevelt National Parks.

Idaho Needs the Water

The people of northeastern Idaho are badly in need of water wherewith to increase their irrigated area by 200,000 acres of land. This land would bring forth $10,000,000 worth of food products annually and would support 10,000 additional people. The water for such beneficial use can be secured only by conserving and storing the headwaters of the Fall River, in the extreme southwestern portion of the Yellowstone National Park. The creation of a storage reservoir would cover about 8,000 acres of unsightly swamp land now infested with mosquitoes and flies and would create a beautiful lake. This portion of the park is never seen by tourists and never will be, for it contains no points of interest. Its scenery and natural conditions are exactly the same as may be observed over a course of 100 miles in approaching the park from the southwest. Here is a case where the beauty of the park would be increased by the development. Moreover, by utilizing this now wasting water 200,000 acres of now arid lands would be reclaimed and a thriving agricultural community established. Thus the water resources of a national park could be utilized



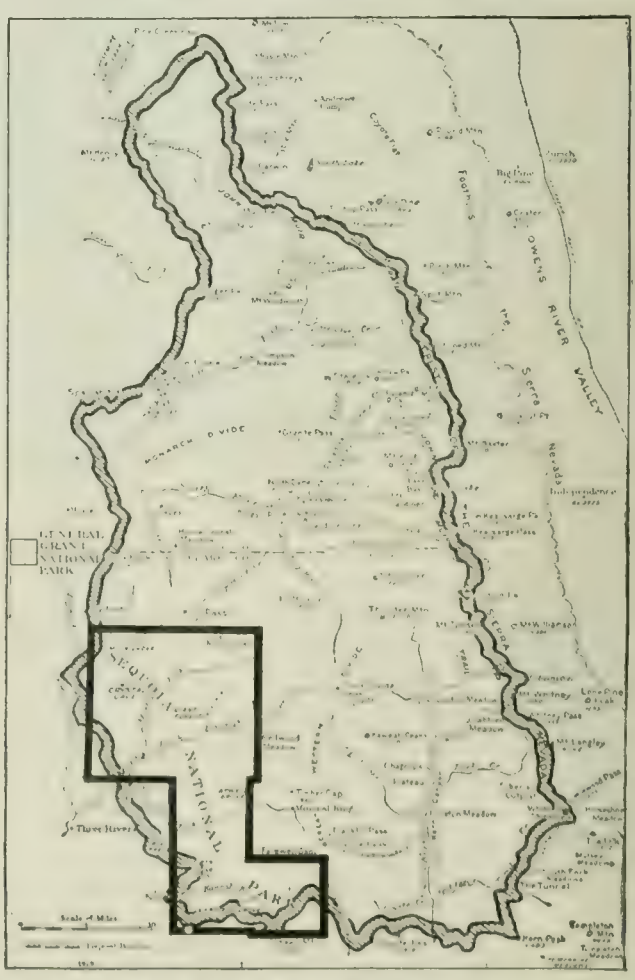
MAP SHOWING THE PROPOSED ENLARGEMENT OF THE CRATER LAKE NATIONAL PARK



MAP SHOWING THE PROPOSED ROOSEVELT NATIONAL PARK IN RELATION TO YOSEMITE NATIONAL PARK



MAP SHOWING PROPOSED ENLARGEMENT OF YELLOWSTONE NATIONAL PARK AND DEVELOPMENT OF SOUTHERN ENTRANCE



MAP SHOWING PROPOSED ENLARGEMENT OF SEQUOIA NATIONAL PARK INTO ROOSEVELT NATIONAL PARK, CALIFORNIA

for much-needed purposes and the beauty of the surrounding scenery be at the same time greatly increased.

The necessity for the development of the water powers of the country is shown by the fact that since the enactment of the federal water power law in June last the Federal Power Commission has received 102 applications for permits, which will, if taken advantage of, mean the development of 7,500,000 hp. This would cost more than a billion dollars and would create taxable values of that amount. The work would require hundreds of thousands of men for a number of years, would save 50,000,000 tons of coal, would cheapen the cost of many of the necessities of life and would be of direct benefit to every inhabitant of the United States.

The foreign nations — France, Italy, Switzerland, Sweden and other countries — immediately after the close of the war turned their attention to the development of their water powers. The shortage of coal during the war had given them a tremendous object lesson as to the value of power, and the very first constructive thing they did was to begin the utilization of their wasting water powers. The foreign countries have cheap labor, which this country has not. The development of their water powers is going to give them cheap power, and with these two elements of cost upon a very low basis, they will be placed in a commanding position in bidding for the markets of the world. If the United States is to compete with Europe in foreign trade it must at least have cheap power for industrial use.

WILL HELP REDUCE H. C. L.

In the western part of the country there are more than 10,000,000 acres of land which cannot be reached by gravity water and can only be reclaimed by water pumped by the electric power now wasting. It would require fully 5,000,000 hp. to operate these pumping plants. An agricultural population of fully 500,000 could be maintained on these acres, and the products would materially tend to reduce the cost of living.

The electrification of a thousand miles of the Chicago, Milwaukee & St. Paul Railway has shown such economies in transportation costs that other Western roads are planning to do likewise whenever the water power is developed.

The enactment of the federal water power law has opened up an enormous field for pioneer enterprise. Those who would develop our wasting water powers will reclaim deserts and make farms, build factories and cities, open up new inland waterways, employ labor, reduce the cost of living, increase taxable values and thus promote the welfare and prosperity of the nation.

The water-power act provides "that licenses shall be issued within any reservation [including national parks and monuments] only after a finding by the [Federal Power] Commission that the license will not interfere or be inconsistent with the purpose for which such reservation was created or acquired, and shall be subject to and contain such conditions as the secretary of the department under whose supervision such reservation falls shall deem necessary for the adequate protection and utilization of such reservation."

Thus the Department of the Interior, which has supervision of the national parks, can by wise administration permit the utilization of the water resources so necessary to the growth of the Pacific Coast States and at the same time fully protect the natural wonders contained in the parks, with the result oftentimes of enhancing the beauty of their surroundings.

Electrifying the Foundry Core Room

Cores Baked in Electrically Heated Ovens Shown to Have 50 to 200 per Cent Greater Strength than Those Baked in Fuel-Fired Ovens

BY J. L. JONES
Westinghouse Electric & Manufacturing Company
Experimental Laboratory

PRESENT-DAY foundry practice calls for closer attention to the core department than was given it in the past. Core baking in particular has received little attention, and the old fuel-fired ovens, which had in most cases neither insulation nor temperature control, are being supplanted by electric ovens.

Tests which have been run on recently installed equipments have shown that the electric oven has the following advantages: Uniformity of temperature, freedom from gases, higher speed of baking and more uniform quality. No attempt was made in the tests to obtain very accurate readings of the energy consumed, but it is estimated that about 12 lb. (5.4 kg.) of green cores were baked for each kilowatt-hour.

TABLE I—THREE CORE MIXTURES WHICH WERE BAKED FOR TEST PURPOSES IN OVENS HEATED BY ELECTRICITY, GAS, AND GAS AND OIL

	No. 3 Molding Machine Work Per Cent	No. 4 Heavy Bench Work Per Cent	No. 7 Spider Cores Only, Per Cent
Silica sand	63 92	16 03	97 30
Molding sand	21 35		
Sand blast dust	11 88	19 60	
Old core sand		64 14	
Oil	1 78		2 03
Dextrine	1 04	0 23	0 67

The tests were made to determine what would be satisfactory baking conditions for the electric core oven and to ascertain some of the advantages of this oven over fuel-heated ovens. It was not intended to deal specifically with any particular type of oven, but to investigate some of the advantages of electric heat in an oven where ventilation is carefully regulated, the temperature accurately controlled and the heaters so

TABLE II—COMPARATIVE STRENGTH TESTS WHICH WERE MADE ON FOUNDRY CORES BAKED UNDER VARIOUS CONDITIONS

Mixture	Temperature (Deg. Fahr.) Initial	Temperature (Deg. Fahr.) Final	Baking Time, Hours	Crushing Load (Lb.)	Tensile Strength (Lb.)	Per Cent Moisture—Core Sand	Per Cent Moisture—Baked Cores	Energy Consumption (Kw.-hr.)
ELECTRICALLY HEATED OVEN								
No. 3	300	300	3	293	21	5 74	0 15	40
No. 3	300	450	1½	1,739	187	5 44	0 15	40
No. 3	300	500	1	1,516	142	5 44	0 11	20
No. 4	350	350	1½	276	46	6 38		20
No. 4	400	400	1½	1,206	105	6 47	0 14	40
No. 4	450	450	1½	1,590	132	6 38	0 14	60
No. 7	300	300	1	815	97			20
No. 7	350	350	1½	1,313	118	6 13		40
No. 7	400	400	2	3,854	342			80
OVERHEAD GAS HEATED OVEN								
No. 3			2	707	62	5 44	0 12	
No. 4			2	779	65	6 38	0 14	
No. 7			2	997	87	6 17		
GAS AND OIL FIRED OVEN								
No. 3			1	832	140	5 44	0 15	
No. 3			2½	1,519	192			
No. 4			1	633	57	6 38		
No. 4			2	779	78	6 38	0 16	

placed as to give a uniform temperature in all parts of the oven.

The oven used was of a draw-shelf, commercial type. It was 5 ft. 8 in. (1.75 m.) wide, 6 ft. 8 in. (2.03 m.) deep and 7 ft. 6 in (2.29 m.) high, of sheet-steel construction, with walls about 4 in. (10 cm.) thick, fairly well insulated except on the bottom, where the concrete floor allowed the escape of considerable heat. The oven was equipped with a fan driven by an adjustable-speed motor and so arranged that the air could be exhausted or recirculated or a portion could be exhausted and the rest recirculated. Accurate thermostatic control was provided.

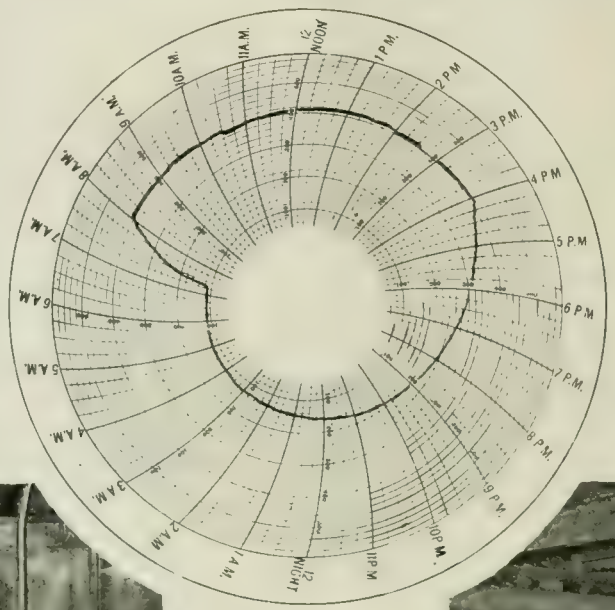
As it was desired to ascertain the conditions under which cores of the very best quality could be produced, a number of runs were made on each of the above mixtures, varying the temperature and time of baking. Test cores of two kinds were used to judge thoroughness of the baking. For the tensile test the regulation brass molds designed for making specimens for cement testing were used, and for compression a 2-in. (5-cm.) cube was made. Compression and tensile test pieces were placed on the top, middle and bottom shelf with each lot of cores.

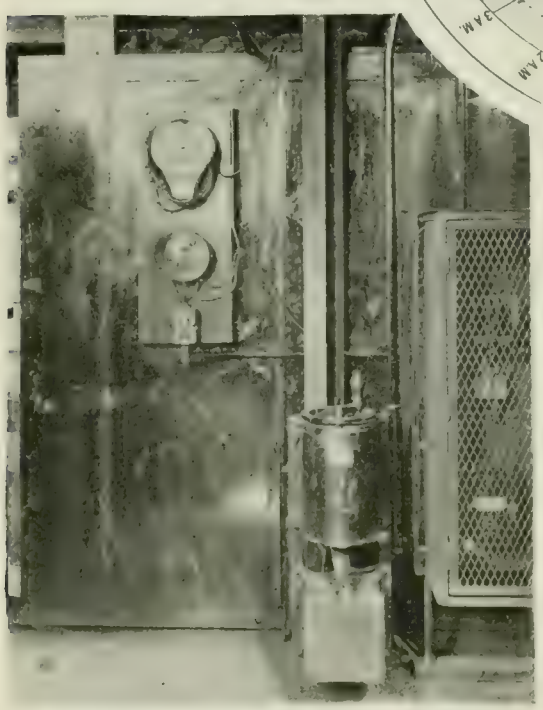
Prior to making the tests a number of runs were made to insure the satisfactory ventilation of the oven. In this case the oven was operated at a constant temperature of 400 deg. Fahr. and loaded with weighed charges of production cores, test pieces being placed on the top, middle and bottom shelves. The rate of change of the air in the oven was controlled by dampers and the speed of the motor, the air pressure being registered with Pitot tubes. The changes of air were obtained by calculation from the volume of the oven and the pressure temperature of the air exhausted and recirculated. Recirculating the air thirty times per hour was the rate decided upon and used in the tests made.

The results obtained in the comparative tests show that the electrically heated oven produces cores having from 50 to 200 per cent greater strength than the fuel-fired ovens. In baking large cores containing oil it is customary to heat at a low temperature at first to allow the moisture to escape before the oil hardens. The first tests on No. 3 core mixture showed, however, that this is unnecessary on small cores. The excessive moisture (26.70 per cent) which was found on one test did not crack the cores or injure them in any way. It is undesirable, however, as energy is wasted in expelling it. An inspection of the results obtained indicates that baking at 450 deg. Fahr. for somewhat less than one hour gives the best results. The dextrine binder seems to be weakened by prolonged baking above 400 deg. Fahr. However, overbaking by 50 per cent does little harm. One lot of cores containing oil which was baked overnight because of neglect to turn off the current was found to be of good quality. When forcing an oven at a high temperature, time-clock control or an alarm clock is useful to indicate when the cores should be removed to prevent overbaking and waste of heat.

It was found that the weight of the cast-iron core plates was almost equal to the weight of the cores. It is desirable to reduce the weight of the core plates to the minimum consistent with stiffness. However, the current loss due to heating these plates is only about 20 per cent of the radiation loss of the oven.

This information was presented before a recent meeting of the American Foundrymen's Association.







Electric Core-Baking Ovens Are Supplanting Fuel-Fired Equipment Because of Proved Superior Operating Results

Control equipment for a shelf-type oven is shown in the view on the left. The temperature control is by thermostat, the graphic chart indicating the exactness of regulation. As shown on the right, the draw shelves are pulled out on a roller carriage.

Factors Governing Rural Extensions

Six That Need Careful Consideration Are Pointed Out by Wisconsin Commission in Approving Rural Service Rules Features of Rules Are Cited—Basis for Rates, Financing and Ownership Are Discussed

By G. C. NEFF
General Superintendent Wisconsin Power, Light & Heat Company, Madison, Wis.

ADMITTING that rural extension presents so many problems that rules to cover adequately all the points that may arise are out of the question, the Wisconsin Railroad Commission has none the less approved regulations which it holds cover the more important factors and the application of which will provide data for the further development of the code. The rules in question were filed by the Wisconsin Power, Light & Heat Company, the Central Wisconsin Utilities Company, the Wisconsin Valley Utilities Company and by several other Wisconsin light and power companies. They have since become known in discussion as the Wisconsin rules, though the commission has not made them mandatory for the entire state, feeling that much more development work and investigation must be carried out before a final and definite code can be adopted. At present this code constitutes the most definite and probably the most consistent step that has yet been taken in solving the problem of rural service.

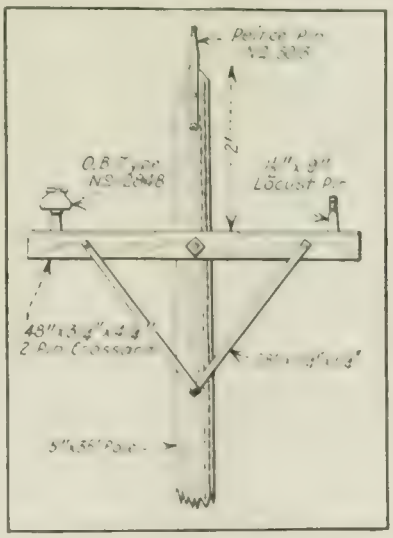
Factors to Be Considered

Several definite factors were pointed out by the commission as needing careful consideration on the part of utility men. They are as follows:

(a) It is important that a utility develop its rural business on such a basis that it will be self-supporting within a reasonable time and impose no undue burden on the urban consumer.

(b) The fixed charges, losses and operating expenses are much greater than the same items for an equivalent income from urban business.

(c) Adoption of high construction standards may in many cases make the service prohibitive in cost, but the connection of inadequate or unsafe construction to the transmission or distribution systems of a utility introduces a hazard to the entire service which cannot be tolerated.

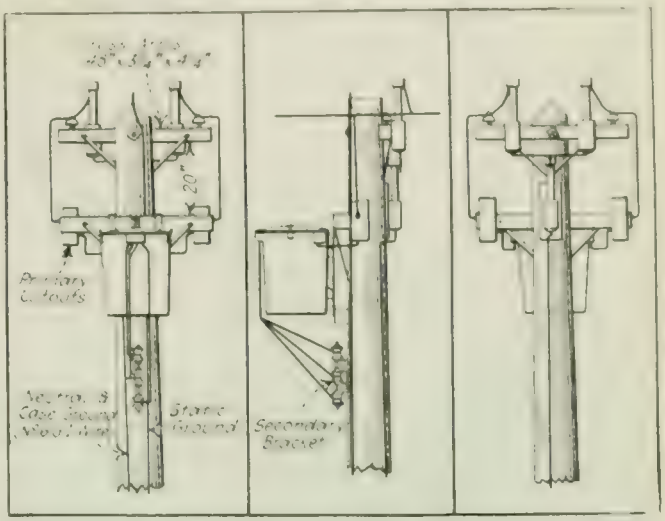


POLE-TOP CONSTRUCTION FOR RURAL LINES

Suitable for single-phase in beginning and convertible to three-phase when necessary. The ground wire is coiled in a spiral of three turns and stapled to bottom of pole. The riser is similarly fastened every four feet.

(d) To encourage development of rural service the business must earn the same rate of return that is considered reasonable in the urban portion of the utilities business and the utility must be permitted to make terms as to financing which will render possible the immediate investment of considerable sums in rural extensions without taxing the resources of the utility for obtaining capital.

(e) The organization of rural consumers into corporations forces the rural consumer into a business



TRANSFORMER MOUNTING FOR 6,600-VOLT RURAL LINES

about which he knows little, burdening him with the expense of an organization and the compilation of comparatively unimportant but legally necessary reports, and places responsibility for maintenance of lines and equipment in inexperienced hands, with all the consequent liability to trouble.

(f) While the rules do not provide for apportionment of the cost of lines among the various consumers, it is the opinion of the commission that a rural extension should, as far as practicable, be considered a community enterprise in which all will benefit equally, even though in the final analysis strict justice would probably demand that no consumer should pay more as a member of a group than he would if he were served under the rules as an individual.

The foregoing points must be thoroughly considered in any scheme of rural service and carried in mind in the discussion of the following rules:

Rules Governing Rural Service

I. *Rural Extensions Defined.*—Rural extensions as herein used shall include all extensions to distribution systems built primarily to serve consumers located outside the corporate limits of cities or villages or other territory which has the character and density of population similar to urban conditions.

II. *Cost of Extensions Defined.*—Estimated construction cost shall include all material, labor and other expense required for the distribution and installation of poles, wire, crossarms, insulators, line hardware, switching and protective devices, transformers, appurtenances, right-of-way permits, etc. Metering equipment shall be supplied by the utility, and the cost of same shall not be included in the estimated construction cost.

An item not exceeding 10 per cent of material cost shall be included to cover purchasing expense, freight, cartage to storeroom and stores department expense.

An item not exceeding 15 per cent of all above-mentioned items shall be included to cover general overhead, engineering, promotion, office supervision, clerical labor, contingencies, etc.

III. *Analysis of Extension.*—When one or more prospective rural consumers make application for electric service the utility will investigate the extension, ascertain the number of consumers who can be advantageously served, the number who will contract for service under the terms herein prescribed, and will estimate the construction cost as outlined in Rule II.

IV. *Payments by Consumers.*—When the prospective consumers shall have paid to the utility the estimated construction cost of the extension the utility will construct the extension and render service.

If the actual construction cost exceeds the estimated construction cost each prospective consumer shall, upon demand, pay a part of the difference in proportion to the amount originally advanced. If the actual construction cost



ELECTRICITY CAN BE USED FOR THRESHING, ENSILAGE CUTTING, MILKING, ETC.

The demand for electricity in rural districts exists, so that if the service is properly financed the business may become profitable eventually.

is less than the estimated construction cost, the utility will refund the difference to the consumers in proportion to the amount advanced.

V. *Connection Charge.*—Before service is rendered from an extension a connection charge shall be filed with the commission, which charge shall be applicable to additional rural consumers desiring connection to the extension subsequent to the consummation of the original agreement.

This connection charge shall be determined by dividing the actual construction cost of the extension by the number of original consumers.

If an additional consumer desires connection to an extension and can be connected in such a manner that the estimated cost of the line extension required is less than the connection charge the consumer shall pay the connection charge to the utility and the utility shall connect the additional consumer and render service.

The difference between the actual cost of the line extension required to serve the additional consumer and the connection charge paid by the additional consumer shall be refunded to the consumers, including the additional consumer, in proportion to the total amount paid toward the construction cost. In case an additional consumer desires connection to an extension and the estimated construction cost of the required extension is greater than the connection charge the consumer shall pay to the utility the actual cost of the extension instead of the connection charge and no refunds will be made to the original consumers.

In case an urban consumer is connected to a rural extension in such a manner that the actual cost of connection is less than the free limit as defined in the urban rules of the utility, then the difference between the urban free limit and the cost of connection of the additional urban consumer shall be refunded to the original rural consumers in proportion to the amounts advanced.

VI. *Rates.*—The rates for rural service shall be: (a) A rural charge plus (b) the regular urban rates.

(a) *Rural Charge.*—The rural charge shall cover the amount by which the fixed charges, energy losses and operating expenses incident to rural service exceed the corresponding items for city service.

1. Annual rural charge for extension: The annual rural charge for the extension shall be equal to 10 per cent of the total construction cost of the extension plus the total transformer core losses per year computed at a rate of 1½ cents per kilowatt-hour minus 13½ per cent of two times that part of the annual revenue from the extension which is computed at the regular urban rates.

2. Annual rural charge for individual consumer: The annual rural charge of the individual consumers will then be determined as follows: Fifty per cent of the total annual rural charge shall be apportioned equally among the consumers. Fifty per cent of the total annual rural charge shall be apportioned among the consumers according to installed transformer capacity. In case two or more consumers are served from the same transformer the installed transformer capacity for each consumer shall be considered as the estimated portion installed for the requirements of each individual.

3. Monthly rural charge: One-twelfth of the annual rural charge so apportioned to each consumer shall be billed monthly by the utility and paid by the consumer as the monthly rural charge.

(b) *Regular Urban Rate.*—In addition to the rural charge the consumer shall pay the regular rates charged for service in the adjacent urban community where the extension originates. This charge will include all minimum-service and demand charges which are a part of the urban rates.

VII. *Annual Adjustment in Rural Charge.*—Adjustments will be made in the rural charge at the end of each calendar year to allow for changes in the number of consumers, changes in revenue from line, changes in transformer capacity, etc., and the rural charge then fixed shall be effective for the folllowing calendar year.

VIII. *Combined Transmission Line and Rural Extensions.*—In case the rural extension is constructed for use partly as a transmission line to some large consumer, city, village or hamlet and the business to be derived from the use of the extension as a transmission line is inadequate to justify the construction of the extension without a portion of the cost being paid by rural consumers the matter shall be referred to the commission for determination as to the fair apportionment of costs in case of failure of the parties involved to agree.

IX. *Title to Extensions.*—The title to all extensions toward which consumers have advanced money shall remain with the utility.

X. *Extensions from High-Voltage Transmission Lines.*—Rural extensions from transmission lines of over 15,000 volts may be considered special by the utility.

[XI.-XV. Five other rules are included, covering access to premises, inspection rights, continuity of service, urban rates and default, but they are not peculiar to rural service nor are they new.]

Basis of Rate Form

The largest amount of discussion has centered about the form of rate. The cost of serving a rural consumer was divided into operating and maintenance expense, power losses, depreciation and taxes. On these

items the urban rate covers the normal, while the excess for rural service must be covered by the rural charge. In addition, the return on investment was considered, but this is covered by the urban rate, since no investment other than metering equipment is made by the utility. The basis of the 10 per cent factor is as shown in the accompanying table.

	Per Cent
Excess operating and maintenance expense, based on the rather meager data available	2.5
Depreciation	4.0
Taxes	1.5
Allowance for hazard and cost of developing the business	2.0
Total	10.0

Taking 10 per cent on the total cost of a rural extension duplicates the factors covering the same items in the urban rate, and a correction factor to eliminate the duplication is necessary. This was arrived at by examining data from twenty-five utilities, by which it was determined that the normal investment in distribution systems per urban consumer was approximately twice the annual revenue. Thirteen and one-half per cent (returns, 8 per cent; depreciation, 4 per cent, and taxes, 1½ per cent) of the normal investment per consumer (*i.e.*, twice the annual revenue) was therefore eliminated from the 10 per cent factor in the rural charge.

In the consideration of losses the committee assumed that the total primary loss, transformer copper loss and secondary loss in rural service is equal to the same losses in city service, and the excess energy loss in rural distribution was considered as equal to the total core losses of all transformers used in supplying rural service. As originally formulated, the rules called for computing this part of the rural charge at the utility's power rate, but the rules as filed were amended to require computation at 1½ cents per kilowatt-hour.

The statement of the method of calculating the rural charge is confusing at first glance, but analysis indicates that it is along the right lines, the method of statement being due to a lack of definite data which will be supplied by careful analysis of extensions made under the rules. The attempt was to establish a principle rather than a definite rate. Concentration on the study of the factors involved will solve the specific problem and produce a clearer statement of the rule.

Cost of Extensions, Financing and Ownership of Lines

The method of estimating cost of extensions is important, as it recognizes the factors of purchasing, stores handling and hauling, engineering and other general expenses that are too often forgotten, but have nevertheless to be met. Many of the cost figures on rural extensions that have been given in various meetings and publications ignore these factors completely.

Objections have been raised to the rules because they give to the utility property showing no value on its books that in later years, when large networks have been built up, will prove embarrassing in property and rate adjustments. Provision has been made to care for this in the Wisconsin Accounting System. The commission has pointed out that the problem of the moment is one of financing, which must be done at the lowest possible rate if at all. Future financing will undoubtedly be determined by the development of the business. Adjustment to changing conditions should not be a difficult problem if utility records are properly kept.

In general the rules are on trial. No one feels that the final answer has been reached. It is felt strongly that the principles upon which they are based are sound and that, pending experience which will clarify their language and development, they furnish a safe guide to prevent major errors and permit ready correction of minor ones. The latter are undoubtedly present but not visible because of lack of experience that enables operators to detect them.

The data on which the 10 per cent return on the cost of extensions is based is too meager to allow confident assertion of its sufficiency, therefore those engaging in rural service work under this plan should concentrate their efforts on the collection of data bearing on the subject. Arrangement of accounting methods to show these costs accurately from year to year is a necessary step in the study as well as means of collecting and tabulating data on ways and means of handling maintenance.

Mines Versus Tidewater as Locations for Super-Power Stations

A NUMBER of reasons have been advanced by George S. Rice, chief mining engineer of the Bureau of Mines, for the location of super-power stations at the mines rather than at tidewater. Since the whole matter of super-power in the Boston-Washington area is now under study, Mr. Rice has given out the following statement of his views:

"There is no difficulty whatever in finding suitable locations in the North Appalachian coal fields so far as grouping mines is concerned. The coal requirements could be satisfied in any one of the following localities, where abundant coal resources can be found for a period of seventy-five or a hundred years within a distance of 20 to 30 miles of the respective points:

"Anthracite District of Pennsylvania.—Wilkes-Barre, on the Susquehanna River, 100 miles from New York; Mauch Chunk, on the Lehigh River, also 100 miles from New York.

"Bituminous Field of Central Pennsylvania and Maryland Fields.—Mount Union, on the Juniata River (Broadtop field tributary), 150 miles from Philadelphia; Clearfield, on west branch of the Susquehanna River, 180 miles from Philadelphia; Tyrone, on the Juniata, 160 miles from Philadelphia; Johnstown, on the Conemaugh, 195 miles from Philadelphia; Cumberland, Md., on the Potomac (Myersdale and Somerset, Pa., and Cumberland field tributary), 110 miles from Washington, D. C.

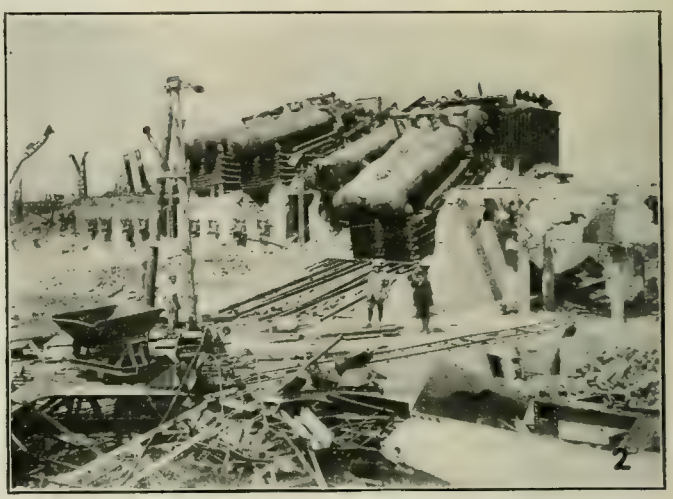
"West Virginia Field.—Fairmont, W. Va., on the Monongahela River, 170 miles from Washington, D. C.

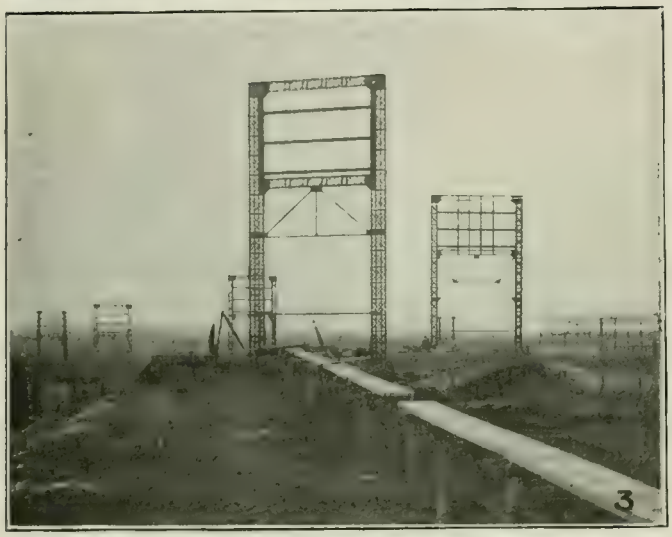
"The size and character of super-power plants in these districts will, therefore, be determined by the water conditions which may be developed rather than by the coal conditions.

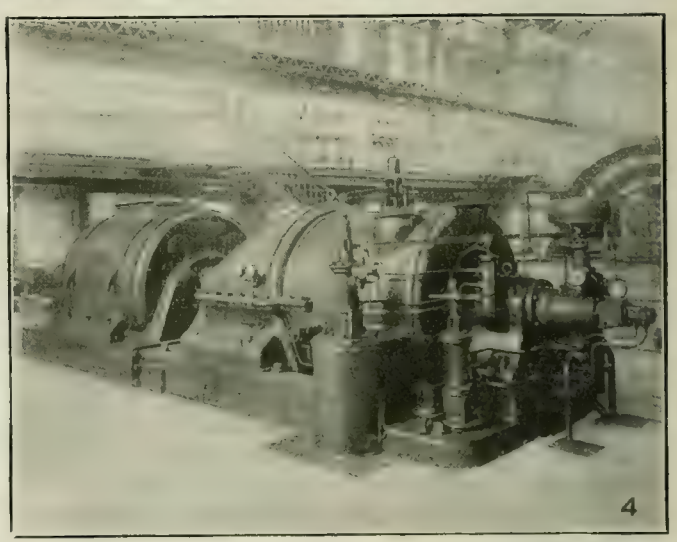
"To locate super-power stations at tidewater will mean long railroad hauls over mountain grades, except on coal hauled from the anthracite field, and distances by railroad of from 150 to 300 miles, and it means the hauling over railroads already crowded to capacity and through congested terminals. It seems evident from recent experience in obtaining fuel, both in the East and the West, that the trouble arose not because of any shortage at the mine but through lack of rail capacity.

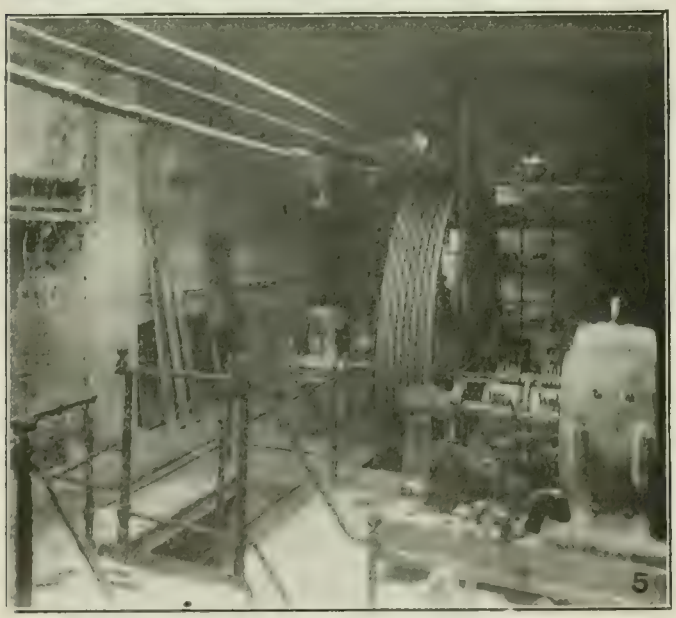
France Is Rapidly Restoring Electric Systems Destroyed During War











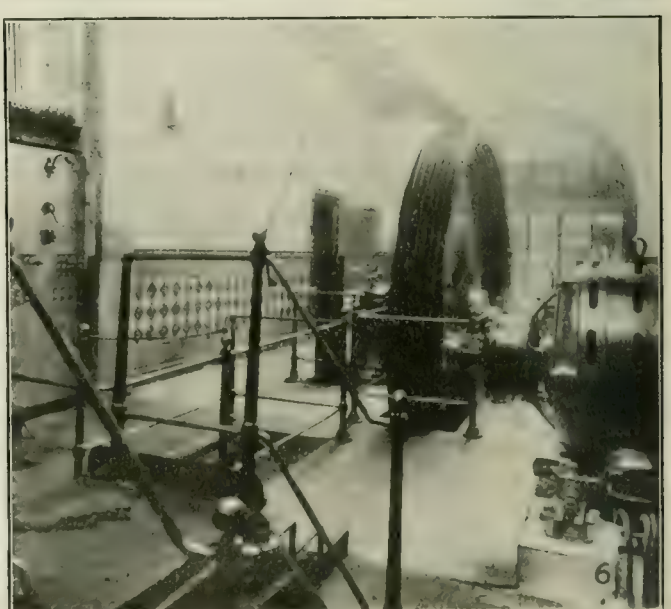


Fig. 1—Compagnie Electrique du Nord, at Beautor, Department of the Aisne. This shows what war did to a 14,000-kw. central station between Soissons and St. Quentin.

Fig. 2—Same plant as in Fig. 1. The reconstruction and salvage under way early in 1919.

Fig. 3—New transmission-line towers for the lines from the station shown in Figs. 1 and 2. The French government network program includes lines from here at 45,000 volts or 65,000 volts, one to Rheims and one to Hirson. Destroyed lines to St. Quentin and other places are being rebuilt.

Fig. 4—Compagnie des Tramways at Lille. The turbo-alternators as well as the boilers were taken away. This view shows the plant once more in operation, Feb. 2, 1920, with a 3,000-kw. Swiss generator in the foreground.

Fig. 5—Engine room of an industrial plant. View taken Feb. 3, 1919, showing the results of bombardment. Note the snow from lack of roof, the few relics of the stolen switchboard and the continuous-current generator.

Fig. 6—The same engine room as in Fig. 5, but taken on Feb. 14, 1920. This shows the reconstructed plant in actual operation, with a new switchboard and an alternating-current generator having directly-connected exciter.

Rebuilding France and Belgium Electrically

Extensive Electrification of Railroads and Industries Included in Reconstruction Plan—Partly Destroyed Central Stations Rapidly Resuming Operation

BY OLIVER FIELD ALLEN
Formerly Major of Engineers, A. E. F.

THE war had been going on less than nine months when the French, in May, 1915, began to think of reconstruction. On May 12, 1915, the Chamber of Commerce of Paris stated that the government must prepare to furnish to the devastated regions as soon as they should demand it tools and equipment, much more useful than an indemnity in money, to insure the immediate resumption of work. The matter was studied during that summer specially by the industrial organizations which had existed before the war, and on Sept. 8, 1915, an organization was created by a committee composed of representatives of the various trades in the invaded regions.

One of the first problems studied was the replacement of the destroyed and stolen electric plants and transmission lines. The investigators realized that power plants must be tied together to exchange surplus energy. It was agreed to make three-phase, 50 cycles, the standard for all electric service except the electrification of steam railways, for which 1,500 volts, continuous current, has since been adopted. Ordinary distribution systems for lighting and small power are at 3,000 volts. Main transmission and power systems are from 5,000 volts up to 120,000 volts, according to size and distances. A rating of 5,000 kw. was selected as one generally applicable to turbo-generators, and several units of that rating were ordered from French builders in 1917. A few were installed in 1918.

By 1917 the extensive use of electric power in war became general, and the first part of 1918 found the French and the British services closely co-ordinated, electrical energy being available along the entire line of the western front.* Many miles of transmission lines had already been built behind the lines. Central-station and industrial power plants had been interconnected, and in some cases augmented by additional units. There were, in addition to the little portable gasoline sets, used by the hundreds, and the big stationary plants of the S O S., 50-kw. power plants installed on freight cars, which could be left on sidings near places where more energy was required. Army electrical construction is being used as far as possible for peace-time work. The woodworking establishment of the American army concrete factory, for instance, with its 5,000-volt transmission line, substation and motor-driven tools, all installed by our army engineers, is now busy building wooden parts for houses for the reconstruction. The 100,000-volt transmission line from Switzerland to the northern edge of the Department of the Vosges, started in 1918 by the Service Electrique to give more energy to the armies to be massed before Metz, has been completed by civilian enterprise.

The need for a comprehensive distribution system and for the greater use of electric motors was fully appreciated and the problem studied with a thoroughness surprising in view of the attention which had to be given to day-to-day war needs. While the Germans were at the very gates of Paris the officers of the Service Electrique and the technical men of the big electric companies, with the engineers of the Comptoir Central d'Achat, were planning a great high-tension network for the frontier departments which had been devastated. This developed into a project covering the vast industrial and mining areas from Switzerland northwest through Alsace and Lorraine to Briey and Longy, across the Ardennes, and up through the Nord to Lille, with a main line from the center of the mining district, near Lille, down to Paris, involving hundreds of miles of transmission lines to be built by the French government. They will be the main arteries of the great system and tie together the existing and future local networks. According to the original plan about one-half will operate at 120,000 volts and the rest at 45,000 volts and 65,000 volts. The program for the power houses has now been expanded to include several very large central stations, each of more than 60,000 kw. capacity. By the end of 1919 there had actually been constructed 110 km. (68 miles) of these government lines, and 290 km. (180 miles) were under construction.

The government is carrying on a campaign of education in regard to the greater use of electricity. In a bulletin issued in November, 1919, by the Ministry of Industrial Reconstruction, called "Electrifiez-vous" ("Use Electricity"), after commenting on the large amount of coal imported into France even before the war, the slowness and difficulties of the renascence of the coal-mining industry and the greater thermal efficiency of the large central stations as compared with most factory plants, the following words appear: "The purchase of energy from these networks will result in an important economy of fuel for the entire country."

Some of the accompanying photographs show a little of the destruction of central-station buildings wrought by shell fire, machine guns and bombs. Much of the most valuable equipment was stolen and taken to Germany. The same thing was true of the industrial plants, especially of the steel works, and of mine surface machinery. In the great metallurgical works of both France and Belgium not only were the generating units, and sometimes the boilers, taken but virtually all of the motors. Happily much of this loot has been recovered. The best-informed managers state that its average value is about 50 per cent of its pre-war value.

Allied electrical manufacturers have had to make apparatus and auxiliary equipment to work in connection with that of German manufacture to an extent never dreamed of before the war, for a large part of the electrical machinery of all kinds in the mining and metallurgical establishments of France near the frontier, as well as in Belgium, was of German manufacture.

The situation in Belgium has been very much the same as in France in regard to electrical matters, except as to long transmission lines. Belgium is fortunate in having a large part of her great industries which require power very near her mines. She has been able to resume coal production much faster than France because destruction in her mines was almost entirely confined to the surface works, while in France the shafts and galleries were blown in and flooded. But the Belgians also realize the necessity for fuel economy and are perhaps even more alive than the French to the value of motor drive for increasing production.

*See "Army Electrical Work in the Advance Areas in France," by the author, in *General Electric Review*, August, 1919, Vol. XXII No. 8.

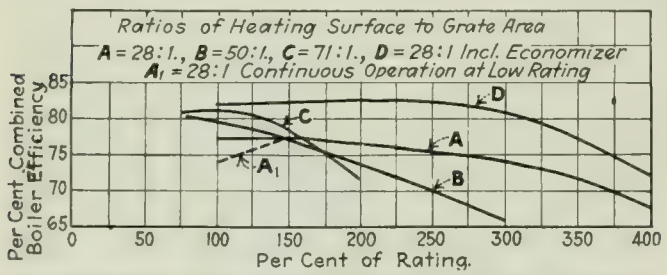
The Effect of Boiler Ratings on Furnace Maintenance

Desirable Ratings and Areas for Industrial and Central-Station Loads—Operating and Design Conditions Which Make for Low Maintenance Cost

By Theodore Maynz
Efficiency Engineer Cleveland (Ohio) Electric Illuminating Company

THE rating at which boiler units should be driven or for which they should be designed depends primarily upon the load characteristic of the plant and upon the cost of the fuel. To determine the best rating an analysis of the steam-demand curve should be made, a test efficiency curve of the complete boiler unit should be plotted, and from the cost of the fuel for various ratings the lowest total production cost should be determined. Having determined the rating for lowest cost of energy the boiler units should be designed or modified to obtain a minimum cost of maintenance.

In industrial plants with steady loads boiler units designed to operate at approximately 125 per cent to 150 per cent of rating will probably produce the cheapest power. Should the load vary greatly and the peaks exist for six or eight hours, moderately high ratings of about 200 per cent to 250 per cent, and even 300 per cent with economizers, will produce the lowest total power cost. In plants where the steam demand varies, for example, from 20,000 kw. to 100,000-kw. peaks of short duration, few units operated at extremely high ratings during the peak loads will produce the cheapest power, even though the boiler efficiency may drop to 65 per cent or 60 per cent.



CHARACTERISTIC BOILER EFFICIENCIES AT VARIOUS RATINGS AND WITH DIFFERENT GRATE AREAS

These curves are for Babcock & Wilcox boilers of different types and sizes equipped with underfeed stokers and with widely differing ratios of heating surface to grate areas.

When boilers are forced considerably above their normal rating, the efficiency of the unit decreases, but the point of maximum boiler and furnace efficiency can be varied considerably by changing the proportion of grate area to heating surface. The curves published with this article show distinctly how the efficiency is increased at low ratings by an excess of heating surface, while the over-stokered boilers are more efficient at high ratings. A point to be considered is that it is extremely difficult to operate stokers at very low combustion rates, so that though tests may show high efficiencies at low ratings on over-stokered boilers, normal operation has shown that this is not maintained (see curve A-1). The grate area is also influenced by the character of the fuel, as the use of a high-ash fuel necessitates a larger grate area than is required with a low-ash fuel. The ratios of heating surface to grate area vary from about 75 to 1 to about 28 to 1. If properly applied, the higher of these ratios would indicate the use of expensive low-ash fuel, boilers normally operated at from 100 per cent to 125 per cent rating, and a constant steam demand.

The economizer and boiler curve D when compared with curve A shows how the economizer increases and maintains the combined boiler efficiency over a large range in load. The rise in flue temperatures due to higher ratings cannot be avoided, and thus far economizers are usually installed when boilers are to be operated at ratings of 250 per cent or more.

The draft loss through the boiler setting increases slightly more than the square of the rating, so that the draft loss at 400 per cent would be a little more than sixteen times the loss at 100 per cent rating. Obtaining chimney draft to remove the gases at ratings in excess of 200 per cent involves extremely high stacks, so that even if economizers are not used, induced-draft fans are usually necessary. These increase the fixed and operating charges.

Both banked and reserve boilers are uneconomical and entail additional first cost and fixed charges for building, boilers and stokers, but provision should be made, especially if the units are few in number, to carry the load if one boiler should have to be taken off the line on account of trouble. In every plant there should be a sufficient number of units to permit maintenance and repairs to be made thoroughly without any loss in steam output. A fair way to determine how many extra boilers a plant should have for twenty-four hour service is to take one boiler plus 10 per cent of the number of boilers required to carry the load. As an example, if the load requires a maximum of eight boiler units operating at, say, 200 per cent rating, there should be ten boilers installed. However, the draft, chimney, flues and stokers should be designed to allow seven boilers to carry the load; that is, on a basis of a maximum of 230 per cent rating on each unit.

Maintenance of boiler, stoker and furnace at high ratings is a serious problem. The maintenance of the boiler itself is dependent upon the quality of the feed water, so that for continuous ratings above 200 per cent to 250 per cent the make-up water must be distilled or treated, preferably the former. Raw untreated water should not be used, even though the same water has been successfully used at lower rates of evaporation. With distilled or correctly treated make-up water, thoroughly systematic boiler cleanings and inspection, the boiler maintenance cost should be the same per 1,000 lb. (450 kg.) of steam produced at all ratings.

The brickwork maintenance increases with the combustion rate, but if the furnace is properly designed and installed, this will not be the limiting factor. A furnace will not last so long at high rating as at low, but a boiler unit whose stoker and furnace is designed for a high output will be much cheaper to maintain than one that was originally designed for moderate outputs and is then forced. The latter condition is the reason for the prevailing opinion that high ratings are extremely destructive to furnace brickwork.

Stoker maintenance is dependent upon the tons of fuel fired. If stokers are designed to maintain high boiler ratings so that the fuel consumed is held to the moderate combustion rates of 50 lb. or 60 lb. of fuel per square foot (250 kg. to 300 kg. per sq.m.), and if there is sufficient draft to eliminate all pressure in the furnace so that the gaseous products of combustion are removed as fast as generated, the stoker maintenance will then be normal.

Maintenance Problems and Solutions

Some Outstanding Problems of the San Joaquin Light & Power Company in Connection with Water and Steam Generating Equipment Are Discussed—Control Systems, Insulator Troubles and Distribution Transformers Are Touched On

By E. A. QUINN* and R. C. DENNY†
San Joaquin Light & Power Corporation, Fresno, Cal.

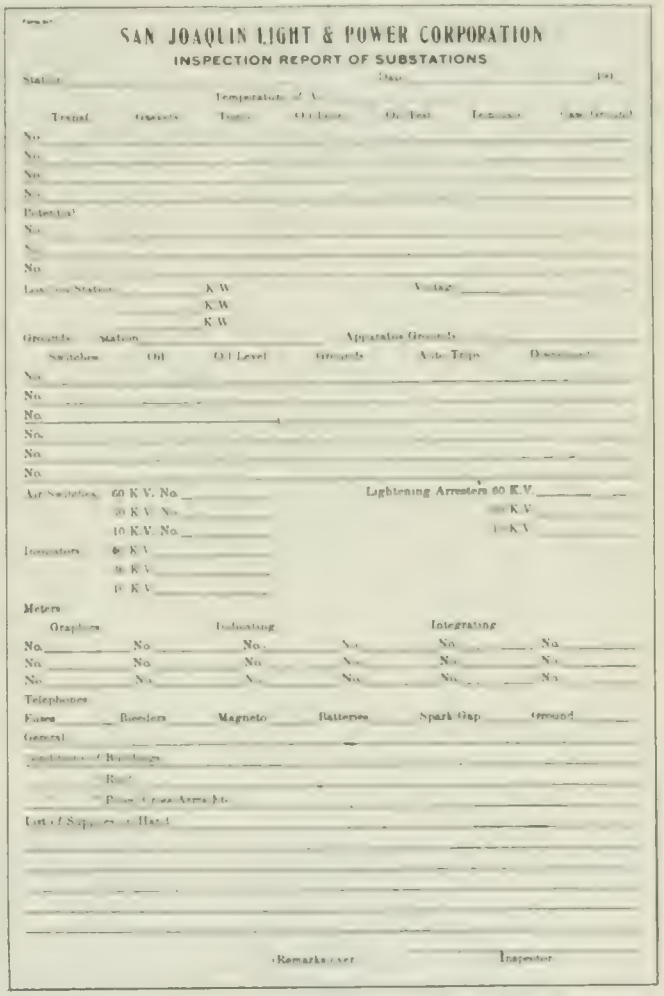
ON ANY electric power system where steam plants form a large part of the output inspection and upkeep of these steam plants are quite as important as any maintenance work on the system, for, if neglected, the greatest hazard to continuous service is incurred, economy of operation is affected, and considerable expenditure is often made necessary. Moreover, this is a phase of maintenance that is difficult to accomplish, as very often these steam plants are required to be on the line continuously for many months at a time. This observation refers to the main units themselves, their condensers and other important auxiliaries that are not provided in duplicate. Turbine troubles may be made evident from outside indications, such as a rapid rise in temperature, while still maintaining a good vacuum, or from the rubbing of buckets causing excessive vibration. Reduction of efficiency may be caused by leaky packing glands, due to low water pressure or to low steam pressure on carbon packing if of that type; in fact, this is quite a common, although not a serious, trouble. Loss of blading is probably more common in turbines operating on extensive high-voltage transmission systems on account of the many short circuits encountered.

Causes of Turbine Blading Failures

The drawing of "slugs" of water over from the boilers into the turbine may give trouble as this sometimes happens during a short circuit on account of the sudden tremendous overload forcing the boilers. It is prevented to a great extent by the use of superheaters, but not in all cases. Another cause of blading trouble is the admission of high-pressure steam to the intermediate stages by the auxiliary valve during a short circuit. This is often serious, and the opening of the auxiliary valve should be somewhat limited and no attempt made to keep the unit up to speed beyond a reasonable overload during a "short." On clearing a "short," with the usual resulting total loss of load and often before normal operation can be resumed, while still maintaining a vacuum, the turbine is subject to serious overheating from windage. This may be prevented by connecting a small steam line with the turbine and using it at such times. Any turbine that has been kept continually in service and subject to short-circuit strains for several months should be opened up for inspection when the system load will permit. Very often worn or broken blades are detected on such examinations, and if these are removed and replaced by new ones, whole stages may be saved, or insufficient clearances may be revealed, the correction of which will prevent the rubbing and possible damage of thousands of dollars' worth of blading.

Condenser troubles where cooling water is drawn from irrigation ditches or ponds are very often due primarily to leaves and vegetation stopping up the tubes. This results in a low vacuum and a hot condenser, and after a few such occurrences the tubes begin to leak. This can be prevented only by the use of trash racks or screens and by employing sufficient reliable labor to keep them clean.

In oil-burning steam plants, or where oil is used as a stand-by in gas furnaces, the inspection and care of the burners and oil-piping system is of utmost importance.



SAN JOAQUIN LIGHT & POWER CORPORATION

INSPECTION REPORT OF SUBSTATIONS

Station _____ Date _____ 191

Temperature of Air

Transf. | Oil Temp. | Oil Level | Oil Test | Insulators | Arm (Ground)

No.
No.
No.
No.

Potential

No.
No.
No.

Load on Station _____ K.W. _____ Voltage _____
K.W.
K.W.

Grounds: Station _____ Apparatus Grounds

Switches | Oil | Oil Level | Grounds | Auto Trips | Disconnecting

No.
No.
No.
No.
No.
No.

Air Switches: 60 K.V. No. _____ Lightning Arresters 60 K.V. _____
30 K.V. No. _____ K.V.
10 K.V. No. _____ K.V.

Insulators: K.V.
K.V.
K.V.

Meters

Graphic | Indicating | Integrating

No. _____ No. _____ No. _____ No. _____ No. _____ No. _____
No. _____ No. _____ No. _____ No. _____ No. _____ No. _____
No. _____ No. _____ No. _____ No. _____ No. _____ No. _____

Telephones

Fuses _____ Receivers _____ Magneto _____ Batteries _____ Spark Gap _____ Ground _____

General

Remarks over _____ Inspector

FIG. 1—SUBSTATION INSPECTION REPORT FORM USED BY SAN JOAQUIN LIGHT & POWER CORPORATION

The strainer in the oil system should be watched closely and not allowed to become clogged. They are generally arranged for blowing out with steam, and a pressure gage each side of the strainer will indicate any stoppage. In regard to the burners themselves, complicated burners should be avoided, as there are simpler ones on the market with fewer parts that are just as efficient and more satisfactory from an operating standpoint. The burner plates are subject to the most wear and they should be inspected often and changed, otherwise they will cause uneven fires, with resulting loss in efficiency and furnace troubles. New burners should be kept on hand and in order, to replace clogged burners.

*General superintendent. †Operating engineer

Probably the greatest cause of reduction in boiler efficiency is the formation of scale. This can be controlled by treating the feed water and should not cause much trouble in a modern condensing plant. Condenser leaks are sometimes responsible for this in otherwise well-regulated systems by allowing the cooling water to get into the boiler water. Tests should be made on the boiler-feed water occasionally, and once a month the boilers should be examined, not only for scale but for leaky settings, baffles and burned or cracked firebricks. Burning and cracking of the furnace walls can generally be ascribed to forcing the fires too hard or to uneven fires, and possibly to burners becoming turned to one side. Cracks should be repaired with plastic cement. Gas fires give little or no trouble in this connection; neither does the gas fire cause any soot deposits.

Maintenance of hydraulic apparatus in water-power plants, while of great importance, does not assume the significance of steam plant upkeep. The moving parts of hydraulic apparatus are generally so massive that years of service will result in only slight reductions in efficiency. This depends a great deal upon the pressure head and whether the water carries much silt or sand;

Form 1166

Tester _____ Date _____ 19____

Power _____ Gas _____ Routine _____

Lighting _____ Demand _____ Complaint _____

Day	Not Registering	Below 90	90-95	95-98	98-99	99-100	100	100-101	101-102	102-105	105-110	Above 110
Mon												
Tue												
Wed												
Thur												
Fri												
Sat												
Total												

FIG. 2—METHOD OF RECORDING METER ACCURACY

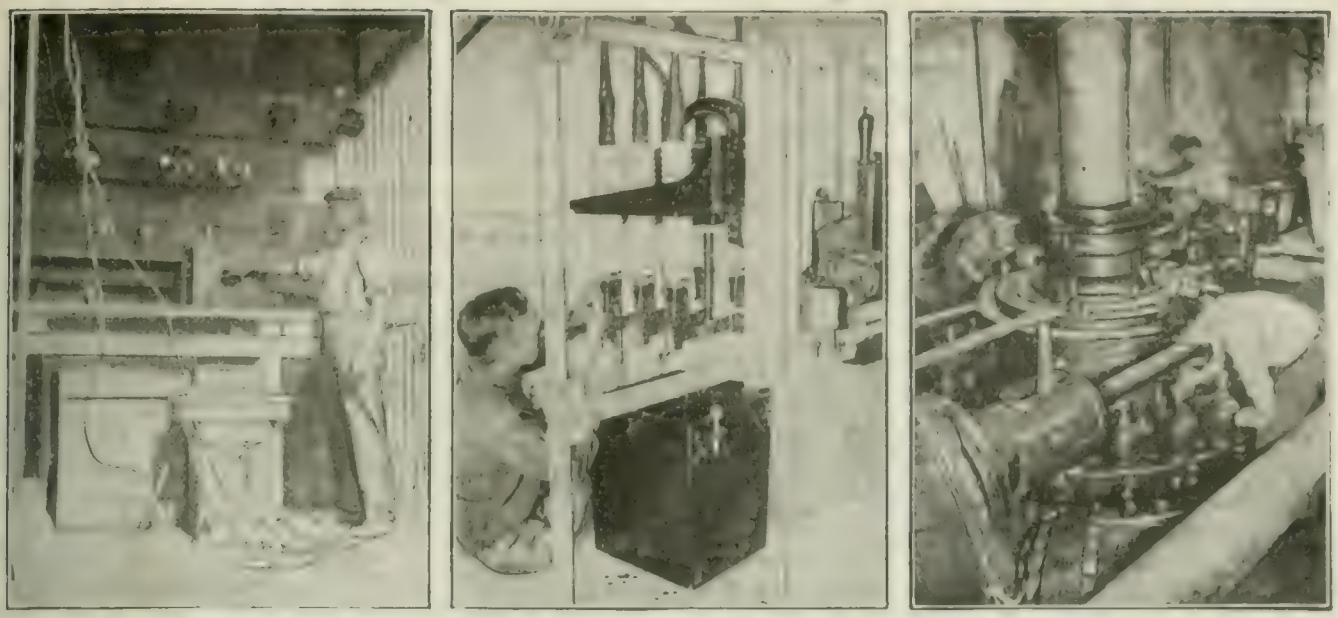
also upon the material of which the runners or buckets are made. Bronze runners operating under a few hundred feet head have been known to wear thin enough to fail completely within three years, while bronze buckets operating at more than a thousand feet head have been in service for ten years. In the one case no sand traps or settling basins were in use, while in the other both methods were used and with great apparent success. Sand is also very destructive to the main needle and nozzle, necessitating frequent replacement of needle tips and throat rings.

In hydro-electric plants having Venturi meters in the penstocks or other accurate means of measuring the water used it is very easy to keep an every-day check on the over-all plant efficiency, and knowing the electrical efficiency to be high and fairly constant, the decrease in hydraulic efficiency can thus be observed. The inspection and maintenance of hydraulic relief valves is highly important, as failure to operate during times of trouble might result in bursting the main pipe line. The water supply to the relay valve of the relief valves is always run through a strainer, and this should be inspected often and kept clean; otherwise the relay valve tips and seats will be cut out and affect the operation of the valve. The relief valve should be opened once a day by hand to note the time of closing. It should be entirely closed as slight leaks will cause cutting of the main piston and seat, or if obstructions cause it to remain open considerably, much water will be wasted. Little trouble is experienced with governor connecting rods or with gate arms and links or shift rings if close attention is paid to turning down grease cups and keeping all packings tight.

There have been several generator burn-outs that have been difficult to account for; that is, failures under absolutely normal operating conditions and with no overload. It is a certainty, however, that in no case was the trouble due to clogged ventilating ducts or to vibration of coil ends. Probably in one or two cases of old generators the trouble was due to deterioration of the coil insulation, inasmuch as the same units are operating in a perfectly satisfactory way with new sets of stator coils and even overloaded. Another case was suspected to be caused by field-coil trouble and loss of excitation, subjecting the stator to short-circuit current and breaking down of coil insulation. Other cases of generator failures are known to have been due to lightning and to high voltage during runaways puncturing the coil insulation. This last-mentioned difficulty can be overcome by the use of a high-voltage cut-out relay in connection with the voltage regulator. There is little protection from lightning where overhead circuits are fed directly from the bus at generator voltage. It was found advisable for this reason to change one or two such circuits to operate at a different voltage, and the necessary intermediate transformers have resulted in adequate protection. The insulation resistance of generators should be "meggered" once or twice a year, or more often, on units that have had particularly severe strains.

Little trouble is experienced in the operation of control systems. Fuses blow occasionally during trouble, probably because of induced disturbances, but cause no great inconvenience. All relay and operating contacts are cleaned at least twice a month and as a result give no trouble. In most cases control systems are operated from separate direct-current generators but are arranged to be switched to exciter buses instantly on necessity.

In the thirteen generating plants and forty-odd substations there are about 400 oil switches, ranging in voltage from 2,300 to 110,000, to be inspected and maintained. This constitutes probably the largest maintenance problem, because it is as extensive as the system itself. In the generating plants this work is taken care of by the chief operator. The substation inspection and repairs are handled by eight men who are constantly on the move from one substation to another in their divisions. In general the arrangement of the oil switches and paralleling buses is such that almost any switch may be taken out of service for inspection and repair without interruption to the circuit that it serves. A large majority of the switches are automatic and quite frequently operate to break considerable over load current. This results in burning and blistering of contact fingers and blades, which is more noticeable on some types of switches than on others. Those having arcing tips in connection with the main contacts give the least trouble. Blistering and burning of contacts is probably the greatest cause of switch trouble and can be detected and remedied only by frequent inspection and repair, at which times particular attention is also paid to loose contact jaws, blades and supporting



AT LEFT, DISTRIBUTION TRANSFORMERS UNDER TEST. IN CENTER, INSPECTING AND ADJUSTING 10-KV. OIL SWITCH. AT RIGHT, TURNING DOWN GREASE CUPS AND TIGHTENING PACK GLANDS ON 15,000-HP. TURBINE

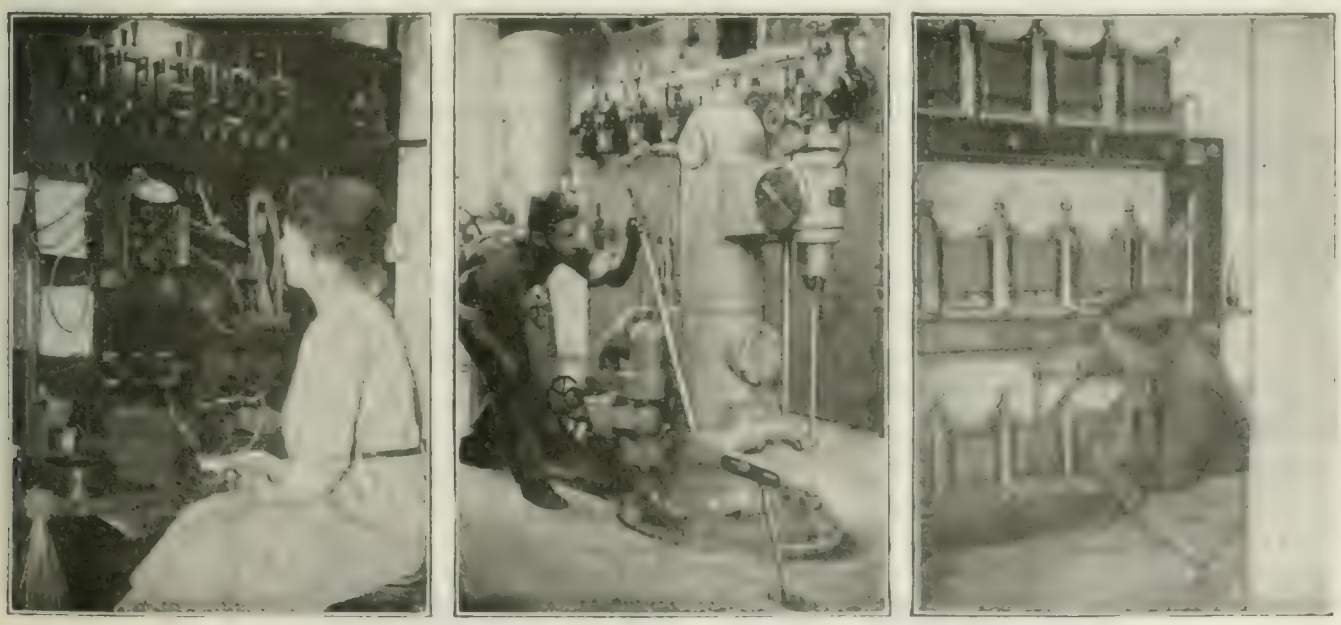
insulators. Bushings and leads are also inspected but never have given any trouble. Oil sometimes leaks from the drain cocks, but this trouble has been prevented by capping them. Oil samples are taken from the switches regularly and tested at headquarters.

All switches are inspected once a month and as a result give very little trouble.

Batteries are not used in the generating stations for tripping switches; however, in the substations they are necessary and storage batteries have been found to be the only reliable battery for the purpose. Ordinary portable automobile-type batteries are used and are carried by the inspector once each month to central points where they are charged by small rectifiers. Several extra batteries are provided in each division and kept charged for replacements.

Probably the greatest source of trouble with distribution transformers is caused by broken or loose bushings causing the leads to be pulled down and "short" on the case inside the transformer. Bare leads are a necessity to prevent the oil creeping up and rotting the insulation. Terminal boards are rarely every primarily the cause of trouble but are often "shot" by lightning, causing a short circuit and burn-out of transformer. Defective insulation and moisture in oil are accountable for only a very small percentage of transformer troubles. All distribution transformers are fused. The blowing of these fuses is generally the first indication of trouble in the transformer, and this leads to an inspection and tests. With the exception of 2,300-volt transformers, all distribution transformers are inspected once each year for mechanical faults; the condition of the oil is also noted at these times and more oil is added when necessary.

The most frequent causes of insulator trouble on the transmission and distribution lines are those over which the company has little or no control. Many insulators are broken by gun shot, some by stones thrown by



AT LEFT, TESTING METERS IN LABORATORY. IN CENTER, ADJUSTING GOVERNOR ON 15,000-HP. TURBINE. AT RIGHT, TAKING HYDROMETER READINGS IN STORAGE BATTERY

children, and quite a few by large birds and water fowl grounding lines to cross-arms and hardware. Probably only about 2 per cent of these happenings ever actually cause service interruption. A very thorough system of patrol of all lines, approximating 3,700 miles (5,950 km.), at least once each month discloses all broken insulators, and those considered likely to cause line trouble are changed at the time. Considerable trouble was experienced with strain insulators puncturing at dead ends and corners. This has been remedied to a great extent by the use of a different type of insulator. No insulator failures are thought to be due to temperature change, although an average daily variation of 80 deg. Fahr. in temperature prevails through the summer months in the San Joaquin Valley, the yearly maximum and minimum being perhaps 140 deg. Fahr. in the sun and as low as 28 deg. on some winter mornings.

The one remaining important phase of maintenance work is the inspection and testing of consumers' meters. This requires an extensive organization of testers and repairmen under expert supervision. The testing of the 34,000 consumers' meters is handled from three points on the system, with the same methods and records.

All meters are of the induction type, 15 per cent being for power purposes and 85 per cent for lighting. Before the war routine tests were made on all meters, covering lighting meters in twenty months and power meters in fourteen months, more than 80 per cent of all meters testing within plus and minus 2 per cent. However, during the war and afterward, owing to labor difficulties, the periods have lengthened to thirty and twenty-two months respectively. This has had its effect on the accuracy of the meters, as only 73 per cent now test within the plus and minus 2 per cent.

In comparing the accuracy of power and light meters as a whole, the latter type shows less error. This is a natural consequence, since the lighting meter operates under more favorable conditions. It is well protected from the weather and is rarely ever subject to vibration. Of the meters registering between plus or minus 2 per cent, the lighting class shows 83 per cent against 67 per cent for the power class. Of the meters registering below 98 per cent, lighting meters show 1 per cent against 7 per cent for power meters.

The record of meter accuracies is compiled from weekly reports made by each tester on a card form. On these the tester enters the tally of the full load (or normal load), using a separate card for routine power, routine light, complaint power, complaint light, routine demand and complaint demand. The demand record is further subdivided into power or light, and from these weekly cards monthly and annual reports are made up.

Growth of Electrical Industries

1917 Census of Central Stations, Electric Railways, Telephones and Telegraphs Indicates Large Increases During Five-Year Period

THE 1917 census of central electric light and power stations, recently issued by the Bureau of the Census, some of the principal features of which were outlined in the Sept. 4 issue of the ELECTRICAL WORLD, is the final installment of that bureau's 1917 report on the electrical industries, which in its entirety also covers electric railways, telephones, telegraphs, municipal electric fire-alarms and police patrol signaling systems. This is the third report of these industries that has been taken in conformity with the requirements of the act of Congress of June 7, 1906.

Table I gives general statistics relative to the four primary electrical industries and Fig. 1 shows diagrammatically the number of employees, capitalization, income, expenses and net income of the electrical industries for 1902, 1907, 1912 and 1917. The relative importance of the four classes is clearly indicated. The electric railways appear to have led continuously in each of the five items with the exception of net income in 1917, when the central electric light and power stations took the lead in this item. This leadership of the electric railways is only apparent on the surface, however, for in 1917 there were 160 plants listed as electric railways by the Census Bureau which did a very large light and power business. It is probable that if the light and power operations of these 160 companies were credited to the central station industry the relations shown in Fig. 1 would be materially changed. The telephone statistics for 1917, 1912 and 1907 are confined to companies or systems having an annual income of $5,000 or more, whereas the statistics for 1902 cover all systems operated primarily for revenue and include a large number of small organizations and rural lines.

TABLE I—CAPITALIZATION, INCOME, NUMBER OF EMPLOYEES AND SALARIES AND WAGES FOR FOUR BRANCHES OF THE ELECTRICAL INDUSTRY

	Census Year	Total	Central Electric Light and Power Stations	Electric Railways	Telephones	Telegraphs (Land and Ocean)	Per Cent of Total: Central Electric Light and Power Stations	Per Cent of Total: Electric Railways	Per Cent of Total: Telephones	Per Cent of Total: Telegraphs (Land, Rail, Ocean)
Number of companies, stations, or systems	1917	10,076	6,542	1,307	2,200	27	64.9	13.0	21.8	0.3
	1912	8,424	5,221	1,260	1,916	27	62 0	15.0	22.7	0 3
	1907	7,612	4,714	1,236	1,636	26	61 9	16.2	21.5	0 3
	1902	7,789	3,620	987	3,157	25	46.5	12.7	40.5	0.3
Capitalization	1917	$9,991,164,215	$3,060,392,141	$5,532,223,818	$1,169,460,470	$229,087,786	30.6	55.4	11.7	2 3
	1912	8,081,223,659	2,175,678,266	4,708,568,141	970,590,442	226,386,810	26.9	58.1	12.2	2 8
	1907	5,830,667,500	1,096,913,622	3,774,772,096	738,688,207	220,293,575	18.7	64.5	13.0	3 8
	1902	3,324,000,034	504,740,352	2,308,282,099	348,031,058	162,946,525	15.2	69.4	10.5	4 9
Number of employees	1917	696,431	105,541	294,826	244,490	51,574	15.2	42.3	35.1	7 4
	1912	582,452	79,335	282,461	183,361	37,295	13.6	48.5	31.5	6.4
	1907	428,765	47,632	221,429	131,670	28,034	11.1	51.6	30.7	6.5
	1902	277,474	30,326	140,769	78,752	27,627	10.9	50.7	28.4	10.0
Salaries and wages	1917	$571,781,197	$95,241,858	$267,240,362	$169,655,066	$39,643,911	16.7	46.7	29.7	6.9
	1912	383,034,528	61,161,941	200,867,052	96,040,541	24,964,994	16.0	52.4	25 1	6.5
	1907	269,229,021	35,420,324	150,991,099	65,009,349	17,808,249	13.2	56.1	24 1	6.6
	1902	160,152,151	20,646,692	88,210,165	36,255,621	15,039,673	12.9	55.1	22.6	9.4
Income	1917	$1,739,664,159	$526,894,240	$730,564,691	$372,501,800	$109,703,428	30 3	42.0	21 .4	6.3
	1912	1,200,138,640	302,273,398	579,208,430	253,893,969	64,762,843	25 2	48.2	21 .2	5.4
	1907	829,877,604	175,642,338	426,900,952	175,750,446	51,583,868	21 1	51.4	1 3	o 2
	1902	463,982,821	85,700,605	250,526,642	86,825,536	40,930,038	18 5	54 0	8 7	8 8

TABLE II.—RELATION BETWEEN CAPITALIZATION AND NET AND GROSS INCOME

Census Year	Central Stations	Electric Railways	Telephones	Telegraph*
	Per Cent Gross Income Is of Capitalization			
1917	17 2	13 2	31 9	47 9
1912	13 9	12 3	26 2	28 6
1907	16 0	11 3	23 8	23 4
1902	17 0	10 9	25 0	25 1
	Per Cent Net Income Is of Capitalization			
1917	3 3	1 5	5 1	7 8
1912	3 1	1 9	5 3	2 8
1907	3 8	1 8	[illegible]	4 4
1902	3 5	2 1	[illegible]	6 1

*Land and ocean

The proportion which the different items for the telephone and telegraph systems bear to the total for the electrical industries is practically constant throughout the period. On the other hand, there has been in practically every case a steady increase in the relative importance of the central light and power business, and just as certain a decrease in the relative importance of practically all items pertaining to the electric railway industry.

The relations which exist between capitalization, gross income and net income are shown in Table II. Until the last census, 1912-1917, total gross income increased less rapidly than capitalization in the electric light and power industry. In the case of the electric railways the gross income has increased with slightly greater rapidity at all periods, while the relations have been relatively constant for the telephone and telegraph companies. The relation between net income and capitalization is quite different. There has, upon the whole, been a tendency to decrease in all of the industries studied. So far as financial returns in the electrical industries are concerned, the electric railways have constantly been in the worst position by far, followed by the central stations. The public utilities have certainly not been operating under conditions of increasing returns as is maintained at odd intervals.

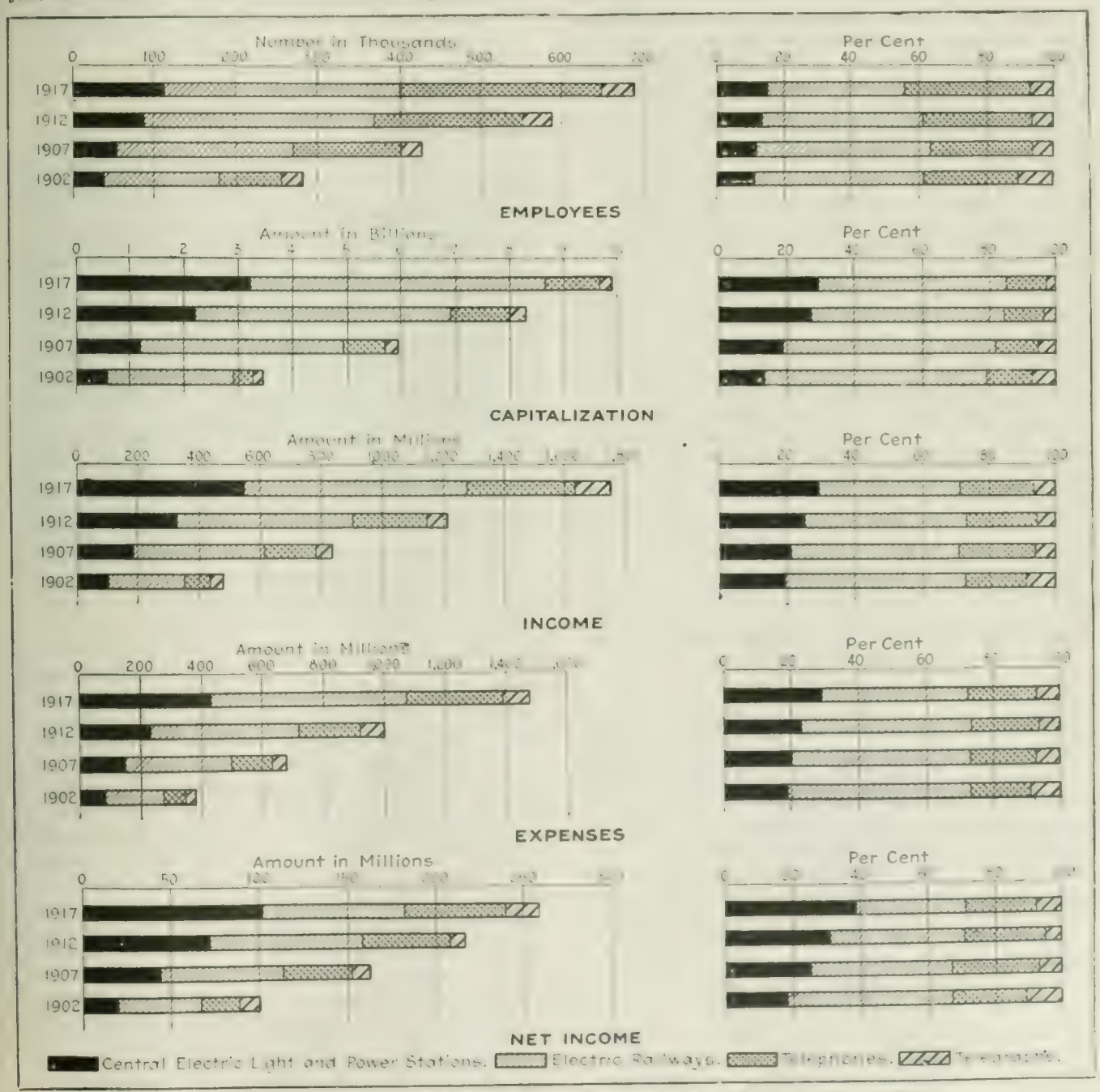


FIG. 1—GROWING IMPORTANCE OF THE CENTRAL STATION IN THE ELECTRICAL INDUSTRY

Readers' Views and Comments

Dr. Butler Turns the Tables

To the Editor of the ELECTRICAL WORLD:

SIR: For a great many years a vigorous and ultimately successful attack was made on the old-fashioned college education, of which Greek, Latin and mathematics formed the triple foundation, on the ground that the results attained were out of all proportion with the effort exerted. It is disheartening to the advocates of the newer studies to have so eminent an authority as Nicholas Murray Butler, president of Columbia University, declare that the criticism once leveled against a classical curriculum can be brought with equal force against the curricula which have largely displaced it. For instance, Dr. Butler says that it is asserted—and he impliedly indorses the assertion—that "for fifty years we have poured out money without stint for the teaching of the natural and experimental sciences and have provided costly laboratories and collections to make that teaching practical, yet the result so far as giving a general command of scientific method or general knowledge of scientific facts is concerned is quite negligible." Dr. Butler's jeremiad contains doubtless only too much of truth, and yet the system and the teachers may not be entirely to blame. Today, as always before, the exceptional man will vindicate his education, whatever it may have been, by his achievements. Today, as always before, no possible college efficiency can change the ordinary into the extraordinary student. If, however, the average culture of the community is less today than formerly, as Dr. Butler seems to think, it is the duty of all concerned with education to reexamine the values apportioned to present-day studies as an engineer would the ratings of machinery from which the output was disappointing.

Brooklyn, N. Y. FRANK W. CHASE.

Court Finds Customer Responsible for Existence of "Jumper" on His Service

To the Editor of the ELECTRICAL WORLD:

SIR: A decision of interest to electric lighting and power companies in general was handed down on Nov. 30, 1920, by Judge Snediker of the Common Pleas Court of Montgomery County, Ohio. The Dayton Power & Light Company has been making strenuous efforts during the past year to break up a practice on the part of some of its customers of tapping ahead of the meter and interfering with the registration of current. The device used to carry current around the meter is usually called a "jumper." When a case of theft is found service is immediately disconnected. In addition to this, a number of customers found using devices to defraud the company have been brought into court, indicted by the grand jury and are now awaiting trial.

In one instance, however, where a jumper was found and service removed, the customer brought mandamus proceedings against the Dayton Power & Light Company to compel it to restore service. At the hearing and also at the trial the company was able to produce two of its own employees and two city detectives as witnesses to the fact that when they called at the house one evening the lights were turned on, the main-line switch was pulled and all the electricity used was passing through a wire around the meter. The plaintiff and his family denied that they had placed the jumper on the service. Nevertheless, the judge immediately handed down a decision denying the prayer of the petition with a severe reprimand to the customer who had brought the proceedings.

The decision is significant inasmuch as it was given in favor of a lighting and power company, although there was no witness to testify that he had actually seen the jumper installed by the customer. The responsibility for the existence of a jumper on his wires is thus placed squarely on the consumer. The decision also sustains the legal right of a utility company to protect itself against consumers who obtain service through fraudulent methods. O. B. REEMELIN,

General Superintendent.

Dayton (Ohio) Power & Light Company.

Lighting and Industrial Accidents

To the Editor of the ELECTRICAL WORLD:

SIR: I have read with interest the article by F. H. Murphy, entitled "Modern Industrial Lighting for Oregon," in the ELECTRICAL WORLD for Oct. 23, and have examined the chart printed on page 820 over the caption "Industrial Accidents Depend Upon Lighting."

Before going further let me say that it is not desired to convey the impression that what may follow advocates the reduction of lighting below a proved safe minimum, but it is hoped that some of your readers may be convinced that the experience of any one company or state does not prove anything definitely. These experiences may point to a tendency, but it is necessary to go further to prove so broad a statement as that the alleged increase of accidents in the dark months is due to a lack of proper lighting.

It is to be regretted that there is nothing under the chart to indicate who furnished this experience. It would help to understand it, for the published statistics available to the writer do not bear out this contention. As establishing the truth of my statement, your attention is called to an article by Lucian W. Chaney, entitled "Influence of the War on Accident Rates in the Iron and Steel Industry, 1914-1919," page 1457, *Monthly Labor Review*, June, 1920. This record is based upon a large number of mills and from 35,000 to 50,000 workers, so that it is fairly representative. On page 1461 of that issue is a table which shows comparisons for 1915-1918. June, July, August, September and October of 1915 are the high months in frequency of accidents per hours of exposure. In fact, January accidents are almost 50 per cent less than those of July, the high month. In 1918 January is the highest month, but October, November and December are the low months. On page 1463 of the same issue is another table showing accidents by months from 1914 to 1919. In 1914 June is the high month, November is the low month. In 1915 August is the high month, January the lowest. In 1916 August is the high month, February the lowest. In 1917 June is high and December low. In 1918 August is high and December low. In 1919 October is high and August low. Other tables might be quoted that are similar to these. J. M. WOLTZ,

Safety Director.

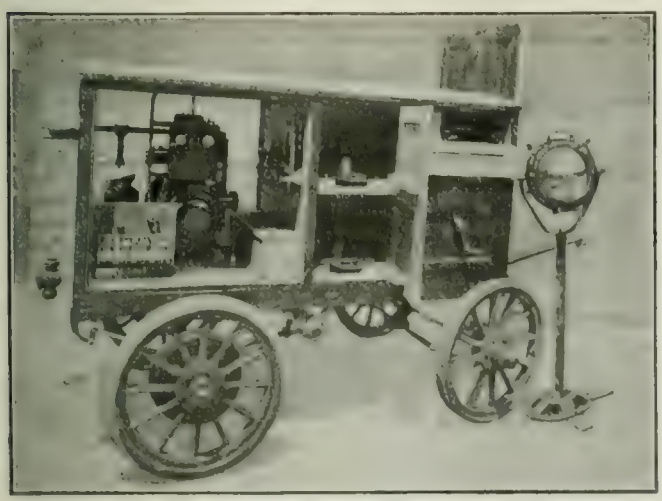
Youngstown (Ohio) Sheet & Tube Company.

Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Portable Generator and Lamps for Outdoor Night Work

FOR lighting work done at night on transmission lines or outdoor substations and similar work a truck trailer has been equipped with searchlamps, extension cables and generating outfit by the Detroit Edison Company. The trailer was made from the chassis of an old electric truck. The generating plant used is a 1-kw. "Delco-Light" portable plant, model 9023, equipped with a 110-volt direct-current generator. It is air-cooled and does not require storage batteries. The fuel used can be either gasoline or kerosene, and by a slight change in the intake valve it can be operated on natural gas. The dimensions of the base



THIS TRAILER CARRIES FOUR FLOODLAMPS AND A 1-KW. GENERATOR FOR NIGHT WORK

are 30 in. x 21 in. (75 cm. x 53.5 cm.) and the height of the engine is 38 in. (95 cm.).

The searchlamps are of the General Electric floodlighting type, having a 15-in. (37.5-cm.) reflector. In use they are mounted on a standard that can be taken apart and placed in a small compartment. Four floodlamps are carried, each mounted in a separate compartment and supported so that no breakage may occur in transportation. A 250-cp. floodlighting lamp is used in each. Extra lamps are carried in a small drawer at the top of the body, each lamp being supported in a socket. Two extra lamps of the gooseneck type are now being made to be clamped on the tops of the poles and reflect directly down for convenience of men working on corner poles or transformers.

At the front end of the body a reel was constructed to carry sufficient wire to extend the lamps at least 1,000 ft. (300 m.) each way from the trailer, which is placed at the most convenient place for lighting the work under way. On the ends of the wire, which is twin-conductor No. 4 stranded, are receptacles. A removable crank extended to the outside of the body enables the wire to be reeled up and conveniently handled. The reel is divided into two sections, one or both of which may be used at a time. At each end of the trailer there are a red light and a license plate. Each section is equipped with removable sides, and when not in use the unit is completely locked up. An inspection is made after use so that the outfit is always ready in case of trouble.

After having built this trailer with the purpose of using it for emergency cases it was found that a great deal of other work could be done at night as conveniently as in the daytime—such as making repairs to outdoor substations, changing transformers and cutting over of transmission lines.

FRED W. BAGNALL.
Detroit Edison Company,
Detroit, Mich.

Rules to Follow During Station Trouble Before Consulting Dispatcher

HOW to handle the situation in case of failure of the alternating-current supply is the subject of an interesting set of rules for the use of its operators issued by the Consumers' Power Company of Jackson, Mich. The theories on which the rules are based are:

1. That operators must do certain definite things preparatory to restoring service.

2. Restoration of service is not helped by communication with the dispatcher, if these things are properly covered by instructions, unless the operator is called or has important information to communicate.

With these two theories in mind a careful study of each station and substation has been made and a definite set of instructions for operators at forty-one points has been worked out. The general rules for operators, applying to all substations, are printed herewith.

RULES FOR OPERATORS TO BE FOLLOWED IN CASE OF FAILURE OF ALTERNATING-CURRENT POWER

In case there are rotary converters or motor generators:

Open all direct-current and alternating-current switches of running machines.

Place alternating-current switches of one machine in starting position and watch for return of alternating-current power.

As soon as alternating-current power is received start machines and restore service in usual manner.

In case there are distribution circuits:

Open all distribution circuit switches and watch for return of power. (The return of power can be determined by hum of transformers, reading of alternating-current voltmeters, lighting of alternating-current lamps and charging of lightning arresters.)

As soon as alternating-current power is received restore service in usual manner or according to special instructions posted.

In case there are both alternating-current and direct-current circuits: (a) Open all direct-current and alternating-current switches of running machines; (b) open all alternating-current distribution circuit switches; (c) prepare and watch for return of power as noted above.

On return of alternating-current power: (a) Restore service to all alternating-current distribution circuits in usual manner or according to special instructions posted. (b) Start machines and restore direct-current service in usual manner.

As soon as service is restored: (a) Make a close inspection of *all* apparatus and note any defects. Pay special attention to brushes, commutators, high-tension insulators, alarm bells, lightning arresters, fuses and meters. Note if broken wedges are around machines or machine band wires are loose. (b) Call load dispatcher or chief operator and report as follows: (1) Service interrupted; (2) time of interruption; (3) duration of interrup-

tion in minutes. (4) cause of interruption if known; (5) damaged apparatus if any.

Operator must notify load dispatcher or chief operator as soon as he is aware of any condition (storm or disturbance) that may affect the service in any way.

Make out "storm or disturbance report" in detail for every storm or disturbance, and if any apparatus is damaged do not fail to make out "damaged apparatus report."

Keep away from telephone during first ten minutes, unless you are called or have important information to communicate. If power is not received at expiration of ten minutes from time of interruption, try to get in communication with load dispatcher or chief operator.

Consider all lines alive until communication is established.

This supersedes all previous rules.

The instructions for a plant that combines generation with transmission-line service are well illustrated by the rules for the operators at the Battle Creek plant, which are as follows:

RULES FOR RESTORING SERVICE IN GENERATING PLANT

(Rules for operations at Elm Street plant, Battle Creek. To be followed in case of trouble on transmission line that interferes with delivery of power.)

(A surge on the transmission line does not necessarily interfere with the delivery of power.)

If the transmission line switches have not opened automatically, start to open them immediately, in the following order, or until the trouble has been cleared:

(a) Open D-4. (b) Open E-5. (c) Open L-12.

NOTE: Immediately prepare to take care of local load. If necessary, cut in additional boilers. If turbines are not running, prepare to get them running. Synchronize with any line as soon as line is energized. If lines are not energized so that you can synchronize, try to energize them as follows:

Try to energize D-4 any time before five minutes have expired from time of interruption. Make at least two attempts to energize this line.

Try to energize the E-5 line any time after two and before five minutes have expired from time of interruption.

Try to energize the L-12 line any time after six and before ten minutes have expired from time of interruption. Make at least two attempts to energize this line.

In all the above cases of closing transmission-line switches stand ready to reopen, should trouble reappear.

Keep away from telephone during first ten minutes, unless you are called or have important information to communicate. Consider all lines alive until communication is established.

This supersedes all previous transmission line rules.

Such rules materially lessen the complication of the dispatching system and leave the dispatcher free to exert his most intelligent efforts in clearing up real difficulties. The story and record of what happened can be procured after the system is back to a normal operating condition.

H. J. BURTON,
Director of Education.

Consumers' Power Co.,
Jackson, Mich.

Life of Cable for Conveying Coal Almost Doubled

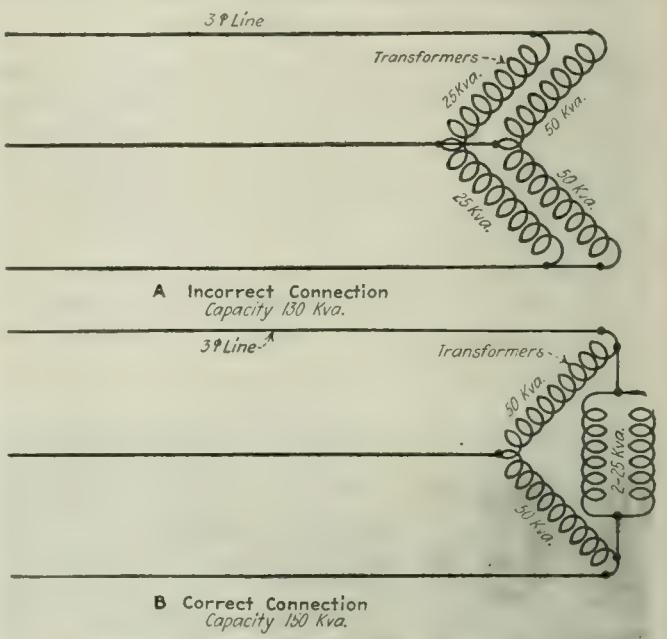
THE life of steel cables and rollers used on cable railways for coal handling has been greatly increased by minor alterations in design on the curves, and principally by changing the roller material and applying guides to reduce friction, in a station of the Philadelphia Electric Company. Previous to this change cables hauled about 30,000 tons of coal before becoming unsafe; the average life is now more than 50,000 tons. The life of the idler rollers was increased from four or six months to eighteen months. These rollers were made of cast iron, in one piece, of the usual spool shape, and weighed about 35 lb. (15.8 kg.) A study by the maintenance section showed that owing to the weight of the rollers the drag of the cable was sufficient to wear but not to turn them. The roller was therefore redesigned to consist of a hollow cylindrical cast-iron wearing piece held between aluminum end disks by through bolts, the whole weighing 13 lb. (5.8 kg.). As a result of the change the rollers turn easily, and when a cylinder wears out, in about eighteen months, it is replaced, using the same end disks, at a cost very small as compared with the cost of a new roller of the original design.

F. C. RALSTON,
Operating Division.

Philadelphia (Pa.) Electric Co.

Connecting Transformers Across Proper Phase Increases Output

A CASE of overloaded distribution transformers which were relieved of their excessive load by simply changing from open delta to closed delta was recently brought to the writer's attention. This was in a small central station where it was noticed that two 50-kva. transformers connected in open delta to supply a power feeder were unusually hot and, in fact, in danger of



INCORRECT AND CORRECT CONNECTIONS OF TWO SETS OF TRANSFORMERS

burning out. It was evident that the transformers were overloaded excessively. On further inspection of the system it was found that two 25-kva. transformers, also connected in open delta, had been added previously to the same feeder and installed further down the line. These transformers were likewise found hot. The transformers were installed in such a manner that one 25-kva. and one 50-kva. transformer constituted a set in parallel across one phase and another 25-kva. transformer and a 50-kva. transformer constituted a second pair across another phase. Diagrammatically the connections were as shown at *A* in the drawing. New transformers were on order, but it was feared that a burn-out might result before their arrival, and something had to be done with present equipment if possible. It was evident that the combined capacity of the two 50-kva. transformers in open delta was not 100 kw. but only 86.7 kva. Likewise, the two 25-kva. transformers had a combined capacity in open delta of only 43.35 kva. instead of 50 kva., bringing about an aggregate capacity of only 130 kva. instead of 150 kva.

Therefore the 25-kva. transformers were disconnected from the feeder and connected in multiple with each other, and this multiple set was connected across the open phase, as shown at *B*. With this combination a closed delta existed and the full capacity of 150 kva. was obtained, an increase of more than 15 per cent. The load on the transformers was still in excess of 150 kva., but there was an appreciable reduction in operating temperature, and the overload was carried satisfactorily.

CORNELIUS G. WEBER,
Electrical Engineer.

Vaughn & Meyers,
Milwaukee, Wis.

Industrial Applications

The Economical Utilization of Electrical Energy
in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

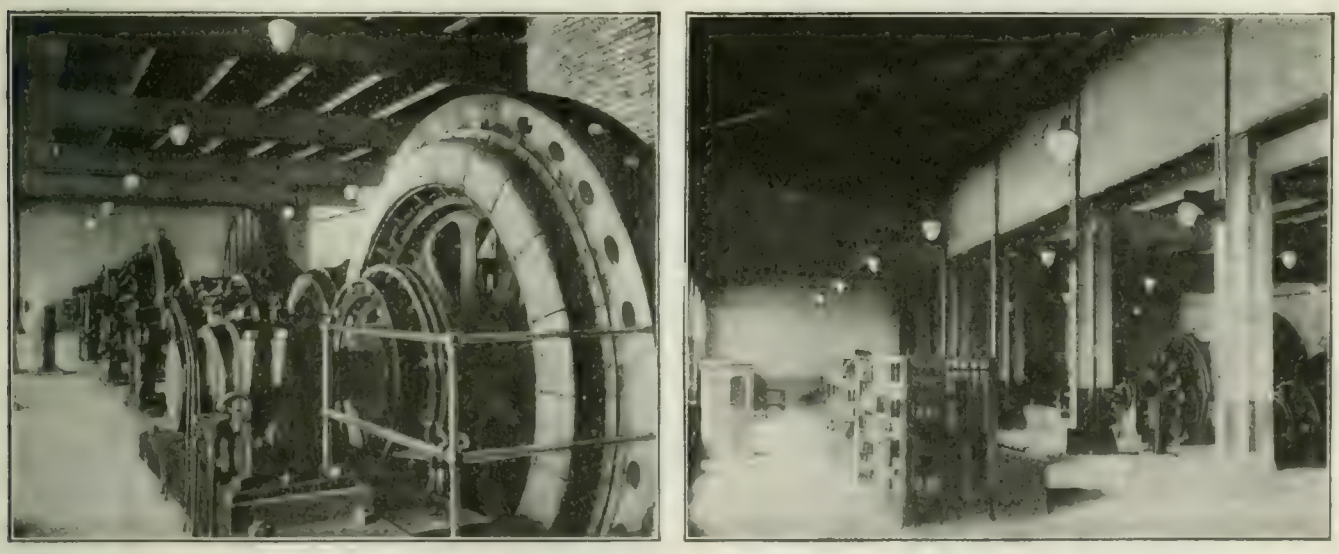
Proper Housing and Ventilating of Steel-Mill Motors

A PROLIFIC source of trouble in steel-mill motors is dust. A test sample of dust taken from the bedplate of a rolling-mill motor contained 81 per cent of good conducting material. It is not surprising, therefore, that such dust tends to impair the insulation of electrical apparatus and reduce the creeping distances. To prevent trouble from this source it has been found advisable to provide motor houses within the mills to protect motor and control apparatus from the dust and gas fumes which attack the insulation. Such a room makes it easier to keep the apparatus clean and to keep unauthorized persons away from the equipment.

One of the most important things to consider in the installation of a motor house is to make certain that the air for ventilating purposes is taken from a clean source. In every case the motor room should be completely closed off from the mill, and where clean air is not directly available an air duct and blower should be used to obtain it. Frequently it is not possible to obtain clean air in the vicinity of a steel mill so that ventilating systems are usually provided with air washers. The amount of air necessary to ventilate a motor depends upon its electrical losses. It is best to have the manufacturer specify the amount of air necessary, but as a general rule about 10 cu.ft. per minute (4,700 cu.cm. per second) per rated horsepower will be sufficient.

In laying out the ventilating ducts care should be taken to avoid sharp turns as these seriously interfere with the passage of air. The ducts should be made as straight as possible and of such dimensions that excessive air velocities will not be encountered. Velocities in the duct of about 2,000 ft. per minute (10 m. per second) have been found very satisfactory.

It is advisable to provide two air intakes—one arranged to take air from the inside of the motor room, the other from the outside of the building. This arrangement is necessary since in the winter air taken from the outside may carry snow and ice into the windings and if an air washer is used it may become clogged with ice. The arrangement suggested permits all or a part of the air to be taken from the inside of the motor room during winter weather. It is best to proportion the amount of air taken from each source so that the temperature in the duct will not be below 50 deg. Fahr. (10 deg. C.). A double door or shutter arrangement should be provided so that in closing one of the intakes the other will be automatically opened. This type of door will prevent the possibility of depriving the motor of its ventilation and will serve as a damper for properly proportioning the amount of air taken from each source.



MOTORS AND CONTROL PLACED IN ROOM SEPARATED FROM STEEL ROLLING MILL

The motor room should be designed with sufficient openings to provide free outlet for the incoming air so that a pressure will not be set up in the room. If the influx of air is opposed by a back-pressure in the room, the amount of air to the machines will be diminished. A good plan is to install exhaust fans near the roof with sufficient capacity to expel the same amount of air as is forced in by the blower.

Sometimes it is not convenient to install a motor house, as, for instance, in a hot sheet mill. In cases of this kind some operators have placed inclosing covers on the motor and have provided a ventilating duct, blower and air washer as described above to blow air directly into the motor.

O. NEEDHAM,
Westinghouse Electric & Mfg. Co. General Engineer.

Separating Hysteresis and Eddy Current Losses in Iron

THE standard method followed for the determination of iron losses consists in measuring with wattmeter and alternating current of a given frequency and at certain maximum flux density the losses in a sample dynamo plate. When it is desired to separate hysteresis and eddy-current losses, such measurements are made at several frequencies or several values of maximum flux density. It is convenient to choose two frequencies such that one is just twice the other, for instance, 50 cycles and 25 cycles. The hysteresis losses for the higher frequency then are just twice, the eddy-current losses just four times, the corresponding losses for the lower frequency, and the two items may be easily separated by solving a simple system of equations. The separation, however, may be still more simplified by the use of an abaque, or alignment chart, designed by A. Joitel and described in the *Revue Générale de l'Electricité*. If for a given induction the total losses at 50 cycles and 25 cycles respectively are read off the corresponding scales *W*50 and *W*25, and a straight line is drawn joining the two readings, then the intersections on the two other scales *F*50 and *H*50 will give the 50-cycle eddy current and hysteresis losses respectively in the sample.

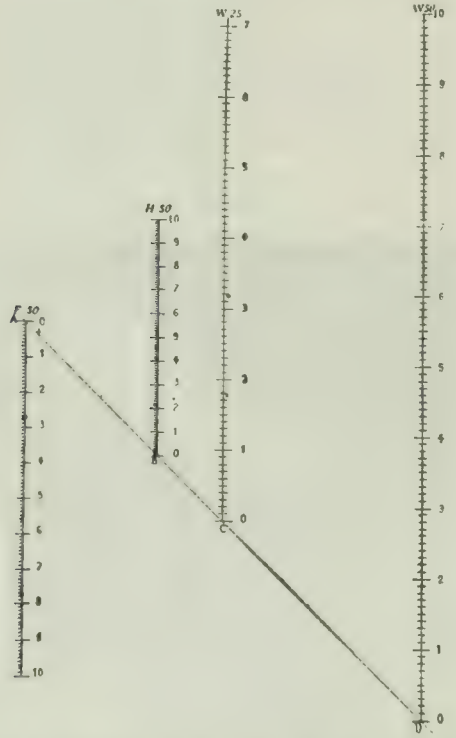


CHART FOR SEPARATION OF EDDY CURRENT AND HYSTERESIS LOSSES AT 50 CYCLES AND 25 CYCLES

The chart may be used also for separation of losses if the measurements were made not at 50 cycles and 25 cycles, but at any other two frequencies which are in the ratio of two to one, and they will then give the separated losses at the higher frequency. If losses are measured in watts per kilogram, the scales will be found to cover most cases which occur in practice. An alternative method consists in measuring the total losses at a given frequency but different values of maximum flux density. A second abaque is presented for separating the two kinds of losses in such a case. Incidentally the same chart may be used for determining the exponents, which in practice seldom take their theoretical values, respectively 1.6 and 2.0. Besides these two analytical charts, an alignment chart is given from which, knowing the separated losses at a given frequency, the total loss at any other frequency may be picked out without computation. Some interesting methods of separating the losses by graphical analysis of experimental loss curves are also described.

Changing Speed of Squirrel-Cage Motor Without Changing Horsepower

CHANGING the speed of a three-phase squirrel-cage induction motor from 900 r.p.m. to 1,200 r.p.m. without affecting the horsepower was accomplished recently by reconnecting the winding to give six poles instead of eight. The motor was rated at 75 hp., 440 volts, 60 cycles, three-phase, 900 r.p.m., eight poles. The orders were that the motor was not to be rewound, nor was the horsepower to be changed. A reduction in the starting torque was allowable as the motor was started satisfactorily on the 50 per cent tap of the auto transformer, and this could be changed to a higher tap if necessary. As received the motor had ninety-six slots and ninety-six coils in a two-layer winding connected series-delta in twenty-four groups, four coils in series per group with a pitch of 1 and 11. Full pitch for the eight-pole winding was 96 slots ÷ 8 poles = 12 slots. A pitch of 1 and 11 gave a span of (10 ÷ 12) × 180 = 150 electrical degrees, and a chord factor of sin (150 ÷ 2 deg. = 0.966. For the six-pole connection full pitch would be 96 ÷ 6 = 16 slots, or 1 and 17. Therefore the 1 and 11 pitch would give a chord factor of sin (10 ÷ 16) (180 ÷ 2) = 0.839. Accordingly after reconnecting for six poles series-delta the machine would be good for a line voltage of (1,200 ÷ 900) × 440 × (0.839 ÷ 0.966) = 508 volts.

SQUIRREL-CAGE MOTOR BEFORE AND AFTER CHANGING SPEED

	Before	After
Horsepower	75	75
Volts	440	440
Revolutions per minute	90	1200
Poles	8	6
Coils	96	96
Pitch	1-11	1-11
Chord factor	0.966	0.839
Connection	Series-delta	Series-delta
Groups	24	18
Coils in series, per group	4	*6 and 5

*Coils in series per group as follows: 655, 556, 565, 655, 556, 565.

With this voltage on the winding the magnetic conditions would be the same as before the change, and as the speed has been increased the horsepower would likewise increase to (1,200 ÷ 900) × 75 = 100 hp. But as only 75 hp. was required the torque will have to be decreased by decreasing the applied voltage to a lower value than 508 volts. The torque for a 100-hp., 1,200-r.p.m. motor is (100 ÷ 1,200) × 5,252 = 438 lb.-ft. This will have to be reduced to the torque for a 75-hp., 1,200-r.p.m. motor, which is (75 × 5,252) ÷ 1,200 = 328.5 lb.-ft. The voltage may be calculated from the formula: $E_1 = E\sqrt{\frac{T_1}{T}}$, where T = torque at full voltage, T_1 = torque at reduced voltage, E = full-line voltage, E_1 = reduced line votage. Therefore

$$E_1 = 508\sqrt{\frac{328.5}{438}} = 439 \text{ volts.}$$

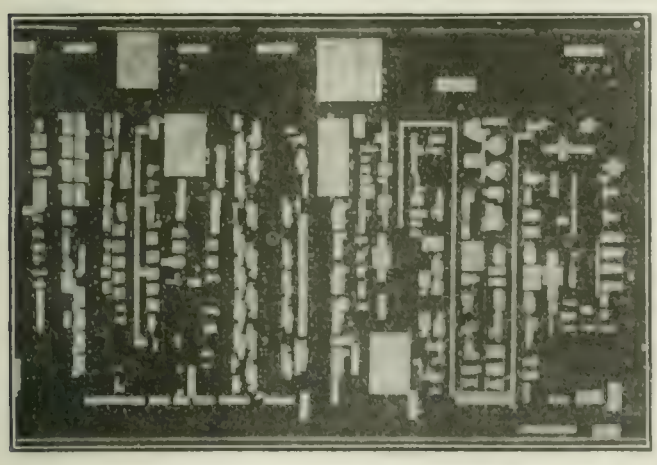
Therefore the motor may be connected to a 440-volt line. Accordingly the winding was regrouped and connected series-delta, top-to-top in eighteen groups, six groups of six coils in series and twelve groups of five coils in series, arranged as follows: 655, 556, 565, 655, 556, 565. It was not necessary in this case to reinsulate the coil ends of adjacent phases after regrouping as the ends of all coils were already covered with two layers of half-lapped cotton tape and the entire winding had been impregnated. After putting the motor back in operation it was found necessary to change the auto-transformer to a 65 per cent tap for starting. The starting torque had decreased because there were more bars of the rotor in parallel per pole, resulting in lower resistance. It was noticed that on account of the same fact when the motor was running the slip had decreased and the efficiency was slightly higher than before the change and that the motor started and carried its load satisfactorily to all concerned.

A. C. ROE.

Detroit, Mich.

Proposed Changes in Factory Distribution Visualized by Cardboard Models

FOR calculating the advantages and problems of changing the location of motor-driven factory machines a Canadian company has a permanent plat of the factory laid out on a board in the office and on this plat the location of each machine is indicated by a



FACTORY PLAT ON WHICH PROPOSED CHANGES IN LOCATION OF MACHINES AND MOTORS ARE WORKED OUT

piece of cardboard which shows the relative size and shape of the machine. There are two shops in this plant, and one of the shops is represented on each side of the board.

Individual drive is used throughout this plant, and there is a power distributing board on every column. As the bays are 30 ft. x 40 ft. (9 m. x 12 m.) no machine is more than about 15 ft. (4.5 m.) away from its source of energy, so that, irrespective of the changes made in the location of the machine, the cost of changing the wiring is very small. Taking the plant as a whole, the size of the motors ranges from ½ hp. to 50 hp. The feeders are designed to meet such combinations as it is possible to get with motors up to 50 hp., and any rearrangement of the manufacturing layout only necessitates changes in the short individual motor circuits from the distributing panels.

Canadian Products, Ltd., Walkerville, Ont.

A. H. MAY, Works Engineer.

Smoothing of Commutators by Sanding and Stoning

SOME hints to follow in sandpapering commutators and grinding them with a stone are embodied in the following paragraphs. If sandpaper is used, it is best to select a rather fine grain. This may take longer, but deep scratches will be avoided and subsequent operation improved. A very fine grain should be selected for the final polish. Best results will be attained by attaching the paper to a block of wood cut to the radius of the commutator. One objection to the use of sandpaper is that it rarely leaves the bars properly round. On an unslotted commutator, particularly where the mica is high, the sandpaper has a tendency to flatten the center of the bars. This can be partly counteracted by the use of a small amount of oil, which tends to make the mica cut more readily and reduces the cutting effect on the copper. Oil should not be used in excess or it will work into the mica, carrying particles of copper with it, and short circuits will result. Oil should never be used when sanding a slotted commutator. On a slotted commutator sandpaper, even when used on a block rounded to fit the commutator, has a tendency to flatten or bevel the edges of the bars.

A hand stone has advantages over sandpaper, provided that a stone with smooth, fine grain and free cutting properties is selected. Its rigidity eliminates any tendency to flatten the commutator segments and also prevents pitting and gouging. However, eccentricity or broad, flat spots can be removed only by grinding or turning. The limitation on the use of a hand stone is a question of whether or not it can be kept from jumping as the inequalities of the surface pass under it. Where a substantial rest is provided for the stone it may be used as a hand-turning tool to remove flat spots which could not be permanently removed by simply holding the stone against the commutator. This method requires a much smaller area of the stone in contact with the commutator than in the previous method. If too large an area is in contact, the stone will slide over the surface instead of cutting steadily. Hand-turning with a stone requires considerably more skill on the part of the operator than holding the stone flat against the surface. The support on which the stone is rested may be mounted securely on the brush arm, and must be very rigid or the stone will vibrate and therefore irregularities and holes in the surface of the commutator will result.

When sandpapering or holding the stone flat on the commutator it is best to run the armature at its normal operating speed. In hand-turning with a stone it may be better to reduce the speed somewhat. This can be determined by experimenting to find the speed at which the stone cuts most freely. If the speed is too slow, pieces of the stone are likely to chip into the commutator, and an excessive speed tends to produce uneven results.

After finishing the commutator it should be wiped off carefully to make sure that all particles of free copper have been removed, and the armature should be blown out thoroughly. It is also well to make an electrical test for grounds before putting the armature back into service.

DONALD S. MERTON.

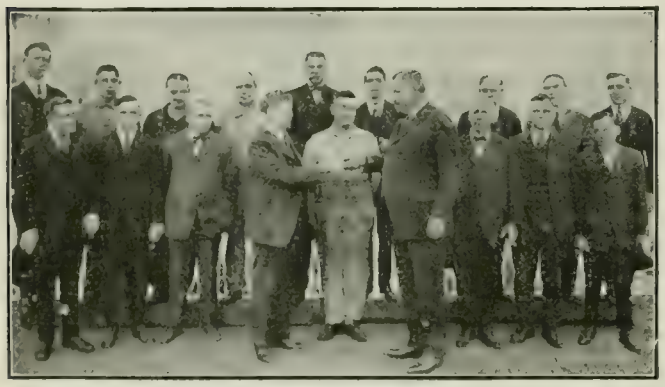
Cleveland, Ohio.

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

Seventeen Utility Employees Receive Medals for Heroism

IN RECOGNITION of heroic service at its Water Street power plant seventeen employees of the Toledo (Ohio) Railways & Light Company were recently presented with medals by the National Doherty Fraternity. In the accompanying illustration J. W. Brown, head switchboard operator, is shown receiving a gold medal from F. R. Coates, president of the company. Last February when one of the generators blew up, scattering pieces of iron castings in every direction in the plant, Mr. Brown risked his life as he stuck to his post just



PRESENTATION OF MEDALS TO EMPLOYEES OF THE TOLEDO RAILWAYS & LIGHT COMPANY

above and opened a switch. This action prevented the wrecking of the entire plant, which would have plunged the city in total darkness and stopped all street cars.

Fellow employees on duty at the same time received duplicates of the medal in bronze. This is probably the largest group of public utility employees ever so recognized. All are members of the local Doherty fraternity. Those in the picture besides Mr. Coates and Mr. Brown are Stephan Hayes, James Bozman, George Kading, S. Nevitt, H. H. Herbert, J. D. Stevens, Frank Brown, J. J. Kelley, Charles Delker, R. A. Washburn, F. Hamman, Charles Baldwin, T. J. Nolan, Fred Landwehr, R. D. Metzler and George Dolling.

Data on Electrically Driven City Pumping Plant

WATER to supply Coleraine. Minn., which requires some 400,000 gal. (1,514,000 l.) per day, is obtained from two deep wells at an energy consumption of less than 1.5 kw.-hr. per 1,000 gal.

Well No. 1 is equipped with a vertical-type centrifugal deep-well pump designed for 80 ft. (24 m.) head and an output of 400 g.p.m. (25 l. per second). The pump has a 6-in. (15-cm.) discharge and is directly connected to a 25-hp., 1,200-r.p.m., three-phase, 60-cycle, 440-volt vertical motor. There is a similar pump on No. 2 well except that this unit is designed to pump 600 g.p.m. (38 l. per second) against a head of 110 ft. (33 m.), has an 8-in. (20-cm.) discharge and is directly connected to a 35-hp. vertical motor. These pumps bring the water to a reservoir. The power requirements as shown by tests are given in the following tabulation:

ENERGY REQUIRED FOR PUMPING FROM WELLS TO RESERVOIR

	Gal. per Minute	Kw.-hr. per 1,000 Gal.
Well No. 1	471	0.295
Well No. 2	554	0.6613
Average	512.5	0.4781

The water is taken from the reservoir to an overhead tank by two 5-in. two-stage 500-g.p.m. centrifugal pumps driven by 50-hp., 1,800-r.p.m. motors working against a head of 235 ft. The tests on these pumps show the following results:

ENERGY USED IN RAISING WATER TO TANKS

	Gal. per Minute	Kw.-hr. per 1,000 Gal
West pump	498	0 8318
East pump	521	0 8214
Average	509.5	0 8266
Both pumps in parallel	824	1.0012

The average pumpage during the winter days is about 386,000 gal. (1,460,000 l.), but on Sunday the average drops to 245,000 gal. (925,000 l.). The average energy consumption from wells to tank is 1.3047 kw.-hr. per 1,000 gal. (340 watt-hours per 1,000 l.) with one set of pumps. When both sets of pumps are operating together the energy consumption goes up to 1.4793 kw.-hr. per 1,000 gal. (370 watts per 1,000 l.).

Low Power Factor Penalized by Increased Service Charge

WITH the idea of discouraging overmotoring in industrial plants and the consequent low power-factor conditions the Cumberland County Power & Light Company, Portland, Me., has added a power-factor clause to its power rate. Customers whose installed capacity exceeds 100 hp. are required to maintain a power factor of 80 per cent between 7 a.m. and 6 p.m. on weekdays. In effect, customers whose power factor is below 80 per cent will be penalized by an increase in the service charge. The clause as filed with the Maine Public Utilities Commission reads:

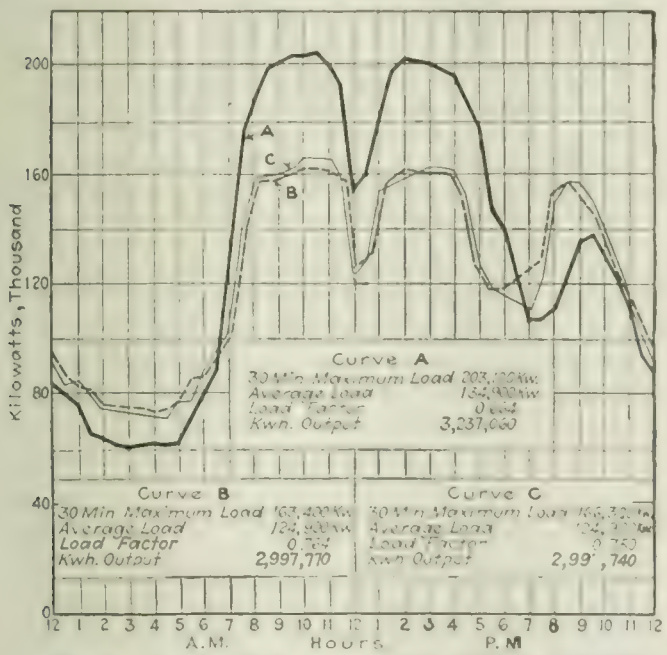
Wherever the installed capacity in electrical equipment exceeds 100 hp. the customer agrees to maintain at all times between 7 a.m. and 6 p.m. on week days a power factor of 80 per cent or higher. Should the company at any time find the power factor to be lower than 80 per cent and so notify the customer, then the customer shall make the necessary changes or additions to its equipment to bring the power factor up to or above 80 per cent. Should

the customer fail to correct the power factor as above within three months of the date of the above-mentioned notice by the company, the service charge of this rate shall be increased by the following percentages until such correction has been made:

Power Factor of Customer's Load per Cent	Per Cent Increase in Service Charge
75 to 79	7½
71 to 75	15
61 to 70	30
51 to 60	60
50 and below	100

Customer Co-operation Reduces Peak During Power Shortage

WHEN accidents to generating equipment made it necessary for the Detroit Edison Company to ask its primary power customers to reduce by 50 per cent their demands for energy between the hours of 7 a.m. and 5 p.m. the customers loyally responded, as the accompanying load curves of the company show. By reducing their use of power requirements wherever possible, by using internal combustion engines and by transferring men to a night shift the industrial customers reduced the maximum demand from over 200,000 kw. to about 165,000 kw. They made the evening peak between 8 and 9 p.m. about equal to the day peak, increased the minimum load between 2 and 4 a.m. by from 12,000 kw. to 16,000 kw. and increased the daily load factor by about 10 per cent. Only during dark days and storm periods would the day load reach temporary demands of about 175,000 kw.



RESULTS OF TEMPORARY POWER RESTRICTIONS IN DETROIT

A—Typical load curve before restrictions were imposed. B—Typical load curve with restricted service, showing about 2[illegible] cent decrease in day demand and considerable increase in night load. C—Curve showing ironing load between 9 a.m. and 11 [illegible] a.m. on Tuesdays.

The electric ironing load of from 4,000 kw. to 6,000 kw. was noticeable on Tuesday, unless there had been inclement weather on the day previous. In that case the ironing load came on Wednesday. When this load happened to come on a dark day, as it did on at least two occasions, it came near to being the "last straw."

When general business began to slow down in the latter part of August the curves showed a reduction of night work, and it was apparent that many plants reduced their night force first as their business fell off, until the point was reached where small departments formerly operating at night were put on the day load. Also, some of the gasoline engines used temporarily in plants to help carry the day load were giving out and had to be replaced by electric motors.

As a result the day peak was kept up to an average of 165,000 kw. until the beginning of October. However, beginning with the week of Oct. 4 the day peak began to drop so that when all power restrictions were removed on Nov. 4 there was no large increase in the maximum demand nor was there any marked change in the shape of the company's load curves.

Proposed Policy of Northwest Electrical Service League

RECOMMENDATIONS evolved by the advisory committee of the Northwest Electrical Service League when it was in process of formation have been called to the attention of the executive body of the league for consideration as a general policy, as follows:

1. That all member companies of the Northwest Electric Light and Power Association retailing electrical devices do so at a profit.

2. That all central-station companies engaged in inside wiring business discontinue same wherever the field is properly served by a local contractor-dealer.

3. That all member companies not already holding associate memberships in the state associations of electrical contractors and dealers be requested to apply for memberships in such associations.

4. That a co-operative advertising plan might be formulated by the advisory committee.

5. That for the general good of the industries a plan be formulated to strengthen the weak links in the chain of electrical interests serving the public.

6. That a reciprocal plan of education be carried out between all the elements in the business.

7. Suitable machinery should be set in motion to safeguard all branches of the industry from legislative and political injustice and at the same time properly support corrective legislation and regulatory action.

8. That the very best thought of the men engaged in all branches of electrical industry in this district be applied to the creation and development of a fixed policy that will have as its objective the establishment of the highest standard of business practice possible, so as to make our business from the standpoint of stability and usefulness comparable with any known line of activity in the community.

9. That the electrical interests be encouraged to use the greatest practical care in the selection of men who are employed or induced to engage in the business, with the view that in the process of development they are most likely to prove a wholesome addition to the personnel of those already engaged in the business.

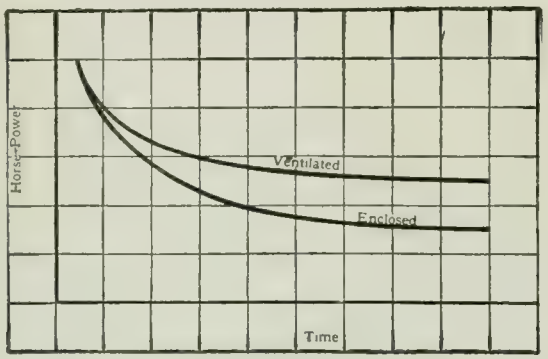
10. We suggest that member companies Northwest Electric Light and Power Association encourage contractor-dealers to affiliate with the state Contractor-Dealers' Association, in the belief that closer co-operation and better results can be secured by associated methods than can be obtained as individuals, owing to the facilities provided for co-operation between the Contractor-Dealers' Association and central stations as now organized.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Direct-Current Motors for Crane and Hoist Work.—F. L. MOON.—After giving details of the importance of selecting the motors carefully for crane work on account of exposure to dirt, moisture and heavy electrical service, the writer makes a comparison between inclosed and ventilated motors with regard to heating and efficiency. The illustration indicates the time during which



TIME VARIOUS LOADS CAN BE CARRIED FOR A CERTAIN TEMPERATURE RISE

the various loads can be carried for a certain temperature rise. The ventilation does not influence the capacity for short time ratings, but increases the capacity for long periods. It is said that the core loss and friction losses would be about the same for the two types of motors, but the I^2R loss would be somewhat greater for a ventilated motor. The loss due to the energy stored in the rotating parts, however, during acceleration would be much less in the case of the ventilated motor.—*Electrical Journal*, November, 1920.

Lamps and Lighting

Illumination and Production.—R. E. HARRINGTON.—The importance of electric lighting is pointed out from the standpoint of health, labor turnover, safety, spoilage and production. In order to show what a relatively insignificant item the investment in good lighting equipment is, the cost per outlet is compared with the wages of one workman. This is shown in the following table:

Cost of lamp (list, subject to discount)	$1 10
Cost of enameled steel reflector (list subject to discount)	2.50
Estimated cost of wiring per outlet	6.00
Total first cost	$9 60
Interest on investment at 6 per cent	$0.58
Depreciation on reflector and wiring at 12½ per cent.	1 06
Power at 5 cents per kilowatt hour	3 00
Cleaning at 3 cents per cleaning, two per month	0 72
Renewal of lamp (600 ÷ 1,000) × $1 10	0.66
Total	$6.02

Wages for eight hour per day, 300 days, at 70 cents per hour are $1,680
Ratio of cost of lighting per man to wages, $6.02 ÷ 1,680 = 0.356 of 1 per cent

It is said that if the workman saves three minutes' time per day owing to correct lighting the entire operating cost of the lighting system is paid for.—*Bulletin L. D. 106, Edison Lamp Works*, May, 1920.

Monograph on Illumination.—GEORGE A. HOADLEY.—A historic treatment of the subject, starting from the bonfire and tracing developments to the modern electric lighting systems of today.—*Transactions Illuminating Engineering Society*, Oct. 9, 1920.

Generation, Transmission and Distribution

Lead-Covered Single-Phase Cables.—CAPEDEVILLE.—This paper forms an elaboration of the note by the same author to the French Academy which was referred to in the Digest some time ago. After showing how magnetic induction will cause very strong currents to flow along the lead covering of single phase alternating-current cables, the author discusses the practical consequences of the phenomenon. The simplest way to deal with the sheath currents is to ground the lead sheathing at either end of the cable. This, however, gives free flow to the current, which may grow very large and cause considerable loss, followed by an apparent increase in resistance. If the cable is grounded only at one end, then, owing to the induced emf., the voltage rises along the cable and an undesirable potential difference may occur between cable sheath and ground. Other methods are discussed, such as cutting up the cable sheathing in mutually insulated sections, each one grounded or each connected to the next through a resistor, the ground connection being made only at one end of the cable. Better equalization is obtained by connecting the midpoint of the resistor at each section to ground, or, finally, by inserting self-inductance coils at the section points.—*Revue Générale de l'Electricité*, Sept. 11, 1920.

Electrical Refrigeration.—C. J. CARLSEN.—An analysis of the ice-making business, where electrical refrigeration is employed, as conducted by a large central-station company, gives the following information: There were forty-one large ice and refrigeration plants on central-station service, with a total connected load of 18,215 hp., a combined service maximum of 12,907 kw. and a consumption of 55,713,226 kw.-hr. Of the latter amount 49,754,000 kw.-hr. was used in the production of 1,056,093 tons of ice, or an average for all plants of 48 kw.-hr. per ton, although the best plant produced at the yearly rate of 37 kw.-hr. per ton. The annual load factor of all plants was 45 per cent.—*Electric Journal*, November, 1920.

Traction

Locomotives for Swiss Electrifications.—SCHRAEDER.—This article contains a detailed description of a type of electric locomotive for mixed service built by Brown, Boveri & Company for certain electrified railway stretches in Bernia. The new electrifications connect the Lötschberg railroad, having a 16⅔-cycle, single-phase, 15,000-volt supply. The locomotive has two twelve-pole motors, of a compensated series type, with resistance connections between commutator and arma-

ture coils and with shunted interpoles. The motors have a one-hour rating of 645 hp. and weigh only 5,300 kg. (11,700 lb.). This is considered an unusually low value, corresponding to only 8 kg. (17.6 lb.) per 1 hp.-hr. The two contact arms on the locomotive are connected to a transformer which steps down the supply current from 15,000 volts. The transformer has a number of taps on the secondary side so that the motor voltage can be varied from 100 to 620 volts, whereby a wide speed range is obtained. The transformer is oil-cooled. In order to cut down the weight it is provided with an oil circulation pump and an effective radiator, served by a fan. The locomotives pull 8,000 kg. (17,659 lb.) continuously for one hour at a speed of 35 km. per hour (22 miles per hour). The maximum speed is 60 km. per hour (37 miles per hour).—*Mitteilungen*, July, 1920.

Installations, Systems and Appliances

Lightning Arresters.— C. E. BENNETT.— A brief statement of the characteristics of the Bennett surge arrester which was described in the ELECTRICAL WORLD of Feb. 14, 1920. Some interesting characteristics of the water tanks in absorbing energy of surges are described in this article.—Paper read before convention of A. I. and S. E. E., October, 1920.

The Induction Electrical Furnace.—G. H. CLAMER.—This is a very complete treatise on the development of induction furnaces. Early historical development is first traced, and then the author deals with the more modern type by giving the purpose and advantages of each. Furnaces for brass—that is, all copper and zinc alloys commonly referred to as "brass"—are dealt with by the author.—*Journal of Franklin Institute*, October, 1920.

Electric Lifts and Cranes.—F. R. HOUSDEN.—In this article motors and control for lifts and cranes and also some characteristics of lifting magnets are discussed.—*Beama*, October, 1920.

Electrophysics and Magnetism

The Audion Oscillator.—R. A. HEISING.—Conditions required for the production of free oscillations in audion oscillator circuits can be mathematically predetermined. This necessitates an assumption of a straight-line characteristic for the tube, which assumption becomes exact for small oscillations. The required conditions can be expressed in terms of the constants of the circuit elements and the constants of the tube. The equations are set up as for ordinary circuits, making use of Nichols' explanation of the behavior of the audion, in which the amplifying action is ascribed to a fictitious generator placed between the plate and filament inside the tube and having a voltage μ times the voltage applied to the grid. Two simple circuits are treated in detail and results plotted in several sets of curves.—*Physical Review*, September, 1920.

Electrification by Impact.—HAROLD F. RICHARDS.—The author suggests that impact of dielectric upon metal, without sliding friction, may cause an electrical effect whose laws will shed light upon the frictional phenomenon. These charges are of the same order of magnitude as those obtained by friction. From his experiment he concludes that there is no direct dependence of the electrical energy upon the mechanical energy lost in impact, and that electrification by impact is similar in nature to the contact effect between metals.—*Physical Review*, October, 1920.

Units, Measurements and Instruments

On the Wave Form of Intermittent and Pulsating High-Tension Currents.—The author has studied the wave form of the secondary current in an induction coil for X-ray work. Certain definite relations were established between primary capacity and the number of pulses in the secondary current wave. A number of very fine oscillograms show that beautiful results may be obtained by the Gehrke vacuum-tube oscillograph, which was used throughout the work.—*Archiv für Elektrotechnik*, Oct. 10, 1920.

Photographing the Stream Lines in Flowing Water.—CAMICHEL.—The motion of flowing water may be explored by a method which is based on photographic registration of the orbits of little bubbles of air carried away in the water. A strong beam of intermittent light is projected into the water. The air bubbles then light up, owing to their strong reflection, and on the photographic plate of a camera the trace of the bubbles will appear as an intermittent curved line, its direction following a stream line in the water, and the length of each dash indicating the velocity of the water particles in each part of the path. Some beautiful plates characteristic of different types of motion and also showing analogies with electric and magnetic field tracings are reproduced and explained by applying fundamental hydraulic equations, the methods of images, etc.—*Revue Générale de l'Electricité*, Sept. 11, 1920.

Telegraphy, Telephony and Signals

The Alexanderson System for Radio Communication.—ELMER E. BUCHER.—It is said that the attainment of a system of radio communication free from the limitations of the arc and spark-gap types has been realized in the Alexanderson system, that it has introduced into the realm of radio the same degree of certainty of expectations and reliability of results in generation, control and distribution as has for a long time been characteristic of operations in the field of light and power. The generator, although necessarily of special construction, is designed in conformity with established electric magnetic and mechanical laws. Its speed is held constant within one-tenth of 1 per cent by an especially developed speed regulator. The output of the station, which fluctuates with the messages being sent, is controlled by an ingenious and extremely sensitive, non-arcing magnetic amplifier. The multiple tuning of the antenna permits of radiating the energy at a greatly improved efficiency. The author thoroughly describes the complete system in great detail.—*General Electric Review*, October, 1920.

Theoretical Principles of the Traffic Capacity of Automatic Switches.—G. F. O'DELL.—Theories for the determination of the number of switches required in automatic exchanges to carry different quantities of traffic are discussed by the author with particular reference to the requirements of actual practice.—*Post Office Electrical Engineers' Journal*, October, 1920.

Miscellaneous

Electrical Goods in Spain.—PHILIP S. SMITH.—It is pointed out that Spain is a country with great water-power resources but that the electrical development has been relatively limited. The report contains a very complete analysis of the electrical apparatus required as power developments increase.—*Bulletin No. 187, U. S Bureau of Foreign and Domestic Commerce*, 1920.

GOVERNMENT regulation of the coal industry is recommended in the report made to the United States Senate by its committee on production and reconstruction, of which Senator Calder of New York is chairman. The report severely arraigns the practices that have grown up among private interests now in control of mining and distribution.

MORE than $200,000 worth of advertising space has thus far been devoted by electrical manufacturers to the co-operative good-will campaign of the industry.

SPEAKING before the Chicago Rotary Club, Samuel Insull declared that if politicians are to attack utilities as a stepping stone to office it will become impossible for the utilities to raise the capital requisite to expand their plants in order to supply the increasing demands of the public.

THE MEXICAN State of Sonora is reported to be making progress toward the construction of its 100,000-hp. hydro-electric and irrigation project on the Sonora River, 75 miles from Hermosillo. The storage reservoir is designed to irrigate 750,000 acres of land. Several great modern dams will be built.

AN ALTERNATIVE amendment to the water-power act has been introduced in the House of Representatives as a substitute for the one fathered by Secretary Payne. The new amendment repeals only that provision of the act which permits issuance of water-power licenses in national parks. The provisions of the other amendment are much more sweeping.

A FURTHER amendment to the water-power act permitting lands found to have no power value to be restored to entry without reservation is understood to be favored by the Federal Power Commission.

MASSACHUSETTS electric light and power companies will probably ask the State Legislature for authority to issue stock to the amount of premiums earned by their securities.

APPROVAL of the plan to equip four of the boilers of the Lake Union steam plant of the Seattle municipal electric works with stokers in order to guard against shortage of oil fuel has been given by the city's Board of Public Works.

A FIFTH plant on the Spokane River is to be begun at once by the Washington Power Company. It is to develop 14,000 hp., which will raise the total capacity of the company to 125,000 hp.

SEASONABLE electrical material has continued in good demand, though hardly up to early expectations. Household heating appliances are selling well, and there is a fair demand for appliances driven by motors. Little change in demand for wiring materials is reported. Jobbers and dealers are both buying cautiously. Transportation is now good, and stocks are improving. Pipe is said to be shortest of all items. The credit situation is no worse. Lamp sales are excellent.

News in Brief

Summary of Market Conditions and of Recent and Approaching Happenings of Importance to the Industry

CALIFORNIA is incorporating in the electrical safety orders of the Industrial Accident Commission rules which four years of field experience have shown to be necessary.

LEGISLATION requiring the registration of engineers and architects is to be sought in Ohio this year. The bill has been drafted by the Ohio Association of Technical Societies.

SAFETY is to be the keynote of the Detroit meeting of the Western Association of Electrical Inspectors next month, to which central-station men, manufacturers and other nonmembers are invited to contribute.

PLEADING for support of the Federated American Engineering Societies before the Chicago Engineers' Club, Herbert Hoover gave expression to the view that the regulation of public utilities is essentially a problem for engineers.

STANDARDIZATION of lamp voltages is being strongly backed by the lamp committee of the National Electric Lamp Association.

A COMMISSION of expert engineers to consider the best methods of carrying out the Chicago terminal electrification has been appointed by the Illinois Central Railroad.

THREE new members and nine new associate members have been elected by the Edison Pioneers.

AN ADVANCE from 7 per cent to 7½ per cent less depreciation in permitted earnings for the purpose of rate fixing has been announced by the Missouri Public Service Commission as a change in its policy.

ASSERTED failure of an Illinois electric light and power company to make improvements ordered by the Public Utilities Commission has led to a reduction being ordered in a surcharge previously allowed the company.

ANNOUNCEMENT is made that the Western Canada Power Company has passed into the control of the British Columbia Electric Railway Company as the outcome of a transaction involving between $7,000,000 and $8,000,000.

JOINT meetings on water power in its various aspects are being held in Boston by the electrical, mechanical and civil engineering societies. The first of three arranged for took place last night.

A SHORT intensive course for metermen is announced by the extension division of the University of Wisconsin.

A DISCUSSION on the relative merits of 40-deg. and 50-deg. motors formed the program of the Cleveland meeting of the Association of Iron and Steel Electrical Engineers. The A. I. E. E. is to take up the subject.

CENTRALIZED control of power districts was the subject of animated discussion at the meeting of the American Society of Mechanical Engineers in New York.

CONTRACTS for electrical equipment approximating $2,000,000 have been awarded to Canadian electrical manufacturing firms by the Ontario Hydro-Electric Power Commission.

A SUBSTANTIAL output of transformers is reported to be coming from the manufacturing plants. Demand is not so great as last summer and spring. Typical deliveries of distribution transformers range from stock to eighteen weeks.

MANUFACTURERS of both friction and compound tape anticipate a good year in 1921. Reduction in prices is not expected to exceed 10 per cent in view of the continuing high cost of labor, fuel, transportation and materials.

WITH the object of broadening the export field, the Foreign Trade Financing Corporation is to be launched as the result of a conference of representatives of agriculture, finance and business from all parts of the United States.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

A. I. E. E. to Sponsor 40-Deg.-50-Deg. Motor Investigation

SPONSORSHIP for the investigation of the general subject of temperature rise in rotating electric machines, which include the 40-deg.-50-deg. motor situation, has been assigned by the American Engineering Standards Committee to the American Institute of Electrical Engineers. The investigation will be made through a sectional committee of the American Engineering Standards Committee which will be chosen by a steering committee appointed by the A. I. E. E., and composed of Prof. D. C. Jackson, who is chairman of the Institute's standards committee, as chairman; L. T. Robinson of Schenectady, N. Y., and James Burke of Erie, Pa. On the sectional committee all interested bodies will be represented.

It is proposed to investigate two main subjects in a thorough and unbiased fashion. These are:

1. Standardization of motors as regards temperature rise, whether 40 deg., 50 deg. or some other limit.

2. Standardization of large generating and motor equipment using the class B (mica and similar insulation) designation for temperature rise.

More Than $200,000 Already Placed for Co-operative Good-Will Advertising

ALREADY more than $200,000 worth of advertising space has been set aside by electrical manufacturers for the co-operative good-will campaign in the electric light and power industry. In making this announcement at the meeting in Chicago last week of the executive committee of the Public Relations Section, N. E. L. A., P. L. Thomson of the manufacturers' advertising committee said that several large electrical manufacturers had placed their space in national mediums at the disposal of the committee and that forty smaller manufacturers had agreed to assist in every way possible through trade-journal advertising and otherwise.

The direct "tie-in" advertising in the national periodicals by the N. E. L. A. was approved.

Utility Regulation an Engineers' Problem, Says Hoover

PUBLIC utility regulation was discussed by Herbert Hoover on Dec. 10 in the course of a plea for support of the Federated American Engineering Societies made at a meeting under the auspices of the general committee of the technical societies of Chicago. Such regulation, Mr. Hoover said, has heretofore been in the direction of negative control, and in the future a way must be found to protect the public from monopoly and at the same time restore the initiative necessary for successful utility operation. Engineering thought must be brought to bear on the problem.

Mr. Hoover asserted that the form of organization and constitution were of secondary importance, but that some organization representing all engineering thought and not that of special groups must be perfected if the ability of the engineer to look at pressing national problems from a detached point of view, free from selfishness and special interest, is to be utilized. He pleaded that personal opinion should be laid aside and effective organization to utilize this ability for the public welfare be perfected.

Other Amendments to Water-Power Act Thought Desirable

THE first finding under Section 24 of the water-power act was made by the Federal Power Commission at its meeting Dec. 13, when it restored to entry certain lands along the Coquille and Rogue Rivers in Oregon, with the reservation that power developments are to be unimpeded.

The commission very evidently believes it desirable to procure an amendment to the act so that lands found to have no power value can be restored to entry without reservation. In addition, it is believed that the amendment should provide that lands which ought not to be restored may be used temporarily under lease or permit. Another amendment which appears desirable would give the commission jurisdiction over all water-power projects. As the law stands, the Departments of War, the Interior and Agriculture retain jurisdiction over projects authorized under the laws prior to the enactment of the water-power act.

Centralized Control of Power Districts Discussed by A. S. M. E.

A POLICY for future power development and some of its financial and legal aspects proved to be subjects of considerable interest at the Power Section session of the American Society of Mechanical Engineers on Dec. 10. Another closely related and interesting subject of discussion was the effect of load factor and size of plant on the unit cost of electrical energy. Addresses on the three topics named were made by Col. J. P. Jackson, Col. Peter Junkersfeld and George Orrok, respectively. Among those who took part in the discussions were John W. Lieb, I. E. Moultrop, John H. Stevens, W. B. Jackson, Harold Doolittle, E. B. Powell, Charles Penrose, Prof. Charles W. Thomas, Walter N. Polakov, Commander E. H. DeLany, W. S. Murray, Henry Harrison Suplee and James T. Enes.

Colonel Jackson gave warning that the United States is entering the keenest trade competition it has ever experienced and that therefore, more than ever, it is essential to utilize power resources in their maximum extent and efficiency to help reduce manufacturing costs. Because of technical financial or market conditions it

may not be economical to develop all potential water powers, but nevertheless six billion dollars will have to be invested in electric service equipment in the next ten years to keep up with the demand for service. It will be necessary to develop systems that will insure the greatest conservation of natural resources and the most convenient utilization of energy, and then to supply isolated plants and railroads, which if they generate their own power use two to four times the coal per unit of energy produced that central stations do.

The present tendency, Colonel Jackson said, is toward establishing natural power districts in which the power plants will be interconnected for the most economical system of generation and distribution. Before these interconnections can be an absolute success, however, the districts must have a central organization, preferably composed of or supported by the operating companies, to direct the financial and operating problems. The West Penn Power Company and the American Gas & Electric Company have established such an organization for control of activities where they are jointly involved, and several years' trial has proved it a success. Another successful example of centralized control is that recently exercised by the California Power Administrator,in the recent water emergency.

Another subject which needs special attention, Colonel Jackson pointed out, is the development of laws whereby capital will be assured of a stable return. Closely allied with this is the need of offering some inducement for increased economy. London provides such a reward for efficiency by law. The importance of distributing stock among the local public was also emphasized and the methods of making it available described. A properly designed unified plan such as outlined, concluded Colonel Jackson, should command the support of the public and protect the investment.

Commission for Illinois Central Terminal Electrification Appointed

A COMMISSION of engineers to consider the best methods of carrying out the electrification of the Chicago terminals of the Illinois Central Railroad has been appointed by the railroad company. The members of this commission will be A. S. Baldwin, vice-president Illinois Central Railroad, chairman; Daniel J. Brumley, chief engineer of the Chicago terminal improvement; Bion J. Arnold, consulting engineer; George Gibbs, of Gibbs & Hill, consulting engineers in New York; Dr. Cary T. Hutchinson, consulting engineer, New York, and W. M. Vandersluis, expert on electrical signal systems and for many years signal engineer of the Illinois Central, who will serve as secretary of the commission.

"It probably will be about six months before the report of the commission can be made," Mr. Brumley said in commenting upon these appointments. "The commission will consider the advisability of installing a low-voltage direct-current system, a high-voltage direct-current system and a high-voltage alternating-current project. It will consider operation and maintenance of the various systems and will recommend the adoption of the one best suited to the railroad's requirements.

"It is likely that after the commission has completed its preliminary work it will be retained as a permanent body to design, direct and superintend the installation of the system adopted. Under the ordinance the first electrification work should begin not later than early in 1922."

Poor Service Means End of Higher Rates

UNLESS Illinois public utility companies keep their service up to the top notch increased rates will be denied them. This was indicated in an order issued by the Public Utilities Commission of Illinois last week in which it cut the surcharge of 15 per cent on commercial lighting previously granted the McHenry County Light & Power Company to 10 per cent.

The commission some time ago authorized the company to increase its rates to meet the mounting costs. At the same time the commission directed that the company make certain improvements in its system at Hebron and Richmond. This, it is asserted, the company neglected to do, with the consequence that the rates were cut as just stated.

Value of Customer Ownership Pointed Out by Martin Insull

PUBLIC utility securities as logical investments for utility customers were dealt with by Martin J. Insull, president of the National Electric Light Association, before the annual meeting of the Illinois State Electric Association at Chicago last week. As part of the general public, Mr. Insull asserted, these investors are in a position to influence commissions to allow the companies to earn a fair return on the capital invested. The small investor cannot as effectively protect his investment in any other great enterprise, the speaker continued, and it is difficult to find a business that is growing more rapidly. The present annual capital requirements of Illinois utilities, Mr. Insull stated, about equal the total 1905 investment.

The remarks of Mr. Insull on this topic were made in the course of a discussion on the work of the Illinois Committee on Public Utility Information. John F. Gilchrist outlined what the committee had done. B. J. Mullaney attributed the success of its activities to its independent, straightforward statements and to the fact that it is working for the entire utility business and for the public.

Adam Gschwindt, Rockford, was elected president for the ensuing year; D. E. Parsons, East St. Louis, was made vice-president, and R. V. Frather, Springfield, secretary-treasurer. The members elected to the executive committee were R. S. Wallace of Peoria, B. J. Denman of Davenport, Iowa, and H. O. Channon of Quincy. A report in last week's issue covered the addresses of other speakers.

Advanced Work of Federal Power Commission May Be Delayed

WHETHER or not the provisions of the water-power act can be carried through to conclusion promptly depends to a great extent on the necessary funds. The work has gone about as far as it can with the more advanced projects until Congress authorizes the Federal Power Commission to employ the necessary personnel and provides the money required for salaries. O. C. Merrill, the executive secretary, has prepared an estimate, which has been approved by the Secretary of the Interior, calling for $482,065.

Before the end of December the advertising stage will have passed on several of the projects, but further action will be delayed because no license or permit forms have been drawn up and because certain of the essential regulations are yet to be prepared.

Another National Park Water-Power Law Amendment Introduced

NO COMMITTEE action had been taken at the time of this writing in either house of Congress in the matter of the amendment to the water-power act intended to protect the national parks. The amendment submitted by Secretary of the Interior Payne and introduced by Senator Jones and Representative Esch goes further than the precluding of power development and would amend all other right-of-way acts. As drafted by Secretary Payne, no permit, license, lease or authorization for dams, conduits, reservoirs, power houses, transmission lines or works for storage or carriage of water will be granted within the limits of any national park.

On the other hand, Representative Rogers of Massachusetts has introduced an amendment intended only to repeal the provision of the water-power act which authorizes the issuance of water-power licenses in national parks. It is not improbable that the Rogers resolution may be adopted.

Users and Producers Discuss 40-Deg. Vs. 50-Deg. Motors for Steel Mill

THAT a motor driving steel-mill machinery should have a generous margin of power above the normal or the estimated load was the thought generally expressed by the mill engineers at a meeting of the Association of Iron and Steel Electrical Engineers in Cleveland on Dec. 13. It seemed to be the opinion that this overload ability was met satisfactorily in the 40-deg. motor, although 50-deg. motors are operating with perfect satisfaction on certain loads where careful study of the loads was made before installing the motors.

E. S. Lammers, National Tube Company, said he was anxious to have motors large enough to meet the varying conditions in a steel mill. D. Kendall, Alliance Machine Company, said that in selecting crane motors he always purchased a motor larger than that recommended to make sure that the motor would handle any load. First cost, he stated, is unimportant in steel mills compared with continued output. The M. A. Hanna Company, according to C. H. Matthews, its electrical engineer, used both types satisfactorily, but the applications were carefully analyzed before the motors were bought. A. W. Mohrman, Trumbull Steel Company, said it was impossible to foretell the actual load. The duty cycle and not temperature should determine the motor type, according to S. L. Henderson, American Steel & Wire Company.

In addition to the discussion by the users, representatives of a number of prominent motor manufacturers who were present gave a bird's-eye view of the manufacturers' feelings on this subject. In reading the paper on which the discussion took place L. F. Adams, electrical engineer of the power and mining department of the General Electric Company, advocated the 50-deg. motor because it puts the responsibility of selection and operation on the buyer. He stated that the New England Power Company recently found that the majority of its motor installations were overmotored 20 to 25 per cent. Investigation of 743 plants in the West showed 80 per cent of the motors underloaded, 10 per cent carrying rated load and 10 per cent overloaded from 1 per cent to 13 per cent. He claimed that the A. I. E. E. rules allow for a room temperature of 40 deg. C., while the room temperature is seldom actually above 21 deg. C. The French and Germans, he stated, have made 50-deg. motors successfully for several years and the English are now adopting this standard.

J. M. Hipple, design engineer of the Westinghouse Electric & Manufacturing Company, said that lack of education and misunderstanding of the phraseology were obstructing the adoption of the 50-deg. motor.

S. C. Schum, design engineer for the Burke Electric Company, which makes both types, expressed a personal opinion that the 50-deg. motor will ultimately be generally used.

C. L. Collins, president of the Reliance Electric & Manufacturing Company, claimed that proper education as to the application of 40-deg. motors would effect the same saving as could be shown with a 50-deg. motor. He believed the distinction in ratings was more logical for direct than for alternating-current machines.

A. C. Bunker, design engineer of the Crocker-Wheeler Company, claimed the Institute rules set the upper limit of temperature rise and that a conservative limit did not permit a 50-deg. rise. Motor installation costs, he estimated, were only 5 per cent of total factory investment and any saving by installing a motor of higher rating would be comparatively inconsiderable. He stated that any motor was expensive if it broke down frequently and therefore it should not be operated at the ultimate limit of temperature.

Noble Duff and D. B. Wilson of the Electro-Dynamic Company said that their company believed in the 40-deg. machine and kept the operator in mind when making the application, remembering that the load usually increases after some time.

The Lincoln Electric Company, said A. P. W. Smith, preferred a 40-deg. rating, and, as the company's engineer actually made each application, the company assumed the responsibility.

Harry W. Eastwood of the Cutler-Hammer Company said that a 40-deg. motor allowed for a factor of safety that was advantageous.

Detroit Edison's New Rates Reflected November Statement

NOVEMBER is the first month to reflect the full effects of rate increases of the Detroit Edison Company and the removal of restrictions on power users by the placing in service of a new 45,000-kw. turbine and another turbine of the same size which was rebuilt after the accident in July. Both of these machines are operating smoothly, and the company has available sufficient generating capacity to meet present requirements and continue the overhauling of equipment necessitated by previous overloading.

For the month of November this year the total gross revenue was $2,176,859.02, compared with $1,615,615.25 for the same month in 1919, an increase of 34.7 per cent.

Total gross revenue of the company as shown by the consolidated earnings and income statement for eleven months of this year was $19,660,624.49, as compared with $14,746,417.16 for the same period of 1919, an increase of 33.3 per cent. Total operating and non-operating expenses, not including interest on funded and unfunded debt, were $15,829,425.86 for the eleven months, against $10,989,383.49 a year ago, showing an increase of 44 per cent. Interest was $2,207,606.25, an increase of 41.2 per cent, leaving a net of $1,623,592.38, a decrease of 26 per cent.

Missouri Commission Advances Rate Base from 7 to 7½ per Cent

AN IMPORTANT change in what has been the fixed policy of the Missouri Public Service Commission in basing utility rates on a return of 7 per cent less depreciation has been announced by that commission. The commission has changed this rule because of the advance in interest rates and has established 7½ per cent as the new basis. The commission notes in a decision upon lighting and commercial rates at Warrensburg, handed down last week, that since last February interest rates have advanced to such an extent that current rates on good security are 8 per cent and the largest public utilities in the state are paying from 8 to 9½ per cent interest in refinancing their properties.

In the Warrensburg case the commission allowed the company to increase its minimum monthly charge from $1 to $1.50 in order to increase its earnings $13,761 a year and bring the returns on the investment of something over $154,000 up to where the company will earn 7½ per cent on the investment.

Boston Societies Hold Joint Meeting on Water Power

WATER-POWER development in New England was the topic at a joint meeting in Boston on Friday evening of this week of the Boston Sections of the A. I. E. E. and the A. S. M. E. and the Boston Society of Civil Engineers. Prof. Harold K. Barrows was to give an illustrated paper on the subject and Henry I. Harriman, president of the New England Power Company, was to speak on the project for the development of the St. Lawrence River. This meeting was the first of three arranged by the three societies for joint discussion of water power. The second will be held in the latter part of January and the third in February. The meeting just held was under the auspices of the civil engineers; the second and third will be directed respectively by the electricals and the mechanicals.

The Boston Society of Civil Engineers was to vote yesterday, previous to the joint meeting, on resolutions strongly supporting efforts being made by the New England Conference for the Protection of National Parks to amend the water-power act.

New Officers of American Engineering Standards Committee

AT THE annual meeting of the American Engineering Standards Committee in New York on Dec. 4, A. A. Stevenson, representing the American Society for Testing Materials, was re-elected chairman for 1921, and George C. Stone of the American Institute of Mining and Metallurgical Engineers was re-elected vice-chairman. The following were also elected to represent the respective member bodies on the executive committee: Comfort A. Adams, American Institute of Electrical Engineers; Martin Schreiber, American Society of Civil Engineers; Fred E. Rogers, American Society of Mechanical Engineers; A. H. Moore, Electrical Manufacturers' Council; Dana Pierce, fire protection group; A. Cressy Morrison, gas group; N. A. Carle, National Electric Light Association; Albert W. Whitney, National Safety Council; Coker F. Clarkson, Society of Automotive Engineers; Thomas H. MacDonald, United States Department of Agriculture; E. B. Rosa, United States Department of Commerce; O. P. Hood, United State Department of Interior; Francis J. Cleary, United States Navy Department; J. H. Rice, United States War Department.

Washington Water Power Expanding

OWING to heavy power demands the Washington Water Power Company will begin at once construction on its fifth plant on the Spokane River. This plant, which will develop 14,000 hp., will bring the company's installation up to 125,000 hp.

In speaking of the projected improvement, President Huntington said: "This construction is being undertaken at this time, in spite of the high cost of money and materials, because the company wishes to maintain its reputation for taking care of all the business in its territory. Naturally the company hesitates to increase its plant under the unfavorable condition of the money market and material and machinery costs, but we feel that the demands for power demand such a step at this time."

Regulation of Coal Industry Recommended

A SEVERE arraignment of the coal industry was made before the United States Senate this week in a preliminary report of the Senate committee on production and reconstruction headed by Senator Calder of New York. This committee, which has been investigating the coal situation for some time, recommends regulation of the coal industry to cure existing evils. The repudiation of coal contracts, high prices and irregularity of deliveries were sharply criticised.

The text of the coal section of the report is as follows:

National development depends upon an ever-increasing supply of power. Heat is as necessary for production, in fact, for human existence, as is air or water; its use must be continued from day to day and cannot be deferred or interrupted.

The nation is dependent upon coal as its chief source of heat and power, yet the production and distribution of coal are badly organized and subject to manipulation at the expense of the people.

Coal profiteering, especially as it has followed the priority orders issued by the Interstate Commerce Commission, has continued unchecked by the Department of Justice and is a national disgrace. Coal speculation has been permitted to monopolize the transportation facilities of the country, retarding necessary construction and increasing the basic cost of manufacture and distribution of commodities in general. It has bled the home owners, public utilities, and the industries.

The imperative necessity of continuity of supply of fuel demands the fulfillment of contractual relations in this industry more than in any other, and yet one of the primary causes for the disgraceful and disastrous conditions during the past six months has been the repudiation of contracts. An exceptional demand not only brings about reckless and unwarranted repudiation of contracts made for delivery of coal but the substitution of inferior quality at higher prices. Indeed, coal contracts are so drawn as to be breakable in delivery, in quality and in price.

Our investigation into the coal situation has convinced us that the private interests now in control of the production and distribution of coal, in spite of efforts by some, are actually unable to prevent a continuance or a repetition of the present deplorable situation, and that it is the duty of the government to take such reasonable and practical steps as it may to remedy the evil.

An inherent responsibility of the government is the protection of its people. To assure the mining, transportation and distribution of coal at fair prices is a public

The "Electrical World" Street-Lighting Tables for 1920

FOLLOWING its practice for thirty-two consecutive years, the ELECTRICAL WORLD has prepared tables showing the proper time for lighting and extinguishing street lamps. The 1920 tables are now ready, and a copy will be sent free to any reader upon request to the ELECTRICAL WORLD, Tenth Avenue at Thirty-sixth Street, New York. For more than one copy a charge of 10 cents per copy is made.

duty from which the government cannot escape. But your committee believes that governmental administration of the production and distribution of coal should be a last resort, as governmental activities should always be directed toward encouragement of private initiative and enterprise.

While the fulfillment of contractual relations is of first importance to the stabilization of the industry in the interest of the consumer, the producer, and labor as well, your committee believes that the government should at all times be informed as to coal distribution and recommends:

That all coal operators, wholesalers, jobbers and retailers be compelled by statute to file at regular and frequent periods with some federal agency reports on the total tonnage produced or handled, the size and quality thereof, the amount of tonnage contracted for, the amount sold on contract and at spot sale, to whom, together with the prices made or received under such contracts or sales, and producers and distributers to make regular reports sufficient to determine their costs and profits and the corporate interrelations or the communities of interest, if any, between companies producing and distributing coal.

Fuel thrift by the small user and fuel thrift by the large user through storage, scientific combustion, and transmission should be strongly encouraged by the government.

Massachusetts Utilities May Ask Right to Issue Stock for Premiums

MARKETABILITY of Massachusetts public utility stock has been greatly handicapped by the requirement that stock shall be issued at as high a premium as the market will take. Central stations in that state are at present preparing to present to the next Legislature a bill enabling utilities to issue stock to the amount of premiums appearing in the balance sheet. In the case of the Edison Electric Illuminating Company of Boston, for instance, which will be one of the companies affected, the paid-up value of the stock is 180. Should the contemplated legislation be enacted, it would involve in the case of the Boston company an 80 per cent stock dividend.

Toronto Power Situation Cleaned Up

AFTER two years of negotiations, Sir Adam Beck, chairman of the Ontario Hydro-Electric Power Commission, on Dec. 4 concluded an agreement with representatives of Sir William MacKenzie to purchase for $32,734,000 the entire electrical interests of the various companies promoted, controlled or influenced by him in the Toronto and Niagara district. Sir Adam acted on behalf of the city of Toronto and the other Ontario municipalities composing the Hydro-Electric Power Union.

The properties purchased are the Toronto Power Company, the Toronto & York Radial Railway and the Schomberg & Aurora Railway lines, which three properties compose the Toronto Power Company; the Toronto & Niagara Power Company, the Electrical Development Company and the Toronto Electric Light Company.

The purchase will be financed as follows: The consideration is to be $6,971,295 of 6 per cent twenty-year bonds of the city of Toronto, $2,375,000 twenty-year bonds of the Hydro-Electric Power Commission, $613,528 twenty-year 5 per cent bonds of the commission and the assumption by the commission of the underlying bonds of the Toronto Power Company of $4,355,000, $13,558,917 bonds or debenture stock of the Toronto Power Company, $4,103,200 5 per cent mortgage bonds of the Electrical Development Company, $840,000 three-year 6 per cent notes of the Toronto Electric Light Company, and $13,100 outstanding stock of the Electrical Development Company—making up the following total: Bonds to be delivered, $9,958,823; obligations to be assumed, $22,775,177, a total price of $32,734,000.

The consummation of this large deal was virtually made necessary because of existing franchises if the undertaking of the proposed Hydro-Radial railways was to be gone on with. By the acquisition of the foregoing power plants the Hydro-Electric Power Commission becomes the largest generating and distributing concern in the world. The total capacity of the plants owned, acquired and under construction will be more than 1,000,000 hp. The total investment by the end of 1922 will be between $160,000,000 and $170,000,000 by the Province of Ontario and the municipalities.

The capital cost of the power supplied by the Ontario Power Company, which was acquired by the commission over a year ago, is between $125 and $130 per horsepower, and the investment cost of power generated by the Electrical Development Company (the MacKenzie power plant at Niagara now acquired by the above purchase) is from $130 to $135 per horsepower.

The contracts of the Electrical Development Company and the Toronto Electric Light Company will be carried out by the Hydro-Electric Power Commission, those in the city of Toronto remaining under the present prices until the termination of the Toronto Railway franchise in September next. The Toronto Railway Company is now paying $25 per horsepower per annum.

The public-owned Hydro-Electric system nas been in actual operation for ten years. The only power system in Ontario which is not now publicly owned and operated is that of the Dominion Power & Transmission Company of Hamilton.

Ontario Hydro Awards $2,000,000 Worth of Contracts

CONTRACTS amounting to almost $2,000,000 were awarded at a special meeting of the Ontario Hydro-Electric Power Commission on Dec. 10. The contracts covered transformers, electrical equipment, cement and other materials needed in the construction of the Chippawa Canal power development. The purpose in awarding them at this time, it was stated, is to assist activity in the manufacturing industries affected and supply additional employment during the present winter.

Sir Adam Beck, chairman of the commission, before leaving for England said that the power supply now seems sufficient at least for all manufacturers depending on power in the Niagara district and should continuously meet all their requirements except that there may be short-time interruptions on account of ice, should the winter prove a severe one.

Great Falls Development Awaits Action of Congress

APPLICATION by Baltimore interests for permission to build two dams across the Potomac River above Washington had led the Federal Power Commission to announce that no action will be taken on this matter until Congress has acted on the proposed power development at Great Falls. The report by the corps of engineers on the Great Falls project will be submitted before Christmas, it is believed.

Seattle Municipal Plant to Install Stokers to Guard Against Fuel Shortage

APPROVAL has been given by the Seattle (Wash.) Board of Public Works to the plan to equip four of the fourteen boilers at the city's Lake Union steam plant with stokers at a cost of $150,000. The Seattle municipal plant now burns oil. It is claimed by Superintendent of Lighting J. D. Ross that a saving of more than $150,000 a year will be effected through the installation of the four stokers, which will permit the use of mill refuse, coal or oil. These fuels may be used separately or may be used at the same time.

Advertised Water Powers

WATER-POWER projects ordered advertised by the Federal Power Commission during the week ended Dec. 4, with the final date for filing objections, are as follows:

R. W. Hawley, Commercial Building, San Francisco; Silver Creek; Feb. 28.

Roanoke River Development Company, Richmond, Va.; Roanoke River at Buggs Island; Feb. 24.

Snow Mountain Water & Power Company, Standard Oil Building, San Francisco; dam and reservoir in South Fork of Eel River, Lake County, Cal.; Feb. 24.

Henry Ford & Son, Inc., a New York corporation; Troy dam (the application in this project originally was made by the Ford Motor Company of Delaware); Feb. 15.

Central Credit Men Celebrate Twenty-five Years of Association

TWENTY-FIVE years of credit service to the electrical industry were commemorated by the Electrical Credit Association, central division (previously known as E. C. A. of Chicago), at its silver jubilee meeting, held at the Congress Hotel, Chicago, on Dec. 9 and 10. More than 300 members and their guests were present, and they represented thirty-four different cities in the central division. The accomplishments of the past were recounted by Frederick P. Vose, secretary and treasurer of the association since its inception, and still greater possibilities for the association in the future were suggested in an address by Howard A. Lewis, advertising director of ELECTRICAL WORLD, *Electrical Merchandising* and *Journal of Electricity*. The use and abuse of trade acceptances and an adequate accounting system for contractors were also discussed.

Nine past-presidents were at the banquet on Thursday evening, when the membership at large took the opportunity of presenting Secretary-Treasurer Vose with a chest of flat silver and a silver dinner service as an expression of appreciation of his twenty-five years of service to the organization.

B. P. George, treasurer of the Beardslee Chandelier Manufacturing Company, Chicago, was elected president of the organization for the ensuing year, and A. F. Hearl of the American Electric Supply Company, Chicago, was re-elected vice-president.

Paper Manufacturers Purchase Controlling Interest in Utility Company

CONTROLLING interest in the Northern New York Utilities, Inc., of Watertown, N. Y., has been purchased by a syndicate of paper manufacturers headed by the St. Regis Paper Company. Included in the syndicate are also Harry S. Lewis of Beaver Falls, the Remington Paper & Power Company, the Champion Paper Company, Taggart Brothers Company, the Harmon Paper Company and the Warren Parchment Company. The Northern New York Utilities has nine hydro-electric plants totaling 30,000 hp. and operates 47 miles of steel-tower transmission line. These are to be consolidated with the power development of the paper companies.

In a statement regarding the consolidation, Floyd L. Carlisle, president of the St. Regis Paper Company, said: "The purchasers are the owners of large undeveloped water powers which it is believed will be developed in connection with the utilities company, and transmission lines will be greatly extended. The combined developed and undeveloped water powers of the utilities company and the purchasers are from 150,000 hp. to 200,000 hp., which will make it one of the largest ownerships of hydro-electric power in the eastern United States."

Mexico Has Plans for 100,000-Hp. Plant on Sonora River

THE State of Sonora, Mexico, according to Governor Pablo Borquez, has made considerable preliminary progress toward the construction of a great hydro-electric and irrigation project on the Sonora River at a point about 75 miles from Hermosillo and 10 miles from Ures. When finished the storage reservoir will provide water for irrigating 750,000 acres of land. Although no authoritative estimate has as yet been made of the amount of electric power to be generated, it is stated that it will be not less than 100,000 hp.

The dam at El Puerto del Sol, near Ures, will, according to the engineers' report, be 180 ft. high, 800 ft. long at the top and 200 ft. long at the bottom, including a large pipe of cement and masonry 130 ft. in thickness at the base. Construction of this dam will be followed by others until the entire project is completed on the unit system. The second dam and reservoir will be built near Ryon, on the San Miguel River.

Signal Corps Asks Congress for $10,697,000

THE Chief Signal Officer of the army has requested appropriations for the next fiscal year aggregating $10,697,000. This sum is to be used largely in the equipment, operation and repair of military, telegraph, telephone, radio, cable and signaling systems, electric time service, the rental of commercial telegraph lines and equipment, electrical installations and their maintenance at military posts, and the employment of the necessary personnel.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

A South African Project.—An official report to the South African government mentions a plan to develop electrical power at the Kroonstad colliery, whose product is a steam coal of too low quality to compete with better fuel except close to the mine. The scheme is to transmit the power developed through the Orange Free State, with a line to the diamond mines of Kimberley. It is thought that rapid industrial development of a huge tract of country now given up to agricultural pursuits would follow.

Alabama Power Company's Duncan's Riffle Development.—According to an announcement concerning plans of the Alabama Power Company, its application to the Federal Power Commission for permission to construct a dam and power plant at Duncan's Riffle, on the Coosa River, 14 miles below its present development at Lock 12, foreshadows an ultimate installation of 120,000 hp., of which 50,000 hp. will, by the company's plans, be ready in two years. The present Lock 12 development of 90,000 hp. is being increased by 20,000 hp., and the new unit is to be ready next year.

Industrial Lighting Exhibit Opened in San Francisco.—The industrial lighting exhibit which has been installed by the California Electrical Co-operative Campaign with the assistance of the Industrial Accident Commission of the state in the rooms of the commission in San Francisco was opened to the public on Nov. 22. In addition to showing industrial plants the benefits of better illumination, the exhibit will serve to explain and clarify the lighting safety orders recently placed in effect in California by the Industrial Accident Commission. These lighting orders apply in all places where industrial work is conducted and are intended to reduce eye strain and promote the safety of employees as well as to point a way toward increased production.

Electricity in the Spelter Industry of Tasmania.—Last year the government of Tasmania proposed to expend £500,000 in utilizing the water power of Lake Rolleston to produce 50 tons of spelter a day from the zinc mines on the west coast of the island. This scheme has now been dropped, but the mines have been taken over by a company already producing zinc in New South Wales from ores mined there, and the zinc concentrates produced in Tasmania will be shipped for treatment to its plant at Hobart. The government is to purchase and transmit to the Tasmania mines about 1,500 hp. of electrical energy for operating and other purposes.

Westinghouse Company Employs Students on Part Time.—In order that engineering students of the University of Pittsburgh and the Carnegie Institute of Technology may be able to gain practical knowledge regarding the production and testing of electrical apparatus and at the same time earn extra money, the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has initiated a part-time employment plan. Students are allowed the regular hourly rate for work on Saturday afternoons, Sundays and holidays. For the most part the employment consists of storekeeping, which allows the students to become familiar with the size and character of the different kinds of electrical apparatus.

Electrical Operation for Oil-Field Development.—According to an Austin (Tex.) dispatch to the *Manufacturers' Record*, electrical equipment is rapidly replacing steam drive in the oil fields. The saving in fuel alone has been found to pay for the installation of complete electric generating and distributing plants within a remarkably short period, and it is predicted that within a few years all fields except those having an abundant supply of gas will be electrically equipped. Special attention is called to the large salvage value of electrically operated developments over others in cases where fields have to be abandoned. There is besides a great saving in field operations with the elimination of the extension of steam and water lines and of the need for other steam equipment. As yet the actual work of drilling has not been done with electric drive in the fields especially referred to, but this is thought not to be far off.

Electrical Engineering Section of Signal Corps.—In his report to the Secretary of War for 1920 Major-Gen. George O. Squier, Chief Signal Officer, U. S. A., summarizes the recent work of the engineering section of the Signal Corps. A light wire has been produced adapted to field telephone and telegraph work, but as its high quality could not be maintained were a heavy output necessary, work along this line still continues. Good progress is reported in the production of an entirely satisfactory kite-balloon telephone set and of a lead-zinc battery for emergency storage. Experiments in the adaptation of the German buzzers and induction coils of which models were captured in the war are being conducted, work on a field multiple switchboard is being carried on, field telephones are being remodeled, and a universal test set for the use of linemen in the field has been designed and is being produced in quantity. Hand and horse-drawn wire carts have been improved and other mechanical devices perfected. A satisfactory flashlamp model has been furnished, and a simplex telegraph set for use on telephone wires has been developed.

Associations and Societies

A complete Directory of Electrical Associations is published in the first issue of each month.

St. Louis Section, A. I. E. E.—Automatic substations were to be discussed by R. J. Wensley, switchboard engineering department of the Westinghouse Electric & Manufacturing Company, before this section of the Institute on Dec. 17.

Institute Meetings.—The three hundred and sixty-sixth meeting of the A. I. E. E. will be held at Akron and Cleveland, Ohio, on Jan. 14. The Goodrich rubber plant in Akron will be inspected in the afternoon and a technical session on "Rubber-Mill Electrification" will be held at Cleveland in the evening. The date for the midwinter convention of the Institute at New York has been changed from Feb. 23-25 to Feb. 16-18.

Association of Iron and Steel Electrical Engineers.—Tonight (Dec. 18) the Pittsburgh Section of this association will listen to a paper on "Electric Welding, Spot and Butt," by Gordon Hughes, Truscon Steel Company, Youngstown, Ohio. On Monday, Jan. 10, the Cleveland Section will be addressed by L. A. Heath, engineer Morganite Brush Company, New York, and John S. Cavitt, sales engineer and secretary Electrical Engineering & Manufacturing Company, Pittsburgh, on "The Proper Selection of Carbon Brushes." At the Philadelphia Section meeting on Jan. 8, as announced last week, power-factor correction will be discussed. Other meetings of this association are announced for the following dates: Pittsburgh, Jan. 15; Chicago, Jan. 15; Birmingham, Jan. 27; Philadelphia, Feb. 5; Cleveland, Feb. 14. The programs will be announced in this column later.

Coming Meetings of Electrical and Other Technical Societies

Association of Iron and Steel Electrical Engineers—Pittsburgh Section, Dec. 18; Philadelphia Section, Jan. 8; Cleveland Section, Jan. 10; Chicago Section, Jan. 15; Birmingham Section, Jan. 27.

American Association for the Advancement of Science, Inc., Dec. 29-Jan. 1.

American Physical Society (annual meeting), New York, Dec. 29-Jan. 1.

American Institute of Electrical Engineers—Akron, Jan. 14; Cleveland, Jan. 14; Pittsburgh Section, Jan. 15; Philadelphia Section, Jan. 15; Cincinnati Section, Jan. 17; Lynn Section, Jan. 18; Schenectady Section, Jan. 19; Pittsburgh Section, Jan. 20; Chicago Section, Jan. 24.

Wisconsin State Association of Electrical Contractors and Dealers, Milwaukee, Jan. 19 and 20.

American Water Works Association—Chicago, Jan. 19 and 20.

American Society of Civil Engineers—New York, Jan. 19.

Western Association of Electrical Inspectors, Detroit, Jan. 24-26.

Association of Municipal Electrical Utilities of Ontario—Toronto, Jan. 27 and 28.

A. I. E. E. (New York Section) and A. S. M. E. (Industrial Management Division), New York, Jan. 28.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Contributory Negligence in Vermont.—It is the law in Vermont, the Supreme Court holds (Bianchi vs. Millar), that there can be no recovery for injury if plaintiff's negligence contributed in the least degree to the accident. (111 At. 524.)*

Specific Complaint in Damage Suit.—A complaint that an employing company failed to insulate and guard its electrical appliances and negligently failed to warn an employee who was not an electrician of the danger, and also failed to turn off the electric current while this man was working in proximity to live apparatus, stated a cause of action, according to the finding of the Appellate Court of Indiana in Haskell & Barker Car Company vs. Erickson. The court therefore refused to reverse the verdict against the company, which had appealed to it because the trial court had overruled its motion to make the complaint more specific. (128 N. E. 466.)

Fourteen-Year-Old Law Becomes Confiscatory.—By confirming with unimportant modifications the report of a special master appointed to investigate the questions at issue in Kings County Lighting Company vs. Nixon, the United States District Court for the Southern District of New York has declared unconstitutional because confiscatory the "80-cent gas rate" laws passed by the New York Legislature in 1906 and 1916, and an injunction against their enforcement by the Public Service Commission was accordingly granted. While refusing to fix or suggest, directly or indirectly, a proper rate for gas, the court hinted at its power to vacate its own injunction should the plaintiff endeavor to charge an inequitable rate.

Value of Franchises in Rate Fixing.—In handing down the decision of the United States District Court for the Southern District of New York in Consolidated Gas Company vs. Attorney-General, Judge Learned Hand made these observations respecting franchise value: "If the franchise gets a value because the rates have not been controlled, the 'reasonable expectation' of their continuance is without basis, and that is the only possible ground for a vested interest in such rates. The inaction of the authorities in the past gives no prescription, and without such prescription the franchise can have no capital value unless the very point is assumed. That the franchise has a kind of value is, of course, true enough; it alone protects the 'tangibles' from becoming junk; but as a part of the 'rate base' it should never figure." (267 Fed. 231.)

Illegal Action by Commission Overruled.—The Supreme Court of North Dakota has held, in a suit of the state against the Chicago & Northwestern Railway Company, that a rate order issued under the seal of the Board of Railroad Commissioners and signed by the secretary is void for lack of proper action, the hearing having been attended throughout by only one and a part of the time by two of the three members of the board and no vote having been taken at a subsequent meeting of the board, although it was claimed that an agreement had been reached. The requirements of the statute, the court held, had not been complied with; excess fares received by the railroad must be refunded and a rehearing held. (179 N. W. 378.)

No Obligation on Company to Guard Transformers.—In overruling exceptions taken to the ruling of the lower court in Robbins vs. Minute Tapioca Company and Athol Gas & Electric Company the Supreme Judicial Court of Massachusetts declared that neither a manufacturing company making use of transformers nor a power company which maintained these transformers on the manufacturing company's premises was under duty to a boy on the premises, he being a trespasser, or at most a licensee, to inclose or otherwise guard the transformers. The suit was for damages because of the death of the boy, who deliberately touched wires entering the transformer. The only duty of the companies to the boy was to abstain from reckless conduct likely to injure him. Questions as to the safety of the installation addressed to an expert were rightly excluded, that being a question for the jury, which had all the facts. (128 N. E. 417.)

Principles Applying to Determination of Present-Day Rate Base.—It was found by the United States District Court for the Southern District of New York in a suit brought against the Attorney-General of the state by the Consolidated Gas Company that a period of two years, despite the conditions produced by the war, is sufficient for the calculation of the cost of production and the rate base of a public utility for a future time long enough to call for judicial action. In the determination of the rate base a utility company is entitled to the increased value of capital due to the increase in present cost of production, since the increased valuation of the capital will, for the years of the depreciated dollar, leave the company exactly as it was. The proper standard for the rate base being the present cost of a substitute plant of equal capacity, age of the present plant should not be a function in the rate base, although in computing the rate base from the original cost depreciation is of vital consequence. (267 Fed. 231.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Cost of Money and Comparison of Return.—The increase in the cost of money and in the return realized by investors in industrial securities with which public utility securities must compete in the money market is not, in the opinion of the Indiana Public Service Commission, sufficient to justify an increase in the rate of return from 7 to 8 per cent in the case of a utility which pays but 5 per cent on all the money invested in its plant.

Surrendering Franchise in Return for Indeterminate Permit.—In granting increased rates temporarily to the Hope Electric Plant the Indiana Public Service Commission asserted that the company had not surrendered its franchise in return for an indeterminate permit because it had not followed the procedure for accomplishing this end laid down in the statute, but the commission further declared that it has power in an emergency temporarily to alter existing rates even where they are fixed by an unsurrendered franchise. A coal cost of 9 cents a kilowatt-hour was pronounced to be "ultra-excessive" and to indicate inefficiency.

Adequate Street Lighting a Public Necessity.—The Pennsylvania Public Service Commission has ordered the Duquesne Light Company to install seven additional lamps on streets in the township of Penn, notwithstanding that by its contract with the township the company is obligated to install additional lamps only when their distance from one of its circuits will not be more than 500 ft., whereas in the case at issue the distance is 617 ft. The commission held the extension requested by the township to be a public necessity and that the installation of the lamps would not impose an undue burden on the company.

Powers of Nebraska Commission—Illegality of Utility Strikes.—The Nebraska State Railway Commission enjoys, it asserts, jurisdiction on a different footing from that of most regulating bodies in that its powers are not limited except as the field may be occupied by legislation or the matter may be beyond the control of the people themselves. It therefore claims the power to fix a wage scale for street-railway employees adequate to attract efficient men and prevent interruption of service. The state having provided a tribunal for the adjustment of wage disputes, the employees of a street railway, who have undertaken equally with the stockholders of the company to serve the public, cannot lawfully agree to strike.

Page Golsan, formerly assistant to the president of the Great Western Power Company, San Francisco, Cal., and consulting engineer for the Fleishhacker interests and of the Western office of C. B. Peters Company, Inc., exporters, has resigned these positions to become associated with the engineering firm of Ford, Bacon & Davis, New York.

Daniel N. Peirce is now associated with the engineering department of the Philadelphia Electric Company, where he is doing special work. Mr. Peirce has in recent years been largely engaged in newspaper and publication work. Prior to that he was engaged in the engineering department of the Bell Telephone Company of Chicago.

W. H. Glenn, vice-president of the Georgia Railway & Power Company, Atlanta, Ga., tendered his resignation on Dec. 1, in order to assume the presidency of the Shippers' Warehouse Company, a cotton-compressing and warehousing corporation. Mr. Glenn was associated with the Georgia Railway & Power Company for twenty-nine years, during which time he has been connected with the street-railway end of the company's business.

Charles Lyman Rand, secretary and chief chemist of the Mitchell-Rand Manufacturing Company, New York, manufacturer of electrical insulation products, has relinquished his duties as factory superintendent to devote his entire time to important research work in the chemical and allied fields for his company. He will be succeeded as factory superintendent by Joseph T. Lawrence, chemical engineer, formerly associated with E. I. du Pont de Nemours & Company.

T. W. Flowers has resigned as secretary and treasurer of the Cohoes (N. Y.) Power & Light Corporation to become associated with the J. G. White Management Corporation as assistant auditor of the Manila (P. I.) Electric Company. Mr. Flowers has been associated with the accounting section of the electric industry for the past twelve years, entering the business with the Brooklyn Edison Company. He occupied the position of general accountant for that company on Dec. 1, 1918, when he resigned to go to Cohoes.

Ernest Hagenlocker, for the past year and a half associated with Frazar & Company, New York, exporters and importers, has been transferred to the Tokio (Japan) office of Sale & Frazar, Ltd. He will be connected with the engineering department of that firm, handling design and specification work, particularly of machine tools and locomotives. Mr. Hagenlocher was a member of the engineering staff of the J. G. White Engineering Corporation for five years, during which time he served as resident electrical engineer on the United States Nitrate Plant No. 1 at Sheffield, Ala. He was graduated from the University of Pennsylvania in 1911 and for two years acted as instructor in electrical engineering at that university.

Men of the Industry

Changes in Personnel and Positions—Biographical Notes

W. T. O'Connell has resigned as estimator and designer for the electrical division of the Panama Canal to enter the construction engineering department of the General Electric Company of Schenectady, N. Y.

O. P. Hood, the chief mechanical engineer of the United States Bureau of Mines, has been appointed the representative of that bureau on the Superpower Survey. He brings to the organization a familiarity with many of the mechanical problems involved in the plan. In addition, he has an intimate knowledge of fuel utilization and of the by-products industry.



O. P. HOOD

C. M. Harris, heretofore manager of the railroad shop section of the industrial department, Westinghouse Electric & Manufacturing Company, has been appointed vice-president of the Hagerstown & Frederick Railways Company, which operates interurban railways and central stations in Maryland. Mr. Harris was graduated from Pennsylvania State College in 1901 as an electrical engineer and has handled the electrical business of the Westinghouse railroad shops for a number of years. He was made manager of the railway shop section, industrial department, last spring.

J. G. Menut has been appointed general manager of the Vermont Hydro-Electric Corporation, with headquarters at Rutland, Vt. Mr. Menut is a native of Vermont and has had more than twenty years' experience in public utility administration. For the past year he has been at Easton, Pa., as manager of the Pennsylvania Utilities Company and Easton Gas Works. Prior to that period he was general manager of the Colonial Power Company and Claremont Power Company, of Springfield, Vt., and Claremont, N. H., since merged with the Vermont Hydro-Electric property. The local central-station property at Rutland will also be under the general management of Mr. Menut.

George N. Brown, until recently electrical engineer of the New York State Railways, Syracuse-Utica lines, has been appointed district manager of the New York office of the Pittsburgh Transformer Company. Mr. Brown came to his new position from the engineering department of the Brooklyn Edison Company. Twelve and a half years ago he was graduated from Cornell University, where he took a course in electrical engineering. He immediately thereafter began railway work. In November, 1910, he became connected with the Boston & Maine Railroad and took part in the Hoosac tunnel electrification, afterward acting as switchboard operator in the North Adams power plant. In May, 1912, he became assistant engineer of the three lines which now form the Syracuse-Utica division of the New York State Railways. He was later promoted to be electrical engineer of these lines. During the war Mr. Brown served as a first lieutenant of engineers and was later promoted to the rank of captain. He went overseas in the spring of 1918 and was with the British in Flanders and later with the American Expeditionary Force at St. Mihiel and in the Argonne.

Obituary

Ernest R. Woodbury, manager of the Salem (N. H.) Electric Light Company, died recently at his home in Salem.

John Guest, the patentee of an arrangement for leading wires into incandescent lamps to conserve platinum, died Nov. 29, at his home in Brooklyn, N. Y.

Frederick B. Eaves, assistant general sales manager of the Bryant Electric Company, Bridgeport, Conn., died suddenly on Dec. 12. Mr. Eaves was a graduate of Harvard University, class of 1905, and had been connected with the Bryant company for over nine years. Until 1918 he was field representative of the company in New England and New York State. During the war he served in the electric power and equipment division of the War Industries Board, having charge of the question of essentials as it related to the electric jobbing industry of the country. Soon after the signing of the armistice he returned to the service of the Bryant company, and in 1919 he made an extended trip through Europe as a special representative of the company's export department.

Trade and Market Conditions

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

Pamphlets on Trade Acceptances for Distribution

IN ITS endeavor to assist in every way possible at this time of credit strain, when it is needful for banks and business men to have their assets in liquid shape, the American Acceptance Council announces that it has for distribution a comprehensive series of pamphlets on bankers' and trade acceptances. These publications may be purchased and copies are available in small or large quantities upon application to the council. For some time the electrical industry has been using trade acceptances to a certain degree and to a constantly increasing extent, but without doubt their use would become more general were the trade more familiar with their workings and advantages. One method for gaining this familiarity is that here outlined.

Favorable Outlook Seen in Cotton Belt

ONE of the foremost electrical supply jobbers in the Southern cotton belt, in looking forward into the coming year, has sounded a rather optimistic note as regards business in the electrical industry in that section in the near future.

"We believe that the outlook in our territory for 1921 is good," he says. "Cotton is the foundation of everything, but cotton prices, although low, seem to have reached the bottom and a certain amount of stability is bound to exist. Operations which ceased temporarily must be resumed even on a lower economic basis, and the resumption of work compels necessary purchasing at least.

"Electrical apparatus and electrical devices bear an important part in operations and in the daily life of the operators and the farmers. The market for these will continue to be on the increase until the field is more thoroughly developed than at present. The period of education is in full swing in this section of the country, whereas in the North the education is nearer completion. The North has more nearly reached the point of saturation, while in the South they have just begun to climb."

German Manufactures Showing Up in Foreign Trade

TO SHOW the extent to which German electrical manufacturers have come back into their export market, recent reports show a few interesting contracts which have just been closed by German manufacturers to supply electric materials for foreign use. The German-Chilean firm Saavedra Bénard, representing the Maschinenfabrik Augsburg-Nürnberg A. G., has closed a contract with the Chilean government for eight electric cranes of 3-ton capacity each and fourteen cranes of 1½-ton capacity. These are intended for use in the harbor of Valparaiso, and the purchase price is given as 1,200,000 gold pesos. This is said to be the first large government order from Chile since the war. The Norddeutsche Seekabelwerk Noordam has received an order from the Dutch government for cables for the Dutch Indies, which will keep the works fully employed for several months.

An order for electric cables from the Swiss government has been placed with Siemens & Halske, amounting to 2,500,000 francs. This order has been given for immediate delivery. It is stated that Siemens & Halske had the cables ready for the German Telegraph Administration, which, however, withdrew from the contract in favor of the export to Switzerland.

The same company has received a large order for electric machinery for Chinese mines, railroads and industrial establishments. This order has been secured in competition with American, English and French manufacturers, which have been considerably underbid by Siemens & Halske.

The A. E. G. has received an order from the north of England for electric material amounting to £200,000, to equip a plant with generators, motors, switchboards and other apparatus. Another English order has been given to the Orenstein & Koppel A. G. for mine equipment and narrow-gage railroads, and still another to the Linke-Hoffman Werke, one of the largest railway-car building works in Germany, for special-purpose machinery.

For the Russian Soviet government the German electrical industry has also lately received orders which have aroused considerable attention. Among these was one for 1,500,000 incandescent lamps. Difficulties have, however, arisen with regard to payment, it seems, which are not yet settled and which are not likely to be overcome, although it is stated that the Soviet government is prepared to pay in gold. The Soviet government is, however, unable to produce a guarantee in specie and wants to keep open an alternative to pay by rail and raw material.

Transformers in Good Demand

ALTHOUGH the demand for transformers is somewhat reduced as regards new orders in comparison with the business of last summer and spring, a substantial output is coming through the manufacturing plants. This class of apparatus appears less susceptible to trade fluctuations than many other products. In one of the larger transformer factories recently visited by a representative of the ELECTRICAL WORLD practically full-time production was under way and full use was being made of the opportunity to complete various sizes of distribution transformers for stock deliveries. Raw material is coming into the factories at a better rate than for some time, although it is only within the past two or three weeks that conditions have been so good that output could be pushed without much fear of shortages disturbing production schedules. Even now no great excess of materials of all classes exists. Power transformers are not generally stocked, and deliveries here run from a normal of three to four months up to five or six months, depending largely upon the existence of back orders. Typical deliveries in distribution transformers range now from stock to about eighteen weeks.

The future course of prices is not well defined as yet, although some of the materials entering into manufacture have been reduced. There are still stocks of raw materials to be worked up which were purchased in good faith at higher levels than prevail today, and there has been little tendency toward reduced labor costs in this field. Transformer manufacturers point out that at no time did prices follow the advance of raw-material costs to their peak, and the increases established were moderate in comparison with many commodities.

No very decided drop in quotations is anticipated for the immediate future. Much study is being given to the materials of transformer manufacture and the problem of obtaining insulating paper of a higher degree of dielectric strength is a live one among designing engineers. In some cases it has become necessary to purchase this material at prices comparable to the cost of the higher grades of writing paper, and the problem of avoiding metallic

particles revealed only by the microscope and by electrical tests is one of considerable moment. By and large this branch of the industry is holding its own very satisfactorily considering conditions in many other fields.

Practical Instructions in Boxing and Crating

IN AN effort to save shippers and manufacturers an estimated daily loss of $500,000 due to poor packing and to the use of expensive and improperly designed containers for all classes of domestic and foreign shipments, the Forest Service of the United States Department of Agriculture has been conducting mechanical tests and commercial research at the Forest Products Laboratory, Madison, Wis., since 1915. As a result of this work a practical training course in boxing and crating has been laid out and in five and one-half days the students are taught how to make efficient containers which will deliver the contents in a satisfactory condition at a minimum cost. The dates set for the starting of the next three courses are Jan. 10, March 7 and May 2, 1921. A co-operative fee of $100 payable to the Forest Products Laboratory is charged to cover part of the cost of the instruction.

Further Steel Price Cuts by Independents

AS YET there has been little reaction in buying to the recent price cuts made by independent steel producers bringing the price level of many of their products down to the quotations of the U. S. Steel Corporation. Demand for sheets, bars, shapes, wire products, etc., continues light, and independent mills are further curtailing their output, which in many cases now averages only 50 per cent or less of capacity.

The gap between prices of the corporation and independents has been further closed as more of the independents fall in line and price cuts on additional products have been made. Sheets is the latest item on which the independent market has dropped. The base price of 3.55 cents for blue annealed, 4.35 cents for black and 5.70 cents for galvanized sheets is now quotable for both the independents and the U. S. Steel Corporation. Pipe is now the only product which presents two market levels as demand for pipe has continued with no let-up. Consequently the independents still maintain their prices at about $7 per ton over the corporation list.

Weak Market for Insulation

CURRENT weakness in the market for insulation of all sorts apparently is felt by one manufacturer as much as another. Consumer demand is of the lightest hand-to-mouth variety, even repair shops now having ceased to buy. Electric railways, in spite of the imminence of winter, bringing necessary repairs to equipment, are not as yet providing for their needs in such lines as tapes, varnished cloth, etc.

Foreign buying is as badly off as domestic demand, present exchange rates being largely held responsible. Reports are received that foreign competition is now starting to make itself felt. Samples of insulation material that are said to compare favorably with the product of home manufacturers have been received in this country with a view toward introducing them in the American market.

The general attitude of consumers at present is to await lower prices. Even some manufacturers are holding off buying raw material in view of the uncertain condition of the market. Stocks of finished insulation with large consumers are said to be low, however, and hence producers feel optimistic regarding a return to normal business before spring. At the factories inventories, though in ample shape to care for customers' current needs, are not very large, as the policy of manufacturers has been to avoid stocking high-priced material on a declining market.

Deliveries are about all that can be desired. Virtually all standard material can be shipped from stock, though how long this condition would obtain with a good volume of orders is a question. Prices have slumped considerably following the falling off in demand and lower raw material costs. Varnish gums, shellac, linseed oil, etc., have eased off in price, consequently insulating paints and varnishes are lower. Spot cotton at this writing is quoted at 16¼ cents and the low levels of these materials have been reflected in a drop of from 15 to 20 per cent on varnished cambric and silk, and about 20 per cent on armature twines within the last month. Tapes, though not reduced by all manufacturers, are lower, and friction and rubber tape have dropped materially. On the other hand, paper insulating material has undergone no change, as the market for paper is still undersupplied.

New Corporation to Broaden Export Field

A CORPORATION to be known as the Foreign Trade Financing Corporation will be launched immediately, it is announced, as the result of a conference of representatives of agriculture, finance and business from all parts of the United States called by the president of the American Bankers' Association in Chicago on Dec. 10 and 11. To quote from the resolutions passed at that meeting: "The operation of this organization will result in the broadening of the export market, thus relieving this country of surplus stocks of all kinds, with the result of stabilizing prices and benefiting all lines of trade, agriculture and manufacturing, and will have an especial tendency to encourage production."

A capital of $100,000,000 was authorized, giving a potential capacity of one billion dollars under the Edge act, under which the corporation will be organized. Among the committee of thirty named to supervise the formation of the corporation are found the names of Herbert Hoover and E. M. Herr, president of the Westinghouse Electric & Manufacturing Company. It is the intention to get this organization to a functioning point at a very early date, and the entry of such a force in the export finance field should go a long way toward brightening up conditions in all lines of manufacturing.

The Metal Market Situation

THE copper market shows a firmer tone following the recent dip under the price of 14 cents delivered, at which copper is now firmly held for nearby shipment. The improvement does not seem to be due to any large increase in buying, however, for though there are small day-to-day orders being placed general demand remains weak.

Producers are showing no anxiety to sell and refuse to shade their current price of 14 cents per pound delivered, which price also holds for the first quarter of next year. There is little demand in the outside market, where dealers are quoting on a level with producers for prompt shipment but are asking 14¼ cents for first-quarter delivery.

Lead presents a quiet market, though the price holds firm, but zinc, following its recent upward flurry, weakened more than ¼ cent. Tin also declined slightly.

NEW YORK METAL MARKET PRICES

London, standard spot	£77 5 0	£78 15 0
	Nominal 14 00	14 5
	14 00	14 00
	13 25	13 25
	17 00	17 00
	5 00	5 00
	5 70	5 50
	43 00	
		11 50
		6 40 6 50
	34 37½	33 75
	32 90	32 90

OLD METALS

	10 75 11 25	11 00 11 50
		6 00 6 50
Brass, light		
	4 00 4 50	4 00 4 25
	3 75 4 00	3 50 3 75

THE WEEK
IN TRADE

AS WOULD be expected, the demand for seasonable material has been good, although in general it has not been up to last fall's expectations. Household heating appliances are selling well and motor-driven appliances are selling fairly well, and in all probability few heating appliances will be left over by the opening of the year—not because of excessive buying but because of insufficient stocks. Little change in demand for the general run of wiring materials is reported.

Jobbers are buying little in an effort to keep inventories low, and dealers are buying only as necessary for the same reason. Stocks as a whole are improving because transportation is good; in fact, there is more car surplus now than at any time this year. Pipe seems to be shortest of any of the items. Lamp sales are very good, and stocks of certain sizes are spotty, although stocks as a whole are good.

Collections show no change, but constant following of accounts is keeping the credit situation from falling lower.

NEW YORK

Little or no change in existing conditions is evident to indicate a returning market. A fair volume of goods is moving somewhere, however, though the ultimate destination is not exactly clear. As evidence of this current business comes word from another large jobber that sales for November exceeded the corresponding month in 1919. Sales to industrials for maintenance work are fairly large, but demand from the building industry is exceedingly small.

Lamp sales are excellent, and the demand for conduit is also good. Buying of electric heaters, washing machines and vacuum cleaners has slumped, however, due both to a wave of retrenchment and to expectations of lower prices. In spite of the heavy sales of appliances and specialties which are reported with no let-up by one of the leading local department stores, it remains a question whether the Christmas trade will be up to normal. The majority apparently holds that it will not be.

Collections are being closely watched and pushed hard, but the situation remains unfavorable. Surplus stocks, which in some instances are still reported, seem to be mostly on specialties. Staple lines are down to a fairly normal inventory level.

A decline of 6 per cent in the number of workers in New York State factories from October to November is indicated in the Industrial Commission report.

Flexible Armored Conductor.—Although here and there jobbers report an increase in sales demand for the most part is weak. Stocks on the whole are down to a normal level, with a current price of $80 to $85 net for No. 14 two-wire in lots of 5,000 ft.

Conduit.—A few jobbers have noted a falling off in sales, but the general demand remains strong. Most stocks are good, though a few houses are still short on many sizes. One-half-inch black ranges in price from $78 to $86 net, depending upon the quantity, the lower price being for quantities over 5,000 ft., and the higher for under 2,500 ft. Three-quarter-inch black likewise ranges from $103 to $115.

Lamps.—Sales are excellent and stocks are generally in good shape to meet the demand, though the supply of some jobbers is spotty. Most shortage is found in the supply of round-bulb lamps.

Vacuum Cleaners.—Just now the Christmas demand is causing sales to hold up fairly well, but this is considered temporary, as the general demand has slumped decidedly. Stocks are ample. The "Universal" cleaner has been reduced from $59.50 to $50, list price.

Christmas-Tree Lighting Outfits.—Manufacturers report a good year for sales, but with jobbers demand is not extra heavy. Lamps are plentiful, except perhaps those of the fancy type, and there is a large amount of low-priced Japanese material on the market.

Heaters.—Demand is conceded to fall below expectations, the absence of cold weather apparently accounting for the lack of sustained buying. The supply is ample for all needs.

Dry Cells.—Stocks are in good shape to meet the normally heavy volume of demand which is felt during the holiday season. Prices remain steady, No. 6 bringing 36 cents net in barrel lots.

Washing Machines.—Demand has dropped off considerably, though some jobbers still report fairly good sales. The general buying public seems to expect lower prices and will not buy. Small motors are no longer holding up the supply of washers, and these are now plentiful.

CHICAGO

Locally conditions are unchanged. Christmas trade, beginning at least a week late, is proceeding in enormous volume, but the start was so tardy as to render the possible total below expectations. A certain feeling of improvement is noted in the construction field. It is hard to analyze and seems to be based more on the idea that the period of stress is drawing to a close rather than on any concrete fact. Jobbers made reductions in the prices of building materials a week ago, and this should tend to accelerate the progress of small jobs.

Collections remain difficult. Concerns covering the entire country report the Middle West as appreciably slower than either the East or the West. This is due to the difficulties in which the agricultural interests find themselves.

Motors.—Stock conditions continue to improve, those sizes which it has been hardest to obtain now being easier. Inquiries from the railroads continue, but purchases from this source are almost negligible. Manufacturers, still behind in deliveries of certain sizes, are continuing operations and show every sign of confidence in the future.

Meters.—The utmost efforts of manufacturers have so far failed to produce meters in sufficient quantity to supply the demand. All plants are reported as working full time and with a comfortable volume of orders on the books. Deliveries range from six weeks to three months.

Instruments.—While demand is much lessened in the last few weeks all jobbers still report many unfilled orders and manufacturers are working under pressure to supply old requirements. This line, requiring the finest of materials and highly skilled workmen, has felt no demand for lowered prices.

Lamps.—Despite the lack of new construction the volume of business in lamps is very gratifying. This is largely because stocks, so seriously depleted during the eighteen months just passed, have not yet been built up to normal. Production is proceeding at a high rate, and receipts are clearing rapidly through jobbers' hands. Some price advances are recorded in special types.

Fans.—It is reported that one or two advances in list have been quoted by manufacturers, based on high production costs. The tendency on the part of the jobber is to resist any advance, and but few orders are being booked on the new basis. The advance is said to amount to $1.25 on a fan costing $16. Jobbers' stocks are all in fair shape, and dealers are showing no anxiety to increase holdings.

Porcelain.—With the exception of heavy insulators all porcelain products are getting easier. Knobs, tubes and cleats, firm in price, are now obtainable in reasonable quantities for immediate delivery and indications are that with enlarged factories future demands will be met promptly.

Appliances.—As was to be expected during the Christmas season sales of all appliances are reaching a high figure. This is particularly felt in the case of washing machines, which are enjoying heavy sales in all sections of this territory.

BOSTON

Little change appears in the volume of trade this week compared with last. Although jobbers' stocks are somewhat spotty a general condition of oversupply exists and buying from the manufacturers is rather inactive except in some appliance lines. Prices are still firm, barring weakness in insulated wire. Collections are fairly good this week and are being kept up well. Deliveries are highly satisfactory from the buyer's side. Building operations are slow and little new work is in sight at present. Replacement orders are being handled in good volume and many back orders are being cleaned up also. A wage cut of 22½ per cent is announced in some of the larger textile centers.

Street-Lighting Equipment.—Manufacturers are booked about two months ahead. Prices are steady and new business is not up to normal. The expiration of contracts, however, tends to develop orders independently of general business conditions.

Motors.—Back orders are occupying the attention of manufacturers and deliveries show much variation. Small motors of 3-hp. to 5-hp. rating are hardest to obtain at present, representative deliveries running around twenty-six weeks. Many hold-ups and cancellations are slowing down shipments. Odd lots of motors are furnishing quick deliveries here and there. Prices are firm.

Rigid Conduit.—Stocks are uneven and prices none too certain. The demand is only fair in view of the relatively low volume of construction work now being handled.

Fixtures and Portable Lamps.—A good sale is reported and much business is coming through via the old house-wiring route. Sharp competition is evident in the retail trade, where stocks are large and some price cuts are apparent.

Wire.—Rubber-covered No. 14 wire is weak, quotations being $9 per 1,000 ft. in 1,000-ft. lots. Weatherproof base is 23 cents, bare base being 19 cents. The demand is not very active and stocks are of liberal size.

Christmas-Tree Outfits.—Trade is not up to last year's but fair sales are nevertheless being made. In lots of twelve an eight-lamp outfit is quoted around $2 each. Stocks are easily meeting the demand.

Flexible Armored Conductor.—No. 14 single-strip is quoted at $85 in 1,000-ft. lots. Sluggish movement is apparent.

Dry Cells.—Business is fairly good, though not up to the summer sales volume. No. 6 cells are quoted at $37.35 per 100 and the ignition type at $38.35. No complaints are heard now as to difficulty of supply or delivery.

Appliances.—Toasters, percolators and flatirons are moving well. A substantial holiday trade is expected in the more ornamental and smaller devices. Prices are steady. Radiators are moving well, and owing to hand-to-mouth ordering by jobbers a shortage after Jan. 1 would not be surprising. One manufacturer had less than 4,000 in stock Monday.

ATLANTA

Business in general continues rather slow. There is a feeling that the worst of business conditions has passed and that from now on till early spring conditions will slowly improve and that they will be on a normal footing by the middle of March. A number of textile mills that had shut down have recommenced operation, some of them with wage reductions. Government reports show that most of the ginning has been completed, and as soon as the price of the staple rises the crop will undoubtedly begin to move, thus opening up business in general. Retailers report the holiday trade on the increase and are more optimistic regarding the outlook for the remainder of the year, though it is apparent that the Christmas trade will not be so heavy as anticipated in the early fall.

Schedule Material.—All jobbers have good supplies on hand and report their ability to obtain shipments on almost any article in this line. Owing to quiet building activities, however, stocks are moving rather slowly. Prices: Key sockets, carton lots, 39 cents; cleat rosettes, standard packages, 15 cents; friction tape, 71 cents.

Poles.—The movement of poles has slowed down materially, as the smaller companies are not doing any construction and the purchase of poles is confined almost exclusively to maintenance work by the larger utilities. Chestnut poles of satisfactory quality are almost impossible to obtain. Prices: Western red cedar, 30-ft., $16.70; 35-ft., $24.90.

Cross-Arms.—Stocks and shipments of cross-arms are reported quite satisfactory, with the larger utilities buying in fair quantities. No heavy movement of cross-arms is to be noted, the sales being about normal for this time of the year.

Wire.—The decline in the price of wire has served somewhat to check the demand, though the popular sizes of both weatherproof and rubber-covered continue to move fairly well to fill current needs. Stocks are reported in good condition and shipments satisfactory.

Flexible Non-Metallic Conduit.—The predicted price break has not materialized, though jobbers report heavy stocks and slow sales. Quotations are on the basis of $30 per 1,000 for ⅜-in. size.

Lamps.—Lamp stocks are moving briskly. The 60-watt to 300 watt sizes are particularly lively, and some shortage is reported because shipments are somewhat slow.

Household Specialties.—Vacuum cleaners, washing machine and heavier lines are taking on more life and retailers seem to feel quite hopeful. Stocks are in sufficient volume to meet requirements.

Rigid Conduit.—Stocks of pipe in both galvanized and black are in excellent shape—in fact some firms report an overstock. As in all other building material lines sales are rather slow being made for current requirements only.

ST. LOUIS

Jobbers report a slightly greater volume for the past week, particularly in the sales of seasonable goods. The market remains dull in other lines, but the situation does not seem to be the source of any worry to jobbers. It is generally admitted that inventories will be high, but every one in the trade is expecting a rush of construction to start early in the spring, and if this occurs the overstocks of various items will be cleaned up quickly.

Retail sales of holiday specialties, while not entirely a disappointment, will not compare with those of last year in spite of the fact that central stations, dealers and department stores are using compelling merchandising methods.

Collections remain slow, but are not becoming any more difficult. One jobber reported an average of forty-five days for his collections, but the general average is around sixty days. The burdens of the credit men have been somewhat lessened of late owing to the conservative buying being done in all branches of the business.

Transformers.—Manufacturers report an increase in new business, and inquiries also have been heavy for all types. Books have not been cleared of back orders, and as a result the increase in new business has retarded deliveries to some extent again. Power transformers are being promised on about four months' deliveries and distribution types in about eight weeks.

Insulators.—Jobbers have fairly complete stocks of porcelain insulators, but a steady demand has not allowed them to build up reserve stocks. Glass-insulator stocks are spotty and demand for them is strong. Prices are holding firmly.

Rigid Conduit.—Jobbers have fair stocks of most sizes with the exception of ¾-in. and ½-in. black conduit, shipments on which are reported, however. Demand has become very slow, but the prospect of renewed building in the spring is holding prices at their former levels. Representative prices are $80 per 1,000 ft. of ½-in. black in lots of 5,000 ft. or more and $148 for 1-in. black.

Wire.—The situation is unchanged, with quotations on the 23-cent base. It is thought generally that another slight drop is due before very long. Demand is small.

Washing Machines.—There is practically no call at present, but prices of manufacturers here are holding at former levels.

Vacuum Cleaners.—There is a fairly good demand and jobbers have normal stocks.

Curling Irons and Percolators.—Jobbers are receiving from dealers numbers of orders for these appliances which they are unable to fill because of the shortage which has existed for some time.

Toys.—Dealers and department stores are finding the call fairly steady but not as strong as that of last year. Small wireless outfits are selling well.

Christmas-Tree Lighting Outfits.—Jobbers have normal stocks, but the demand is not quite up to expectations.

Cross-Arms.—Demand is spotty. Stocks are about normal and jobbers can make immediate delivery on moderate quantities.

SAN FRANCISCO

Rains suspended active building for nearly two weeks, but a few days of fine weather recently have caused a jump in the value of building permits. The unusually heavy rains have done some damage because of high water in the big rivers, but in the mountains the snowfall has assured the much-needed frozen storage for 1921.

Line-Construction Material.—Power companies are buying heavily because they are preparing to distribute the enormous increase in horsepower that will be available early next year. The business in insulators, pole-line hardware and construction tools has been pretty generally distributed among jobbers who specialize in those lines.

Heating Appliances.—About three weeks ago the trade in heating appliances dropped off very suddenly and alarmingly. It is expected that this will be a late buying season, but on the other hand dealers who placed large orders on the strength of the pre-season demand and congested Eastern factories and are accordingly heavily stocked are now becoming rather anxious. Despite urgent appeals, comparatively few purchases are being made by the buying public. Urn-type percolators, so difficult to get a few months ago, are piled up on many a shelf.

Wiring Material.—Dealers are purchasing their schedule material in small lots, and there seems to be a general expectation of sharp drops in prices in the near future. Stocks are not only high on the Coast but the market is falling.

Radiators.—After Jan. 1 the standard house-size Majestic radiator will retail for $13.50. Orders delivered before that time will carry the present price of $12 each, list. Deliveries of all makes have been very good this season, and dealers are carrying not only a variety of makes but a far greater variety of sizes than ever before. An especially encouraging feature has been the number of larger-than-socket radiators sold this season, which will provide an entering wedge for the intensive campaign that is sure to be waged in the next two or three years when larger power supplies are available.

Holiday Novelties.—Jobbers are completely sold out on their early deliveries of Christmas-tree outfits, but later deliveries are expected to supply all demands. Dealers report comparatively few sales of outfits as yet, but expect to be sold out within the ten days preceding Christmas. There is a widespread call for toy ranges retailing for about $15, but there are very few of these to be had.

SEATTLE—PORTLAND

The widespread curtailment in general business prevalent throughout the Northwest is greatly affecting the electrical industry. With the exception of holiday business, which up to date has been light, there is little activity along electrical lines. Sales of housewiring devices, industrial appliances and equipment are at a minimum, and it is not believed these lines will show movement of any moment until early spring. While considerable optimism exists as to the outlook for next year's electrical sales present conditions do not warrant a prediction along that line.

Collections show no improvement, and the credit situation is unchanged. Many of the lumber mills and logging camps in Oregon and Washington which are still operating have announced intentions of making repairs and extensions involving installations of some electrical equipment during the holiday shutdown period. Closing down of mills and cutting of wages is general. The non-employment situation is becoming serious.

Manufacturers in the Portland district report business continuing to hold its own. Indications now are that it will be a better month than November. Inquiries in regard to projected work are very active. It is felt that the credit situation will be somewhat easier in a short time. Jobbers in this district report a further tendency downward in the prices of all types of wire. Business continues good.

Contracting business in the Portland field is slowing up somewhat, but prospects are that business for December will be nearly normal. By the first of the year contracts in hand now will be virtually completed, and there is very little new business in sight.

Hollow Ware.—Holiday demand for toasters, percolators, grills, etc., is far in excess of last week, but still much lighter than anticipated. As a whole, retailers agree, this year's holiday demand will be much less than that of several years past. Up to date stocks have been ample.

Heaters.—Inclement weather during the week speeded up heater sales. Stocks are sufficient to meet the demand to date.

Floor Lamps.—Demand is fair but not so large as anticipated. Inquiries are not resulting in sales owing mainly to price. Stocks are in good shape.

Wire.—The market remains weak with no immediate signs of strengthening. Stocks are being kept down because a decrease in price would not be unexpected.

SALT LAKE CITY—DENVER

That business conditions are slowly on the mend is the general opinion of those most competent to judge. Bank clearings are high, and many houses report their volume of sales more satisfactory than during the corresponding period of last year. Belief is expressed that liquidation of prices is approaching a basis of stability in many commodities, if the bottom has not already been reached. Dealers are amply stocked for a none too brisk holiday trade and for the present have practically quit buying. This condition, however, is incident to pre-inventory activity and hence is considered normal by jobbers.

It is expected that there will be a big impetus in consumer demand for electrical appliances in the next two or three days. One thing favorable to business acceleration is a payment to sugar-beet growers amounting to many millions of dollars. There is little building and development activity; consequently contractors are not in the market with their usual demand for construction materials. This condition, though unfortunate in nearly every sense, has at least favored manufacturers in the way of helping them to catch up on back orders. There are scattered instances of non-employment throughout the Intermountain region, but the condition is not by any means acute or general.

Wire.—The shortage reported a few weeks ago has now been completely overcome. Stocks for immediate shipment are more than ample. Jobbers are selling on an 18-cent base, representing a reduction of 25 to 30 per cent. There has been a corresponding falling off in price of insulated wires and cords.

Porcelain.—There is still a shortage on porcelain, factories not having been able to catch up on back orders.

Hollow Ware.—A little spurt in the electrical cooking-appliance trade has been noted. There is no evidence of a general decline in retail prices.

Electric Ranges.—The sale of ranges is only occasional as winter is the off season. Jobbers are stocking heavily, however, in anticipation of a good consumer demand next spring and summer.

NEW APPARATUS & APPLIANCES

A Record of Latest Developments
and Improvements in Manufacturers' Products
Used in the Electrical Field

Flexible Conduit Fitting

The Nicholson box connector for metallic flexible conduit has been placed on the market by the Nicholson Electric Fittings Company, Wilkes-Barre, Pa.



PROJECTION HOLDS FLEXIBLE CONDUIT IN PLACE

It has a projection on the clamp and inside sleeve which engages in the groove of the conduit. Because of its adjustable clamp, its adaptability to several sizes and types of flexible metallic conduit is asserted by the manufacturer.

Electric Truck for Foundry Use

For packing and transporting pots in the process of making malleable castings, the Elwell-Parker Electric Company, Cleveland, Ohio, has developed a storage-battery truck capable of carrying a 4,000-lb. load and placing it in the oven. The lift mechanism is a completely inclosed unit, all parts of which run at slow speed in oil. The



LOAD OF 4,000 LB. MAY BE CARRIED

driving unit consists of a totally inclosed motor directly connected to a worm gear driving through a four-bevel pinion differential to the wheels. All units are standardized and built on an interchangeable system. The complete unit is 12 ft. over all in length and weighs 3,600 lb.

Electrical Window Cleaner

The Hartford Electrical Appliance Company, Hartford, Mich., has developed an electrical device that, according to the manufacturer, will remove snow and ice from the outside of windows while at the same time cleaning the inside of the glass.

Connector

A connector embodying the jam-nut principle has been developed by R. A. Macbeth, 1424 Girard Street, Los Angeles, Cal. The wire grooves are V-shaped to afford greater contact surface, while one screw and one nut secure as many as five wires. Different sizes of wire may also be used.

Ice-Cream Freezer

An ice-cream freezing mechanism has recently been placed on the market which will drive any ordinary ice-cream freezer of from 2 quarts to 6 quarts capacity. The machine consists of a drive wheel and a motor, mounted on a baseboard, the drive wheel being adjustable on frame rods to accommodate the various heights of different freezers. The power may be supplied by an individual motor or by a motor from some other machine, such as a washing machine. The Taylor Brothers Churn Company, St. Louis, Mo., which makes the machine, supplies the motor, driving machine and freezer complete or in part.

Notes on Recent Appliances

Candle Socket

A turn-candle socket for individual control of lights is being marketed by the Bryant Electric Company, Bridgeport, Conn.

Ironing Machine

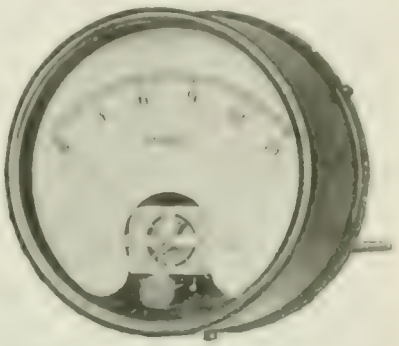
An electric ironing machine with ruffler attachment has been developed by the Western Electric Company, 195 Broadway, New York City.

Water System

The Thompson Manufacturing Company, Des Moines, Iowa, has placed on the market a self-contained electrically operated water system.

Ammeters and Voltmeters for Special Applications

Type DX instruments placed upon the market by the Westinghouse Electric & Manufacturing Company are, according to the manufacturer, especially suitable for use on switchboard panels, on radio communication sets, on small charging and lighting panels, and for use on marine, dental, telephone and telegraph panels. They operate on the D'Arsonval principle and are characterized by ruggedness and lightness of moving parts. The case is punched from sheet metal and is made moisture



SPEED AND TEMPERATURE MAY BE MEASURED

proof, and an external zero adjuster is provided on the front of the case.

The ammeters are furnished self-contained up to and including high capacities for use with shunts. The voltmeters are furnished up to 500 volts, self-contained. They can be furnished for higher voltages with external resistances. On the type DX instrument the heating strip and thermocouple are mounted as a unit and these units are interchangeable on instruments of the same capacity. Special ammeters for measuring high-frequency currents of low capacity can be made up by using heaters and thermocouples mounted in gas-filled bulbs.

Bell-Ringing Transformers

The Vim bell transformer, brought out by the Betts & Betts Corporation, New York City, is of the porcelain type. A metal lip on the bottom plate is used



SECURED TO SUPPORT BY METAL HANGER

to secure the transformer to its support. Its output capacity is given as 12 watts on 110 volts primary, the secondary voltage being [illegible]. Weight is 1 lb.

MANUFACTURERS' ACTIVITIES

Record of Changes Affecting Sales and Distribution Together with Trade Personals and Notes on Foreign Trade, Jobbers' News and New Trade Literature

W. J. BURTON, manager for the adjustment bureau of the St. Louis Association of Credit Men, has been appointed receiver for the Bluebird Appliance Company, St. Louis, formerly the jobbing company for the Bluebird Manufacturing Company, which has been taken over by the Davis interests of Dayton, Ohio. An involuntary petition in bankruptcy was filed against the appliance company several weeks ago, but the appointment of a receiver was delayed until the agreement of Sears Lahmann, attorney for the company, was secured. Mr. Burton's bond was fixed at $50,000.

THE BALDOR ELECTRIC COMPANY, St. Louis, Mo., announces its intention of beginning production of 3-hp. and 5-hp. repulsion induction single-phase motors. They will be 60-cycle, six-pole, 110/220-volt interchangeable machines. The largest motor built by the company at present is 2-hp.

THE UNITED STATES ELECTRIC COMPANY, New London, Conn., has recently purchased the property of the J. N. LaPointe Company, formerly the Forbes factory, in New London, and will use it for a manufacturing plant. The company makes electric forges and electric hot-water heaters.

THE HUGRO MANUFACTURING COMPANY, Warsaw, Ind., announces a consolidation of its interests with those of the Remmert Manufacturing Company, St. Louis, the merger having taken effect Dec. 1. W. L. Groth, president of the Hugro company, will be president of the consolidated companies, and William Remmert, formerly president of the Remmert company, will be vice-president and sales manager. Headquarters will be removed to Warsaw as soon as possible. The Warsaw plant will be devoted to the manufacture of vacuum cleaners, and the St. Louis plant, which will be known as the Remmert branch of the Hugro Manufacturing Company, will continue the manufacture of washing machines. The present combined capitalization of the two companies is $1,800,000, but it is planned to increase this to $5,000,000.

THE EMERSON ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., has announced the results of the election of officers by the board of directors as follows: H. L. Parker, formerly president of the company, becomes chairman of the board of directors; T. M. Meston, formerly vice-president, becomes president; H. I. Finch, formerly vice-president and superintendent, becomes first vice-president; E. L. Barkhouse, formerly vice-president and sales manager, becomes second vice-president; C. C. Connor, formerly assistant secretary, becomes third vice-president; H. S. Gilliam, formerly assistant treasurer, becomes treasurer; L. L. Whittemore was re-elected secretary.

THE STANDARD ELECTRIC MANUFACTURING COMPANY, 216 North Clinton Street, Chicago, Ill., has awarded contracts for a two-story building, 125 ft. x 162 ft., at 925-29 Wrightwood Avenue, to cost $135,000.

THE BELDEN MANUFACTURING COMPANY, 2300 South Western Avenue, Chicago, manufacturer of electrical appliances, has rescinded the increase in capital stock from $2,000,000 to $4,000,000, recently authorized. The stockholders have voted an increase in capitalization to $3,000,000.

THE FAIRBANKS STORAGE BATTERY COMPANY, 438 Atlantic Avenue Stamford, Conn., is planning to erect a building, 50 ft. x 150 ft. on West Avenue, Norwalk, Conn., to cost about $50,000

THE UNION ELECTRICAL SUPPLY COMPANY, Providence, R. I., manufacturer of electrical specialties, has increased its capital stock from $50,000 to $200,000.

THE BATES EXPANDED STEEL TRUSS COMPANY, 200 South La Salle Street Chicago manufacturer of steel poles, etc., has awarded contract for an addition, 100 ft. x 135 ft., one story, to its plant on Forsythe Avenue, East Chicago, Ind.

THE NATIONAL SCREW & TACK COMPANY, Cleveland, Ohio, has taken over the property and holdings of the Adams-Bagnall Electric Company, Cleveland, manufacturer of small motors, lamp reflectors and fans. The plant of the latter company will be operated as the A-B Products Division of the National Screw & Tack Company. No change will be made in the management. W. D. B. Alexander is president of both companies.

THE CHAMPION IGNITION COMPANY, Flint, Mich., has postponed indefinitely the opening of its Canadian plant in Brantford, Ontario.

The F. B. ELECTRIC & MANUFACTURING COMPANY, Detroit, Mich., manufacturer of a complete line of electrical devices for service stations and battery stations, now sells all its products directly to the consumer or through its own sales channels. The company's products were previously handled through the Fairbanks Company, New York City.

THE AMERICAN ELECTRICAL & MAINTENANCE COMPANY, Philadelphia, announces the removal of its offices and shop to its new building at 519 Cherry Street and 524 Quarry Street.

THE STAR BRASS WORKS, 3114-28 Carroll Avenue, Chicago, manufacturer of spray cooling systems, has established a Pacific Coast office in the Rialto Building, San Francisco, Cal., in charge of L. M. Page.

THE ROBBINS & MYERS COMPANY, Springfield, Ohio, has appointed Herbert T. Lewis manager of its Philadelphia office, succeeding the late A. S. Farr. Mr. Lewis entered the employ of the company in February, 1913, as salesman in the Philadelphia office. The territory under his jurisdiction will include the State of Pennsylvania, Virginia, West Virginia, Delaware, Maryland, North Carolina, South Carolina, Georgia, Florida, southern New York and eastern Tennessee.

THE STANDARD ELECTRIC TIME COMPANY, Springfield, Mass., has issued its thirty-fifth annual catalog, covering all sorts of electric time equipment for schools, factories, etc. A special folder showing in condensed form its equipments for industrial purposes has also been issued by the company.

THE LINCOLN REVOLVING TRANSFORMER COMPANY, Cleveland, Ohio, recently organized by J. C. Lincoln, president of the Lincoln Electric Company, to manufacture a revolving type of transformer developed by Mr. Lincoln, has established a plant at 2400 Woodland Avenue.

THE LIGHTING ENGINEERS COMPANY has opened an office at 1270 Broadway, New York City, for the design and installation of scientific, commercial and industrial systems of illumination. The company would like to receive for its files trade publications from manufacturers of lighting units, fittings and fixtures used in modern systems of illumination.

THE AMERICAN EVEREADY WORKS, Long Island City, N. Y., reports the greatest demand in its history among the retail trade for flashlights to be sold as Christmas gifts. A feature of this, of course, is the potential demand that should ensue for batteries as refills.

THE MITCHELL-RAND MANUFACTURING COMPANY, New York City, manufacturer of insulating material, has concluded arrangements whereby the company will handle and stock the products of the Irvington Varnish & Insulator Company for Eastern territory at mill prices.

CHARLES LYMAN RAND, secretary and chief chemist of the Mitchell-Rand Manufacturing Company, New York, manufacturer of electrical insulation, has relinquished his duties as factory superintendent to devote his entire time to important research work in the chemical and allied fields for his company. He will be succeeded as factory superintendent by Joseph T. Lawrence, chemical engineer, formerly associated with E. I. du Pont de Nemours & Company.

THE ABSOLUTE CON-TAC-TOR COMPANY, Chicago, has moved its factory from 2003-2005 Larrabee Street to larger quarters at 4056-4058 Armitage Avenue. The offices of the company remain at 127 North Dearborn Street.

THE GOLD SEAL STORAGE BATTERY COMPANY, Green Bay, Wis., recently incorporated with a capital stock of $300,000, proposes to erect a plant early next year for the manufacture of accumulators. As yet details for the project have not been given out. F. J. Mankin is interested in the company.

THE BURTON-ROGERS COMPANY, 755 Boylston Street, Boston, Mass., sales department of the Hoyt Electrical Instrument Works, has established a new sales office at 23 West Peachtree Street, Atlanta, Ga., and 908 Race Street, Cincinnati, Ohio. This gives the Burton-Rogers Company an office in seven of the principal cities of the country.

Supply Jobbers' Notes

THE ERNER ELECTRIC COMPANY, Cleveland jobber, entertained the Cleveland Women's Advertising Club on Nov. 9 at an electrically cooked dinner.

THE CARTER ELECTRIC COMPANY, electrical jobber in Atlanta, is building a new three-story warehouse on Haynes Street, adjacent to a convenient railroad siding. This warehouse will provide 55,000 sq.ft. of space and will be occupied on Jan. 1. The present retail store will remain on Peachtree Street in Atlanta, but all the wholesale service will be provided at the warehouse. This jobber maintains a warehouse in Savannah, Ga., which has 20,000 sq.ft. of space and a stock of $75,000. L. L. Shivers is vice-president and general manager of the Carter Electric Company and is in direct charge of its business. F. S. McGaughey is assistant manager and J. J. Perry is sales manager. This company has made rapid strides in extending its business in the past few years until it is now one of the largest jobbers in the South.

Foreign Trade Notes

ELECTRICAL EQUIPMENT WANTED FOR AUSTRALIAN POWER PROJECT.—Tenders will be received by the secretary Electricity Commissioner, State of Victoria, 673 Bourke Street, Melbourne, Australia, until Feb. 24, 1921, for equipment for power plant and transmission line in connection with the proposed 75,000-kw., 11,000-volt Morwell electric power scheme. Copies of specifications may be seen at the offices of the Canadian Manufacturers' Association, Traders' Bank Building, Toronto, Ontario, and 42 Lacrament Street, Montreal, Quebec.

AUTOMATIC ELECTRIC ELEVATOR DEVICES.—By a recent order of the Manitoba Elevator Board all passenger elevators in the Province of Manitoba, Canada, must be equipped with an automatic electric interlocking device which will prevent the movement of the car while any elevator shaft door is open. One year, it is reported, will be given in which to equip passenger elevators with an approved device before the penalty imposed by the order becomes effective

HYDRO-ELECTRIC DEVELOPMENT IN NEW ZEALAND.—The Hawkes Bay Power Board contemplates raising a loan of $973,000 to build a hydro-electric power plant on the Waikaremoana River to distribute electricity in Wairo and surrounding country.

DUTCH COMPANY INCREASES CAPITALIZATION.—The Hengelosche Electriche en Mechanische Apparaten Fabriek (Heemay) of Hengels, which is now capitalized at 5,000,000 florins, has authorized an issue of new shares for 2,250,000 florins at the price of 106 per cent, the proceeds to be used for general business expansion purposes and for extensions to works and warehouses. The company is also having its articles of association modified so as to raise the nominal share capital to 10,000,000 florins.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An inquiry has been received from a man in England (No. 34,134) wishing to obtain representation of firms for the maintenance of a permanent exhibit of American electrical goods.

A firm in China (No. 34,150) requests catalogs and price lists with discounts, of electric lamps and fixtures, generating sets, community lighting units of all sizes, etc.

A mercantile company in India (No. 34,154) desires to secure an agency and purchase electric appliances and electric goods.

Frank Moffet, formerly with E. C. McCullough & Company, Manila, P. I., is now associated with C. S. Salmon & Company, P. O. Box 1634, Manila, as manager of their new electrical department. The company is desirous of receiving catalogs and price lists from all electrical manufacturers interested in foreign trade and is particularly interested in obtaining an electrical fan agency.

Trade Publications

ELECTRIC HEATERS.—"Electric Heating of Air" is the title of a four-page pamphlet being distributed by the Curtis Hammer Manufacturing Company, Milwaukee, Wis., describing and illustrating the C.-H. connector type electric air heaters.

ELECTRIC FURNACES.—The Electric Construction Company, Ltd., Charmonth Street, Leeds, England, is distributing four booklets entitled "Electric Furnaces for Melting Non-Ferrous Metals," "Electric Furnaces for Heat Treatment of Metals," "Automatic Electric Rivet Heaters" and "Electric Hardening and Tempering Plant for Steel Wire and Strip."

"AUTOMOTIVE EQUIPMENT."—The Motor Specialties Company, Waltham, Mass., has issued a catalog covering the "Mosco" automotive equipment and electrical specialties manufactured by the company.

VALVES.—The Scott Valve Manufacturing Company, Detroit, Mich., has issued catalog No. 12, containing 185 pages, in which it describes and illustrates its different types of valves.

OIL CONSERVATOR.—The General Electric Company, Schenectady, N. Y., has issued bulletin No. 19,706, describing the construction and function of the conservator type of oil tanks for power transformers.

New Incorporations

THE ROBY (TEX.) WATER & LIGHT COMPANY has been chartered with a capital stock of $20,000 to construct and operate an electric light and power plant and waterworks system. L. C. Eastland is interested in the company.

THE ROSCOE ELECTRIC COMPANY, 126 West State Street, Rockford, Ill., has been incorporated by W. C. Sparks, Stuart A. Ralston, of Rockford, Ill., and John Faissler, of Sycamore. The company is capitalized at $10,000 and proposes to distribute in Roscoe electricity which will be purchased from the Rockford & Interurban Railway Company, Rockford.

GEORGETOWN (IND.) ELECTRIC LIGHT & POWER COMPANY has been incorporated with a capital stock of $4,500 by J. A. Wright, A. E. Kelly, W. A. Smith, E. J. Taylor and O. M. Byerly. The company plans to build an electric plant to supply electricity in Georgetown.

THE CITY ELECTRIC COMPANY, Wheeling, W. Va., has been chartered by William E. Rodenback, Willis H. Marshall, Jr. and Edwin Weidebusch. The company is capitalized at $10,000 and proposes to manufacture electrical devices.

THE NITRO ELECTRIC COMPANY, LTD., Toronto, Ont., Can., has been chartered with a capital stock of $40,000 by Frank Bott, 156 Yonge Street; Robert D. Hume, 157 Yonge Street; Ernest V. McKague and others. The company proposes to manufacture electric fixtures, machinery, motors, etc.

THE ELECTRICAL MATERIAL COMPANY, Weehawken, N. J., has been organized by George Emerson and Walter L. Fischer to manufacture electrical equipment.

THE INSTANT ELECTRIC COMPANY, Maysville, Ky., has been chartered by Andrew Clooney, Clement Ford and E. H. Knapp. The company is capitalized at $25,000.

THE WEAVERVILLE (N. C.) ELECTRIC & TELEPHONE COMPANY has been incorporated with a capital stock of $25,000 by J. V. and Edith Elrskine and T. O. Deadrick.

Construction News

Projects, Plans, Bids and Contracts. Contemplated or Under Way

New England States

BOSTON, MASS.—The Boston Elevated Railway Company, 101 Milk Street, has petitioned the Legislature for authority to spend $1,421,000 for the erection of a power house.

SOUTHBRIDGE, MASS.—Permission has been granted to the Webster & Southbridge Gas & Electric Company by the Department of Public Utilities to issue $200,000 capital stock, part of the proceeds to be used for extensions.

PROVIDENCE, R. I.—Plans have been filed by the Providence Ice Company, East Providence, for the erection of a power house for use in connection with its plant.

WATERBURY, CONN.—The Connecticut Light & Power Company has been granted authority to construct two high-tension lines in the southern and western sections of the city.

Middle Atlantic States

BINGHAMTON, N. Y.—It is expected that the Board of Contract and Supply will receive bids soon after Jan. 1 for the installation of boulevard lights on part of Washington Street, bonds for this improvement having been authorized. Petitions are being circulated for installations on a number of other streets.

GOWANDA, N. Y.—The city officials and Board of Commerce of Jamestown are interested in a proposition to establish a power plant on Cattaraugus Creek near Gowanda for the purpose of furnishing light and power to Jamestown.

NEW YORK, N. Y.—Bids will be received by the Superintendent of Schools of the Board of Education, room 2800, Municipal Building, until Dec. 27 for the installation of electric equipment in the new school, No. 59, borough of the Bronx; Public School No. 39, Far Rockaway, and in the addition and alterations to Public School No. 29, Richmond High School and Jamaica Training School, borough of Queens.

PENNINGTON, N. J.—The Pennington Seminary contemplates the erection of a laundry and power plant. H. W. Caster, Stephen Girard Building, Philadelphia, Pa., is architect.

CAMBRIDGE, MD.—The Eastern Shore Gas & Electric Company contemplates the installation of considerable equipment for improved and increased service. Betterments to its transmission lines to Salisbury, Benton, Federalsburg, etc., will also be made.

HIGHLANDTOWN, MD.—The Wizard Check Indorser & Printing Machine Company, care of F. S. Weise, Calvert Building, Baltimore, is having preliminary plans prepared for a factory and power plant at this place to cost about $300,000. Bids will be taken on the first unit in January or February by F. A. Fletcher, architect, 407 North Charles Street, Baltimore.

CHARLESTOWN, W. VA.—The city officials contemplate the installation of an electric chlorine plant and motors in connection with the water system at this place.

MARTINSBURG, W. VA.—It is reported that the work of the Potomac Light & Power Company was damaged by fire causing a loss of between $15,000 and $20,000.

SOUTH CHARLESTON, W. VA.—Bids will be received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Jan. 4 for the work and equipment for three substations at the naval ordnance plant at this place. [illegible] will control the incoming 6,600-volt, three-phase, 60-cycle light and power lines; the 6,600-volt [illegible] power [illegible] of [illegible] [illegible] [illegible]

pare plans for the installation of electric lights.

CONRAD, IOWA.—The Conrad Commercial Club is preparing plans for the installation of street lights.

GEORGE, IOWA.—H. C. Hatch has applied for permission to erect an electric transmission line.

PRESCOTT, IOWA.—Bids will be received by Mayor J. P. Martin until Jan. 4 for the erection of a transmission line to cost about $12,000.

EMINENCE, MO.—The Western Tie & Timber Company, Walter Poleman president, Syndicate Trust Building, St. Louis, is promoting a project for the erection of a hydro-electric plant on the Current River near this place. The erection of a transmission line from the plant to Poplar Bluff, a distance of 75 miles, will cost between $350,000 and $400,000.

ST. LOUIS, MO.—The United Railways Company, 3869 Park Avenue, has arranged for an issue $4,200,000 in certificates, the proceeds to be used for extensions, betterments and general operation. R. Wells is in charge.

SPRINGFIELD, MO.—Negotiations are under way between Mayor Woolsey of Ash Grove and the Federal Light & Traction Company, 60 Broadway, New York City, for the erection of a transmission line from the company's properties in Springfield to Ash Grove and several other adjoining cities.

CANOVA, S. D.—S. H. Butler and other business men of this place are considering the purchase and improvement of the Canova-Howard electric transmission line.

MILFORD, NEB.—The Milford Electric Light Plant has plans under way for additions and improvements, including: One generator, complete steam plant, waterwheel, etc.

Southern States

GREENVILLE, N. C.—The town officials plan to issue $65,000 in bonds on Jan. 10 for the erection of a light plant and waterworks. A. H. Taft is town treasurer.

LOCKHART, S. C.—The Lockhart Power Company contemplates the erection of a hydro-electric plant on Broad River.

TYBEE, GA.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., contemplates the erection of radio compass buildings at Tybee Island.

QUINCY, FLA.—At a recent joint meeting of the City Council and Board of Works it was decided to appoint an electrical engineer to inspect the electric light and power plant and make recommendations for improvement.

JACKSON, MISS.—The State Bond Improvement Commission at this place will supervise the expenditure of $600,000 for repairs to old power plants and the erection of new plants at the various state institutions. T. C. Link, care of the commission, is architect.

MERIDIAN, MISS.—An election will be held on Jan. 11 for the purpose of submitting to the voters a proposition to erect, equip and operate electric light and gas plants.

HINDSVILLE, ARK.—Plans have been prepared for the installation of a street-lighting system.

BELCHER, LA.—The Borough Council plans to rebuild the electric plant recently destroyed by fire.

BANGS, TEX.—J. Sanders contemplates the installation of an electric light and power plant.

BONHAM, TEX.—The City Council will be petitioned to order an election to be held for the purpose of submitting a proposition to erect a municipal light plant.

DALLAS, TEX.—The Dallas Athletic Club, W. E. Greiner, president, will receive bids after Jan. 1 for the erection of an office building to cost about $1,000,000. The club also plans to generate its own electricity. Lang & Witchell, American Express National Bank Building, are architects.

JEWETT, TEX.—The Jewett Electric Light Plant, recently destroyed by fire, will be rebuilt. J. A. Dean and W. N. Martin are the owners.

SWEETWATER, TEX.—A committee has been appointed to circulate a petition for an election to be held for the purpose of submitting to the voters a proposition to issue bonds for the erection of a municipal light plant.

WINNSBORO, TEX.—The Winsboro Ice & Light Company, recently organized by R. C. Campbell and others, contemplates the operation of an electric system for general commercial service.

Pacific and Mountain States

OCEAN PARK, WASH.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., contemplates the erection of a radio compass building at this place. (Specification 4349.)

SPOKANE, WASH.—It is understood that the Great Northern Railroad has had plans prepared for the construction of a dam and hydro-electric power plant at Lake Chelan, to cost about $1,500,000. The electrification of the Washington lines of the railroad is also under consideration. L. G. Gilman is executive vice-president.

LANKERSHIM, CAL.—Residents of Sutton, Florence, Louise and Marion Avenues have petitioned the Street-Lighting Commission for electric street lights.

SAN DIEGO, CAL.—The Department of Public Works plans to erect a transformer house.

VAN NUYS, CAL.—The re-establishment of lights on the boulevards leading into Van Nuys is under consideration. G. F. Beales is chairman of committee appointed to inspect the lighting system.

Canada

KEMPTVILLE, ONT.—A bylaw has been passed by the ratepayers, authorizing the raising of $25,000 for installation of new distribution lines. S. H. Guest is town clerk.

LONDON, ONT.—The Utilities Commission contemplates the expenditure of $125,000 for extensions and additions to the electric light distribution system. Energy will be supplied by the Hydro-Electric Commission of Ontario.

Record of Electrical Patents

Notes on United States Patents

(Issued Nov. 30, 1920)

1,360,700. PROCESS FOR THE ELECTROLYTIC PRODUCTION OF PERMANGANATE; Robert E. Wilson and William G. Horsch, Washington, D. C. App. filed Nov. 29, 1918. Manganese converted by oxidation.

1,360,701. SIGNALING DEVICE; James A. Wotton, Montclair, N. J. App. filed June 13, 1918. Telephone plug.

1,360,712. TELEGRAPH SYSTEM; John H. Bell, South Orange, N. J. App. filed Nov. 3, 1917. For repeating service between land and submarine cables.

1,360,713. TELEGRAPH SYSTEM; John H. Bell, South Orange, N. J. App. filed Nov. 22, 1917. For overcoming wandering zero.

1,360,722. TELEPHONE SYSTEM; Henry P. Clausen, Mount Vernon, N. Y. App. filed Nov. 27, 1916. Improved signaling means.

1,360,738. TELEPHONE SYSTEM; John A. Hall, East Orange, N. J. App. filed July 24, 1917. Automatic.

1,360,740. REDUCTION OF DISTORTION OF SIGNALING CURRENTS; Ralph V. L. Hartley, Brooklyn, N. Y. App. filed Sept. 8, 1917. Wire or wireless telephone.

1,360,745. SYSTEM OF CONTROL; Rudolf E. Hellmund, Swissvale, Pa. App. filed Sept. 27, 1916. Regenerative.

1,360,752. STATIONARY INDUCTION APPARATUS; Svend E. Johannesen, Pittsfield, Pa. App. filed Aug. 5, 1918. Transformer.

1,360,757. LOADED TELEPHONE CIRCUITS; George A. Kelsall, Jersey City, N. J. App. filed Aug. 16, 1917. Large number of circuits.

1,360,822. REGULATING SYSTEM; Louis W. Thompson, Schenectady, N. Y. App. filed Jan. 29, 1920. Vibratory device for controlling excitation.

1,360,823. INKING APPARATUS; Charles B. Thwing, Philadelphia, Pa. App. filed Nov. 30, 1918. For recording meters.

1,360,904. ELECTRICAL RESISTANCE; George H. Dorgeloh, Bloomfield, N. J. App. filed Aug. 28, 1919. Continuous element formed into successive grids.

1,360,918. AUTOMATIC CURRENT-CONTROL AND BRAKE-VALVE MECHANISM; William Gardiner, Chicago, Ill. App. filed Feb. 16, 1918. Street car.

1,360,948. WELDING MACHINE; William F. Hendry, Ossining, N. Y. App. filed March 22, 1920. Spot welds.

1,360,954. SIGNALING SYSTEM; Richard M. Hopkins, New York, N. Y. App. filed Oct. 20, 1916. Fire alarm.

(Issued Dec. 7, 1920)

1,361,024. SIGNALING CIRCUITS FOR TOLL LINES; John Davidson, Jr., Montclair, N. J. App. filed Dec. 12, 1918. Long-distance.

1,361,026. TESTING APPARATUS; Charles S. Demarest and Hugh F. Shoffstall, Brooklyn, N. Y. App. filed March 19, 1919. For locating faults.

1,361,028. HUMIDIFIER; Clarke S. Drake, Milwaukee, Wis. App. filed April 19, 1920. Water heated by lamp.

1,361,032. ELECTRIC SOLDERING IRON; Ferdinand Eichenberger, Aarau, Switzerland. App. filed April 8, 1920. Removable blade.

1,361,041. ELECTROLYTIC PRODUCTION OF OXIDES IN NEUTRAL WATER SOLUTIONS; Sidney Fry, Spreydon, Christchurch, New Zealand. App. filed Nov. 13, 1916. Production of oxide direct from metallic iron.

1,361,048. CONTROL FOR ELECTRIC LIGHTING SYSTEMS ON VEHICLES; Jesse H. Griswold and Otto H. Lutz, Zion City, Ill. App. filed Sept. 26, 1916. For Ford automobiles.

1,361,075. ELECTRIC WELDING OF ALTERNATING-CURRENT MOTORS; David C. Larson, Yonkers, N. Y. App. filed May 28, 1918. Squirrel-cage rotor.

1,361,088. TIMER FOR IGNITION CIRCUITS OF ENGINES; Clyde J. Myers, Indianapolis, Ind. App. filed April 6, 1918. Commutator type.

1,361,095. HEATING SYSTEM FOR HYDROCARBON ENGINES; Robert P. Perrine, St. Louis, Mo. App. filed Nov. 17, 1917. To preheat the air.

1,361,097. AUTOMATIC ELECTRIC POWER PLANT; Edward B. Reese, Indianapolis, Ind. App. filed Aug. 14, 1916. Electrically controlled valve.

1,361,099. THERMIONIC DEVICE; Henry J. Round, London, England. App. filed May 21, 1920. Radio valve.

1,361,133. ELECTRIC IGNITION APPARATUS; Frederic Billon, Solothurn, Switzerland. App. filed Dec. 5, 1917. Magneto.

1,361,136. DYNAMO-ELECTRIC MACHINE; James Burke, Erie, Pa. App. filed Feb. 6, 1917. Small motor.

1,361,197. ELECTRIC REGULATOR; Erwin R. Stoekle, Milwaukee, Wis. App. filed Oct. 5, 1917. For measuring flow of fluids.

1,361,216. ELECTROMAGNETIC POWER CONTROL; Frank W. Adsit, St. Paul, Minn. App. filed Dec. 4, 1916. For automobiles.

1,361,224. METHOD OF CONTROLLING ELECTRIC MOTORS BY MEANS OF ELECTRIC-CURRENT-CONTROLLING DEVICES; Lynde Bradley, Milwaukee, Wis. App. filed March 14, 1918. Compression resistance type.

1,361,229. MOTOR COMPRISING A SINGLE COIL; Loren O. Crenshaw, Los Angeles, Cal. App. filed May 7, 1919. Traffic signal.

1,361,232. SPARK COIL; Burns Dick, St. Louis, Mo. App. filed March 10, 1919. For internal-combustion engines.

1,361,244. POWER-TRANSMITTING APPARATUS; Valere A. Fynn, St. Louis, Mo. App. filed May 9, 1916. For automobile.

1,361,245. ALTERNATING-CURRENT MOTOR AND METHOD OF CONTROL; Valere A. Fynn, St. Louis, Mo. App. filed Jan. 2, 1917. Wide speed range.

1,361,259. STARTING AND IGNITION SYSTEM; Otto E. Huebner, Toledo, Ohio. App. filed Jan. 8, 1919. Improves spark.

1,361,269. ELECTRODE FOR ELECTRIC WELDING; Royal Mattice, Middletown, N. J. App. filed May 17, 1920. Cabled wires.

1,361,313. IGNITION SYSTEM; Alfred C. De Lorme, East Orange, N. J. App. filed Oct. 29, 1917. Magneto.

1,361,314. IGNITION SYSTEM; Alfred C. De Lorme, East Orange, N. J. App. filed Oct. 29, 1917. Magneto.

1,361,317. BURGLAR LOCK; Sigmund Lulczewski and Henry Stempkowski, Buffalo, N. Y. App. filed Feb. 18, 1920. Controlled from various points.

1,361,333. STANDARD ELECTRIC LAMP; George T. Irwin, Toronto, Ont., Can. App. filed May 22, 1919. Supported in various positions.

1,361,362. MEASURING AND INDICATING APPARATUS; Henry Brewer, Philadelphia, Pa. App. filed Feb. 21, 1919. Graphic meter.

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Cheerfulness as an Antidote to Depression

CHRISTMAS is always associated with joyfulness and happiness. Its sentiment grips the heart and stirs the will of even the most callous and brings to light the truth of the saying "It is more blessed to give than to receive." The potency of happiness as an incentive to good will cannot be better illustrated than by this Yuletide spirit. Cheerfulness, however, ought to manifest itself on every occasion and not just at the end of the year. It is just as efficacious in changing the human viewpoint as it is in changing the human aspect. It is the panacea for gloom, and we recommend it to those who woefully shake their heads at the present business depression. Deflation there must be, and chastisement, however grievous, is nevertheless edifying. The application of a little of the Christmas spirit to present conditions would be most salutary. Certainly the future would then appear far from dark.

Commemorating the Electrical Pioneers

IT IS NATURAL that the Oersted-Ampère centennial celebrations we have recently gone through should emphasize the interest in electrical history and the value of its study. History has been defined as a narrative of everything that helps explain present conditions. Its importance lies in handing on great ideas and traditions from one fruitful thinker to another, from one generation of workers to the next. In the present issue one of the former editors of this journal makes an eloquent plea for honoring American electrical pioneers whose centennials loom ahead. He offers four practical suggestions, which have our approval. One is the formation of an American electrical historical society. The second is the publication of electrical history in continuous periodical form. The third is the association with the general national Memorial Day of a special remembrance of our own pioneers and heroes, who lie mostly in forgotten graves while their work lives on for the growing benefit of mankind. A fourth suggestion deals with an obviously more difficult enterprise, the creation of a museum of American pioneer electrical apparatus. Electricity needs its Hall of Fame, in such a shrine of its modest beginnings.

Public Aspects of Interconnection

OPPONENTS of interconnection—and there are some—are losing much time and energy in fighting a well-established economic tendency. Whether interconnection will pay or not in a particular case is an engineering problem, susceptible of pretty accurate solution in advance of the necessary plant and line construction. Attacks upon interconnection as a general program may be made for political reasons or from an honest doubt of the practicability of tying lines together to save money and improve service. Opposition on general grounds, unsupported by evidence, is largely a kicking against the pricks of economic progress. Experience favors greatly increasing this modern electrical operating *entente*. It is incumbent upon the advocates of interconnection, however, to reinforce their widely accepted statements of principle by examples of actual savings accomplished. This has been done to some extent, but a wider publicity is desirable. If a tie-in between a city station and a neighboring hydroelectric property saves 5,000 tons of coal in a year, let the public be so informed. Rate increases may have been smaller because of an advantageous tie-in which has held back a sharp rise in operating costs. Emergency service may have kept things going despite local plant disturbances. Let proper credit be given to the new order of affairs in the local press—it has real news value when "featured" with a big storm, an exceptionally high tide or in connection with an unpreventable failure of equipment.

Careless Thinking on Rural Problem Needs Correction

CARELESS thinking as to the cost of rural-service lines is producing its natural fruit. The letter from G. C. Neff, published on page 1271 of this issue, addressed originally to the *Country Gentleman*, and referring to an article in that periodical, calls attention to one piece of evidence indicating the need of action on the part of the central-station industry. The figures given in the article alluded to indicate that the cost of rural lines is from $500 to $650 a mile. A careful examination, however, shows that this covers only bare material and labor for the line itself, as was clearly pointed out by D. L. Gaskill, president of the Greenville (Ohio) Electric Light & Power Company, in the ELECTRICAL WORLD (Oct. 23, page 838), when the material and labor cost of a typical mile of a 2,300-volt line was shown to be $750. To this must be added the cost of transformers and protective equipment, meters and services, as well as the cost of engineering and superintendence, and last but by no means least the cost of caring for the interference, either physical or electrical, with paralleling telephone lines. The cost of the lines is that required to furnish all equipment necessary for giving service, and regardless of the way in which the expense is divided this total cost must be borne by the service.

The best figures that are available indicate that this total cost per mile varies from $1,200 to $1,500, with a cost per consumer of from $200 to $500. A recent Middle Western investigation gave an average of $480

per consumer. . A line which will have three consumers per mile is probably the average, or a little above the average under present conditions, so that the figure from this investigation tallies well with other investigations.

The whole difficulty arises from fear on the part of the central-station industry to face the issue as it has presented itself. This fear has led to the formation of rural utilities and "passing the buck" to the farmers, with a consequent obscuring of the real conditions. The problem is one belonging to the central station, and no amount of dodging will evade the issue eventually, though it may result in an unnecessary expense caused by the formation of utilities that are legally competent but practically incompetent to carry on the business. The solution will not be easy, particularly under present conditions, but it must be found, and the central-station must find it or admit itself beaten at its own game.

The Power Development of the Future

THERE has seldom been a more powerful discussion of this all-important problem than that recently presented by Col. J. P. Jackson before the American Society of Mechanical Engineers. That the future supply of power is of vast importance to the prosperity of the country is self-evident. So far as the manufacturing interests of our nation are concerned, shortage of power certainly means shortage of prosperity, and industries gather where the power supply is plentiful. The actual source of power for a long time was a matter of comparative indifference, and streams were harnessed or coal was transported to meet the requirements of each individual case. Today an entirely different set of conditions must be faced. Transportation has become the dominant factor in industry. We may find fault if we like with what seems and, indeed, is a faulty system of distribution, but we have to face the facts as they are. The result has been that natural water powers well situated with respect to market have been in large measure used up. In fact, few if any of importance remain, so that the country depends on transmitted power either sent over wires in the form of electrical energy or hauled over rails in the potential energy of coal, and coal is undeniably getting scarce.

We should not base estimates of the needless cost and consumption of fuel on present data alone, but must look forward to the inevitable time, not far distant, when the price of coal will rise to an even higher point, throwing a still heavier burden on manufacturer and on railway, and with all this the country is now entering on a period of the most formidable international competition in every industry, to meet the needs of which power should be cheaper rather than dearer. It is for this reason that Colonel Jackson, like all other careful students of economics, turns to transmitted power as the remedy for a condition rapidly growing desperate. In ten years the power plants of the country have grown from an output of nine billion to about forty-six billion kilowatt-hours, and the call for energy is now even louder than it was a decade ago. The remedy is obviously the greatest possible conservation of our natural resources and their development in such wise as to make power supply as nearly as may be universal in distribution and economical in application. To this end it is plain that uneconomical generation of power must be checked, the burden of production thrown on efficient sources, and these so co-ordinated as to take full advantage of the diversity factor, not between city block and city block, but between state and state.

Errors That Meter Records Should Eliminate

METER records constitute the basis of central-station revenue and the final evidence on which controversies as to service rendered are adjusted. It is therefore necessary that any system of meter records should provide the utmost precautions not only against physical loss of the meters themselves but also against inaccuracies in the measurement of the energy used. The latter is the subject portion of the problem, since meter-testing methods have been pretty well standardized and the overhauling of the meters themselves is largely a routine process. In the record system, however, the usual tendencies are to one of two extremes. The first is an elaboration that sometimes becomes so cumbersome as to defeat its own ends and which at the best is expensive. The other is an entire neglect of the record, it being viewed as a necessary evil to be forgotten as far as possible. The description elsewhere in this issue of the system of the Iowa Railway & Light Company outlines a method that experience has shown can provide against loss or mislaying with a minimum of clerical labor.

This system is well worth study, particularly on the part of central-station managers whose service will not support the elaborate meter laboratory arrangements that the larger central stations can maintain and who must depend upon the simpler routine test standards, checked by secondary standards that can be periodically sent to a well-equipped laboratory for calibration. While the larger stations can and must support elaborate meter records, because of the large number of instruments handled, there is no reason why the smaller companies cannot support records that will accomplish the same results. The smaller stations handle a smaller number of meters, have not so many complications to deal with and consequently need fewer safeguards. This fact is too often lost sight of in the working out of meter record systems.

Insufficient Furnace Capacity an Enemy to Economy

IN NO branch of engineering has antiquated convention been so slavishly followed as in rating boilers. The result is that the real conditions of economy are hidden behind a mass of irrelevant data which ought to be brushed aside. It is the particular virtue of the little paper by Theodore Maynz which we published last week that the facts he presents enable one to see through the smoke to something of the real relations between heating surface, efficiency and maintenance. The broad situation is, as Mr. Maynz's diagram shows, that a boiler fitted with an economizer and with plenty of furnace capacity will excel in economy over a wide range of load the more conservative proportions of earlier practice. For central-station working a flat-topped economy curve is all important, for it enables a formidable peak to be carried without losing much in efficiency even when pushing reduced draft. The penalty of too hard driving is increased upkeep even more than loss of efficiency, particularly if the furnace and

stoker dimensions are skimped. With a reasonable number of units in service there is little excuse for operating at under-loads—a practice disastrous to economy.

The boilers themselves will show about the same maintenance cost per unit weight of steam produced within limits of forced output, while with properly proportioned furnace and stoker no excessive maintenance cost will appear. All these facts indicate that, given intelligent care, bad performance of the boiler plant can generally be traced to improper design or operation of the furnace. Insufficient furnace capacity is probably the worst enemy of economy, and this is doubly true when it becomes necessary to operate with inferior fuel. Efficient steam output is the final test of performance.

Getting Away from Antiquity

IT TOOK the automobile designers a good many years to get away from the standard designs for horse-drawn vehicles and evolve something that would make the most of the new propelling power. In the same way it has taken the designers of waterwheels a long time to get away from the idea of treating a low-head hydraulic development along lines of practice which have been based for the most part on fairly high-head conditions.

Happily the old designs have now been abandoned and radical improvements have been taken up in two directions. These, as pointed out by L. E. Ayres in this issue, involve first the redesign of the turbine itself for efficient running at much higher speeds than was once customary, and, second, the treatment of the emerging water column in such way as to give free flow with as little friction and eddy as possible and to regain something of its residual kinetic energy as available pressure. The first end has been met by a radical change in runner construction, by passing from the older design with numerous blades to a four-blade or three-blade type resembling a well-designed ship's propeller more than an old-fashioned waterwheel. The result of recent improvements has been to produce, as is shown in Mr. Ayres' article, runners with four or even three blades comparing quite well in efficiency with the best that has been done with the more conservative constructions. For instance, the actual tests in two typical cases cited show a maximum efficiency of 85 to 87 per cent in three-blade and four-blade runners, going to about 600 hp. under 15-ft. head and at 200 r.p.m. These figures are within 2 or 3 per cent of the performance of standard wheels of similar capacity and head, but of much lower speed, and they are altogether higher than would have been obtained twenty years ago.

Part of the improvement in general results, as already indicated, lies in the more skillful treatment of the outflow. Two analogous but different methods have been used in the plants referred to—one an improved design of draft tube, the other a somewhat more radical treatment of the problem through the introduction of the hydraucone regainer, the construction of which has recently been noted in our columns.

In one instance cited by Mr. Ayres a change from the old to the new type of low-head plant actually increased the hydraulic efficiency nearly 40 per cent and, one may add, undoubtedly decreased attention and repairs in a degree equally conspicuous.

Utilities Entitled to More than Current Investment Earnings

IN ONE way or another the valuation of a utility is used as a working basis for determining rates upon which the actual return to the investor depends. All sorts of hypotheses for equilibrating costs on one theory or the other have been tried out with rather indifferent success. Add to this the complication arising from statutory requirements, which are themselves often vague, and the difficulty of doing the right thing is unpleasantly apparent.

A paper by P. B. Warren in the current issue takes up another phase of the matter in attempting to apply to the question of valuation of public utilities what amounts to a correction factor for the varying value of the dollar. This leads to a value which, although in terms of a somewhat arbitrary unit, takes in a certain measure account of the fluctuations in price on which the cost at any particular epoch may be determined. The fundamental point of doubt in all cases comes from the fact that in a public utility which has been built up perhaps through a quarter of a century there have been many fluctuations in price, and a valuation made on any theory for one particular epoch cannot long remain true. This difficulty confronts one at every turn on whatever theory he proceeds, and Mr. Warren's approximate solution is only one of the ways by which the variation here considered may be taken into account. When it comes to valuing a utility with reference to rate making a wider field of inquiry is open.

One thing is certain, that money put into a plant in the course of its development is entitled to a fair return, and not only to a fair return at the time of investment but to a fair return at the particular epoch for which the information becomes necessary in adjusting rates. It seems to us that what constitutes a fair allowance actually depends on the value of the dollar as expressed, for instance, in current rates of return upon investment. If 8 per cent was a figure considered fair and just as a return when current funds were earning 4 per cent or 5 per cent, a proportionately larger allowance represents a fair return when investments commonly bring 7 or 8 per cent, quite irrespective of what the fluctuations in price may have been in the interim between the two epochs considered. Reconstruction values and modifications thereof are somewhat difficult to apply, because in justice and fairly to represent the conditions of actual construction these reconstruction values ought to be applied with some reference to the times of actual building and the then existing conditions. If all the factors are taken into account, as Mr. Warren points out, the differences in valuation are more apparent than real. It appears to us, however, that actual cost is the most nearly ascertainable basis of real investment, and that the fluctuating value of the dollar so far as it is taken into account, as it should be in ascertaining an equitable return, is more safely based on current investment earnings than on anything else, always admitting that an industry like a public utility is fully warranted in claiming a liberal return on its work as well as on its past investment and that dividends apparently liberal ten years ago do not fairly requite the industry today. By thus applying the correction for fluctuating values to the earning rate permitted from time to time one does not cut loose from the fundamental fact of actual capital invested, while preserving the rights of the stockholders to a fair return even in defiance of a shrinking dollar.



Harold Winthrop Buck

Inventor, engineer, designer, advocate of 13,000-volt generation and pioneer in the development of long-distance hydro-electric transmission

EAGERLY and with a certain sureness do we talk today of 220,000-volt transmission, yet it was only a few years ago that 100,000 volts became an actuality. It was at Niagara Falls, N. Y., about twenty years ago, that H. W. Buck, then electrical engineer for the Niagara Falls Power Company, which at that time was the wonder water-power system of the world, experimented on a 100,000-volt line a mile long. In 1907 he installed a 110,000-volt system for the Great Western Power Company. To perfect a commercial system for such high voltages required considerable research work, particularly on insulators. He became convinced that some other way of insulating high tension lines than by the upright pin-type method was desirable.

As a result he developed with E. M. Hewlett of the General Electric Company a suspension insulator system for use on some high voltage lines projected by the Niagara Falls Power Company. Mr. Buck was also the first to advocate 13,000-volt generation. Prior to that generator voltages were much lower. In addition he is credited with having designed a three-phase motor operating by static induction.

Mr. Buck was born in New York City May 7, 1873. He received his bachelor's degree from Yale in 1894 and in the following year the degree of electrical engineer from Columbia. The next two years were spent as a student at Schenectady in the General Electric works, after which he went into the lighting department as assistant to the chief engineer.

In 1900 Mr. Buck became electrical engineer for the Niagara Falls Power Company, and seven years later, with M. A. Vielé and F. O. Blackwell, he joined the now well-known organization of consulting engineers—Vielé, Blackwell & Buck.

In addition to high-tension work Mr. Buck has always taken a large interest in hydro-electric development. While at Niagara Falls he had charge of the designs and installation of all the electrical equipment of plant No. 2 and of the Canadian Niagara Power project. Furthermore, his own organization from its inception has specialized on hydro-electric projects.

His counsel is much sought in engineering societies, which he has frequently served on important committees. He is a past-president of the American Institute of Electrical Engineers and at the present time he is the representative of that body on the American Engineering Council.

The Justice of Current-Cost Valuations

Although Original Cost Will Give Same Figure, Provided that Proper Relative Weight in Purchasing Power Is Given to Dollar, Still the Dollar Now Current Is the One Which the Utility Pays Out for Supplies and Receives for Energy

By PHILIP BARTON WARREN
Member of the Illinois Bar

DETERMINING the proper method of utility valuation is of the gravest importance to the continued development of the country's resources. Until the basis of return for money invested in utility property is convincingly and firmly established new money will not flow into this industry. The value of property used in furnishing service is the basis of just and reasonable rates. Because of the importance of this factor much attention has been centered thereon for the purpose of evolving plausible theories that as the interest of the parties dictate will increase or diminish the value. There are advocates of original cost, cost to reproduce at average prices for various periods, cost to reproduce at so-called normal prices, cost to reproduce at trend prices, cost to reproduce at present prices, and the theorists have not yet stopped working. But the truth as to value cannot be altered. Every appraisal, honestly made, on each one of these various theories will reproduce substantially the same value. The difference is only apparent, not real.

Measuring of Results

All will agree that the investors in a utility are entitled to a "fair return upon the reasonable value of the property at the time it is being used for the public." As it is value that is being sought, the meaning of value must first be understood. Value itself is not a vague, indefinite or uncertain characteristic. No one has been able to improve on John Stuart Mill's definition that "the value of a thing is its general power of purchasing, . . . the command which its possession gives over purchasable commodities in general." Clearly, the value of any economic quantity always has been, and always will be, any other economic quantity for which it can be exchanged. In the complexity of affairs it is impracticable to exchange a kilowatt-hour for a certain quantity of bread or nails. This difficulty was overcome many centuries ago by the adoption of a medium of exchange called money. The function of money is that of facilitating exchanges of commodities, and to function it must afford a ready means of estimating the comparative value of the different commodities. Therefore that into which the value of all commodities must be translated for expression and intelligent understanding is money of present purchase power. Value can neither be expressed nor intelligently understood by any other means. Every person who hazards an opinion as to the value of an economic quantity expresses it in current dollars, and no commission ever made a finding as to value that was not expressed in the kind of dollars that were current at the time of expression.

The sole object of a rate proceeding is to ascertain what are just and reasonable rates for utility service at the present and in the immediate future, not at the time of the original construction of the property or as constituting an average during any five-year or ten-year period. The tribunal is endeavoring to ascertain what amount of income, expressed in the kind of dollars current today, will constitute a fair return for the service rendered when paid in rates today and in the immediate future. It cannot ignore the actual conditions existing today, because it is under these conditions the service is to be rendered. Nor can it ignore the kind of dollars that are current today because it is only with that kind of dollars that the customer can pay for the service.

In honest endeavors to determine the value of a property in rate proceedings, widely varying conclusions can almost always be traced to a failure to use the present medium of exchange as a method of expressing value. Money is an economic commodity just as certainly as wheat or coal. Fluctuation in the purchase power of the medium of exchange has always existed and cannot be ignored when expressing value. It is axiomatic that "the value of money is inversely as general prices—falling as they rise and rising as they fall." The result is that when we speak of a dollar in 1910 we are not speaking of the same measure of value as when we refer to a dollar in 1920.

In 1910 a dollar would purchase so much wheat, so much coal or so many hours of labor, and in 1920 it takes two dollars, generally speaking, to purchase the same quantity and quality of wheat, of coal, or of labor. In other words, it takes two of the 1920 dollars to equal one of the 1910 dollars. Therefore, before we can measure the relative probative force of two appraisals of the same property, expressed in dollars current at different periods, we must know what the relative purchase power of the dollar was in the respective periods. If not identical, then proper allowance should be made for the difference. If this is done, no difference will be found in honest valuations of the same property.

The Current Dollar

This problem of the kind of dollar to be used is not difficult of solution. The object of a rate proceeding is to determine what, under the conditions existing at this time, the consumer shall in fairness give to the owner of the utility in exchange for the service rendered. There is to be an exchange of commodities and fairness demands they shall be of equal value. If electric light and power rates are being determined, the commodity offered by the owner is energy and that offered by the consumer is money.

The kind of dollar that is to be exchanged for the energy is the kind of dollar that is current today. The value of the energy is made up of the use of the value of the property by which it is produced and the value of the labor and material consumed in producing it. We are trying to translate these values into a thing that will be comparable with the dollar which is to be paid for them. The only way it can be accomplished is by translating them into the very kind of a dollar the consumer is going to use when he pays for them.

The energy is offered for exchange today. We are

endeavoring to ascertain the power of that energy to purchase other commodities today. We can only measure its purchase power today in terms of the kind of dollar in use today. It may be that the energy and all of the property creating it have no more intrinsic value today than they had ten years ago, but the dollar of today has less intrinsic value, and those are the kind of dollars that must be accepted in exchange for the energy. Every fair mind will recognize that the dollar of today is worth no more in appraising the property than it is when paying the lighting bill. When a commission expresses its opinion of the value of a property in dollars, as the basis of rates to be paid in dollars, the dollars used in both expressions should be the same kind of dollars.

Exchange Value

What determines a thing's value is what it is in its existing conditions and relations—its present actual exchange value. The phrase "exchange value" is not here used in the sense of being the profits of an enterprise capitalized at a given rate of return. That is one measure of an unregulated competitive business. But the moment an enterprise becomes subject to regulation as to its profits—and those profits must be just and reasonable—obviously the existing profits cannot be made a factor in determining just and reasonable profits. The phrase is here used in the sense of being the aggregate costs of energy and material necessary to reproduce the entire property.

The argument advanced against exchange value is that the property is not for sale, that there is no intention to sell it, and therefore that there should not be placed upon it a value based upon demand and supply. True, the property itself is not for sale, but the use of the property is for sale, and every piece of material, from the smallest nail to the largest engine in the plant, and every bit of labor used in its construction and operation, can be acquired by the utility on no other basis than that of exchange value. With no way of altering this fact, how can it be said that the aggregate of the exchange values of all the component parts does not constitute the total value of the physical property? So long as the utility must part with its money upon the exchange value basis for the component parts, is the public entitled to the use of the whole upon any other basis?

Investment in Property

If it were possible for the public to pay the owner for the use of its property in the same kind of dollars that were current at the time of original construction it would not be unfair to accept the original cost as present value. It must not be forgotten that the owner's investment is not the dollars it parted with to acquire the property, but its investment is the property that it thus acquired. True, at that time the property was the equivalent of those dollars, but the owner parted with those dollars and kept the property. It serves no purpose to ascertain the number of dollars it parted with unless we intend to value those dollars. That can only be done by comparing their purchase power with the dollars of today. But why attempt to put a value on the thing the owner parted with when we can more readily put a value on the thing it retained and is now using to produce the service, that is, the property?

The only argument which has ever been seriously advanced in favor of adopting what is called original cost is that stability is thereby given to rates. The fallacy of this is that rates constitute the compensation to be paid by the public for the use of the property. If that compensation is to be measured by a fair return upon the value of the property used, then the relative value of the medium, in which the compensation is to be paid, to the property used, should be known. The rates to be paid are the values to be received by the owner of the property for its use. The value contained in the rates, when expressed by the medium of exchange, is unstable, variable and regulated by the inexorable laws of supply and demand. The customer is no more entitled to stability in rates, when expressed in the medium of exchange, than he is entitled to stability in the price of any commodity—or than the owner of the utility is entitled to stability in the purchasing power of the medium of exchange in which the customer pays for service. The service and use of utility property can only be furnished the customer by means of labor and material, and so long as the cost of labor and material depends upon supply and demand it will be unstable and the charge for the product—*i.e.*, the utility service—must likewise be unstable. The medium of exchange in which the customer pays the owner for the service will likewise be unstable. It would be unjust to make one stable while the others remain unstable.

Effect of Regulation on Return

No one will deny that at the present time the purchase power of the dollar has decreased and there are those who admit that for additions and extensions made today the owner is entitled to a valuation at present-day prices, thus giving effect to the decreased dollar; but they claim it is unfair to measure the value of property acquired some years ago by the present medium of exchange because it would be giving the owners of utility securities an advantage which is not given to the owners of farm mortgages and other securities. This contention ignores the fundamental distinction which exists between those investing in regulated securities and those who invest in unregulated securities. The investor in a farm mortgage or government bond makes a contract that he shall have for a definite period a certain return for the use of his money. No regulatory body can at any time thereafter say he shall not have that return because it is unjust or unreasonable. The man who invests in public utility securities knows that at any time the public utilities commission may investigate and cut his return down if the rates producing it are not just and reasonable. He also knows that no matter what his contract may be he will be permitted to have only a fair rate of return.

It is not absolutely essential that appraisals based on original cost, or average costs during some selected period of time, should be disregarded. The courts have said they are "matters for consideration" and that they are to be given "such weight as may be just and right in each case." But if they are "considered," then in weighing them to ascertain their probative force for the purpose of ascertaining present value the same scales must be used. They are evidence of present value, but before their true weight can be ascertained they must be translated into the terms by which present value is to be expressed; this is, the kind of dollars current today. When they are so translated they will express the same quantum of value as an appraisal based on the cost to reproduce at present prices and will serve as a check.

Certainly one expects to find more accuracy in an

appraisal expressed in dollars of the present day than in one expressed in dollars of some other period. It is much easier for the appraiser to ascertain accurately the present prices of labor and material than it is those that prevailed years ago. It is much easier to test the knowledge of the appraiser as to the latter than as to the former. It is much easier for an appraiser deliberately to deceive the commission as to prices which prevailed many years ago or the average prices of some other period. Furthermore, if appraisals expressed in dollars of some other period must be translated into the dollars of this period before they will express present value, there is always the chance of errors and inaccuracies in making the translation.

The iteration and reiteration of the present tense by every authority on the subject, when speaking of the time as of which the value must be ascertained, shows a deep conviction that value must be translated into and expressed in the kind of dollars current at "the time the property is being used for the public." It recognizes that conditions change from time to time and that it is only fair to fix the value at the time and under the conditions which exist when the service is rendered. It recognizes the fluctuation in the purchase power of the medium of exchange with which the service is to be paid, and thereby provides that the effect of the fluctuation shall at all times bear equally on the owner and public.

The basis of the reasoning is that at all times—abnormal, subnormal or war times—the patron is entitled to a reasonable rate and the owner is entitled to a fair return; that a fair return is a certain percentage of the value of the property—*i.e.*, a definite ratio between the value of the property and the value of the return; that this ratio is not maintained unless the same measure of value is used in determining the return as in determining the property.

If in the future general prices fall and valuations are made on the then prevailing prices, the owner will lose nothing, for the simple reason that the increased purchasing power of the dollar (caused by the fallen prices) in which the return is to be paid will exactly compensate for the decrease in the number of dollars produced by the decreased rate, and the owner will be receiving the same quantity of value for the service he has rendered as he was accustomed to receive during the period of high prices.

THE *true test of success in business is not profits but economy. Profits may be the result of good fortune, of a fleeting period of inflation, of temporary conditions of any kind, but a business structure which is built simply upon the profit sheet of the moment is built upon the sands. The only business foundations which are sure and steady are erected upon the rock of economy. The great need of the world today is to work hard and save. This applies not alone to the laboring man but to the man of great means. There is no place in America today for the loafer. The laboring man is entitled to his full share for the contribution he makes to the value of an article. The laboring man should be taken into the fullest confidence of his employers. He should be so sure of getting his fair share of the wealth he produces that he will work with zeal and enthusiasm. Not merely increased production, but increased efficiency in production, is essential.*—CHARLES M. SCHWAB.

Adapting Signal Indicators to Power Plant Use

Device Developed for War Use Found Valuable for Plant Purposes—Synchronous Motors Arranged for Transmitting Signals

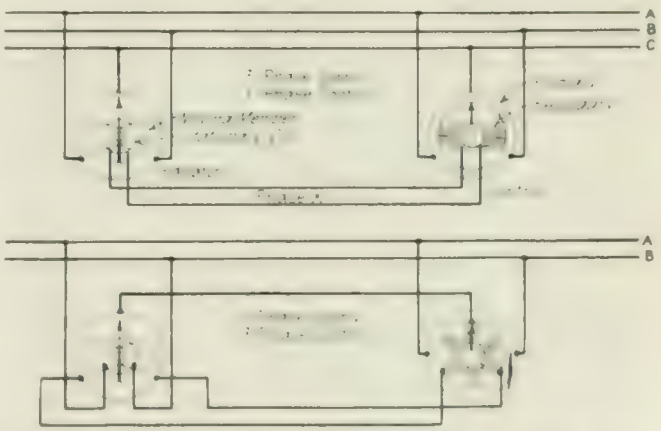
BY H. P. SPARKES
Engineer Westinghouse Electric & Manufacturing Company

DURING the stress of the war, when development of apparatus for military purposes was so great, not a few devices were perfected of a kind which could later be adopted for commercial use. Manufacturing companies, turning their full energies to helping to bring the war to a successful conclusion, accomplished in many instances a great deal more than might have been possible under peace-time conditions. Furthermore, it is surprising to find to how many commercial uses such devices may be applied. One instance of this is a direction-bearing indicator which was developed for the United States Navy. This apparatus consists of two synchronous motors connected so that when the rotor of one, the transmitter, is placed in a certain position the rotor of the other, the indicator, will be in exact synchronism and will thus indicate the position at which the transmitter is set. On board ship they are used by the mariner in the chart room to inform the pilot as to the proper bearing of the ship. Here they obviate the speaking tube or telephone and allow the information to be conveyed correctly, positively and in a minimum time.



WHEN POINTER IS ROTATED THE DISTANTLY LOCATED INDICATOR FOLLOWS IT

The application of these instruments in the Cheswick station of the Duquesne Light Company, Pittsburgh, Pa., is somewhat similar to their use on ships. The transmitter is placed at the switchboard operator's desk. From the load and weather conditions he estimates the probable power requirements in advance. Then by means of the indicative apparatus he signals the boiler-room that certain requirements will be necessary.



TWO SYSTEMS OF CONNECTIONS ARE USED, DEPENDING ON WHETHER THE PRIMARY WINDING IS CONNECTED TO A POLYPHASE OR SINGLE-PHASE CIRCUIT

The use of these instruments by the Philadelphia Electric Company is also interesting on account of their automatic operation. They are installed on motor-operated induction regulators in such a manner as to indicate the position of the secondary coil at all times. If the regulator secondary is out of phase, the device will indicate the position, and steps may be taken to adjust the phase relation. In other words, the phase relation of the primary coil and secondary coil of the regulator is indicated at all times.

Operates on Principle of Synchronous Motor

The principle of operation of this outfit is the same as that of two synchronous motors, one motor being used as a transformer supplying energy to the second motor from its secondary winding. The second motor, acting as an indicator, receives the energy from the transforming motor into its secondary. At the same time it receives energy into its primary winding from the same source as that from which the primary winding of the transforming motor receives energy. The two primaries of the motors are connected to a polyphase alternating-current system, and, having the same number of poles in the field, they will tend to have magnetic fields operating in synchronism with each other. As the induced current flowing in the secondary winding must become balanced before the motion of each rotor is zero, there will be a tendency of each rotor to move in exact synchronism with the rotor of the opposite motor. According to theory, these two machines will stay in exact synchronism. However, because of friction, there would be some power consumed by the indicating motor when overcoming the initial friction, thus causing an angle of lag. To overcome this error an indicating instrument is utilized which is similar to the switchboard-type power-factor meter. This instrument has practically a zero friction error, and as the movement is exceedingly light and well balanced, it is suitable for rugged service. This allows the use of a motor connected to a power-factor meter or synchroscope in initiate angular relation.

There are two possible systems of connection as shown in the diagrams. The upper diagram shows a polyphase system to which the primary windings of both systems are connected to a three-phase supply, the secondary windings being connected by means of a single-phase circuit. The principle of this system is based on the angular relation between the voltage in the primary winding and the voltage in the secondary winding of the indicator, and as a result this system is free from all practical voltage error.

The lower diagram shows the single-phase connection of the primary windings and the polyphase connections of the secondary windings. This single-phase system depends upon the induced voltages in the secondary winding of the controller, the voltage of each phase being proportional to its angular position in the single-phase field. This instrument may have slight errors due to voltage conditions and inaccurate windings on the controller. On the other hand, the system has the advantage that it requires only a single-phase energy supply.

The normal operating conditions and the insulation of the indicating instrument limit the voltage to 110. However, transformers may be used for long-distance indications. It is preferable to operate this instrument at approximately 100 volts, as above this voltage the installation becomes dangerous, owing to the fact that a breakdown may develop into a grounded system.

The torque characteristics of these instruments depend entirely upon the energy consumed by the indicator, the torque at all points of indication remaining the same. The angular position which the pointer assumes is the position where the flux of the two coils is in phase. If the pointer is distorted from this position, therefore, the torque is proportional to the cosine of the angle.

By calibrating the indicator with the controller with which it is to operate, the maximum and average error can be made very small. This might cause the scale to be slightly distorted, but it is not noticeable on a 7-in. (17.78-cm.) instrument.

These instruments are equipped with dynamic damping disks by means of which the dead-beat characteristics may be adjusted to suit the operating conditions. Such a device was especially necessary to take care of the roll of the ship or periodic vibration.

Effect of Outside Agencies

The use of armored cables with these instruments may cause some trouble on account of the inductance of the armored cables, which sometimes tends to change the power factor of the system. When all leads are of the same length this trouble may be obviated by adjustments.

Little trouble was experienced in the variation of the resistance leads or other resistance inserted into the circuit. The fact that these instruments normally operate with 1,000 ohms per phase, connected in series with the polyphase winding, precludes an appreciable error. This is so because any other resistance inserted in the circuit, such as contact drop or temperature changes causing the copper to change resistance, is comparatively small. However, the cable leads are made the same length if possible. Care must be taken in this system to prevent grounds from occurring. The ground on the circuit may tend to overload or unbalance the system and cause a distortion of the field and in the indicator, thus causing the reading to be incorrect. There is no danger of exterior magnetic fields causing trouble nor of the indicator and controller affecting other devices. Both instruments are surrounded by large iron cores which should prevent any magnetic disturbance. The presence of wireless apparatus or other high-frequency or high-potential systems will not be the cause of any disturbance. Of course, if a high-tension conductor should come in contact with the system, there naturally would be some trouble caused.

It is possible to operate from one to approximately ten indicators from one controller, provided that the rating of the controller will permit this load. If any other controller is connected in such a circuit, it will tend to operate as an indicator having small angular error due to frictional losses. In case one of the windings of one instrument should burn out, which is most improbable, there may be a slight error produced in the other instruments.

Bridgewater Station Turbines

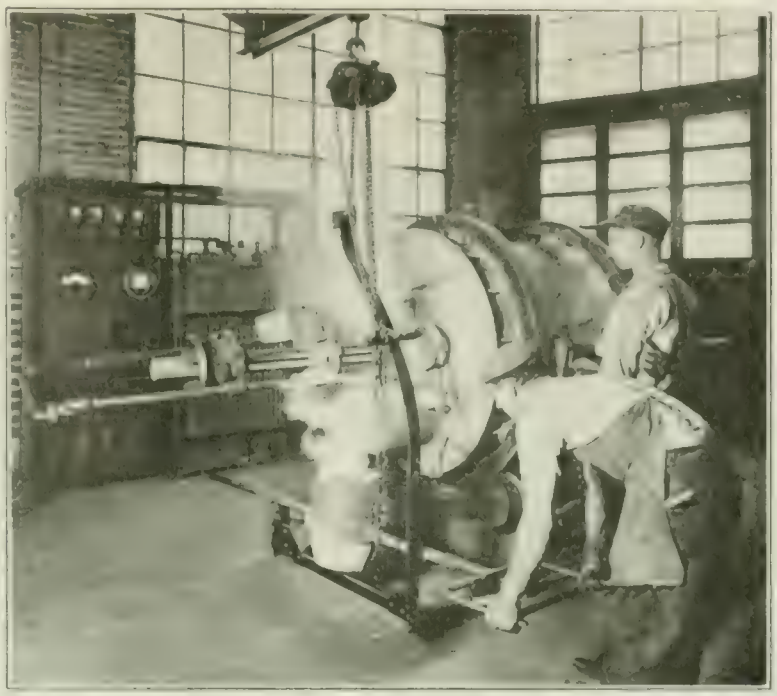
Attention has been called to the fact that the turbines connected to the Allis-Chalmers generators in the Bridgewater station of the Southern Power Company, which plant was described in the Electrical World for June 5, are I. P. Morris wheels.

Economies of Melting Brass Electrically

Operating Records Show the High Economy that Has Been Attained by the Utilization of Small Rotating Arc-Type Furnaces in Brass Foundries Preheating for One Shift Successfully Eliminated

WITH more than 200 brass-furnaces now installed and in successful operation in this country it may be said that electric melting of brass has passed beyond the experimental stage. Many advantages have been claimed for the electric furnace in the melting of non-ferrous metals, and experience has seemed to indicate that in this employment the electric furnace possesses the following characteristics:

(1) Clean, reducing, non-oxidizing atmosphere; (2) superior working conditions—atmosphere not unduly heated and furnace gases reduced to a minimum; (3) ability to obtain any range of temperature, with simple methods of control—using pyrometer if desired; (4) reduction of metal losses to the lowest limits, and (5) low labor and upkeep costs.



AUTOMATIC ELECTRODE CONTROL HAS REDUCED LABOR COST FOR OPERATING THE ROTATING ARC-TYPE FURNACE

The brass foundry needs a small, efficient melting unit to handle the large variety of mixtures comprised in the day's run. Large heats cannot be handled to good advantage for many reasons, but principally because of the difficulty in keeping the metal up to temperature and the long shutdowns between heats. The records presented deal with a rotating arc-type furnace and show conclusively that it is practicable to use a small-type furnace for intermittent daily operation and still obtain low cost records.

Rotation of Furnace Exposes New Metal Surfaces to Hot Lining

In melting yellow-brass turnings and borings, which constitutes one of the most difficult materials to handle in any type of furnace, especially when they are full of dirt, oil and other foreign matter, the furnace should be loaded well up on the walls at either side of the electrodes. The door is then closed, one or both of the electrodes being withdrawn to permit the escape of burning oil and moisture, and the furnace is placed in rotation. As the borings tumble around inside of the furnace new surfaces are constantly exposed to the hot lining, and the oil and dirt are rapidly burned out. In this connection it should be noted that the electric furnace is more valuable as a melting medium than as a drying or oil-burning vessel, and if the constant run of material charged is very heavy with oil it will soon pay, through saving in furnace time alone, to remove the greater portion of the oil before charging. However, if desired, the foreign matter can be easily expelled in the simple manner described before the actual melting begins. As soon as the flame from the burning oil drops off the rotation is stopped, the electrodes are inserted, the power is switched on and the melting started.

The size of the charge will determine when it is practicable to commence complete rotation. If a maximum loading has been made, experience shows that it is desirable to leave the furnace stationary for a brief period and then turn the shell occasionally to mix up the charge, finally allowing complete rotation, which should be continued for ten or fifteen minutes before pouring. This method reduces and sometimes prevents any breakage of electrodes. If a smaller charge has been used rotation can be started immediately. The first method has the advantage that the largest practicable heats can be run, resulting in the maximum daily output. The difference in the metallic shrinkage for the two methods is small.

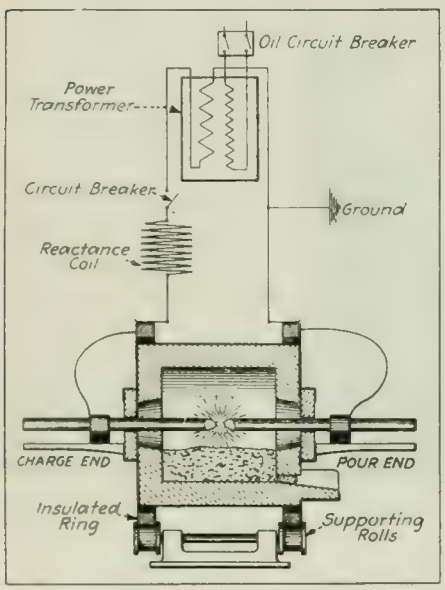
Recent records obtained from the Prime Manufacturing Company, Milwaukee, Wis., on a 500-lb. (230-kg.) rotating electric furnace are given in Table 1. This furnace is used almost exclusively for the melting of yellow-brass turnings and borings, pouring directly into castings. When melting this class of material all live parts of the furnace are carefully cleaned with compressed air after each heat to prevent any short-circuiting by deposits of zinc dust. This requires only a few minutes' time and is generally done between ladles. The movement of the electrodes through the cooling collars is also tested after each heat, and any loose slag is removed from the furnace after each heat is poured.

The melting of other finely divided materials containing less zinc, such as red-brass borings, turnings, skimmings, washings, etc., is comparatively easy to handle, with metallic shrinkage losses averaging not more than 1 per cent and an energy consumption averaging not more than 350 kw.-hr. per ton, even with a small furnace like a 500-lb. (227-kg.) unit, operating only one shift a day and including all energy used for preheating.

With heavier materials, such as heavy scrap, ingots, foundry returns, etc., the practice followed is to hold the furnace stationary after charging until the metal has softened; then partial rotation is started, and finally complete rotation is established.

It has been found possible to eliminate entirely the time usually consumed in preheating the furnace in the morning. Where a foundry has one shift of eight to ten hours a day all that is necessary is fully to charge the furnace at the end of the day after the last heat is poured, ready for the first heat of the following day. Careful measurements with a pyrometer show that when a furnace is left empty over night the temperature of the melting chamber in the morning has dropped to 450 deg. Fahr. (230 deg. C.), but when charged the night previously the temperature of the melting chamber the next morning is up to 900 deg. Fahr. (480 deg. C.). This indicates the possibilities of the furnace in heat absorption and retention.

Records recently obtained on a 500-lb. (227-kg.) rotating electric furnace at the plant of the Enterprise Brass Works, Muskegon, Mich., melting red and yellow brass for castings, in the proportions of about two-thirds red to one-third yellow, show what can be expected when using the furnace on heavy metal. These records follow: Average pounds melted daily, 4,800; average charge per heat, 600 lb.; number of heats per day, nine hours, 8; average power consumption per ton, 310 kw.-hr.



SIMPLICITY IS A BASIC FEATURE OF THE ROTATING FURNACE

A furnace of the same size is in operation at the plant of the Fulton-Harwood Brass Works, South Bend, Ind., and the results obtained are given in Table II. Considering that this furnace was not being charged to its capacity the showing made is considered exceptionally good. It shows what can be done with the furnace even at reduced output. The records given in Table II were from June 9 to July 9, 1920, and the charges consisted of new copper, tin, lead and zinc, with an analysis of 85-5-5-5 per cent. No record was kept of the shrinkage at this plant, but under similar conditions at other plants the metal loss has not averaged more than one-half of one per cent.

The Yale & Towne Manufacturing Company, Stamford, Conn., recently completed thorough tests covering every phase of the operation of a 500-lb. rotating electric furnace. The user in this case requires a high pouring temperature owing to the light-weight castings made, and likewise the time between heats is lengthened since the metal is all drawn into small pots. As a consequence it was necessary to keep the power on the furnace while pouring, which made the power consumption high and slightly increased the metal loss. There were other disadvantages in handling due to the location of the furnace in the foundry, so that when the foundry practice is thoroughly worked out much better records should be made. The analysis of the metal in percentage was: Copper, 86.93; zinc, 9.62; tin, 1.86; lead, 1.38; iron, 0.21. A summary of the test data is given in Table III.

TABLE I—OPERATING RECORD OF 500-LB. ROTATING FURNACE MELTING YELLOW-BRASS TURNINGS

Pounds melted per day—one shift	3,900—5,500
Average daily output, lb.	4,950
Average charge per heat, lb.	550
Number of heats per day	8—10
Number of hours' power on furnace daily	10—11
Average melting time, minutes	40
Time between heats, minutes	15—25
Average power consumption per ton, kw.-hr.	300

Lining (made of good grade of arch fire-clay brick) has lasted approximately 500 heats and is good for many more. Electrode consumption per ton metal under 6 lb. No records as to net metallic shrinkage, exclusive of oil, dirt and moisture, are available, but careful tests made on the same type and analysis of material in other furnaces show that this need not exceed an average of 2 per cent.

It is significant that, even with an energy rate in virtually all of these plants of at least 2 cents per kilowatt-hour and occasionally up to 3 cents, the energy cost per ton of metal melted is no higher than present-day costs for coke, coal, oil and gas. As the use of crucibles for melting is eliminated with this furnace and the total upkeep and repair costs on the 500-lb. furnace do not average more than $2 per ton of metal melted, which is considerably lower than the cost of crucibles alone, the large savings made in metal losses and in labor show a handsome margin in favor of the electric furnace.

For the brass melter who has a large number of mixtures or whose daily output is limited a rotating electric furnace of still smaller holding capacity can be obtained. This is known as the 250-lb. (115-kg.) size. In all details of its construction it is identical with the 500-lb. furnace, and the power input is proportioned so that the same speed of melting results. Figures from a recent day's run on a 250-lb. furnace at the plant of the Hill Pump Valve Company, Chicago, will illustrate this point in Table IV.

Leitel Brothers, Chicago, have a 250-lb. furnace which

TABLE II—RECORD OF 500-LB. ROTATING FURNACE MELTING RED BRASS

Pounds of metal melted	80,000
Kw.-hr. consumed	14,761
Kw.-hr. per ton of metal	370.8
Pounds of metal per kw.-hr.	5.42
Cost of electric energy, per ton	$8.68
Electrode consumption, lb.	147½
Electrode consumption per ton metal, lb.	3.7
Cost of electrodes per ton of metal	$0.925
Number of heats	147
Life of lining in which these heats were melted, heats	520
Cost of lining per heat of metal	$0.3846
Cost of lining per ton of metal	$0.961
Cost of electrical energy, electrodes and lining, per ton of melted metal	$10.566

TABLE III—TESTS OF 500-LB. ROTATING FURNACE ON HIGH TEMPERATURE WORK

Heats	Charge, Lb.	Melt Time, Minutes	Kw.-Hr. to Hold Heat	Total Kw.-Hr. Used	Delay, Minutes	Total Time, Minutes	Metal Poured, Lb.
7	4,060.0	317	69 8	712.4	7	552	*
5	3,045.0	292	60.0	729.8	22	538	3,007.5
4	2,436.0	295	38.0	644.2	50	530	2,391.0
7	4,263.0	363	0.0	783.8	41	608	4,209.5
6	3,654.0	305	13.0	791.2	21	545	3,620.5
5	3,045.0	254	51.0	595.0	38	501	3,010.5
34	20,503 0	1,826	232.6	4,256.4	174	3,274	*16,239.0
Ave. per ton (10.252 tons)		178	22.7	415.2	16.9	319	
Ave. per heat		53.7	6.84	125.0	5.1	96.4	

Average weight of heat, lb.	603
Total working time, hours	54.6
Average time between heats, minutes	37 4
Average metal melted per day, lb.	3,417
Average kw.-hrs. per ton	437.9
Average electrode consumption per ton, lb.	16.55
Gross shrinkage, per cent	1 24
Non-metal in charge (approximately), per cent	0.13
Net metal loss, per cent	1 11

* Box of gates missing 12 8 lb Nipples

TABLE IV—A DAY'S RUN ON A 250-LB. FURNACE MELTING RED BRASS

Heat No.	Power On	Power Off	Kw.-Hr. Used	Wt. of Charge, Lb.	Time Between Heats, Min.
1	6:00 a.m.	8:35 a.m.	125	346	25
2	9:00	9:58	50	348	24
3	10:22	11:25	52	351	23
4	11:48	12:50 p.m.	52	340	25
5	1:15 p.m.	2:15	50	362	25
6	2:40	3:40	53	384	27
7	4:07	5:00	48	371	
Total			438	2,502	

Average energy consumption, 343 kw.-hr. per ton. No preheating required. From three to five minutes taken to skim through door on each heat. Zinc added at this time. Metal used, old scrap copper (bearing blocks). Pouring time ten to twelve minutes between heats. Remainder of time cleaning electrodes and coolers and charging furnace.

has been in operation for more than a year and a half (see ELECTRICAL WORLD, Dec. 20, 1919, page 1107, for early records). Many of the heats of yellow-brass scrap have shown an energy consumption of 240 kw.-hr. per ton, while on yellow-brass turnings and borings 210 kw.-hr. per ton has not been uncommon. Some of the linings have lasted almost 900 heats and none less than 600 heats. This represents a cost of less than 10 cents per heat, or, conservatively, 75 cents per ton. Accurate weighing of electrodes each day shows only 3½ lb. to 4 lb. (1.6 kg. to 1.8 kg.) consumption, including breakage, per ton of metal. Shrinkage has not averaged more than three-quarters of 1 per cent on red brass, nor more than 1.4 per cent on yellow brass. Heats as small as 100 lb. (45 kg.) have been made showing only a slightly higher average for all items than when the furnace is run to rated capacity. The most efficient basis naturally is to charge a maximum of metal per heat, which for this furnace would be approximately 380 lb. (110 kg.).

The Nordyke & Marmon Company, Indianapolis, Ind., is using one of the 250-lb. furnaces for making its most difficult alloys and castings, including silicon bronze and other special mixtures. A considerable portion of the time the furnace runs for sixteen hours per day. Many heats of red brass have been made at the rate of 270 kw.-hr. per ton, which is generally considered a good record even for a 2,000-lb. (900-kg.) furnace.

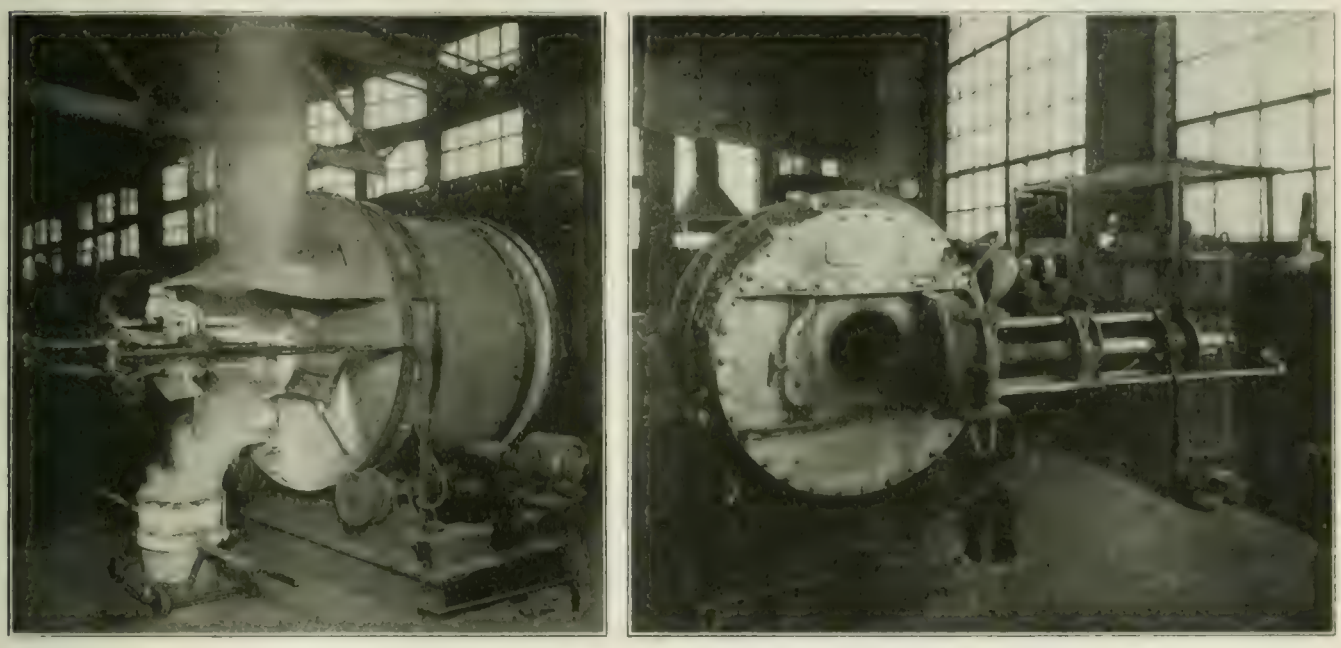
TESTS MADE ON A ONE-SHIFT BASIS

No records are yet available showing what results can be secured when operating the different sizes of rotating furnaces on a twenty-four-hour schedule. The tests herein recorded are all on a one-shift basis averaging ten hours, including all time for preheating.

It will be noted that the number of heats per nine-hour day will average eight on yellow brass and seven on red brass, the charge in each case being about 20 per cent heavier than the rated holding capacity of the furnace. This will work out uniformly for all sizes. It is therefore entirely practicable to make a reasonable estimate from these data as to what this type furnace will do on a twenty-four-hour day schedule, if operated on the same basis of efficiency.

Eliminating from consideration the first heat of the day, and allowing an average of twenty-five minutes between heats, these data indicate that the 250-lb. furnace would have a total daily output of at least 6,000 lb. (2,700 kg.) and an average power consumption of 285 kw.-hr. per ton on red brass and 235 kw.-hr. per ton on yellow brass. With the 500-lb. furnace the output would reach 12,000 lb. (5,400 kg.), and the average power consumption on red brass should be 275 kw.-hr. per ton and that on yellow brass 225 kw.-hr. per ton. The 2,000-lb. furnace should melt a daily output of 48,000 lb. (21,600 kg.) with an average power consumption on red brass of 250 kw.-hr. per ton and on yellow brass of 210 kw.-hr. per ton.

This subject was also discussed before the American Foundrymen's Association by C. H. Booth of the Booth Electric Furnace Company.



EXPERIENCE HAS SHOWN THAT THE ELECTRIC FURNACE OFFERS AN ECONOMICAL SOLUTION FOR THE MELTING PROBLEM OF THE BRASS FOUNDRY

On the left is shown a 2,000-lb. booth furnace at the plant of the Michigan Smelting & Refining Company pouring yellow brass after melting a charge of yellow-brass turnings and borings containing nearly 4 per cent of oil. The ¾-hp. motor used for automatically controlling the operation of the electrode may be seen in the middle at the left-hand side of the photo. This motor can be thrown out of gear if hand operation of the electrodes is desired. On the right is shown the electrode-holder construction of a 500-lb. furnace. The furnace is in the shape of a cylindrical drum, which minimizes the radiating surface. The doors are placed at the axis of the shell where the electrodes enter the furnace. The cylindrical walls of the shell are unbroken, thereby permitting complete rotation of the furnace. The electric current is brought onto the furnace by moving-contact method

Meter Records Can Be Simplified

A Record that Requires a Minimum of Labor, but Is a Thorough Check Against Loss—Shortage of Competent Metermen Makes Training School Necessary—Rules for Guidance of Wiring Contractors Found Necessary

By EDWARD HOWELL and CHARLES L. ROSE
Iowa Railway & Light Company, Cedar Rapids, Iowa

THE meter department headquarters of the Iowa Railway & Light Company is situated at Cedar Rapids, Iowa, and supervises the meter maintenance and repair work of the Iowa Railway & Light Company, Iowa Electric Company and the Iowa Falls Electric Company. The systems cover a large section of central Iowa as shown in Fig. 2. All meters required for the three companies are furnished through the Cedar Rapids meter storeroom, which carries a large stock of repair parts and handles all meter repairs, the meters being shipped from other points to Cedar Rapids for that purpose. Because of the territory covered and the number of small communities receiving service, this centralization is necessary, the individual communities not being large enough to support separate meter departments. The Cedar Rapids office alone handles the installation, removal and repair work in the Cedar Rapids division for approximately 12,000 meters in addition to its supervision of the remainder of the system.

In common with all other companies the Iowa Railway & Light Company experienced extreme difficulty in securing competent men during the war and some of the details of the record system described were dropped after years of successful use and the meter department has not been able as yet to pick them up again. The record system as described originated in Cedar Rapids in 1902 and has the merit of long continued use, during which the usual development difficulties have been thoroughly weeded out.

Training Meter Department Men

Owing to the shortage of competent men the department has found it necessary to establish an informal school in which the men are taught elementary electricity and the meaning of the electric circuit, the aim being to give them a thorough grounding in the fundamentals, after which the proper care of meters, repairing and adjusting are taught. This training is accomplished largely through lectures and blackboard illustrations given once a week.



FIG 2—EIGHTY IOWA CITIES AND TOWNS IN TERRITORY SERVED BY IOWA RAILWAY & LIGHT COMPANY, IOWA ELECTRIC COMPANY AND IOWA FALLS ELECTRIC COMPANY

Actual Working of Meter Records

The meter record consists of: Meter card, meter location card, meter test card, record of tests on meter, meter summary card.

The method of use of these cards is as follows:

The Meter Card (Fig. 3-E) is a permanent property record of the meter giving all of the physical data affecting the meter and the history of its entry on the property, its cost and final removal. These cards are filed in manufacturers' numerical order, the company having found it unnecessary to establish its own numbers.

Date..... Order No.....
Name
Address
Order
Connect
Disconnect
Remarks
Probable Load

Form C308-10M-4-20
Date.....19..... Order No.....
Name
Address
Clearance No..... Work Order No..... Date Issued.....
Class..... Credit.....
Connected to Transformer at.....

METERS	SUPPLY RECORD		LOAD RECORD		
	No	Ledger	No	Kind	Capacity
	Reading	Meter Loc			
	Make	Meter Sum			
	Voltage	Cons Rec			
	Size	Cons Sum			
	Kind	Load Rec			
	Constant				
	CONNECT				
	DISCONNECT				

Remarks
Approved..... Signed.....

FIG. 1—ORDER FORM FROM WHICH ENTRIES SHOWING INSTALLATION AND REMOVAL OF METERS ARE MADE
Only three cards are handled and entries made after the cards are originally filled out. These are the location cards, the record of tests on meter and meter summary

The Meter Location Card (Fig. 3-D) contains the name plate data of the meter and space for installation, and removal data as the meter is handled in the process of meter operation. These are filed by manufacturers' serial number.

The Meter Test Card as shown in Fig. 3-F is a record of each individual test made on any meter and is filed by manufacturers' serial number.

Record of Tests on Meter—This is a record of the series of routine tests on any given meter and is filed by dates of the last test shown in the entries. See Fig. 3-C. The purpose of the card is shown under the remarks on testing.

The Meter Summary Card shown in Figs. 3-A and 3-B is designed to show the number of meters both by sizes the inventory, which shows at once if any errors have been made. When meters are scrapped the proper red ink entries are made under storeroom and total heads. This method gives the nearest to an infallible check on the loss of meters that it has been possible to devise.

These are all 3 by 5 in. (7.6 by 12.7 cm.) cards excepting the last named, which is 6 by 9 in. (15 by 23 cm.).

SOURCE OF ENTRIES FOR METER CARDS

In the above no mention has been made of the source of entries on the meter location card and summary. As orders for connection or disconnection are received the form shown in Fig. 1 is filled out by the order clerk as to name and address and sent to the line and meter

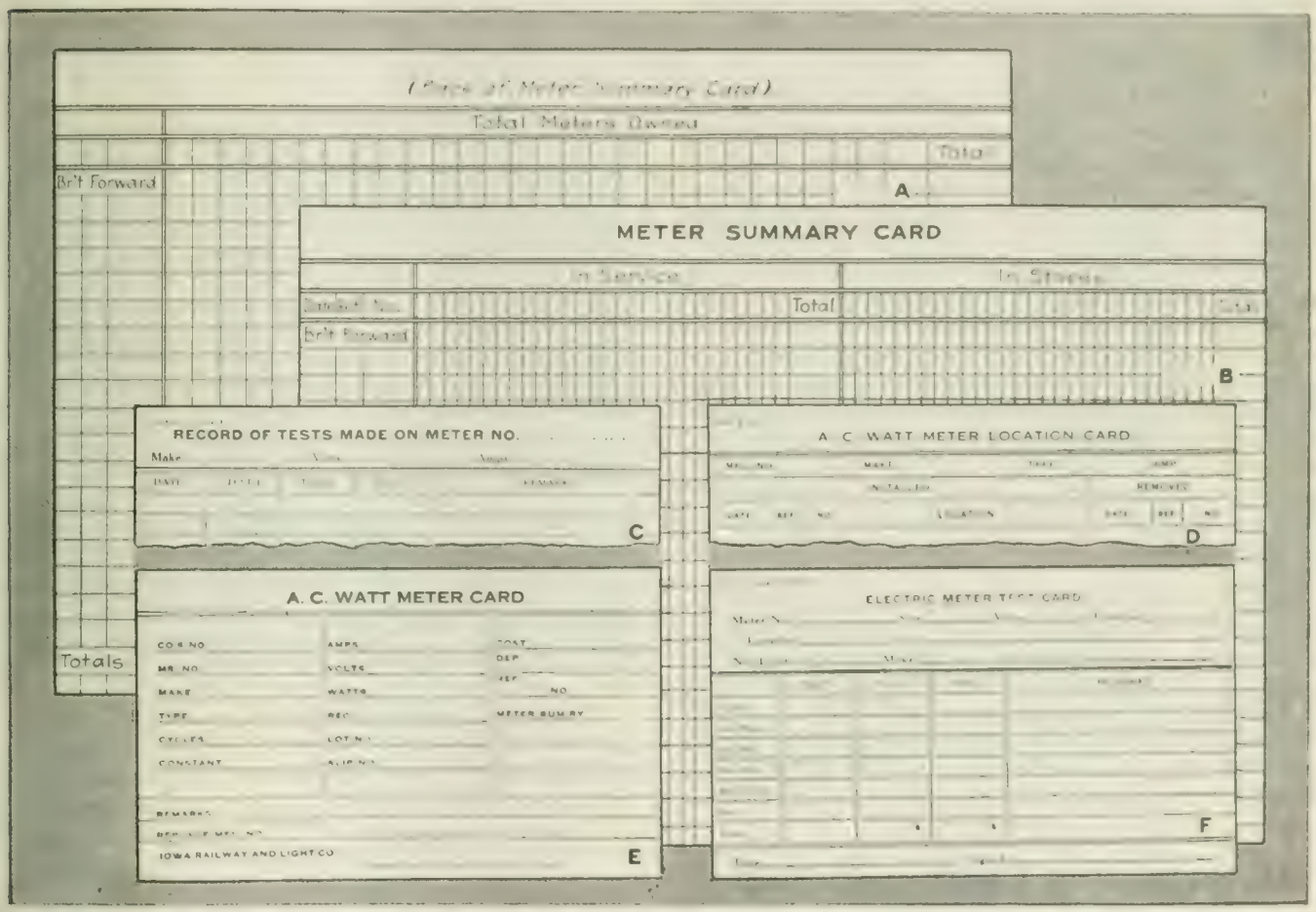


FIG. 3—COMPREHENSIVE METER RECORDS THAT CAN BE MAINTAINED WITH A MINIMUM OF WORK

A and B. Meter summary card. C. Record of all tests on any given meter. D. Location card recording travels of the meter in routine operation. E. Permanent record of meter. F. Record of individual tests.

and total in service, in the storeroom and owned, at any given time. In handling, when new meters are received, the proper entries are made under the storeroom and total heads in black ink. When meters are transferred from the stores to service the proper entries are made under the meters in service in black ink and under storeroom in red ink. In carrying over from card to card, each card must be balanced between the totals on the back and the sum of the totals in service and in stores, while at the end of the calendar month an inventory by serial numbers of the meters in the storeroom is taken. The location cards are separated in the file between those in service and in storeroom. Location cards shown in the storeroom are checked against departments for execution. The order comes to the meter department when the line department has completed its work and the meter department fills in the meter and load data. Each day before the completed orders are turned in to the accounting department the meter location and summary cards are entered, thus insuring the keeping up of the meter record day by day. When the orders are made out at the order desk they are numbered serially, the stub being retained by the order clerk as his record and a check against any possible loss of the form in routine handling.

All meters are tested as received from the factory and as they come into the meter storeroom during the course of routine operation. It has been the plan to test meters

in service periodically, but the program has been somewhat upset by lack of competent men. Routes were laid out originally and tests made which are recorded on the forms shown in Figs. 3-F and 3-C. Fig. 3-C was then filed in date order. As the testing is a continuous process the result is a test file in the order in which tests have actually been made that the testing force follows as a guide. The installation of new meters or recently tested meters on a route introduces a slight complication which is handled either by advancing the date on the test card to correspond with the date on which the route is tested or handling the new meters as pickups along with the meters that are missed for one reason or another in the routine testing. It has not been found necessary to provide primary standards to control test standards, but a set of secondary standard instruments sent when necessary to an outside laboratory for calibration are used to maintain standard test instruments.

Rules for Repairing and Installing Meters

All meters brought into the storeroom for any cause are cleaned, tested, adjusted and if necessary repaired, the repairing consisting of anything from slight repairs to overhauling as complete as the condition of the meter indicates necessary.

Meters received from other points for repairs are recorded under a shop number in an ordinary stock blank book, the name plate date of the meter being given. The test data before and after repairing is recorded, also the material and time taken for repairs, as well as the point from which the meter is received and finally shipped to. A shipping tag showing the shop number, the point from which it was shipped and the name plate data is attached to the meter when received and when repairs are complete the final test data is also recorded on this tag preparatory to reshipment.

Because of the widely scattered nature of the territory and the numerous small towns, rural territory in which there is no municipal inspection service and no rules established, the company has found it necessary to establish rules governing meter installations. Copies of the rules were sent by registered mail to every wiring contractor in the territory and strict compliance is insisted on.

Determining Corona Voltages for Actual Lines

Tables for Transmission Line Corona Voltages Agree Well with Equations Set Up—Some Expedients for Avoiding Abnormal Losses

By F. W. Peek, Jr.
Consulting Engineer General Electric Company

In order to complete the discussion of transmission line practice in America, as outlined by the writer in Electrical World of Nov. 27 and Dec. 4, it is essential that some discussion of corona voltages for high-tension lines should be added to give data on this important characteristic as determined by several years of study and also by tests of transmission lines in this country.

On the higher-voltage lines it is necessary to take certain precautions, otherwise the air insulation immediately surrounding the conductors will be broken down or corona will appear, with the accompanying loss.

The laws of corona have been quite definitely worked out and are as follows:

(1) Disruptive critical voltage:

$$e_o = g_o m_o r \delta \log_e (S/r) \text{ kv. to neutral}$$

(2) Visual critical voltage:

$$e_v = m_v g_v r \log_e (s/r) \text{ kv. to neutral,}$$

where

$$g_v = g_o \delta \left(1 + \frac{0.30}{\sqrt{\delta r}}\right) \text{ kv./cm.}$$

$$\delta = \frac{3.92\, b}{273 + t}$$

(3) Power loss:

$$p = (241/\delta)(f + 25)\sqrt{(r/s)}\,(e - e_o)^2 10^{-5} \text{ kw. per kilometer of single conductor,}$$

where

e = effective kilovolts to neutral applied to the line
= ½ kv. between lines single-phase; $1/\sqrt{3}$ kv. between lines for three-phase.
δ = air density factor = 1 at 25 deg. C. and 76 cm. barometer.
b = barometric pressure in centimeters.
g_o = disrupture critical gradient
= 21.1 kv./cm.
g_v = visual critical gradient kv./cm.
t = temperature, deg. C.
r = radius of conductor in centimeters.
s = distance between conductor centers in centimeters.
f = frequency, cycles per second.

Irregularity factors:

m_o = 1 for polished wires
= 0.98 — 0.93 for roughened or weathered wires
= 0.87 — 0.83 for seven-strand cables.
m_v = m_o for polished wires = 1.
m_v = 0.72 for local corona all along cable.
m_v = 0.82 for decided corona all along cable.

For approximating storm loss consider
e_o = 0.8 of fair weather value in equation (3).

Special Calculations.—For small conductors the loss is calculated from the following equation:

$$p = (241/\delta)(f + 25)\sqrt{\frac{r + (6\,s) + 0.04)}{s}}\,(e - e_d)^2\, 10^{-5}$$

kw. per kilometer of single conductor.

$$g_d = g_o \delta \left(1 + \frac{0.30}{\sqrt{\delta r}} \frac{1}{1 + 230\, r^2}\right).$$

$$e_d = g_d r \log_e (s/r).$$

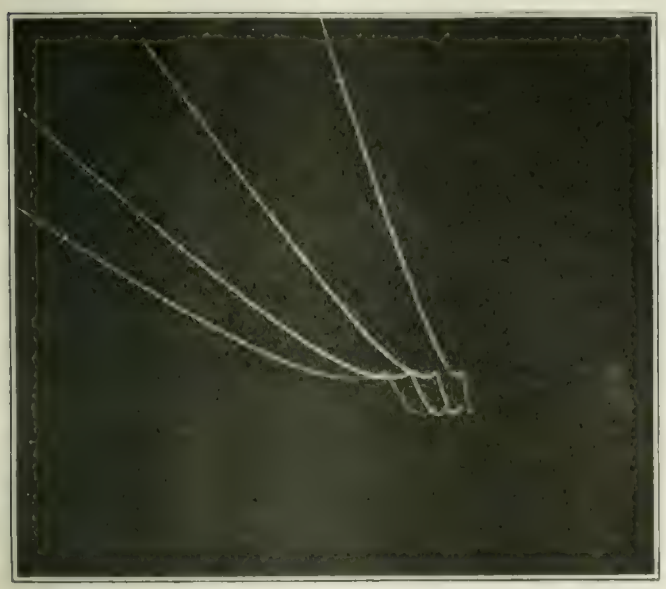
The *visual critical voltage*, e_v, is the voltage at which the wires begin to glow.

For clean wires there should be no loss until the voltage e_v is reached, when the loss should suddenly assume a definite value and increase as the square of the difference between the applied voltage and the *disruptive critical voltage*. The visual critical voltage takes into account the apparent strength, which is a function of the wire diameter; the disruptive critical voltage corresponds to the constant strength of air for uniform fields, which is 21.1 kv./cm. The visual critical voltage is always higher than the disruptive critical voltage. Owing to irregularities there is always a loss below the visual critical voltage. This loss follows the

probability curve. On transmission lines, however, the quadratic law (3) is generally closely approximated even on this section of the curve.

Safe and Economical Voltages.—It will generally be found that it is safe and economical to operate a line up to but not above the fair weather e_o voltage at summer temperature. This will give loss during storms. During cold weather, however, the critical voltage will be higher and the storm loss less. Beside the loss of energy, corona may be undesirable from the standpoint of harmonics.

Arrangement of Conductors.—In the above formulas it has been assumed for three-phase lines that the conductors are arranged in an equilateral triangle. When conductors are not so placed, but in a plane, corona will start at a lower voltage on the center conductor than on the outside conductors. The actual critical voltage on the center conductor will be approx-



CORONA AT 230 KV. (1.19-CM. DIAMETER [0.47-IN.] CABLE—3.10 CM. [10-FT.] SPACING)

imately 4 per cent lower and on the outside conductors 6 per cent higher than for an equilateral triangle of the same spacing.

Various means have been used for increasing the size of the conductor. For equal conductivity an aluminum conductor has about a 25 per cent greater diameter than a copper conductor and, therefore, approximately 25 per cent higher critical voltage. The advantage of aluminum may be still further increased by the addition of a steel cable core. Such a cable has been used for several years on a 154-kv. to 165-kv. line in California. A copper tube or a copper conductor with a suitable core may be used. Several conductors of the same potential may be arranged close together.

Agreement of Calculated and Measured Losses on Actual Transmission Lines.—In most cases when losses have been measured on transmission lines the check is in close agreement with the calculated values. The agreement is, in fact, within the limit of error of the measurements on commercial lines. Apparent discrepancies have generally been due to the fact that the measurements are often made at voltages below the visual critical voltage where the loss depends upon irregularities as discussed above. The loss between e_v and e_o closely follows the quadratic law for large conductors,

TABLE I—CORONA LIMIT OF VOLTAGE—STRANDED CABLES
(Kilovolts between lines, three-phase, sea level, 25 deg. C.)

Size, B. & S. or Circ. Mils	Diameter, In.	Diameter, Cm.	Spacings, Cm. and Ft. 91 (3)	122 (4)	152 (5)	183 (6)	245 (8)	305 (10)	366 (12)	426 (14)	490 (16)	610 (20)
4	0 230	0 584	..	56	58	60	62	64	66	68	69	71
3	0 261	0 663	..	62	65	67	70	72	74	76	77	80
2	0 290	0 736	..	..	71	73	76	79	81	83	85	87
1	0 330	0 839			79	81	85	88	91	93	95	97
0	0 374	0 950				90	95	98	102	104	106	109
00	0 420	1 07	..	..	..	98	104	108	111	114	117	121
000	0 470	1 19	..	..	..	..	114	118	121	124	127	132
0000	0 530	1 35	..	..	..	..	125	130	135	138	141	146
250,000	0 590	1 50	..	..	..	..	138	144	149	152	156	161
300,000	0 620	1 57	..	..	..	..	..	151	156	161	165	171
350,000	0 679	1 73						161	166	170	175	180
400,000	0 728	1 85	..	..	..	..	..	171	176	180	185	192
450,000	0 770	1 96	..	..	..	..	..	178	184	190	194	200
500,000	0 818	2 04	..	..	..	..	..	188	194	199	205	210
800,000	1 034	2 62	..	..	..	..	..	..	234	241	244	256
1,000,000	1 152	2 92	..	..	..	..	..	..	256	264	270	281

but for new conductors, and especially for small conductors at high altitudes when the difference between e_o and e_v is quite large, the loss will generally fall below the quadratic curve.

Corona Limit on High-Voltage Transmission Lines.—The accompanying tables give the corona limit of voltage for various conductors at various spacings. A

TABLE II—CORONA LIMIT OF VOLTAGE—WIRES
(Kilovolts between lines, three-phase, sea level, 25 deg. C.)

Size, B. & S. or Circ. Mils	Diameter, In.	Diameter, Cm.	Spacings, Cm. and Ft. 91 (3)	122 (4)	152 (5)	183 (6)	245 (8)	305 (10)	366 (12)	426 (14)	490 (16)	610 (20)
4	0 204	0 524	51	54	56	58	60	62	64	65	66	68
3	0 229	0 581	..	59	62	64	66	68	70	72	74	76
2	0 258	0 655	..	..	69	70	74	76	78	80	82	84
1	0 289	0 734	..	..	75	77	81	83	86	88	90	92
0	0 325	0 826				85	89	92	95	97	99	102
00	0 365	0 928				94	98	102	105	107	110	113
000	0 410	1 04					109	113	116	119	121	124
0000	0 460	1 17					120	125	128	131	134	138

table is also given for altitude correction. It will be noted it does not require a conductor of unreasonable size to transmit at 250 kv. or even higher.

The values in the above tables correspond to the disruptive critical voltages at 25 deg. and 76 barometer and give an approximate idea of the voltage limit imposed by corona. For single-phase or two-phase

TABLE III—ALTITUDE CORRECTION FACTOR AT 25 DEG. C.

Altitude, Feet	Altitude, Meters	δ	Altitude, Feet	Altitude, Meters	δ
0	0	1 00	5,000	1,530	0 82
500	152	0 98	6,000	1,835	0 79
1,000	305	0 96	7,000	2,140	0 77
1,500	459	0 94	8,000	2,450	0 74
2,000	611	0 92	9,000	2,750	0 71
2,500	765	0 91	10,000	3,050	0 68
3,000	918	0 89	12,000	3,670	0.68
4,000	1,220	0 86	14,000	4,290	0 55

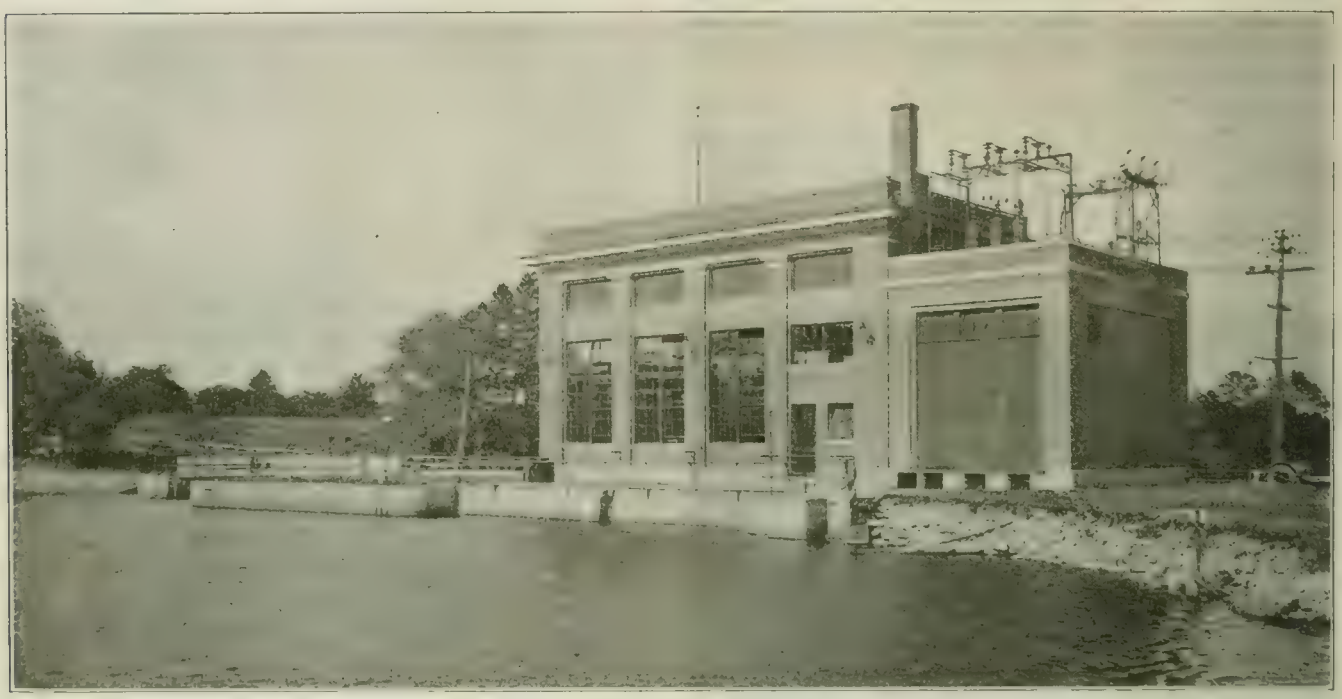
multiply the three-phase values by 1.16. To find the value at any altitude multiply the voltage found above by the corresponding δ.

REASSURANCE *of this principle [private property] came at a time when not only our people but the world had need of it. I hold that no more dangerous attack can be made upon liberty than by the adoption of a general policy of government ownership. By it the government would finally own the people.*—VICE-PRESIDENT-ELECT CALVIN COOLIDGE.

Developing the Low-Head Plant

Rehabilitation of Old Plants by Installing Hydraucones with High-Speed Runner—Gain in Efficiency Should Be at Least 25 per Cent—Comparison of Hydraucone with Stream Line Draft Tube

By LOUIS E. AYRES
Principal Assistant Engineer to Gardner S. Williams, Consulting Engineer, Ann Arbor, Mich.



LOW-HEAD PLANTS SUCH AS THE GEDDES PLANT OF THE DETROIT EDISON COMPANY ARE BECOMING MORE ATTRACTIVE FINANCIALLY SINCE IMPROVEMENTS IN DESIGN HAVE TAKEN PLACE

IN ANY attempt to utilize more completely the low-head water powers of this country, of which so many are to be found throughout the North Central States, the engineer is confronted with two types of problems—first, those involved in the reconstruction of old, inadequate and badly deteriorated mills and electric generating stations, and, second, those arising out of the design of new water-power plants to operate under heads as low as 8 ft. to 10 ft. (2.4 m. to 3 m.). It frequently happens that such reconstruction projects and low-head developments may not, on preliminary inspection, appear attractive financially. The most efficient design and most economical construction may often be necessary in order to turn the scales in favor of a particular undertaking. Any suggestions, therefore, leading to increased efficiency and more economical construction would seem to be in order.

Old plants, in general, may be placed in one of two groups—first, those which are virtually used up and worn out and must be abandoned or completely rebuilt; second, those which are structurally in a fair or good state of preservation and can be repaired and utilized for many years, but which contain obsolete, ill-fitted or worn-out hydraulic machinery.

Some old paper mills and hydro-electric generating stations in Michigan, Minnesota, Wisconsin, Illinois and adjoining states which were built thirty to forty years ago fall into the first group. The old timber flumes are now rotted and leak badly; the turbine-gate mechanisms are so worn that they no longer effectively shut off the water and other means must be employed to stop the turbines; bearings are continually settling and require constant "shimming" to keep them in line, and in some instances the building sills and superstructure are in such a state of dilapidation as to be a constant source of danger to the lives of the operators. Ordinarily nothing can be done with these old plants except to rebuild them completely. Frequently there is no salvage unless it be the scrap value of the machinery.

But there are also many old mills of a more substantial type of construction whose walls were built of stone, or of concrete after the advent of Portland cement as a common building material. The effective rehabilitation of such old plants may be accomplished with comparative ease. The old structures can for the most part be utilized, and the task of rebuilding consists mainly in replacing the hydraulic equipment by modern turbines designed for the existing head and speed, of adequate capacity and properly installed.

Although one finds instances where turbines are operating above their proper speeds and with efficiencies lower than 50 per cent, as a rule it may be said that economic speeds are roughly approximated. Turbine efficiencies have, however, been increased about 10 per cent during the last twenty-five years. If no further improvement could be effected in a particular plant than to replace old by new turbines, an increase in efficiency of at least 10 per cent is to be anticipated from such a change. As great an opportunity, or even a greater one, for bettering the efficiency lies, however, in an improved setting. It may be conservatively

stated that where an increase of efficiency of 10 per cent is possible by replacing old by new turbines, at least an additional 15 per cent may be expected from a well-designed, modern setting.

TYPICAL EXAMPLE OF HOW PLANT EFFICIENCY MAY BE INCREASED

As an example of what may be accomplished in a modern mill, the Watab Pulp & Paper Company of Sartell, Minn., in 1916 replaced its hydraulic equipment by more efficient, modern turbines in improved settings. The original plant was built in 1908 and was therefore only eight years old at the time of its hydraulic reconstruction. The magnitude of the undertaking was considerable, involving as it did the replacement of fifty-one runners in twelve main units. The result of the change was to increase the hydraulic efficiency about 40 per cent, the plant machinery capacity 100 per cent, and the annual output of water-ground pulp more than 50 per cent. It was estimated by the management that the increased revenue resulting from the changes would be sufficient to cover the cost of the improvement in about two years.

In two hydraulic power plants recently completed in Michigan* there are incorporated new features in design which are marked departures from past practice and have an important bearing on the problems involved in both the rebuilding of old and the development of new water powers under relatively low heads. The plants referred to and herein described are that of the Cheboygan Electric Light & Power Company, on the Black River, near Cheboygan, Mich., and the Geddes plant of the Detroit Edison Company, on the Huron River, just outside of Detroit.

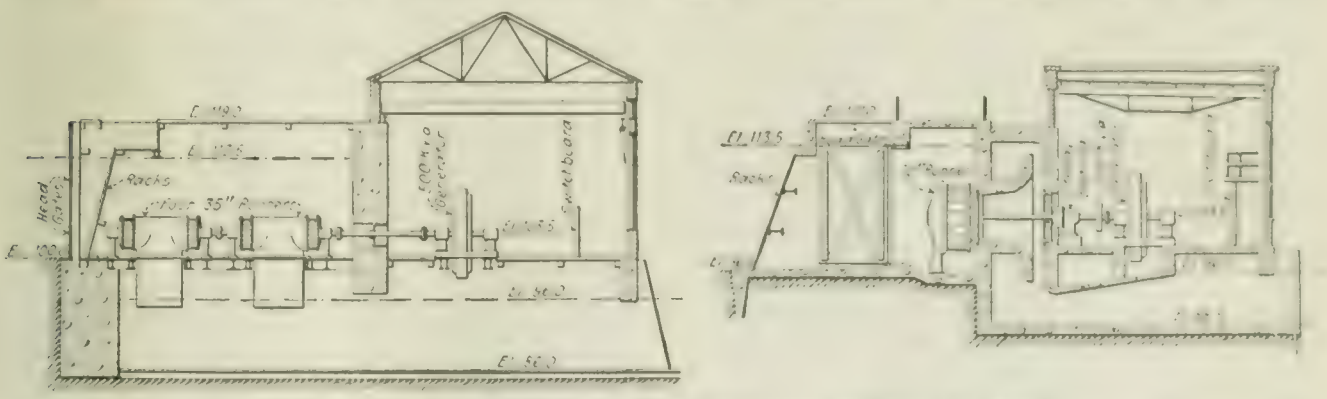


FIG. 1—COMPARISON OF THE OLD-TYPE LOW-HEAD PLANT WITH THE NEW

On the left is shown a section through old hydro-electric plant of the Cheboygan Electric Light & Power Company, Cheboygan, Mich. On the right is a section through new hydro-electric plant of the Cheboygan Electric Light & Power Company, [illegible] compactness as compared with the old [illegible] distance from bulkhead to upstream bearing [illegible]

REDUCTION OF FLOOR SPACE IS SHOWN IN THE CHEBOYGAN PLANT

In Fig. 1 is shown a cross-section of the old station of the Cheboygan Electric Light & Power Company of Cheboygan, Mich., compared with a cross-section of the new station. The old station was equipped with horizontal quadruplex units similar to many installed during the last quarter of a century. In the new plant a single runner replaced four runners, driving the old generators at the original speed. The over-all distance from the inside face of the bulkhead wall to the farthest upstream bearing is less than half as great in the new plant as it was in the old. This shortening of the driving shaft and reduction of the number of bearings from four to two results in a simpler, cheaper and more compact design.

Incidentally it may be noted that the flume walls of the new plant have been carried upstream of the turbine a sufficient distance to allow the installation of head-gates of the swinging "barn-door" type. Such gates have proved a practical success in several plants. They enable the penstocks to be readily drained for turbine inspection and as quickly filled, and they appear to be less expensive than any other gate that has been satisfactorily employed for such purpose.

The new Cheboygan plant is the first application of the hydraucone with high-speed runner to a horizontal setting. The design allowed the utilization of the old generators, and the saving effected thereby together with that resulting from the shorter flume and a single turbine instead of a quadruplex unit made it possible to build this plant at a very reasonable cost. The power house complete, including about 600 ft. (183 m.) of head and tailrace rendered necessary in order to keep the old plant in operation during construction, cost less than $45 per horsepower of installed capacity. In view of the fact that the average cost of low-head water-power developments in Michigan at pre-war prices may be placed at approximately $150 per horsepower of machinery capacity, including both power house and dam, the Cheboygan plant without the dam may be considered at least an average investment.

ADAPTABILITY OF PRESENT DESIGNS TO REBUILDING OF OLD PLANTS

The chief interest in this design arises from its applicability to the rebuilding of old horizontal electric plants and paper mills where the structures are substantial and well preserved.

Fig. 2 illustrates the application of the Cheboygan design to a mill typical in cross-section of many now in operation in this country. The flume originally contained a quadruplex unit which pretty well filled the space available. The old concrete is shown single-hatched and the new concrete with the usual symbol. The changes include lowering the old floor and building a 3-ft. (0.9-m.) concrete bulkhead across the old penstock to act as a back to the sheet-steel hydraucone. The center line of the shaft remains as before. The amount of concrete to be removed and replaced per penstock is quite immaterial in view of the change effected. If

*Designed by Gardner S. Williams, consulting engineer, Ann Arbor, Mich.

by such a transformation of the hydraulic end of a paper mill an increase of efficiency of 20 to 30 per cent can be consummated it would be obviously very well worth while.

Fig. 2 shows clearly the saving that might have been effected originally had a present-day high-speed runner then been available, as there is a waste space of over 20 ft. (6.1 m.) upstream of the new turbine. In such instances this waste space may well be utilized by installing swinging headgates similar to those shown in the Cheboygan plant (Fig. 1), as such gates are measurably superior to the ordinary sliding type.

Comparison of the Hydraucone with the Stream-Line Draft Tube

In Fig. 3 appears a cross-section through the Geddes plant of the Detroit Edison Company showing in solid lines the hydraucone of unit No. 1 and in dotted lines the outline of the stream-line draft tube of unit No. 2. This plant is also unique in that it contains side by side the best present-day conception of two types of turbine settings. The hydraucone is the design of William M. White, manager and chief engineer of the hydraulic department of the Allis-Chalmers Manufacturing Company, Milwaukee, Wis., and the draft tube is the design of Gardner S. Williams. The plant contains two Allis-Chalmers vertical high-speed units of 500-kva. capacity each, together with the usual accessory equipment. Although of liberal inside dimensions, the structure housing this equipment is unusually compact and attractive. It is located 30 miles (48 km.) west of Detroit on the main line of the Michigan Central Railroad.

The "hydraucone regainer" is an "apparatus for utilizing the hydraucone action of water" perfected by Mr. White and covered by United States patent No. 1,223,843, issued April 24, 1917. This invention "designs to provide a device for changing the direction of a body of water flowing through a closed conduit in as short a distance as possible and with regain of pressure from velocity by utilizing the hydraucone action of water in power-plant construction where the cost and difficulty in excavation beneath the power house for the draft tube are important factors." By the "hydraucone

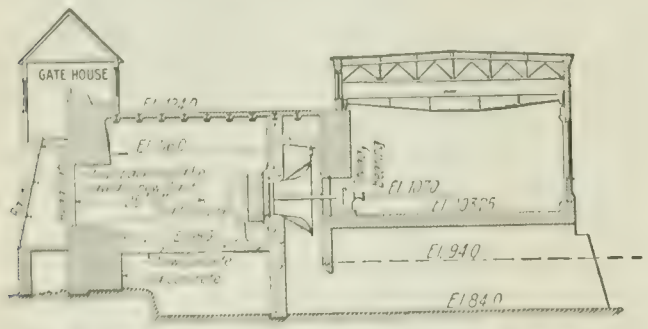


FIG. 2—INSTALLATIONS OF THE NEW TYPE—SAVE SPACE

Application of Cheboygan design to a typical mill installation, showing the space that could be saved in a new plant with the improved design with resultant economy in cost of construction.

action of water" is meant "that action which occurs as the stream impinges against a surface and is deflected therealong." By experiment the shape of the frustoconoid formed when a free circular jet impinges against a plane surface has been carefully determined and the proportions applied to the construction of the outlet conduit below the turbine.

The draft tube below unit No. 2 is the result of a considerable amount of experimentation to determine the most efficient form. Heretofore good draft-tube design has been an attempt to apply experimental knowledge of the action of water flowing past a 90-deg. bend in a pipe. The tube in the Geddes plant, however, is designed on the theory that the column of discharging water may be treated as though it were a portion of a

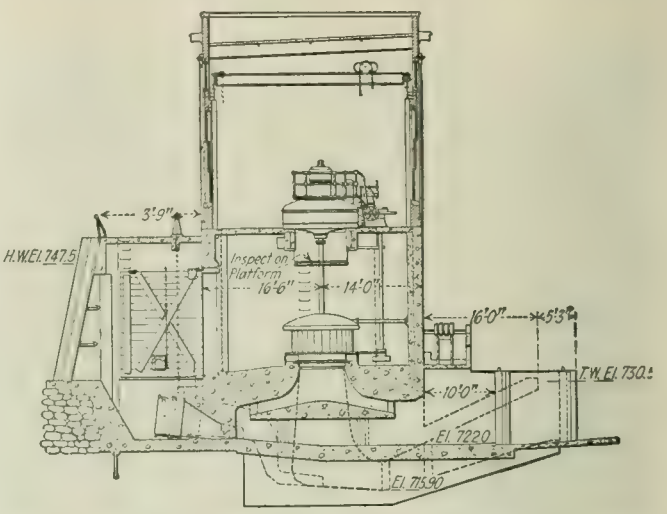


FIG. 3—SECTION OF THE GEDDES PLANT SHOWING IN SOLID LINES THE HYDRAUCONE OF UNIT NO. 1 AND IN DOTTED LINES THE DRAFT TUBE OF UNIT NO. 2

jet impinging on a flat plate, having a radius equal to the draft-tube diameter at the outlet of the turbine.

It may be of interest to note that in 1915 a draft tube was designed for a low-head plant in Michigan which was constructed in the same power house as another draft tube designed according to the practice then and still generally accepted as the best. On actual test this tube gave about 7 per cent more power and 5 per cent better efficiency than the standard form.† This incident is mentioned merely as evidence of the fact that the design of the outlet conduits to a turbine may affect efficiency to a much greater extent than is generally supposed.

Experiments on a model of this first Williams draft tube, made in connection with the development of the "hydraucone," showed the hydraucone to give an efficiency at least as high. It will therefore appear that inasmuch as the Geddes draft tube, as shown by the test curves in Fig. 4, is for the higher gates about 2 per cent more efficient than the hydraucone, the improvement in draft-tube design from the standard type to the hydraucone is about 5 per cent and to the Geddes stream-line design nearly 7 per cent. In comparing the two designs it is to be remembered that the draft tube requires the deeper and the hydraucone the wider setting.

High-Speed Runners of the Nagler Type Are Used

The runners installed in both the Geddes and the Cheboygan plant are of a new type designed in 1916 by Forrest Nagler and now being manufactured by the Allis-Chalmers Manufacturing Company. In appearance the Nagler runner resembles an ordinary ship's propeller and is built with either three or four blades. There are now in operation at the Geddes plant a three-blade runner discharging into a hydraucone and a four-blade runner discharging into a draft tube, both

†See *Transactions A. S. C. E.*, Vol. 78, page 1572.

set vertically, and at the plant in Cheboygan County two four-blade runners, set horizontally, discharging into hydraucones. The four-blade runner is of cast steel, rated at 600 hp. at 15-ft. (4.6-m.) head and 200 r.p.m.

The history of the development of these runners and their hydraulic characteristics are quite completely set

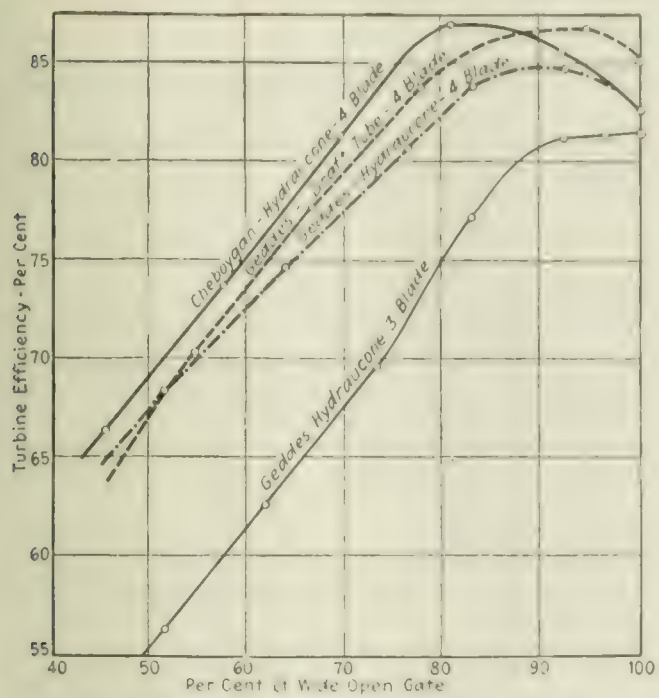


FIG. 4—EFFICIENCY CURVES OF THE GEDDES AND CHEBOYGAN TURBINES

forth in a paper presented by Mr. Nagler before the American Society of Mechanical Engineers in December, 1919. The reader is also referred to an article on "High-Speed Wheels for Low-Head Plants," by A. Streiff, printed in the ELECTRICAL WORLD for July 17, 1920.

OVER-ALL EFFICIENCY AS HIGH WITH HIGH-SPEED WHEELS AS WITH STANDARD TYPE

Complete efficiency tests were made of the Geddes plant in 1918 and of the Cheboygan plant in 1920. At Geddes two four-blade runners, one set over the draft tube and the other over the hydraucone, were first tested. This gave opportunity for comparison of settings. Later the four-blade runner was removed from the hydraucone setting and replaced with a three-blade runner, thus affording comparison of runners under identical conditions. The units were tested at all gates and over the entire speed range from zero, or blocked wheels, to runaway speeds. Heads were observed in accordance with accepted practice and the wheel discharge was measured at Geddes over a sharp-edged weir in the tailrace and at Cheboygan by current meters near the flume entrance.

In Fig. 4 are presented the efficiency curves determined by the tests. The maximum efficiency appears to be about 87 per cent in the case of the four-blade runner in the horizontal hydraucone setting at Cheboygan. The same runner in the vertical setting at Geddes closely approximates the Cheboygan efficiencies, with its best efficiency on the stream-line draft tube about 86.7 per cent, and on the hydraucone slightly less than 85 per cent, in both the latter settings the maximum coming at a higher gate opening than at Cheboygan.

The three-blade runner is for the highest gates about 1 per cent and at lower gates within its working range 5 per cent less efficient than the four-blade runner. The advantage of the three-blade runner, however, lies in its greater capacity, which is a characteristic of some importance during high water.

The important point to be emphasized with reference to these tests is that for the first time in experience with low-head developments it has been possible to obtain efficiencies on horizontal-shaft units equal to or better than those obtained in vertical installations and better than those obtained at Holyoke.

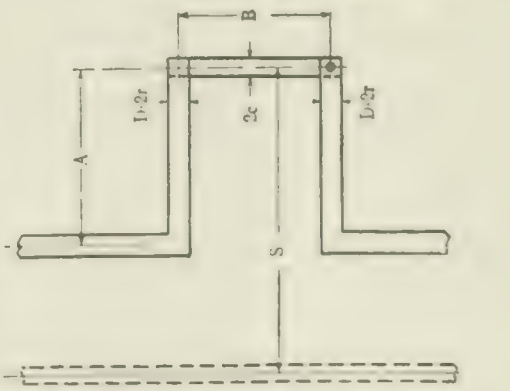
Contrary to notions thus far accepted, the efficiency of the high-speed runner appears to be within 2½ per cent of that of the best standard-type runners for similar capacities and heads, and this deficiency is usually made up by the increased efficiency of the generator due to higher speeds.

Magnetic Forces in Disconnecting Switches

A FORMULA for the calculation of the forces acting on disconnecting switches as published in the ELECTRICAL WORLD for July 10, page 63, contained errors, not in the original, which are corrected below. The paper of H. B. Dwight from which the formula was abstracted said that the calculation of the forces acting on disconnecting switches is useful to switch designers and also to designers of electric circuits who desire to know what form of circuit will produce the least strain on the switch. The results of an analysis of this problem were discussed in the two following equations:

The total force at the break jaw when A is greater than B (see figure) is:

$$4.45 \times 10^{-7} I^2 \left[2.30 \log \left(\frac{B}{r} \right) + \frac{1}{3} - \frac{B}{A} + \frac{1}{4} \frac{B^2}{A^2} + \frac{3}{20} \frac{r^2}{A^2} - \frac{1}{32} \frac{B^4}{A^4} + \frac{B}{S} \right] \text{lb.}$$



LAYOUT TO EXPLAIN MAGNETIC FORCES ACTING ON A DISCONNECTING SWITCH

When A is less than B, the force is:

$$4.45 \times 10^{-7} I^2 \left[2.30 \log \left(\frac{2A}{r} \right) - \frac{2}{3} - \frac{1}{2} \frac{A}{B} + \frac{1}{6} \frac{C^2}{A^2} + \frac{3}{20} \frac{r^2}{A^2} + \frac{1}{24} \frac{A^2}{B^2} + \frac{1}{24} \frac{AC^2}{B^3} - \frac{B}{S} \right] \text{lb.}$$

where I is in amperes. If the circuit does not return behind the switch, the term $\frac{B}{S}$ is zero.

Readers' Views and Comments

Honoring the American Electrical Pioneers

To the Editor of the ELECTRICAL WORLD:

SIR: Your issue of Dec. 11 contained a most interesting suggestion from a correspondent to the effect that the recent Oersted-Ampère celebrations might well lead to a revival of interest in electrical biography and history. My own association with this subject, whether as an editor for twenty-eight years of this journal or in other capacities, is perhaps well enough known to justify me in seeking to give a very emphatic approval to the remark of "W. C. F." that "The human element which interests men so strongly in geographical discovery and exploration is present, too, in the new worlds first revealed by devoted and intrepid scientists and has too long suffered neglect." And I would venture to quote from my own appreciation of Thomas Davenport, the forgotten builder of electric motors in 1834-35, at the unveiling of his memorial at Brandon, Vt., in 1910: "A nation that spends as much every year for electricity as for daily bread may well entertain sentiments of reverence for its pioneers in the electrical arts."

We electrical engineers have indeed ourselves been neglectful of our forerunners; but you hardly ever find Pilgrim Fathers putting up monuments to themselves, and electricity is still in its foundational, constructive stages. It is always a sign of a more advanced civilization to be appreciative of its creators and find time for reverential recognition. The continuing desire for knowledge of human leaders and what they have done is attested by the fact that "The Outline of History" by H. G. Wells is distinctively the "best seller" of 1920.

The writing of its history is but one of the obligations that we owe to the electrical past and to future generations whose lives will be governed by it. At no distant date we shall probably have an electrical historical society with its magazine of *memoires pour servir*. That is one necessity. But we also need a museum of electrical history. Today the relics of early American inventions and mechanisms, even when poorly preserved and authenticated, are widely scattered in the most distressing fashion. Our commercial companies, spurred on by patent litigations, have done more to save them than the technical societies; but the factory museums are literal morgues—not centers of education and inspiration. A few collections are found in the colleges, and the National Museum in Washington has made a feeble effort to do justice to the numerous electrical arts. It all needs co-ordination as the result perhaps of some great endowment.

Meantime, perhaps the suggestion may be offered that while writing their histories and collecting with filial care their pathetic little pieces of crude apparatus we might now and then honor the graves of these men. There should be an electrical decoration day, part of the national celebration, for those who often gave more than their lives to create the arts and industries by which we live. Who knows where the great American electricians lie, excepting Franklin? Who can lead us to the resting places of Henry, Morse, Davenport, Farmer, Wallace, Van Depoele, Phelps, Rowland and others whose deeds can never sink into the twilight of oblivion?

Might not the electrical groups in each part of the country where our heroes lie help keep their graves green and bear witness each year to the splendor of the gifts conferred by these pioneer American electricians on all mankind? So far is this from being merely sentimental, it might well be regarded as an element in further electrical development.

New York City. THOMAS COMMERFORD MARTIN.

A Business Where Honesty Prevails

To the Editor of the ELECTRICAL WORLD:

SIR: For generations it has been the wont of Americans to asperse their politicians. Charges against them of robbing the public which has honored them by election to office and which they have sworn to serve have been distressingly common. All too often these charges have been substantiated or at least have not been shown to be slanders, though one would think that no self-respecting representative of the people would remain quiet a moment under accusation of dishonesty, whether of the kind constituting a legal crime or of the subtler, safer and more prevalent variety where legal accountability is avoided though moral dereliction is perhaps quite as great. Politicians, however, like worms and barrel hoops, if trodden on too heavily, will turn; and now comes Senator Lenroot of Wisconsin with the following declaration:

"Disregard for law, contempt for legal obligation, seems to have struck the business world with blighting force. I have been engaged in politics for more than twenty years. I used to say that we should demand the same standards of honesty in politics that business men demand in business. I cannot say that any more. Indeed, I could today almost plead with business men to have the same standards of honesty in business that politicians have in politics."

If Senator Lenroot's indictment be true—and its substantial truth so far as some industries in some parts of the country are concerned is only too apparent—the electric light and power companies have good reason to felicitate themselves that they at least are not besmirched. Perhaps this recommendation sounds like emulation of the pharisee of old, but the temptation is strong.

Honestly captained and honestly capitalized, submitting willingly to the governmental regulation that their character as public utilities invites, they stand out as encouraging examples of a fact too often doubted—that great executive ability can be attracted and developed without the incentive of profits which are fabulously large.

The breakdown of the building trades under the weight of a rampant and greedy individualism, on the one hand, and the failure of the national government, on the other, to conduct successfully and free from thieves the business of transportation by land and by sea, throw into cheerful prominence the great electric light and power industry that has led all other public utilities along the middle path of sagacity and rightly founded progress. FRANK W. CHASE.

Brooklyn, N. Y.

Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Pulverized Coal Versus Stoker Firing

BURNING pulverized fuel was found to be more economical, under certain conditions, than stoker firing, in recent trials made in Milwaukee, Wis. These conditions are that the coal has not over 12,000 B.t.u. per pound (1,370 cal. per kg.), that the plant load factor is not over 70 per cent, that the coal costs not under $4 per ton and that the developed boiler-horsepower amounts to at least 3,000. Pulverized coal firing is of particular advantage in plants operating under a widely varying load, under loads of low factor and when the quality of the coal used varies widely.

STOKER AND PULVERIZED FUEL GROSS EFFICIENCY FOR EQUAL NET RESULTS

	Pulverized Plant	Stoker
Coal preparation	$0 30	$0 00
Firing, ash disposal and maintenance	0 12	0 25
Increased fixed charges	0 06	0 00
Total	$0 48	$0 25
Cost per ton fired, 12,000 B.t.u. coal	$6 48	$6.25
Gross boiler efficiency, per cent	80 67	78 00
Net boiler efficiency, per cent	74 85	74 85

The output of a pulverized-coal-fired boiler which has been idle twelve hours can be changed in ten minutes to 100 per cent output and can be dropped back to zero in a few minutes without blowing the safety valve.

The only no-load loss is radiation, which is negligible compared with the cost of banking stoker-fired boilers. The saving during the period of banking increases with the cost of coal.

The saving due to the use of powdered coal increases as the calorific value of the coal decreases, because the gross boiler efficiency with this kind of fuel is practically independent of the quality or heating value of the coal, while with stoker operation the boiler efficiency decreases with the heating value of the coal. This allows for the fact that the cost of preparation is greater with poorer grades of coal.

Recent improvements at the Oneida Street plant of the Milwaukee Electric Railway & Light Company indicate that the cost of coal preparation in a plant developing about 20,000 boiler-hp. at 70 per cent load factor and burning 700 tons (630 metric tons) per day would be 25 cents per ton for $4 coal, and 30 cents per ton with coal at $6 per ton. Using the figures for the 12,000 B.t.u. coal at $6 per ton, a comparison is made in the accompanying tabulation of stoker and pulverized coal firing. This shows that to equal the efficiency of pulverized coal a stoker would have to develop a gross efficiency of 78 per cent, which is rarely obtained in the best stoker operation with such coal. With coal cheaper than $4 per ton the advantage is with the stoker.

Present best practice in firing powdered coal allows between 12 per cent and 13 per cent CO_2. When this is exceeded the furnace temperature rises proportionately, destroying the furnace brickwork, and a hard-ash slag difficult to remove is formed on the bottom of the furnace. The combustible in the ash averages less than 7 per cent. Automatic firing can be carried on to a further extent with pulverized fuel than is possible with stoker firing. The furnace volume required with powdered coal is about 2.5 cu.ft. (0.071 cu.m.) per developed boiler-horsepower. The boiler and furnace maintenance cost at Milwaukee has been low. No trouble has been encountered from ash or slag adhering to the bottom tubes.

S. N. CLARK.

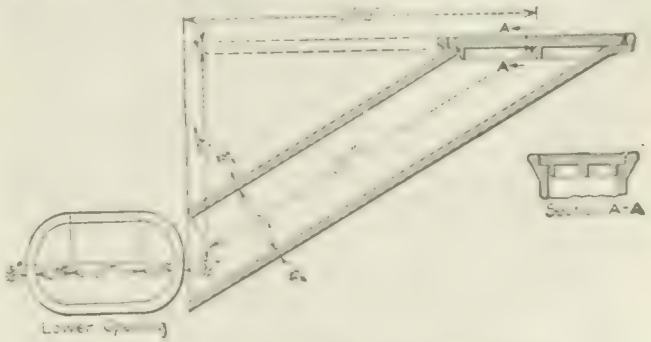
Chicago, Ill.

Melting Current of Aluminum and Copper Wires Compared

TO COMPARE the melting points of copper and aluminum wires of about the same resistance per foot a test was made recently in which No. 4 steel-reinforced aluminum wire was placed in series with No. 6 stranded copper wire and 1,000 amp. was allowed to flow through the circuit. The copper wire melted in four seconds. Using the same steel and aluminum wire, the burned copper wire was replaced by a new one. When the current was again turned on the aluminum wire failed in four and one-half seconds. This test was mentioned by M. E. Noyes, Aluminum Company of America, at a section meeting of the American Institute of Electrical Engineers.

Handhole Assists in Pulling Underground Cable

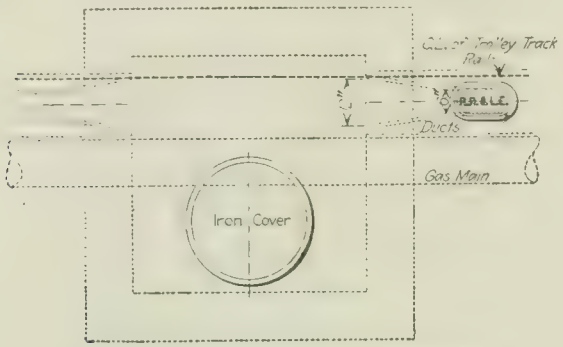
A SPECIAL handhole for the entrance of cable was fitted on manholes of the Rochester (N. Y.) Gas & Electric Company where it was impossible to place the manhole opening in line with the cable ducts. The duct runs almost directly below a street-car rail, while just outside the rail and parallel to it runs a gas main. As neither track nor main could be disturbed, the opening to the manhole had to be placed outside the pipe. With an opening so far out of line with the duct it is



SPECIAL HANDHOLE USED FOR PULLING CABLE

very difficult to install or remove cable. Therefore the special handhole was installed near the track directly over the duct.

This handhole is made up of a casting in the form of a funnel with the large end opening into the manhole wall over the duct line and the small end cut at an angle so as to be flush with the street surface and closed with a cast-iron cover. The inside shape and



HANDHOLE PLACED IN LINE WITH DUCT TO FACILITATE PULLING CABLE

size are such that a cable can easily be fed in either direction. A number of these handholes have been made and have proved a great help to the underground department.

HENRY A. DAVIS.
Rochester Gas & Electric Company,
Rochester, N. Y.

Rules for Installation of Meters and Motor Equipment

DIRECTIONS to be followed by contractors who install meters, motors and their wiring have been drawn up by the Iowa Railway & Light Company, Cedar Rapids. These rules cover meter loop wiring and the location and protection of meters and motors. The rules are as follows:

Location of Meters.—All meters hereafter installed on customers' premises shall be located either in the cellar or on first floor and as near as possible to the service, in a clean, dry, safe place and on a support free from vibration. Where it is necessary to install meters out of doors, they shall be protected from the weather.

In no case shall meters be installed in coal or wood bins or on partitions forming such bins, nor on any unstable partitions or supports. Meters should not be placed in attics, sitting rooms, bathrooms, bedrooms, restaurant kitchens, over doors, over windows, or in any location where the visit of the meter reader or tester will cause annoyance to the customer.

In the case of office buildings, or buildings of a similar nature, it is recommended that meters for each floor be grouped and located on each floor respectively.

Height and Spacing of Meters.—All light meters shall have a space provided for each meter 12 in. high and 8 in. wide, and a minimum depth of 8 in., not higher than 8 ft. from floor or platform nor lower than 4 ft.

All power meters shall have a space provided 18 in. square, and a minimum depth of 8 in., not higher than 6 ft. nor lower than 4 ft.

Wiring of Meter Loops.—All meter loops for polyphase service shall be polyphase loops consisting of line wire, load wire and shunt wire for each phase. The shunt wire shall not be larger than No. 12 B. & S. gage.

Meter loops for three-wire service shall be three-wire meter loops consisting of two line wires and two load wires.

In meter loops for installation where service is three-wire but distribution to different consumers is two-wire and loops are installed for each consumer, all shunt wires must be taken from neutral wire, except in cases where regular meter panelboards are installed. All other meter loops must have two lines and two loads. Meter loops for light must have each wire at least 12 in. long.

Meter loops for power must have each wire at least 18 in. long.

When meters are to be installed on brick, stone or concrete walls, a suitable board must be provided and installed by contractor doing wiring to hang meters on. In case meters are to be installed in metal boxes, studs must be provided to support meter.

Inside wiremen are not to take down or move meters, nor are they to leave loops closed.

Protection.—When installing additions to old work, the new work shall be put upon the old service, and an entrance large enough to take care of the entire load shall be installed along with a suitable meter loop. The new load shall not be combined with the old load on the old meter without the consent of the meter department. All meter loops for connection to service wires must be run out of the building at a point nearest our secondary distribution and if there is any doubt as to this, the question must be referred to the distribution department.

All meters shall be protected by a fused entrance and with a fused branch block on all loads coming from the meter; this applies to two and three-phase installations as well as single-phase power and light. Except in cases where motors are started without fuses, meter must be protected on the running side.

Motor Installation.—Starting compensators together with overload relays and no-voltage releases are required on all induction motors up to 25 hp. and beginning at 7½ hp. Motors below 7½ hp. do not require special starting equipment with polyphase. Motors 25 hp. and above, polyphase, are to be of the slip-ring type. They are also to be provided with an oil-switch equipment with overload and no-voltage releases. Single-phase motors, 1½ hp. and above, require starting equipment, overload releases and no-voltage releases. The maximum horsepower for single-phase shall be 15 hp.

All wiring jobs requiring motors or new meters must have loops installed according to above rules to insure connections being made.

Tree Used as Temporary Pole for 11-Kv. Line



A SNOWSLIDE having put a considerable part of an 11,000-volt line on the system of the Utah Power & Light Company out of commission, the patrolman made repairs by attaching cross-arms to trees, as shown in the photograph. It may be said in passing that sections of this line operate for months every winter buried completely under snow.

Industrial Applications

The Economical Utilization of Electrical Energy
in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

Maximum Speeds for Motors Recommended by Electric Power Club

MAXIMUM motor speeds for different sizes of belted and geared motors are recommended by the Electric Power Club in a report dated November, 1920, and are extracted in the accompanying table. These recommendations are in line with the other efforts of the club on standardization. Briefly the purposes of the organization are: (a) To describe, classify and define commercial types of electrical machinery, their operating characteristics and the terminology of structural details; (b) to establish commercial rating standards, such as standard voltages, load ratings, time ratings, speeds, etc.; (c) within the general engineering limitations of the Standardization Rules of the A. I. E. E., to establish the kind of rating to be used and the actual performance guarantees under which different types of electrical machinery are manufactured and sold; (d) as far as practicable to establish standards in manufacturing practice and in the structural details of electrical machinery.

MAXIMUM SPEEDS FOR BELTED AND GEARED MOTORS

Speed, R.p.m.	Largest Motor Which Should Run at This Speed, Size, Hp	
	Belted to High-Speed Drives*	Geared, with Steel Pinions
1800-1700	40	5
1500	50	10
1200-1150	75	25
900-850	125	50
750-720	....	75†

* The above limitations are based on the use of pulleys as standardized by the Electric Power Club. The limitations are higher when motors are belted to slow-speed drives, such as countershafts.

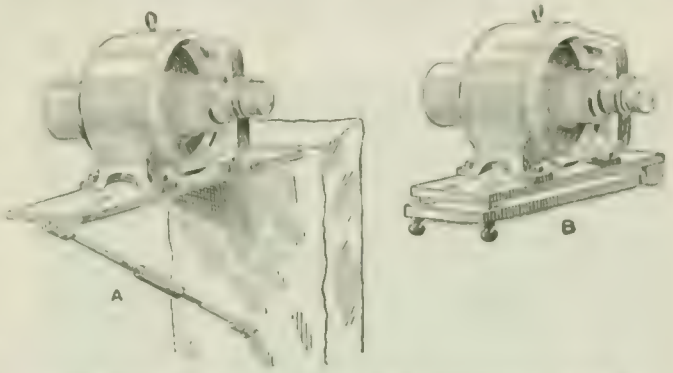
† The use of outboard bearing should be specified for general-purpose motors with geared drive in frame sizes of 75 hp., 850 to 900 r.p.m., and larger.

Tightening Short Belts on Individual Motor Drives

TWO methods of tightening short belts of motors mounted for individual drive directly on the driven machines are employed by the writer. One scheme is to mount the motor on a plate slightly larger than the base of the motor. One end of this plate is hinged and the other is supported on a bar of steel containing a toggle joint with right-hand and left-hand threads (*A* in the drawing). There is a tendency to tip the motor up on one side as the belt is tightened, but the plan has worked very well, and the motor need not tip to any appreciable extent if the belt is kept at about the right length.

In case there is no room for the use of a toggle joint the motor is mounted on a cast plate and the belt is tightened by the aid of two setscrews in a stationary plate below the one upon which the motor is mounted (see *B*). The upper plate is hinged at the side farthest from the setscrews.

By using such devices full benefit of individual drives can be realized. If a motor is so placed that it takes up valuable manufacturing floor space, part of the advantage of individual drive is lost, and, on account of the overhead belting required, the same is true if the motor is placed near the ceiling. These objections can be overcome in many instances by mounting the motor on the machine. This means comparatively short centers between driving and driven pulleys, which requires an idler pulley or some other effective yet simple means of tightening the belt such as those described.



TWO BELT TIGHTENERS USED WITH INDIVIDUAL MOTORS MOUNTED ON MACHINES

ALEX. H. MAY,
Works Engineer.
Canadian Products,
Walkerville, Ont.

Energy Requirements in Butt-Welding Steel and Iron Pipe

ELECTRIC butt welding of steel and wrought-iron pipe has been successfully utilized at the factory of the Whitlock Coil Pipe Company, Hartford, Conn., for about two years. The time required with different currents and voltages and the amount of energy consumed in making welds on various sizes of pipe are shown in the accompanying table.

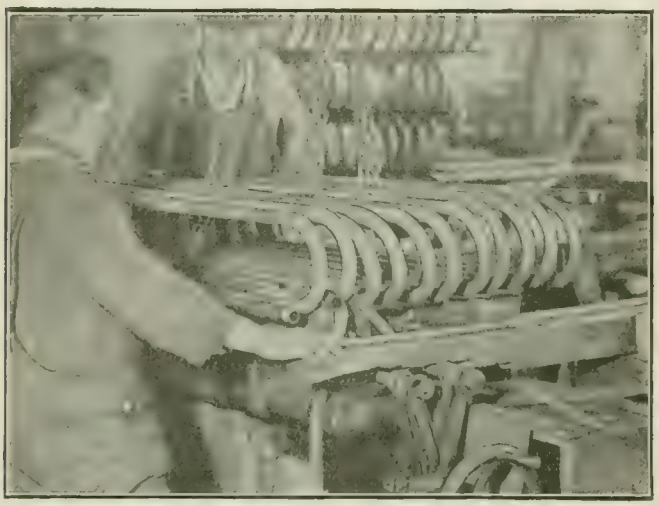
CURRENT, TIME, ETC., OF BUTT-WELDING IRON PIPE

Welder	Size Pipe, In., Extra Heavy	Volts	Amp.	Kw.	Kva.	Duration, Seconds
B	1½	340	95	25	32.5	50
D	1½	270	180	42	48.5	38
F	1½	270	160	42	51.5	34
A	1¼	345	160	45	-	47
C	1¼	345	170	47	58.5	24
B	2	345	208	24	37.5	120
C	2	330	225	5	74.5	45
D	2	275	140	38	52.5	120
F	2	260	200	39	55.5	200
C	2	320	235	55	75	75
A	3	325	175	54	55	240

It is seen from these figures that the all-important factor, time, is practically dependent on the current

alone, higher currents taking less time. It has also been demonstrated in other lines of welding that high currents give the strongest welds. The cost of a typical 1¼-in. extra-heavy butt weld was 15 cents, including labor, material and energy. By the hand methods formerly used such a job required about three-quarters of an hour against an average of thirty-eight seconds when butt-welding with 180 amp. Another advantage of this method over arc or oxyacetylene welding is that the original material is used for making the joint. In a number of tensile tests made in these shops on butt welds locally made the pipe has torn in each case before the weld was damaged in any way.

The butt weld is made by cutting a female scarf in each pipe end. The ends are then pressed together under an oil pressure of five tons while the current is passed through the joint. As the current heats the



PIPE COILS ARE FORMED QUICKLY BY ELECTRIC BUTT-WELDING IN THIS PLANT

ends to be welded, the scarfed portions are thrust outward and the area of the weld is increased over the annular area of the pipe. The inside is not constricted or reduced, but is left smooth and clean. The only objection is that the pipe is increased in outside diameter at the weld, which makes it impossible to use the weld on spiral and other coils made on a former shaped to fit the ordinary outside diameter of the pipe. Where it is essential to secure a weld without reduction of bore or enlargement of outside diameter, lap welding with a mandrel is employed.

G. T. Jacocks.
Whitlock Coil Pipe Company,
Hartford, Conn.

Care and Operation of Commutators on New Machines

COMMUTATORS on new machines require special attention to insure the best operation and to lessen future troubles. During the first few months that a machine is run under load the commutator is "seasoning." That is, the mica is settling into permanent position and the binding material (usually shellac) is working out from points which are under pressure. During this period the commutator bolts should be tried every two or three weeks while the machine is warm, and if found slack they should be set up tight. In setting up the bolts a little slack should be taken on each one all the way around, then a little more, and so on until all are tight. Where the flange is in short pieces the middle bolt in each piece should be set up first, then the end bolts and then any others in between, giving uniform pressure on the whole flange section. It is possible to set the bolts too tight; hence an extra large wrench should not be used. After the seasoning period the commutator may be out of "true," and if so it should be turned or ground.

A good commutator has a dark-brown color and high polish. When first put in service the copper is raw and pink, but it can be burnished with a hard piece of canvas fastened on a wood block and moistened with a little engine oil. Some grades of brush, particularly soft graphite or "doped" or paraffined brushes, smut the commutator with black dirt and prevent the formation of a good polish; in such a case the smut should be washed off with a rag dampened with gasoline while the machine is shut down. Do not use too much gasoline as it is liable to dissolve grease and dirt and carry them into the mica, where carbonization may take place, causing short circuits in collars or between bars. Kerosene should never be used for cleaning commutators, because it lodges in the mica, never getting dry, and thus causes short circuits to start.

To take down high mica or remove small flat spots or ridges a sandstone, a carborundum block or a piece of an ordinary grindstone can be used. The stone should be anchored so that the man doing the work can give his attention to putting on pressure with no danger of the stone being pulled out of his hands. Often a strap-iron stirrup can be bolted on the brush arm to guide the stone. To avoid glazing the stone, all dirt should first be removed by a damp gasoline rag and vigorous sandpapering until the copper shows pink. Then the stone will be able to cut steadily. After stoning polish with fine sandpaper moistened with a little oil and burnish with a hard, oily rag backed up with a block of wood. During stoning all the brushes should be removed or raised. Careless handling of a commutator stone on a rapidly running machine is dangerous both to the machine and the workman, and care must be used to avoid damage.

Never use waste for wiping off a commutator. The lint will stick to the copper and be carried under the brushes and cause sparking or glowing. Cheesecloth, a piece of clean cement bag or a scrap of overall cloth is much better.

When sufficient lubrication is not given automatically by the brushes it is sometimes advisable to put on a little good engine oil to stop brushes from squealing. The oil should be put on a canvas pad, which is passed over the surface of the commutator. Immediately afterward a clean rag should be used to wipe off the excess oil. Under ordinary conditions no lubrication is necessary. Regular wiping with a dry rag will be enough to keep the surface good.

Most commutator breakdowns are caused by oil getting into the mica and carbonizing. Oil may accumulate from bearings either in fluid form by throwing or creepage along the shaft or by deposit of atomized oil from warm bearings. There are other sources of oil such as overhead cranes that must be watched for. The oil soaks in the mica and collects dirt. After a while the warmth and drying carbonize the oil and the insulating qualities of the mica disappear, allowing breakdown from bar to bar or between bars and ground.

Reliance Engineering Company, James Dixon.
Cleveland, Ohio.

Motor Arranged for Either 440 Volts or 220 Volts

A MOTOR which will operate on 220 volts or on 440 volts, according to the position of a special switch, was recently connected by the writer for a building contractor whose work changed from one place to another. This contractor had three 10-hp., three-phase squirrel-cage motors. In moving around he encountered first 220-volt service and then 440-volt service. He wished to avoid repeatedly reconnecting his motors or buying duplicates for each voltage. Accordingly, after some study the motor was reconnected as in Fig. 1 and nine leads were brought out so that a series-star or two-parallel-star connection could be made, which allows operation on 440 volts or 220 volts respectively. Six more holes were drilled in the motor frame and a new terminal block was put on for the nine leads. The small diagram *M* in Fig. 1 shows schematically the series connection. The pole-phase groups are connected in series in pairs; for instance, in the *A* phase group 1 and group 4 are in series. The leads are brought out from the beginning and the end of this series, as A_1 and A_2. Likewise the other two groups of the *A* phase, 7 and 10, are in series, and a lead A_3 is brought out, while the other end is connected to like ends of the *B* and *C* phases, making a permanent star point. The *B* and *C* phases are connected similarly. The only difference between this connection and a straight series-star connection is that instead of putting a jumper between the groups 4 and 7 the jumper is cut in half and the ends are brought out to the terminal board.

For 220 volts a two-parallel connection (*N* in Fig. 1) is made by connecting leads A_1 and A_2 to line *A*, B_1 and B_2 to line *B*, and C_1 and C_2 to line *C*. A_3-B_3-C_3 are all three connected together to form the second star connection, which is separate from the star in the motor. The fact of the two star connections being separate does not affect the motor operation.

To simplify the change from one voltage to another a special switch was designed. This was a five-pole, double-throw, 30-amp. knife switch connected as shown in *P* (Fig. 1). The nine leads from the motor were connected to points on the switch marked to correspond. Terminals were fastened to lugs A_1-B_1-C_1 as the line leads were always connected to these lugs, and connections were made at the back of switch as shown. When the switch is thrown up for 220 volts A_1 and A_2 are connected to the line and lugs 1-2-3-4 short-circuit A_2-B_2-C_2, thus forming a double star. With the switch down, for 440 volts, A_1 is connected to the line, and A_2-A_3 are tied together. The cover was made so that the switch could be locked open or locked closed on 220 volts or 440 volts. The top of the box was marked 220 on one side and 440 on the other. The switch handle projecting through acted as an indicator. The cover was hinged to prevent reversing the marks.

Fig. 2 shows the method of connection for a 220/440-volt series and two-parallel delta circuits.

Bronx, N. Y. C. A. JOHNSON.

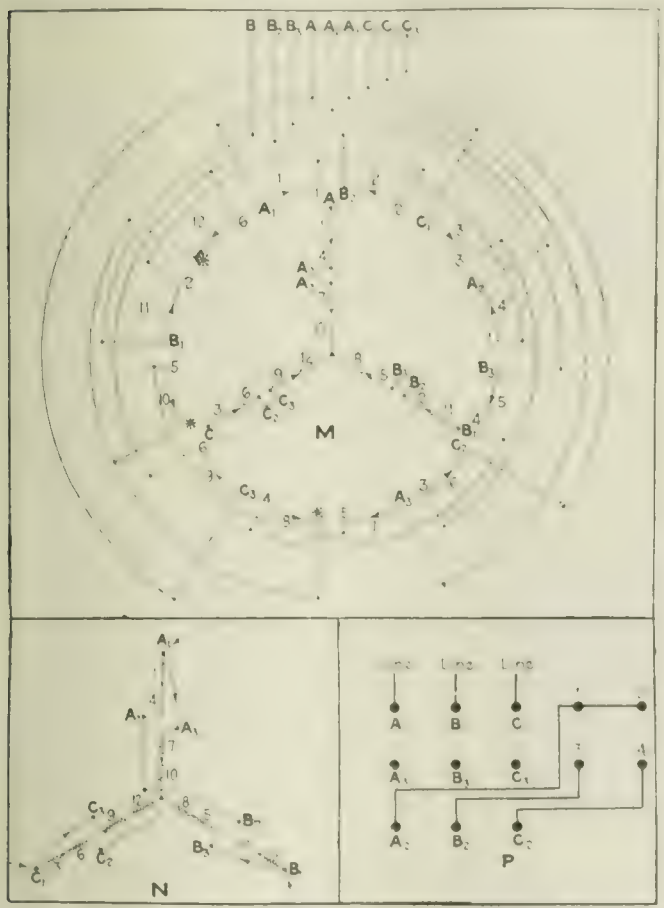


FIG. 1—MOTOR RUN ON 220 VOLTS OR 440 VOLTS BY CHANGING SWITCH

M—Series-star connection for 440 volts obtained by throwing switch *P* down. *N*—Two parallel star for 220 volts obtained by throwing switch *P* up.

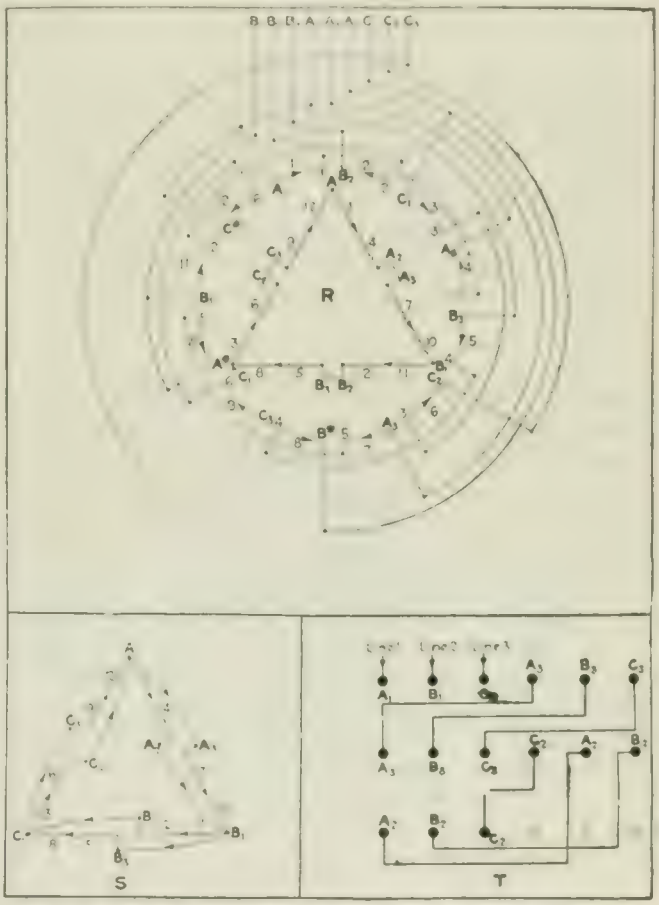


FIG. 2—DELTA-CONNECTED MOTOR FOR EITHER 220 VOLTS OR 440 VOLTS

R—Series-delta connection for 440 volts, switch *T* thrown down. *S*—Two-parallel delta connection for 220 volts, switch *T* must be thrown up

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

Education of User Insures Electric Truck Success

By Secor Cunningham, Jr., and L. T. Carpenter
Commonwealth Edison Company, Chicago

CO-OPERATION between the central station, the manufacturer and the user is the solution of the problem of insuring satisfaction in the use of electric road trucks. The biggest factor is the elimination of trouble due to ignorance on the part of operators or owners. This is being accomplished through such organizations as the Electric Vehicle Bureau of the New York Edison Company, whose trained men are always available to investigate troubles, assist in remedying them and guard against their recurrence. The Commercial Electric Garage of the Commonwealth Edison Company has proved a great stimulus to the use of electric vehicles in Chicago. Education of the firms using a small number of trucks, rather than to provide a permanent home for large "fleets," has been the object, and the plan has worked out very successfully.

Carefully kept operating cost records form an important part of any trucking business, and this garage has devoted a great deal of attention to the proper form of record. Above is shown the form upon which the monthly record of every truck is kept. From this record and the garage bills for energy and maintenance the costs of operation, aside from those for general overhauling at approximately eighteen-month intervals, can be readily ascertained. From the records the operating costs and other data on three types of trucks are taken. The trucks were selected as representative of the various service conditions. They are as in accompanying table.

The figures for the 1-ton bus do not include garage charges, since the vehicle was kept in the owner's garage. The figures therefore give the current costs only. The 5-ton truck figures for the winter months is some agency to investigate, indicate the remedy and instruct the operator in proper maintenance methods, dissatisfaction results. The idea that any one with two arms can operate an electric truck has been responsible for much of the difficulty. These trucks are machines requiring the same intelligent care that all mechanical and electrical devices require to insure efficient operation.

Form C 11 2M 8-30-17

NAME The Parmelee Transfer Co. ADDRESS 731 W. Adams St. DATE June, 1920

CAR 141 TYPE Bus RATED CAPACITY 2000# TIRES Solid

BATTERY K.W. CELLS 42 PLATES 15 Plate TYPE --

DATE	MILEAGE TOTAL	MILEAGE TRIP	SPECIFIC GRAVITY IN	SPECIFIC GRAVITY OUT	CHARGING TIME AT START	CHARGING AMP. AT START	CHARGING TIME AT FINISH	CHARGING AMP. AT FINISH	CHARGING IN K.W.H	AMP. HR. METER DISCHARGE	AMP. HR. METER CHARGE	REMARKS For additional remarks use other side
1	304		1160	1270	10	40	5:00	12	22	150	0	Car Washed
2	330	26	1160	1270	9:30	40	3:30	12	22	150	0	
3	359	29	1160	1270	8:30	40	4:30	12	27	180	0	
4	386	27	1160	1270	9:00	40	4:00	12	19	160	0	Battery Flushed
5	406	20	1140	1261	7:30	50	12:30	18	19	180	0	
28	1025	27	1145	1265	9:30	40	5:30	13	25	183	0	
29	1052	27	1165	1270	9:00	40	2:00	14	24	168	0	
30	1080	28	1150	1280	11:30	44	4:30	16	26	174	0	
31	Total	776							717			

ONCE A MONTH GRAVITY READING OF ALL CELLS

CELL	GRAVITY
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
38	
39	
40	
41	
42	

Blank sheets like this will be mailed upon request, Commonwealth Edison Company, 72 West Adams Street

MONTHLY RECORD OF 2,000-LB. ELECTRIC TRUCK

The record showed that the truck was operated 776 miles in twenty-nine days, an average of nearly 27 miles per day. Specific gravity of battery on coming in for charge varied from 1.140 to 1.185. After charge battery showed a specific gravity of 1.270, varying slightly from 1.265 to 1.280. Charging rate was started usually at 40 amp., but this varied from 30 amp. minimum to 60 amp. maximum. At end of charge rate was from 12 amp. to 36 amp. A total of 717 kw.-hr. was used during the month, an average of 24.7 kw.-hr. per charge. The ampere-hour meter showed a daily discharge of from 60 minimum to 204 maximum, with an average of 160. During the period the battery was flushed every seven days.

OPERATING COSTS OF ELECTRIC TRUCKS IN CHICAGO

	Five-Ton Truck		Two-Ton Truck		One-Ton Bus	
	Miles	Kw.-Hr.	Miles	Kw.-Hr.	Miles	Kw.-Hr.
May, 1919	537	942	811	611	633	552
June	576	901	757	417	753	700
July	630	955	823	460	886	710
August	471	852	742	550	812	643
September	570	1,010	774	541	755	616
October	416	884	761	548	654	490
November	412	829	637	526	642	528
December	435	1,110	613	589		
January, 1920	419	1,376	602	665		
February	490	1,313	545	529		
March	570	1,356	448	578		
April	750	1,528	550	562		
May						
June	...	...	...	...	885	649
Total	6,276	12,986	8,063	6,576	6,020	5,044
Energy per kw.-hr.		$0.05		$0.05		$0.05
Cost of energy		649.00		329.00		252.00
Garage expense		444.00		264.00		5.00
Total cost		$1,093.00		$593.00		$257.00
Cost per mile		0.174		0.074		0.042
Kw.-hr. per mile	....	2.06	....	0.82	....	0.84

Five-Ton Truck.—General heavy trucking. Operated by transfer company in Chicago. Equipped with A-12 Edison battery.
Two-Ton Truck.—Merchant Steel Company. Delivery trucking on Chicago streets. Edison A-8 battery.
One-Ton Bus.—Employed in depot-to-depot passenger hauling in Chicago. Kw-42-15 battery.

indicate by increased energy consumption the bad condition of the roads. This truck has been operated by the transfer company through whatever city territory was necessary, regardless of the condition of the streets.

Wrong Impression Conveyed Regarding Cost of Rural Service

THE letter printed below—a copy of one sent to the *Country Gentleman* of Philadelphia—has been received from the chairman of the committee of the Wisconsin Electrical Association which formulated the Wisconsin rural-service rules. The letter is therefore written not only from the standpoint of a utility operator but also from knowledge gained in an exhaustive investigation in Wisconsin. The rules resulting from the investigation have been approved by the Railroad Commission of Wisconsin for use by a number of companies in that state. The *Country Gentleman* article mentioned (published in the Nov. 20 issue of that periodical) contains the following statement referring to rural service furnished by the Greenville (Ohio) Electric Light & Power Company:

"Until 1919 we had but fifty miles of strictly farm lines. During last year, however, fifty more were built by the farmers themselves. These lines, using 25-ft. poles, are costing from $500 to $650 a mile to build. The average cost for each farmer for building the transmission line is from $200 to $300. We had one line with sixty customers built last summer where the average cost was only $65 each. It cost about $35 from the transformer to the house. The balance is just whatever a farmer wants to spend on equipment and wiring. We have an average of about twenty customers to a line. . . .

"After the line is built the farmers' company makes out a bill of sale for the entire line, excepting transformers and service lines, and turns it over to the power company, which is to maintain and assume full ownership and to be responsible for it in every way, the same as if it had originally constructed it. The company installs and owns the meters."

This gives a wrong impression as to the cost of the equipment necessary to give service and also on the question of the desirability of rural utility companies constructing lines to be operated later by utilities; therefore the protest in Mr. Neff's letter is of urgent interest to utility men. This letter was inspired by the fact that reference was made in the *Country Gentleman* article to the work of Mr. Neff as chairman of the committee dealing with rural electric service in Wisconsin. His communication follows:

The *Country Gentleman*, Philadelphia:

GENTLEMEN: I believe that the article as written if published in the *Country Gentleman* will retard the proper development of the rural electric business.

I firmly believe that the rural lines must be owned by the electric utilities if the best results are to be obtained, and a repetition of the present farmer telephone situation is to be avoided. I will admit that the easiest and safest thing for the utilities to do at the present time is to let the farmers organize companies and operate them. This, however is a very selfish and weak position for the utilities to take. Why should farmers go into the electric business, about which they know little, when there is an organized electric company near them with all the equipment, training and knowledge necessary to give proper service?

To serve a group of farms costs a definite amount of money, and proper service costs a definite sum regardless of whether the farmers organize a company and operate their own lines or whether the utilities operate the lines. What, therefore, is to be gained by the organization of the farmer company? Let the utilities face the proposition squarely and assume their obligation and not force a lot of problems which they are afraid to tackle onto an unsuspecting, uninformed farmer organization.

During these times of difficult financing, when farmers have plenty of money, I believe that the farmers should pay to the utility the cost of the rural extension, including transformers. Proper consideration must, however, be given this payment, arriving at a proper rate.

I believe that the article as written indirectly recommends the organization of farmer companies. Owing to the large circulation of the *Country Gentleman* among progressive farmers this paper has a tremendous influence, and for this reason I feel that a public sentiment will be created by this article which will not be to the best interest of either the farmer or the utility.

I also feel that the cost per mile of farm lines is entirely too low and will have a bad effect. It costs our companies about $1,200 per mile to build these lines, including engineering, overhead, etc. With a copy of your paper in his hand we will have hard work convincing a farmer that this is true. Unless the article is modified as indicated above, I would prefer not to have the farmers of southern Wisconsin see it. The rest of the article is in my mind very well written and contains information that should be given to every farmer.

I am inclosing copy of report which contains the rules governing the taking on of rural customers of some of the largest companies in Wisconsin. Very truly yours,

G. C. NEFF,
General Superintendent.
Wisconsin Power, Light & Heat Company, Madison, Wis.

Indianapolis Utility Steps Out of Its Field to Serve Public

AS A MATTER of service looking toward the good will of the public the Merchants' Heat & Light Company of Indianapolis, Ind., on election night received the Associated Press election returns in its building and in conjunction with the local newspapers threw the returns on a screen. The company's office is located at an important point in the center of the city. Traffic officials had blocked off the street, and it was estimated that about eight thousand people watched the returns. This was an unusual service for the utility to render the public and it received much favorable comment.

Digest of Electrical Literature

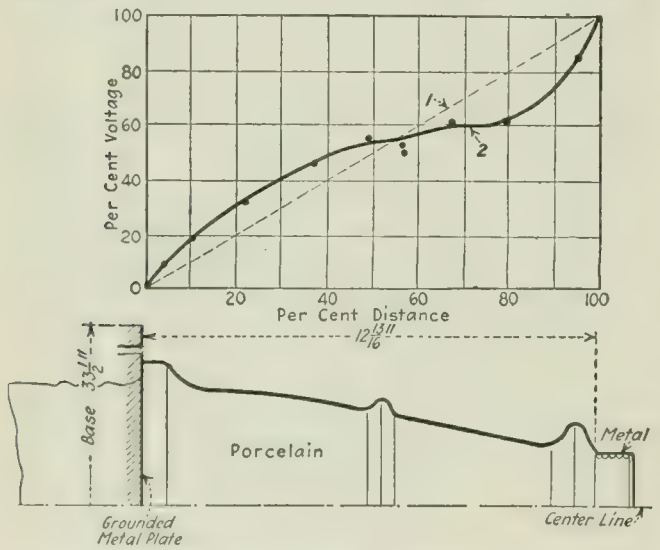
Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Air-Gap Reluctance of Slotted Armatures.—GANS.—The problem is treated in a rather thorough-going mathematical way for the case of an armature with infinite radius and parallel teeth. Expressions for the reluctance per tooth are obtained by complex transformations leading to solutions in the form of elliptic functions and theta functions. In certain practically important cases these solutions are reduced to fairly simple formulas.—*Archiv für Elektrotechnik*, Sept. 20, 1920.

Generation, Transmission and Distribution

Voltage Distribution on High-Tension Insulators.—A. SCHWAIGER.—This author has recently published, as "Mitteilung No. 8 aus dem Hochspannungs, lab. Karlsruhe," the results of an extensive series of measurements of voltage gradients along the spark-over path of insulating apparatus, such as pin insulators, bushings and busbar supports. The Peek definition of the "chain efficiency" of a suspension insulator is used in a generalized sense, the ratio of average to maximum voltage gradient being looked upon as the efficiency of any type of insulator. An ordinary pin insulator has a 45 per cent efficiency, a porcelain bushing about the same, while a condenser-bushing has a gradient ratio of 80 to 90 per cent. A plain, slightly tapered busbar support of porcelain showed about 30 per cent efficiency, while a value of about 75 per cent was obtained with the same support turned upside down so that its widest part was put in contact with the high-tension bus and the narrow end was grounded. The flash-over voltage was 20 to 30 per cent higher in the latter case. The illustration gives representative curve showing the voltage distribution on a Kuhlmann high-tension bushing. The curve shows that by giving the porcelain body a proper form the designer has succeeded in making the gradient at the high-tension end almost exactly equal to the gradient at the grounded end, which clearly means an excellent utilization of the material.—*Elektrotechnische Zeitschrift*, Oct. 28, 1920.



VOLTAGE DISTRIBUTION ALONG A PORCELAIN BUSHING

Electric Power from Tidewater Motions.—Admiral AMET.—A comprehensive memoir dealing with the general problem of a hydro-electric utilization of energy from the tidal motions of the seas. The problem is considered from an economical standpoint, and the inherent technical difficulties are discussed. The author deals with a number of different schemes for obtaining an even power supply during the tidal period and to counteract the lunar variations in the amplitude of the tidewater motions. The isolated tidal plant is said to be uneconomical, a better utilization being obtainable when one or many tidal stations are connected to some distribution system which also has other sources of supply.—*Revue Générale de l'Electricité*, Oct. 2, 9, 16 and 23, 1920.

Traction

Spokane's Traction Problems Are Being Solved.—A description of the interurban system of the Inland Empire, including the supply of energy which is derived principally from a hydro-electric plant on the Spokane River.—*Electric Railway Journal*, Nov. 27, 1920.

Installations, Systems and Appliances

Life and Permanence Tests of Oxide-Film Lightning Arresters.—N. A. LOUGEE.—Operating data obtained during the last five years show, the author says, that little deterioration in the oxide-film cells has occurred. Cells returned from typical installations and tested bear out this statement. In order to obtain information on the life of these arresters several years ahead of reports of those installed, however, an intensive test has been employed during the past few years, and the test methods are described in the paper. The efficiency of the arrester is then discussed from the points of view of sensitiveness, current discharge capacity, reseal and life.—*Journal A. I. E. E.*, November, 1920.

Notes on Rolling-Mill Drives.—L. ROTHERA.—The author states that electricity can be considered almost the accepted form of motive power for rolling-mill drives and that in Great Britain alone more than 500,000 hp. is installed. He points out the lines along which developments in the last few years have occurred and gives data on typical installations for purposes of illustration.—London *Electrician*, Nov. 5, 1920.

The Airplane in Modern Hydro-Electric Practice.—R. C. STARR.—The author states that the application of the airplane in modern hydro-electric practice is receiving its first real test in America in connection with the aërial surveys being made by the San Joaquin Light & Power Corporation in connection with the King's River

hydro-electric project, consisting of eleven plants with a total capacity of 500,000 hp. The most important factors in the design of a hydro-electric project are drainage area, precipitation and run-off. It is held that these may be most accurately determined by means of aërial surveys. Other information, such as the character of timber growth, character of soil and percentage of area exposed to the sun's rays, may also be determined by this means.—*Journal of Electricity*, Oct. 15, 1920.

Electrophysics and Magnetism

Surface Creepage and High-Voltage Insulation.—T. NISHI.—The writer discusses the effect of surface creepage on the potential gradient of insulators and the effect of such voltages on the rational design of high-voltage insulators.—*Journal A. I. E. E.*, November, 1920.

On the Variation of Thermal Conductivity During the Fusion of Metals.—SEIBEL KONNO.—Results of the investigation are summarized as follows: (1) The thermal conductivity of tin, lead, zinc and aluminum decrease with the rise of temperature up to their melting point. (2) For these metals thermal conductivity decreases abruptly during melting. (3) The thermal conductivity of bismuth and antimony slightly decreases at first and then increases a little. (4) During melting the conductivity of bismuth considerably increases, and that of antimony seems to increase only slightly. (5) The thermal conductivity of all liquid metals here investigated decreases but slightly with the rise of temperature. (6) The above changes of thermal conductivity are similar to those of electric conductivity for the same metals.—*Philosophical Magazine*, November, 1920.

Units, Measurements and Instruments

The Magnetic Field Close to an Iron Surface.—LEHRS.—Owing to the high permeability of iron magnetic lines of force tend to leave an iron surface at nearly right angles. As shown by Rogowski, however (see *Archiv für Elektrotechnik*, Oct. 10, 1920), the lines of force sometimes may form a rather acute angle with the iron surface; for instance, if the normal component of field is small, or, in other words, if the magnetic leakage is small. Lehrs has carried this thought further and for certain practical cases has determined the angles of departure of the magnetic-field lines. In certain methods for measuring permeability (Epstein) the exciting field strength is determined by measuring the tangential component of flux in the air just outside the test specimen. It then becomes important to keep track of the magnetic refraction phenomena at the iron surface.—*Archiv für Elektrotechnik*, Oct. 10, 1920.

Emissivity of Heat From Various Surfaces.—V. S. DAY.—The following significant results summarize the investigation reported: (1) The use of thin sheets of asbestos paper on bright tin heat pipes results in a waste of heat. The use should be abandoned. (2) Uncovered bright tin pipes are more efficient carriers of heated air than asbestos paper-covered bright tin pipes. (3) This fact is true regardless of the degree of brightness of the tin surface. (4) No small number of applications of asbestos paper will suffice as an insulator. Several thicknesses are necessary to make a covering equal in this respect to the bare tin. (5) The accumulation of dust and dirt on the pipes does not greatly alter the amount of the loss of the pipes. (6) The heat loss from warm-air furnace pipes covered with one layer of asbestos paper is a serious item in the cost of heating, amounting to more than 5 per cent of the coal consumption, depending upon the number and size of the pipes used. (7) The fact that pipes are partly protected from convection currents of air by joists and studding does not greatly affect the loss. (8) Unless the insulation excels the uncovered bright tin in heat insulation properties it should not be used. (9) Such materials are available and the tests have shown their merit.—*Bulletin No. 117, Engineering Experiment Station, University of Illinois*, November, 1920.

Telegraphy, Telephony and Signals

A New German Submarine Telephone Cable.—What is held to be the largest submarine telephone cable in the world was recently opened for traffic when direct telephone connection was established between East Prussia and Germany over a 160-km. (100-mile) cable in the Baltic. This telephone connection must go over a roundabout route in order to comply with certain regulations in the Versailles peace treaty concerning the "open road" from Poland to the Baltic. The cable contains six pairs of "krarupized" telephone conductors and three single conductors for telegraphic use. The cable has a paper-strip insulation close to the wires and then a lead cover reinforced by a double helix of steel wire with a ¾-in. (19-mm.) pitch. The outside covering is made of jute and compound and is protected by a 5-mm. (0.2-in.) armor made up of twenty-nine galvanized wires of steel with S-section. The outside diameter of the cable is 2 in. (5.08 cm.) and the weight about 11 tons per kilometer (18 tons per mile). The cable was made in three parts, respectively of 21, 77 and 77 km., by the Felten & Guilleaume Carlswerk in Cologne. The attenuation constant of the telephone pairs was found to be 0.015 per kilometer (0.024 per mile), which corresponds to a total attenuation of 2.6. Amplifier stations are installed at both ends, so that the cable can be used in connection with the trunk lines on either side.—*Zeitschrift des Vereines deutscher Ingenieure*, Sept. 25, 1920.

Theory of Antenna Radiation.—A. PRESS.—After considering the previous investigations of antenna radition the author attacks this problem, taking into account the sinusoidal distribution of current and voltage along the antenna. The vertical grounded antenna only is considered. A detailed mathematical investigation of radiation and field strengths at remote points follows. Formulas resembling the Eccles radiation formula and the Cohen dispersion and diffraction factor formula are obtained and interpreted.—*Proceedings Institute of Radio Engineers*, December, 1920.

Multiplex Radio Telegraphy and Telephony.—FRANCIS M. RYAN, J. R. TOLMIE and ROY O. BACH.—The authors classify the chief methods of multiplex radio communication. Duplex and quintuplex radio-telephony and radio-telegraphy over 5 miles (8 km.) at wave lengths around 2,000 m. were experimentally accomplished and are described.—*Proceedings Institute of Radio Engineers*, December, 1920.

Miscellaneous

A New Electric Plow.—DELAMARRE.—A new type of electric farm-labor device, designed by J. Estrade, is described in a well-illustrated article. It is shown that an electric plow of ordinary type weighs three and a half to four times as much as an Estrade plow of the same working capacity.—*Revue Générale de l'Electricité*, Oct. 30, 1920.

THE INCOMING Legislature of New York State is expected to repass the Ferris amendment to the state constitution providing for the development by the state and by corporations of the water powers of the commonwealth. If the amendment is repassed, it will be submitted to popular vote at the next general election.

CONTRACT has been awarded by the State of San Luis Potosi, Mexico, to E. E. Thomas of Tampico for a 100,000-hp. water-power development for hydro-electric and irrigation purposes. This is the first contract of the kind to be awarded by the state since the revolutionary troubles of Mexico began, ten years ago.

THE ACQUISITION by the British Columbia Electric Railway Company of the Western Power Company of Canada has brought about the merger of electrical interests on the lower mainland of British Columbia. A second development on the Stave River is contemplated.

GOVERNOR ALLEN of Kansas will endeavor to have the State Legislature provide for the separation of public utility concerns from the consideration of the Court of Industrial Relations and the reconstitution of the old Public Utilities Commission.

BY THE installation of the first of two 60,000-kw. units the new Colfax plant of the Duquesne Light Company was put into commission last Saturday. Eventually the plant will have six units of this rating.

A BITTER fight over the abolition of the public utilities commission of Arkansas, a project held to have been indorsed in the recent election, is expected when the new Legislature meets.

A STRING of hydro-electric plants along the Tippecanoe River in Indiana is being planned by citizens of that state in co-operation with New York and Chicago capitalists.

APPLICATIONS for preliminary permits or licenses under the water-power act now cover more than 10,000,000 hp., including only 1,500,000 hp. for the California Edison Company's Colorado River project, estimated by some at 3,500,000 hp.

THE AMENDMENT exempting national parks from the operation of the water-power act has been favorably reported to the Senate.

A TEN-MILLION-DOLLAR bond sale is planned by the Pacific Gas & Electric Company of California to be used particularly for financing its Pit River projects.

HOLIDAY demand provides most of the business being done by jobbers and dealers. Wire for lighting and power circuits is in steady demand, but there is no great call for motors and other apparatus. Stocks of motors are better and deliveries quicker. The approaching inventory period prevents any augmentation of jobbers' stocks. Building is as quiet as ever, and collections are about as in the recent past.

News in Brief

Summary of Market Conditions and of Recent and Approaching Happenings of Importance to the Industry

APPROVAL of the direct good-will advertising campaign has been given by the executive committee of the N. E. L. A.

A COMMERCIAL radio service has been opened between New York, Chicago, Detroit and Cleveland.

THREE new issues, totaling $15,250,000 have been reported by electrical utilities this week, the largest being $10,000,000 8 per cent gold bonds of the Kansas City Power & Light Company at par.

PRESIDENT HOOVER has appointed standing committees for the American Engineering Council of the Federated American Engineering Societies.

VERMONT'S new Governor, who takes office next week, is James Hartness, an engineer who was formerly president of the A. S. M. E.

ANNOUNCEMENT is made by the American Engineering Standards Committee that the Electric Power Club has been designated as sponsor for the standardization of terminal markings for electrical apparatus.

THE INDICTMENT charging the Brooklyn Edison Company with a conspiracy to misuse coal priority permits has been dismissed by the United States District Court, as had previously been indictments charging hoarding of coal and a conspiracy to pay more than its fair cost.

VIRGINIA electric light and power companies are, by order of the State Corporation Commission, to put in force a uniform system of accounting.

INCREASED rates at Neenah, Wis., were refused by the Wisconsin Railroad Commission, which said that the electric utility serving that city must satisfy the commission that substantial improvement in its service is being made before the application will be granted.

AWARD of the Janssen medal in astrophysics to Dr. W. W. Coblentz of the Bureau of Standards has been announced by the French Academy of Sciences.

AWARDING the Columbus (Ga.) Power Company a 10 per cent increase in power rates, the Railroad Commission of Georgia also issued an order making it necessary to meter energy on the secondary side of transformers, thus virtually nullifying the increase.

A BILL authorizing the President to invite foreign nations to take part in the proposed Atlantic-Pacific Highways and Electrical Exposition at Portland, Ore., in 1925, has been introduced at Washington.

A BASIC rate for government elctrical workers has been prepared for inclusion in the revised classification bill to be submitted to Congress.

AN INCREASE of 25 per cent in business in 1921 as compared with 1920 is to be sought by the New England Electrical Council.

ONLY raw pipe remains of the steel products which the independent mills were keeping materially above the products of the United States Steel Corporation in price. Merchant pipe is in excellent demand, and the product of the independent mills is quoted about $7 a ton higher than that of the corporation.

INFORMATION received from Germany gives the price in that country of 5-hp. motors, three-phase, 1,500-r.p.m., as $146.90 with exchange at 2 cents per mark. A 30-hp. motor of the same rating brings $504.

LAMP manufacturers have decided to continue in effect their last year's policy of paying as additional compensation the full 5 per cent on the list value of B agents' sales from stock.

DEMAND for small motors rated at from 1 hp. to 25 hp. has fallen off considerably, but the volume of orders received is still fairly good.

RAPID growth of the use of electric trucks throughout the country is reported.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Governor Allen Advocates Separate Utility Commission

AS A RESULT of experience with the operation of the combined industrial court and public utility commission in Kansas since February Governor Allen is advocating the separation of the public utility section from the Court of Industrial Relations and the reconstitution of the old Public Utilities Commission. While important industrial cases have been handled these have been relatively few, the public utility problems absorbing the energies of the court. It is felt that the utility problems, especially now, are of a nature that justifies a separate body the activities of which shall be devoted entirely to those problems. The industrial court can handle industrial problems better if unhampered by utility matters that in the main bear only a remote relation to the industrial problems over which the court has jurisdiction.

It has also been found that the public has a tendency to confuse the work of the court on industrial and utility matters to an extent that leads to misunderstanding of the court's aims. The separation of the two functions will obviate this difficulty. The whole matter will be presented to the coming legislative session. A lively opposition to the proposal is expected.

Senate Water-Power Act Amendment Favorably Reported

THE amendment to the water-power act providing that no permit is to be granted for the construction of project works in national parks has been reported favorably to the Senate by the committee on commerce. The amendment was reported in exactly the language of the draft which was prepared by the Secretary of the Interior. The vote in the committee to report the amendment was unanimous.

Power Club to Act as Sponsor for Terminal Markings

THE American Engineering Standards Committee announces that the Electric Power Club has been designated as sponsor for the standardization of terminal markings for electrical apparatus. A sectional committee responsible for the work and upon which all organizations interested in the subject will be officially represented is being organized.

At the Brussels meeting of the International Electrotechnical Commission in March, 1920, some of the European delegates proposed a method for marking terminals of transformers. The American delegates suggested that it would be preferable to treat the more general subject of terminal markings for electrical apparatus consistently. As a result the Americans were requested to propose a systematic plan covering the whole subject.

The Electric Power Club has already done a large amount of work on these lines and has developed a general plan which is in wide use among American manufacturers. Parts of the plan, particularly the part relating to transformers, have been adopted by other organizations, including the American Institute of Electrical Engineers and the National Electric Light Association.

It is hoped to obtain agreement of all interested bodies on a general plan for representation at the next meeting of the International Electrochemical Commission.

New England Electrical Interests Propose 25 per Cent Growth in 1921

ONE of the largest and most important meetings ever staged by electrical interests in New England is now being planned for Jan. 26 at the Boston City Club, under the auspices of the New England Electrical Council, with the co-operation of all four branches of the industry. The prime object of the meeting, which will take place at the close of a dinner set for 6:30 p.m., is to increase more friendly relations throughout the branches and to create such relationships as will increase electrical business 25 per cent in 1921. Bowen Tufts, president New England Geographic Division, N. E. L. A., will preside.

California Placing New Rules in Its Utilization Safety Orders

THOSE rules which more than four years of actual field experience have shown to be necessary for the proper enforcement of the safety code now in operation and to promote the security of employees of industrial plants will, according to a statement made by R. L. Eltringham, electrical engineer of the Industrial Accident Commission of California, to the ELECTRICAL WORLD last week, be incorporated in the electrical utilization safety orders of the commission.

"The present orders govern the installation and use of electrical apparatus and wiring devices," Mr. Eltringham said, "in so far as the safety of the workers is concerned. In some instances the code has not fully covered all of the features that the commission felt should be covered, and for this reason the inspectors have found it advisable to use and enforce portions of the National Electrical Code devised by the fire underwriters. Thus in actual field inspections the inspectors have constantly referred to the National Electrical Code and have found it almost impossible to separate the provisions and intent of the two codes. For this reason it is now necessary to take certain portions of the National Electrical Code, portions of various city and

municipal codes and portions of all other available codes and incorporate them in the California code. When this work is completed the code will still be entirely an electrical safety code, but it will recognize that there are personal hazards due to possible fires caused by improperly designed or improperly installed electrical devices.

"The code as it stands and as it will grow has police power behind it, and no sacrifice to commercial desires can be possible. Instances are known where the National Electrical Code provisions were set aside by those presuming to enforce them as such enforcement would be detrimental to the rating companies.

"In no sense is the enlarged California code a combination of the Bureau of Standards Safety Code with the National Electrical Code as such, because it is known that portions of both of these codes are antiquated or are impossible of application and the placing of the two codes in one volume would not correct this. The California code is a separate and distinct code which embodies the best of all available codes and has been compiled largely by the interested and experienced men in the industry in the state."

Brooklyn Edison Not Guilty of Lever Act Violations

JUDGE MAYER of the United States District Court on Monday sustained the demurrer of the Brooklyn Edison Company and of Walter F. Wells, its vice-president, to the indictment returned Oct. 4, 1920, which charged conspiracy with B. J. Lynch Coal Company and others to misuse I. C. C. coal priority permits. Three indictments were returned on Oct. 4 against the Brooklyn Edison Company, charging (1) the hoarding of coal, (2) a conspiracy to pay more than the fair cost of coal by way of bonuses to the Adelphia Coal Company, and (3) a conspiracy to misuse priority permits for the advantage of the B. J. Lynch Coal Company.

Demurrers of the Edison company to the first two of these indictments were sustained by Judge Mayer Nov. 10, at which time he reserved decision on the demurrer to the third indictment. The decision then reserved was handed down this week sustaining the contention of the Edison company and of Mr. Wells. By these decisions the court held that the Edison company and Mr. Wells had not been guilty of violation of the Lever act.

New York Rates Adjusted on Coal Basis

EFFECTIVE Dec. 1, all the energy rates in the tariffs of the New York Edison Company, the United Electric Light & Power Company and the Brooklyn Edison Company, as has been previously announced, are to be adjusted monthly on the basis of the increase in the price of coal over the price when the previous rate was authorized. In order to bring the reasons for this action before its customers in such a way that it might not be misunderstood the New York Edison Company has placed the following letter in the hands of all of its consumers:

Permit us to announce that on and after Dec. 1, 1920, an adjustment charge will appear on our bills to offset partly the present abnormal cost of coal. This adjustment is in accordance with our schedules relating to rates and service conditions on file with the Public Service Commission for the First District, and is made on the principle of the "sliding scale," rising or falling with any increase or decrease in the cost of coal. It will entirely disappear if and when this cost returns to the basis upon which the existing rate schedules were established.

When these schedules were adopted we were most apprehensive of future conditions, and the right was then reserved, as is shown by the records of the Public Service Commission, to increase our rates by 1 cent a kilowatt-hour, should conditions justify. Notwithstanding the constantly rising cost of coal, labor and supplies, with which all are familiar, we hoped to get through the entire war and readjustment period without making any change in our schedules. This would have been accomplished as planned, probably, were it not for the abnormal increase in the cost of coal which has now reached a point where it can be carried no longer without jeopardizing seriously the financial position of the company.

The adjustment for low tension service is 0.050 cent a kilowatt-hour for each increase or decrease of 10 per cent above or below the average cost of coal of $3 a ton in 1916, when the present rate schedules were adopted. The actual increase in the cost of coal in each of the 10 per cent steps during the past three years has been slightly in excess of 0.057 cent for each kilowatt-hour; hence we shall continue to bear part of the increased cost of coal over the prevailing averages of 1916, and, in addition, the entire added cost of labor, material, supplies and taxes. We shall endeavor to carry these elements of additional cost throughout the present period of readjustment, trusting that it may not be necessary to ask the Public Service Commission for any further modification of our schedules through which the cost of the service would be increased.

Under an order from the Public Service Commission for the First District the exact cost of coal is reported from month to month, and this adjustment is covered by a monthly rider which is on file at the offices of the Public Service Commission, as well as all of the offices of this company, where it may be consulted at any time. Upon request we shall be glad to furnish any further information desired concerning this adjustment.

It will be apparent that under the "sliding-scale" principle upon which this adjustment is based any reduction in the cost of coal will immediately accrue to the benefit of the consumer. This company is of course in no way responsible for any of these increases in the cost of service. On the contrary, they have been largely, if not entirely, the result of the war and post-war conditions, and many were either approved or actually established by the federal government at Washington as a necessary feature of our part in the great war effort.

In applying the added coal cost to each kilowatt-hour of the entire service of the company the result is spread over a very wide area. It is small as related to the kilowatt-hour, and is practically negligible to a very large percentage of our customers. However small the amount we greatly regret that any necessity to modify our schedules should have arisen, and trust that with the anticipated early return to normal conditions this element of adjustment may speedily disappear. THE NEW YORK EDISON COMPANY.

Ten-Million-Dollar Bond Sale Planned by California Company

FOR the purpose of obtaining funds with which to carry on its hydro-electric construction program the Pacific Gas & Electric Company of California has planned a bond issue of $10,000,000 of 7 per cent twenty-year bonds. It has not been decided at what prices the bonds will be sold. The proceeds of the bond sale are to be used particularly for what is known as the Pit River projects of the Mount Shasta Power Corporation, which is a subsidiary of the Pacific Gas & Electric Company. It is estimated by the company that contemplated betterments and additions to its properties for the years 1921 and 1922 will cost in excess of $20,000,000.

Approval Given to N. E. L. A. Direct Good-Will Advertising

APPROVAL of a direct good-will advertising campaign over the name of the National Electric Light Association was given by the executive committee at its meeting on Dec. 16. This campaign is designed to take in the present good-will campaign conducted by the use of pamphlets and also the good-will campaign cooperated in by the electrical manufacturers. Definite plans already have been made, and the advertisements will begin to appear in popular magazines within the next six weeks or two months, supplementing the advertisements of the manufacturers.

President Insull stated that upon the request of the public policy committee he had appointed a committee on co-operation with other associations to meet similar committees from the American Gas Association and the American Electric Railway Association. The committee appointed by him and ratified at this meeting includes S. Z. Mitchell, Charles L. Edgar, H. G. Bradlee, W. W. Freeman, Joseph B. McCall, John W. Lieb, O. D. Young and Martin J. Insull, ex officio.

President Insull was authorized by the executive committee to take up with the chairmen of the four national sections and the headquarters staff the matter of fixing the time and place for the 1921 convention.

Week Brings $15,250,000 New Financing

THREE new issues totaling $15,250,000 were reported this week. The largest was $10,000,000 first and refunding mortgage twenty-year 8 per cent gold bonds, series A, of the Kansas City Power & Light Company at par. The Consolidated Gas, Electric Light & Power Company of Baltimore, Md., sold a five-million-dollar issue of first and refunding mortgage sinking-fund 7½ per cent gold bonds, series B, at a price to yield the investor 7¾ per cent. The third issue was $250,000 of five-year 8 per cent collateral trust gold notes of the Consolidated Utilities Company at 98, to yield 8½ per cent.

The proceeds from the Baltimore issue and some additional cash will provide $5,625,000 for refunding $468,000 in maturing notes and for additions and extensions to be completed before the end of 1921. The proceeds from the Consolidated Utilities issue are to pay for extensions and betterments.

Standing Committees of Federation Appointed

A MEETING of the executive board of the American Engineering Council of the Federated American Engineering Societies was held in New York on Dec. 17. At this meeting President Hoover appointed the following standing committees: Committee on procedure, Calvert Townley chairman; committee on constitution and by-laws, W. B. Powell chairman; committee on publicity and publications, L. P. Alford chairman; committee on membership and representation, J. F. Oberlin chairman; committee on finance, William McClellan chairman; committee on public affairs, J. Parke Channing chairman.

Mr. Hoover stated that in various cities he had visited lately he had found a general desire on the part of engineers to join in the federation movement, but that there was a general trend toward territorial organization. This question was referred to a special committee.

The American Engineering Council has offered to take over the employment service in which the four so-called founder societies have been associated. An appropriation of $1,000 was authorized as an initial fund to carry on publicity work.

Fight Over Abolition of Arkansas Commission Expected

A BITTER fight is expected in the State of Arkansas soon after the first of the year over the public utilities commission. The incoming administration, which will be headed by Governor-elect McRea, was elected on a platform one of the planks of which called for the abolition of four state commissions, including the public service commission. Such action, however, cannot be taken except by legislation.

The matter came to a head a few days ago when Governor Brough was called on to appoint a member of the commission to fill a vacancy. He asked Governor-elect McRea to assist him, but the latter declined on the ground that the people by their vote had indorsed the commission abolition plank.

New England N. E. L. A. Good-Fellowship Dinner Notable Success

FOUR hundred members of the New England Division of the N. E. L. A. joined in a "good-fellowship" dinner at the Edison Service Buildings, Boston, on Dec. 17. The occasion was marked by the reading of eight prize papers setting forth the advantages of membership in the association, the competitors representing the technical, accounting, public policy and commercial sections of the New England division, and by addresses by Bowen Tufts, president New England Division; Charles L. Edgar, president Boston Edison company and vice-president New England Division; M. H. Aylesworth, executive manager N. E. L. A.; G. M. Guilford, chairman Accounting Section, New England Division; L. L. Elden, chairman Technical Section; H. T. Sands, chairman Public Policy Section, and F. J. Allen, speaking for V. M. F. Tallman, chairman Commercial Section.

L. D. Gibbs, Boston, presented a lantern-slide résumé of the careers of seventeen leading electrical men in New England whose successes have been closely interwoven with N. E. L. A. membership and work. The prize winners were: Technical, first, Gilbert Robinson, Boston Edison company; second, Russell Hastings, Boston Edison company. Public Relations, first, C. R. Hayes, engineering manager Charles H. Tenney & Company, Boston; second, Welles E. Holmes, manager Cambridge Electric Light Company. Accounting, first, Daniel Goss, Boston Edison Company; second, A. G Havlin, Boston Edison company. Commercial, first, J. H. Griffin, Jr., Boston Edison company; second, C. Ernest Greenwood, superintendent appliance department, Boston Edison company. To R. B. Merrill, Boston Edison company, was awarded a year's membership in the New England Division for cartoon work on behalf of the organization. The prizes were presented in person by Executive Manager Aylesworth amid the enthusiastic applause of the audience.

Virginia Utilities to Have Uniform System of Accounting

A UNIFORM system of accounting for all electric light and power companies in Virginia is to be installed on Jan. 1 at the request of the State Corporation Commission, which will provide blank forms for the use of the companies in making their reports. Before issuing its order the commission held several conferences with representatives of the companies concerned, and the subject was thoroughly canvassed.

Colfax Plant Added to Pittsburgh Power Supply

LAST Saturday the first of two 60,000-kw. units of the new Colfax plant of the Duquesne Light Company of Pittsburgh was placed in service in the presence of a large gathering of the city's business men. The plant, which was designed by Dwight P. Robinson & Company, is to have an ultimate capacity of six 60,000-kw. units, which will make this one of the largest generating plants in the world.

This plant will be part of the transmission ring being formed around the Pittsburgh district. Energy is delivered to the district at 66,000 volts from both the Colfax and the Brunot's Island plants and reduced in substations to 22,000 volts and 11,000 volts for distribution over radial feeders into the business district.

Edison Pioneers Elect New Members

NEW members and associate members of the Edison Pioneers were elected at a recent executive committee meeting as follows: Members (men associated with Edison or connected with his work up to 1885 and their descendants)—John W. Lawson, San Ysidro, Cal.; Hermann Lemp, Erie, Pa., and W. H. Brenner, Atlanta, Ga. Associate members (men associated with Edison or connected with his work in the period from 1886 to 1899)—William Slocum Barstow, New York; Walter H. Johnson, Philadelphia; Fred M. Kimball, Boston; W. W. Freeman, Cincinnati; Harry Thomas Edgar, Boston; Walter S. Mallory, New York; Montraville Wood, Berwyn, Ill.; C. H. Pennoyer, San Francisco, and Martin Insull, Chicago.

There are now about a hundred members in each of the two classes. The annual meeting of the society will be held on Feb. 11 next, Edison's seventy-fourth birthday.

Bill Would Authorize the Federal Power Commission to Employ Personnel

TO AUTHORIZE the Federal Power Commission to employ personnel directly, as well as to retain those detailed to it by other departments, Representative Esch, the chairman of the committee on interstate and foreign commerce of the House of Representatives, has introduced the following amendment to the water-power act:

In the performance of its work the commission shall utilize in so far as practicable the field offices and field personnel of the Departments of War, Interior and Agriculture, and it is authorized to employ in the District of Columbia and elsewhere such expert, technical, clerical and other personnel as may be necessary for the purpose of performing the duties imposed by this act and as may be from time to time appropriated for by Congress. The detail of persons for such purpose from the Departments of War, Interior and Agriculture, or the transfer from such departments of any persons engaged in duties which by this act are conferred upon the commission, is hereby authorized, and the restrictions on transfers from one executive department or independent establishment to another imposed by the acts of Congress approved June 22, 1906, and Oct. 6, 1917, shall not apply to such transfers so made.

All the expenses of the commission, including rent in the District of Columbia, personal services in the District of Columbia and elsewhere, reimbursement of other government departments or agencies for expenses incurred in the performance of work for the commission, necessary printing and binding, purchase of equipment, supplies, law books, books of reference, periodicals and directories, all necessary expenses for transportation and subsistence, including, in the discretion of the commission, a per diem of not exceeding $4 in lieu of subsistence incurred by its employees under its orders, or by employees of other government departments or agencies engaged upon the work of the commission, in making any investigation or conducting field work, or upon official business outside of the District of Columbia and away from their designated points of duty, shall be allowed and paid on the presentation of itemized vouchers therefor approved by a member or officer of the commission duly authorized for that purpose; and in order to defray the expenses made necessary by the provisions of this act there is hereby authorized to be appropriated such sums as Congress may hereafter determine, and the sum of $100,000 is hereby appropriated out of any moneys in the Treasury not otherwise appropriated, available until expended, to be paid out upon warrants drawn on the Secretary of the Treasury upon order of the commission.

The amendment also provides that the salary of the executive secretary shall be increased from $5,000 to $7,500.

Intermountain Utility Commissioners Would Form Association

MEMBERS of the public utilities commissions of Utah, Nevada, Montana and Idaho, who recently concluded a conference at the State Capitol in Salt Lake City with a general discussion of problems common to all, found the exchange of ideas and general discussions so helpful that the formation of an Intermountain association of utilities commissioners was very much in favor. It was pointed out that problems common to all the Intermountain country might be discussed at meetings of such an organization and it was suggested that some sort of a sectional meeting might be held with a view to uniform presentation of views to the National Association of Railroad and Utilities Commissioners.

In the absence of some members of the visiting commissions no action could be taken. It was left with Judge Joshua Greenwood, president of the Utah commission, to correspond with other commissions.

Commissioners Skeptical About Service at Cost

A DECIDED tendency to skepticism concerning the plan to solve public utility rate problems by allowing them to furnish service at cost has become manifest on the part of some public service commissioners. This basis of return has been advocated especially for street-railway companies, and service-at-cost plans have been worked out in Cleveland, Cincinnati, Boston, Montreal and other places that met at the time of their proposal with much commendation from the members of regulating boards. A plan along these lines was proposed for Indianapolis and at first aroused the enthusiasm of most of the Indiana commissioners, including E. I. Lewis, the chairman of the body. These commissioners, however, as a result of careful investigation of results attained under the method, have altered their opinion, and in a recent address before the National Municipal League Mr. Lewis gave expression to the following view:

"I fear that service at cost simply means that the lid is taken off. It is possible that some time in the future some workable plan incorporating incentive for efficiency and initiative will be worked out. While the commission does not pass finally on service at cost, nevertheless it seems to most of us to run contrary to human nature, which, at least in business, requires opportunities of a struggle for gain. Psychologically, the blocking out of rates which shall apply if operating expenses increase threatens to become an open invitation for laxity."

Special interest to electric light and power companies in such an altered viewpoint on the part of regulating bodies resides in the probable spread of its application to other utilities. Commissioners already in various states are giving evidence that the coal clauses no longer meet with approval.

N. E. L. A. Backing Lamp-Voltage Standardization

FURTHER stimulus to the standardization of lamp voltages is being given by the lamp committee of the National Electric Light Association. Fully 80 per cent of the large lamps now manufactured are for 110, 115 and 120 volts, and in order to reduce the use of lamps of other voltages the committee is asking N. E. L. A. member companies to indorse these voltages. A questionnaire has gone forth to member companies asking when one of the standard voltages will be used, the voltage now used, and, if no standard voltage is used or has been arranged for, whether such is contemplated and if so of what voltage.

Highway and Electrical Exposition Planned for 1925

A BILL authorizing the President to invite foreign nations to take part in the Atlantic-Pacific Highways and Electrical Exposition at Portland, Ore., has been introduced in the United States Senate by Senator Chamberlain. The exposition is to be held in 1925. The bill provides that whenever it shall be shown to the satisfaction of the President that adequate funds are available for the purpose of carrying forward the exposition he may issue the invitations to other nations.

The exposition is to celebrate the centennial of the invention of the electromagnet and in honor of the completion of transcontinental and Pacific highways.

Kansas Looks Toward Development of Water Power Under State's Auspices

THE pressing need of an economical power supply in Kansas for the development of both industrial and agricultural industries was urged by Dean Walker of the School of Engineering of the University of Kansas in discussing the proposed revision of the method of handling Kansas water resources before the state water congress held recently at Topeka. Industrial development has reached a point where manufactured products, not including coal and petroleum, exceed in value the state's agricultural products, and it is therefor necessary that the most careful survey of the state's water resources be made to determine their value in connection with irrigation and for power purposes, as well as for industrial and domestic water supply, Dean Walker asserted. Six commissions now deal with various phases of the state water supply, and it is proposed to bring in a bill at the next legislative session which will provide for control of the state's water power by a division of water resources to be created as part of the Court of Industrial Relations. All technical service as well as investigations relating to hydro-electric properties and dependent rate matters would be handled by it. A committee of five, representing all interests, was appointed to co-operate with the Governor and the Water Commission in drafting the bill.

Janssen Medal Awarded to Dr. W. W. Coblentz

THE Janssen medal has been awarded by the French Academy of Sciences to William Weber Coblentz of the staff of the Bureau of Standards, Washington, D. C. The Janssen prize, consisting of a gold medal and founded by Jules Janssen in 1886, is awarded biennially by the French Academy of Sciences as a reward for a discovery or a work marking important progress in astrophysics.

The recipient of this year's reward is of Swiss-French descent. He is forty-seven years old and has been in the Bureau of Standards since May, 1905. The medal



DR COBLENTZ AT WORK IN HIS LABORATORY

is awarded for his investigation of infra-red radiation from terrestrial sources and from stars.

Dr. Coblentz was a frequent contributor to the ELECTRICAL WORLD about twelve years ago, when the new incandescent-lamp filaments—tantalum, tungsten, osmium, etc.—came into use. His contributions to the subject of illumination have been mainly along the line of experimental analysis. He attacked successfully the problem of the high luminous efficiency from the standpoint of the spectral absorption and reflection of the metals, in the form of highly polished mirrors—in recognition of which the Franklin Institute awarded him the Howard N. Potts gold medal—and also by spectral emission of the incandescent-lamp filaments. A study was made of the emission spectral of numerous oxides, etc., in the form of rods similar to the Nernst glower. Life tests were made of quartz mercury-vapor lamps, and the ultra-violet component radiations of the sun and other light sources were determined.

Secondary Metering Nullifies 10 per Cent Rate Increase

THE Railroad Commission of Georgia has handed down a decision in answer to the application of the Columbus Power Company for an increase in power rates, the rates in the order as issued giving the company an increase of approximately $60,000 per annum, or 10 per cent over and above the old rate schedule. However, an order of the commission which provides for metering on the secondary, instead of the primary, side of the transformers will virtually nullify the increase as granted. In all probability, the Columbus Power Company will ask for a rehearing of the case.

Registration for Engineers and Architects Proposed in Ohio

A BILL providing for the registration of engineers, architects and surveyors is to be introduced into the Ohio Legislature this winter. Legislation along similar lines is now in force, according to advocates of the bill, in eleven states. The bill was drawn by a committee of the Association of Ohio Technical Societies and is described as the result of nearly twenty years' "spasmodic agitation." By its terms registration may be made under any one of three titles, engineer, architect, or surveyor; but registration under either of the first two titles permits practice over the entire technical field.

Administration will be vested in a board of eight members, appointed by the Governor and serving without pay. The membership of the board shall include at least three professional engineers and three architects.

Fees for registration are to be $25 with examination and $10 without, and the certificate does not require renewal. To issue or revoke a certificate will require the affirmative vote of not less than five members, two of whom must be engineers if an engineering certificate is sought. "Practicing or offering to practice" in violation of the act will constitute a misdemeanor, punishable by fine, imprisonment or both.

American Bureau of Welding Reorganized

AT A MEETING held in New York recently the American Bureau of Welding was reorganized as joint advisory board of the engineering division of the National Research Council and the American Welding Society on welding research and standardization. The advisory board consists of representatives appointed by the American Welding Society, other interested scientific and engineering societies and organizations, classification societies, government bureaus and certain members at large appointed because of their special ability in matters pertaining to welding research and standardization. At this reorganization meeting by-laws were adopted and the following officers elected: Director, Prof. C. A. Adams; first vice-director, H. M. Hobart; second vice-director, Prof. A. S. Kinsey; secretary, W. Spraragen.

The bureau voted to create eight research committees, namely, on electric arc welding, gas welding, welding wire specifications, welding of storage tanks, welding conference, thermit welding, resistance welding and specifications of steel to be welded. The committees on welding of storage tanks, welding wire specifications and the welding conference are already actively at work.

The welding conference committee, of which A. S. Kinsey is chairman, plans through questionnaires to obtain a large amount of detailed information on all of the elements which have entered into the successful welding of pressure vessels in the past.

The committee on welding of storage tanks, of which J. C. Lincoln is chairman, was organized to meet the requests for information from the Standard Oil Company as to the proper procedure for welding storage tanks for holding light oils.

The committee on welding wire specifications, of which C. A. McCune is chairman, has been actively engaged in collecting data as to the chemical analysis of welding wire used for both gas and electric welding in the railroads, shipyards and other places and the service results obtained from the use of such wire. From these data the committee expects to obtain sufficient information to enable it to draw up specifications as to the proper limits of the chemical content of welding wire to be used for different purposes. Specifications have already been completed for wire to be used in welding mild steel and will be extended to include the welding of high carbon, alloy steel and non-ferrous metals.

British Columbia Power Interests Consolidated

BY ACQUIRING control of the Western Power Company of Canada the British Columbia Electric Railway Company of Vancouver, B. C., has brought about the merger of electrical interests on the lower mainland of British Columbia. The acquisition was accomplished mainly by the British Columbia Electric Railway Company guaranteeing the $5,000,000 of Western Power Company bonds. The latter company, formerly known as the Western Canada Power Company, had a capital of $11,350,000. Its plant develops 39,000 hp. at Stave Falls, 31 miles from Vancouver, and, besides selling 75 per cent of its output to the British Columbia Electric Railway, it transmitted power to the Puget Sound Power & Light Company at Sumas, Wash., and retailed energy in the vicinity of Vancouver and New Westminster.

There have been only two power companies in the field in the vicinity of Vancouver, the British Columbia Electric Railway Company, with plants at Lake Buntzen developing 84,000 hp., and the Western Power Company of Canada. The former company purchased 15,000 kw. from the latter and was under the necessity of acquiring more power. The capacity of the Western Power Company's plant is 150,000,000 kw.-hr. a year, but by the raising of the dam and the installation of another unit its output can be increased to 200,000,000 kw.-hr. a year. The plant would then have a total horsepower of 52,000. It is expected that work on the additional unit will be undertaken immediately by the British Columbia Electric Railway Company, the cost being estimated at $1,000,000.

The Stave River affords opportunity for a second development, the site of which is also conveyed in the deal, 3½ miles below the present plant. On this site 80,000 hp. to 90,000 hp. could be developed on a 50 per cent load factor. The cost would be $8,000,000. It is not expected that development work on the second site will be necessary for two or three years at the present rate of increase in demand.

With the acquisition of the Western Power Company the British Columbia Electric Railway Company will have an investment in the province of about $65,000,000.

Radio Service Opened Between New York, Cleveland, Detroit and Chicago

ON DEC. 16 a radio service was opened between New York, Cleveland, Detroit and Chicago by wirelessed exchanges of greetings among the Mayors of the four cities. This intercity wireless system applies the same methods that have been applied successfully in overseas service. Wireless apparatus developed by Emil J. Simon is used for sending and receiving stations, which are remote-controlled from a downtown office.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Elmira to Have Electrical Show.—The Elmira (N. Y.) Electrical Association will hold its first annual electrical show on Jan. 22 to Jan. 29 inclusive. H. S. Bryan, 210 East Water Street, Elmira, N. Y., is the general manager.

Lighting Exhibit for Kansas City's School System.—A permanent industrial lighting exhibit is being arranged for the trade school which is conducted as a part of the public school system of Kansas City. It is intended that this exhibit shall be used by the commercial interests of the city as well as in the instruction of the trade school students.

Electric Trucks in New York City.—The sale of 525 electric trucks in New York since the first of the year brings the total number in use there up to 4,525, according to the *Edison Monthly*. These range all the way from a single vehicle up to big "fleets" and represent an investment of $22,750,000. Up to Nov. 1 the number of vehicles sold was five and one-half times as many as in the same period last year.

A Five-Million-Dollar Texas Hydro-Electric Plant.—Construction of a dam across the Leon River three miles from Eastland, Tex., which has just been completed, assures the operation by the Oil Belt Power Company of a 10,000-hp. hydro-electric plant, on which $5,000,000 has been expended. Energy from this plant will be transmitted throughout the oil fields of central west Texas to pump and possibly to drill wells. It is asserted that electric pumping will increase the yield of the wells in this section fully 10,000 barrels a day.

Electroculture and Electrical Power Applications on the Farm.—An English contemporary, *Electrical Industries*, waxes satirical over a too flowery report emanating from the Ministry of Transport and dealing with "The Electric Age" as the official Commissioners of Electricity see it. The picture painted of mains extending everywhere "throughout the big electricity districts" the electrical journal regards as of a strictly Futurist character because of the vast financial problem involved, and of he official association of electroculture with rural electrical power it says that to make the assertion that "not only will richer harvests be obtained by the use of electricity, but plowing, harrowing, reaping, binding and threshing will be carried out by electrical appliances," is like saying that "not only will electricity be used for lighting cigars in the managing director's office, but the driving of cranes, rolling mills and machine tools will also be carried out by electrical appliances!"

Radio Helps Out Wall Street.—For the first time in the history of Wall Street the wireless telegraph supplanted the ordinary telegraph lines a week or two ago in the carrying on of stock market operations between New York and Chicago. The wire lines were disrupted by a storm and during the final hour of trading on the New York Stock Exchange W. J. Wollman & Company conducted business with Clement, Curtis & Company of Chicago by wireless. The plan worked with such perfection that Mr. Wollman, who instituted the new procedure, declared that it was a tremendous step forward and precluded any possibility of New York being isolated from the rest of the country because of storms.

Informal Complaints Against California Utilities Average Only Seven a Day.—From July 1, 1919, to June 30, 1920, the California Railroad Commission received, according to its annual report, 2,663 informal complaints, of which 467 concerned rates and the rest service. Of the rate complaints 104 were against electric power and light companies, as were 364 of the service complaints, 194 of the latter concerning installations, extensions and cancellations. The records of the gas and electric division show that of 943 complaints filed 648 were adjusted in favor of the consumers and 295 in favor of the utilities. The percentage of complaints per each 1,000 gas and electric consumers, taking the eighteen largest utilities, ranges from 0.25 to 6.07.

English Electrical Homes.—Seventy-three houses in course of construction at Billingham Village, Stockton-on-Tees, England, for employees of the North Tees central station, contain, in marked distinction from ordinary British practice, only two fireplaces each, one in the living room and one in the bedroom immediately above it. The rest of the house is to be warmed by portable electric heaters, which may also be used in the rooms containing fireplaces if the tenant prefers. Each fireless room is fitted with a ventilator. An electric cooker is installed in the scullery, and in the bathroom is placed an electrically heated clothes boiler. Each bedroom has a central electric light fixture and a wall plug to which a heater, flatiron or other appliance may be attached. Although the intention is to fill the clothes boiler with water from a central supply heated by the coal fire, electricity will be used to bring this water to the boiling point. Energy will be supplied at 250 volts, 40 cycles, single-phase, and a three-wire service is to be laid to each pair of houses. The estimated consumption of each house is from 3,480 kw.-hr. to 3,780 kw.-hr. a year.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

The American Washing Machine Association.—This organization plans to hold its annual convention and election of officers at the Sherman Hotel, Chicago, on Jan. 19-20.

A. I. E. E. and A. S. M. E.—The next joint meeting of the New York Section, A. I. E. E., and the Metropolitan Section, A. S. M. E., will be held on Jan. 28, when marine electrical engineering will be the subject. Alfred E. Waller will be in charge.

Wisconsin Contractor-Dealers.—The annual convention of the Wisconsin State Association of Electrical Contractors and Dealers will be held at the Republican Hotel, Milwaukee, on Jan. 19 and 20. A good program, including entertainment, has been prepared.

Boston Section, A. I. E. E.—Dr. Frank B. Jewett, chief engineer Western Electric Company, New York City, is announced to speak on "Wireless Telephony, Its Present Development and Future Possibilities," before the meeting of the Boston Section of the Institute on Tuesday, Jan. 11.

Iron and Steel Meetings.—"Relative Depreciation of Machinery" is to be the subject of an address before the Jan. 15 meeting of the Pittsburgh Section, A. I. and S. E. E., by L. F. Galbreath, West Penn Steel Company, Brackenridge, Pa. On the same date A. B. Clark, engineer with Sargent & Lundy, Chicago, will discuss "Efficient Electric Power Generation" before the Chicago Section.

Coming Meetings of Electrical and Other Technical Societies

American Association for the Advancement of Science—Chicago, Dec. 31-Jan. 1.

American Physical Society (annual meeting)—Chicago, Dec. 28-Jan. 1.

Association of Iron and Steel Electrical Engineers—Philadelphia Section, Jan. 8. Cleveland Section, Jan. 10. Chicago Section, Jan. 11. Pittsburgh Section, Jan. 15. Birmingham Section, Jan. [illegible]

American Institute of Electrical Engineers—New York, Jan. 14. Pittsburgh Section, Jan. 17. Cincinnati Section, Jan. 18. Philadelphia Section, Jan. 19. Detroit Section, Jan. 20. Chicago Section, Jan. 21.

Wisconsin State Association of Electrical Contractors and Dealers—Milwaukee, Jan. 19-20.

American Washing Machine Association—Chicago, Jan. 19-20.

American Society of Civil Engineers—New York, Jan. 19.

Western Association of Electrical Inspectors—Detroit, Jan. 25-27.

Association of Municipal Electrical Utilities—[illegible]

A. I. E. E. (New York Section) and A. S. M. E. (Metropolitan Section)—New York, Jan. 28.

A. I. E. E.—Midwinter convention, New York, Feb. 16-18.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Powers of Arkansas Commission.—The Arkansas Corporation Commission has declared that it has jurisdiction to pass upon the reasonableness of rates, notwithstanding the existence of a contract between the utility and the town in which it is operating, and the fact that the Supreme Court of the state has held that a contract between a town and a public utility company is valid as between the parties does not deprive the commission of its jurisdiction to pass upon the reasonableness of the rates fixed in the contract.

Rates to Diking Districts Must Be Affected by Ability of Consumer to Pay.—In passing upon the reasonableness of an increase in contract rates for electrical energy furnished to diking districts, the Washington Public Service Commission took into consideration the fact that the diking districts are financially weak and that their expense budgets were based upon the cost of energy under the contract rate. An electric company, the commission held, cannot expect to derive a full return for energy employed in draining waste lands and developing new territory. The commission therefore refused to the North Coast Power Company permission to increase rates contained in a contract entered into by it after due deliberation and in reliance by the diking districts upon its continuance during the contract period—particularly where such contract was not entered into before the prevalence of war prices.

Municipal Plant Must Care for Subscribers Within Corporate Limits First.—According to a decision handed down by the Public Utilities Commission of Utah, the Hyrum City municipal electric plant must continue to furnish lighting service to its customers at the present rates, but may increase its rates for industrial power within and outside the city limits. The commission found that the plant was in good condition, and it therefore cut the proposed depreciation charge from 7½ to 5 per cent on the book value. It also pointed out that the interest on outstanding bonds, as well as the sinking fund for those bonds, must, under the law, be raised by the city's general fund and not from the plant itself. On adjusting the calculations of the municipal authorities on this basis it was found that the entire increase asked was not required. The commission remarked that a municipality owning and operating such a system should not contract to furnish power to industries and individuals outside its corporate limits to an extent that will render it unable to provide the necessary energy to meet the reasonable demands within its corporate limits, and that the users of lighting service should not be required to bear the burden of supplying power to commercial industries, one of the principal items of additional operating expense being the provision of essential break-down service.

Summer Service as Viewed by the California Commission.—There is a close analogy between water service and electric service at summer resorts. The problem of equitably distributing the cost of water service at such places and the fixing of reasonable rates has received the attention of the California Railroad Commission. In several cases the commission held that the few regular consumers of a utility serving a summer resort district should not be compelled to pay rates in excess of the value of the service which they actually receive, while the majority of the utility's consumers requiring service only during a few months of the year should be required to pay a rate which would embrace a readiness-to-serve charge covering the time when actual service is not rendered. In accordance with this principle the commission has in a few instances fixed a minimum annual payment which entitles consumers to service during four months of the summer season with additional monthly payments when water is required during the remainder of the year. These rates are so designed that the consumer using water only during the summer season pays a proper proportion of the total annual charges of the water system.

Extension of Service.—Complaint having been made of inequalities in the application of an order of the Public Utilities Commission of the District of Columbia relating to the extension of the service mains of the Potomac Electric Power Company, particularly with reference to the refund of deposits to consumers when additional applicants are connected to the extension for which deposits have been made, the commission has ordered that in cases where the lengths specified are not sufficient to reach the premises the company shall make the entire extension, provided the applicant or applicants deposit with the company $3.25 per linear foot for underground construction and 40 cents per foot for overhead construction for the length of the extension in excess of the free amount of extension per customer. This deposit will bear no interest but will be returned by the company to the depositor at the rate of $114 in the case of underground construction and $100 in the case of overhead construction for each additional customer served from the extension for which said deposit has been made, or from any further extension from and connected to the extension covered by the deposit, until the original principal amount of the deposit is returned, but in no event will the amount refunded exceed the amount of the original deposit.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Public Utilities May Be Forced by Mandamus to Continue Service.—The Supreme Court of North Carolina has decreed that the Southern Power Company must continue to furnish electrical energy to the North Carolina Public Service Company at Greensboro and High Point, in spite of notice given by the Southern Power Company that this service would be discontinued on Jan. 1. The defendant company, appealing from a mandamus issued by a lower state court, declared that the suit was in fact one for a mandatory injunction and should be transferred to a federal court. This the Supreme Court denied, maintaining that the contention of the plaintiff that the Southern Power Company is under legal obligation to furnish it with electricity, defendant being a public service corporation engaged in that business, and its further contention that it is the duty of the defendant to continue this service after Jan. 1 and upon such reasonable terms as may be fixed by the Corporation Commission in the event that the parties cannot reach an agreement, made the issuance of a mandamus the proper remedy.

Public Service Commissions Law Does Not Oust Jurisdiction of Court.—There is nothing in the Public Service Commissions law of New York State, the Supreme Court of that state declared in Village of Warsaw vs. Pavillion Natural Gas Company, which in and of itself abrogates franchise provisions as to rates, although the Legislature has delegated that power to the Public Service Commissions, and until the commission concerned acts a public service company must comply with the provisions of its own contract embodied in a franchise, and to enforce compliance therewith a court has jurisdiction of an injunction. A proceeding before the commission to obtain authority to increase rates does not constitute an action for injunctive relief, and an order of the commission, if valid, does not become effective except by action in the Supreme Court. Hence the tendency of such a proceeding, assuming it to be an action within the meaning of the statute, could not be set up as a ground of demurrer in an action against the gas company to enjoin it from violating its contract included in a franchise fixing rates. (184 N. Y. S. 327.)*

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

W. J. Santmyer, for twenty-one years connected with the Puget Sound Traction, Light & Power Company, Seattle, Wash., as superintendent of steam and advisory engineer, has become president of the Power Plant Engineering Company of Seattle, which has recently been incorporated. Mr. Santmyer will retain his position with the Puget Sound company. He is inventor of the Santmyer powdered-coal burner and feeder.

A. G. Wishon, who has been identified with hydro-electric development in the High Sierras since 1894 and general manager of the San Joaquin Light & Power Corporation, Fresno, Cal., since its organization in 1903, was recently



A. G. WISHON

elected vice-president and managing director of that company. The election of Mr. Wishon to the position of vice-president was celebrated by a luncheon of the executives and department heads of the company. A biographical note on Mr. Wishon appeared in the ELECTRICAL WORLD for Aug. 21, 1920, pages 368 and 402.

John D. Kuster, for several years manager for Santa Clara County of the Pacific Gas & Electric Company of San Francisco, has been promoted to the position of manager of the entire San José division, which includes the territory from south San Francisco to the southern end of Santa Clara County. Mr. Kuster has been active in association affairs on the Pacific Coast.

Arthur R. Wellwood has recently become identified with the engineering staff of the Super-Power Survey, with offices at 709 Sixth Avenue, New York City. Mr. Wellwood, who has a wide experience in construction, operating and engineering work, was formerly associated with the Central Hudson Gas & Electric properties, his last post being that of district operating manager, where his duties covered plant production, transmission and distribution and all construction work in the territory. He received his technical education at New York University and has spent most of the years since his graduation in the utility field. He served overseas with the combat engineer troops.

James R. Cravath, heretofore a member of the firm of Fowle & Cravath, consulting engineers of Chicago, has found it necessary to terminate his connection with that firm and move to California owing to the ill health of one of the members of his family.

H. M. Gansman, formerly manager of the supply division, Philadelphia district office of the Westinghouse Electric & Manufacturing Company, has resigned to become general manager of the H. C. Roberts Electrical Supply Company, Philadelphia.

H. F. Brinckerhoff, who has been in charge of the Bluefield and Charleston (W. Va.) offices of the Westinghouse Electric & Manufacturing Company, has been appointed manager of the supply division of the Philadelphia district office of that company.

Frank F. Fowle, a member of the firm of Fowle & Cravath, consulting electrical and mechanical engineers of Chicago, has formed a new consulting firm, known as Frank F. Fowle & Company, owing to the discontinuance of the partnership of Fowle & Cravath on account of the ill health of one of the members of Mr. Cravath's family, which has forced him to move to California. The advisory services of Mr. Cravath in illuminating engineering will still be available, and he has retained a connection with the new firm for that purpose.

A. W. K. Billings of Barcelona, Spain, is visiting this country on a business trip. Since 1912 Mr. Billings has been closely identified with extensive hydro-electric work at Barcelona as manager of construction, managing director, vice-president and consulting engineer of the Ebro Irrigation & Power Company, Ltd. During the war he was in charge of naval aviation construction in Europe and was promoted to the rank of major. For distinguished services in this work he was enrolled in the Legion of Honor and received the navy cross. Prior to his work in Spain and elsewhere for the Pearson interests, Mr. Billings spent two years in Pittsburgh and ten years in Cuba on power-plant construction and two years in New York as engineering manager of J. G. White & Company, Inc. In 1917, before entering the United States army, Mr. Billings maintained a consulting office at 115 Broadway, New York City. His address while in the United States will be the Engineers' Club, New York.

Gordon Campbell, president and general manager of the Edison Light & Power Company, York, Pa., and also of the York Railways Company, who was appointed vice-president of the Municipal Service Company, Philadelphia, and moved from York to Philadelphia in the latter part of 1919, has recently moved back to York. This move has been found necessary in order that he may devote all of his attention to the York electric light and railway properties. Mr. Campbell became identified with the York properties in 1908. Before that he was associated with public utilities in Denver, Col.; Newark, N. J.; Providence, R. I., and Washington, D. C. Mr. Campbell has devoted a great deal of



G. CAMPBELL

his time to association matters in recent years and has served as a member of the executive committee and as vice-president and president of the Pennsylvania Street Railway Association.

R. S. Whaley, formerly manager of the Rainier Heat & Power Company, Seattle, Wash., has become vice-president and manager of the Power Plant Engineering Company, Seattle, Wash., which company has recently been incorporated to design and install power-plant equipment.

Obituary

John T. Chambers, chief engineer of steam-power plants of the Georgia Railway & Power Company, died suddenly on Sunday, Dec. 12. Mr. Chambers was fifty-two years of age and had been associated with the Georgia Railway & Power Company for twenty-nine years. He was first employed as an oiler and had served in almost every position in the steam stations, being promoted to the position of chief engineer upon the retirement of Mr. Bluxham several years ago. Mr. Chambers was a prominent figure in central-station activities throughout the South.

Trade and Market Conditions

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

Present Lamp Turnover Policy to Hold in 1921

LAMP manufacturers have decided to pay as additional compensation the full 5 per cent on the list value of B agents' sales from stock in the coming year. This is merely a continuance of the policy which they put into effect last winter but which they had expected to change for the year 1921 into one which would place a premium on a total stock turnover of six times in a year. Had the rider gone into effect as proposed the additional compensation would have amounted to 3 per cent on the list value of the lamps sold from B agents' stocks plus 1 per cent on the list value of such sales on a total stock turnover of five times in the year, or plus 2 per cent on the list value of such sales on a total stock turnover of six times in the year.

The question of stock turnover is still one of vital importance in the eyes of the lamp manufacturer because of his heavy capital investment in distributed stocks, and it is felt that still more time is needed in which to gather data relative to additional compensation and turnover.

Appliance Sales in Northwest Below 1919 Holiday Volume

ELECTRICAL jobbers and dealers in the Northwest, as a whole, are of the opinion that this year's holiday appliance sales volume will be light—that it will show a considerable dropping off as compared with the volume at this time for several years past. Their opinions are predicated on several more or less obvious reasons. For instance, Seattle and the Puget Sound section, not unlike other sections of the country, are still wallowing in the trough of the so-called reconstruction period. Generally speaking, industry and business are quiet. The mills and logging camps are either closed down or are running close-reefed because of the high cost of manufacture in the face of a falling market. The shipyards in this district, from all appearances, are "through"—at least for the time being. There is a surplus of labor, both skilled and unskilled, and the number of unemployed is being daily augmented by release of men from the logging camps, mills, factories, machine shops, boiler works and like institutions.

The above facts, in connection with an imminent cut in wages, have tended to discourage buying at Christmas time which might be construed as non-essential. It is conceded that electrical domestic appliances are practical, efficient and much to be desired and also that they do not come under the head of luxuries. However, by the rank and file of wage earners, men who live from a monthly or weekly salary, these same appliances are not considered essentials. Therefore they will not buy them in the face of their own uncertain financial condition. The prevailing opinion that prices of electrical merchandise are high, considering recessions made in other lines, is another deterrent factor.

Jobbers and dealers in the smaller towns and rural communities especially have been conducting sales campaigns on electrical appliances with fair results. Reports from several different sections in this district state that washing machines, vacuum cleaners and socket-device heaters are moving very satisfactorily. Ironing machines also, while new or comparatively so in this territory, are showing a good movement considering their price. With but few exceptions, the small-town dealers report that they have no particular trouble in obtaining sufficient stocks to meet their demands and that replacements come through well.

Oregon stocks of heating appliances in general are in good condition, both with the jobbers and with the dealers. Some lines of hollow ware, such as percolators, toasters, etc., are scarce, however, and will be off the market before the holiday season is over. Stocks of waffle irons are entirely depleted in some instances. Supplies of electric irons are in satisfactory shape and should be ample for the holiday trade. The demand for heating appliances is increasing appreciably, but is not what it was a year ago.

Tape Producers Look for Good Year Ahead

DESPITE recent declines in tape purchases manufacturers of both friction and compound tape will undoubtedly close the year with a large gain in total business handled over 1919. Deliveries are now easy as in many other lines. An optimistic tone pervades the market with regard to next year's sales, even though inquiries and orders are at present running low. It is felt that the necessities of the coming year will require the placing of substantial orders during the course of the twelvemonth period. Some of these commitments may be small and others large, but in the opinion of leading sales executives little reason for pessimism exists.

Some reduction in prices is expected about Jan. 1, but it is hard to see how this can exceed 10 per cent in view of the continuing high cost of labor, fuel, transportation, whiting, surphur and some other material. Sharp as have been reductions in cotton cost, these have been insufficient seriously to affect the manufacturing expense in friction-tape and rubber-tape production. Overhead costs continue at high levels and taxation burdens show small signs of material lightening. The outlook for immediate business is somewhat uncertain, but it is believed in manufacturing circles that easier prices will stimulate orders somewhat and that as soon as buyers realize the relations of various cost factors to current quotations better trade will be enjoyed.

Raw-Pipe Quotations Only Steel Price to Remain Up

OF THE steel products the price of which the independent mills were keeping any distance above that of the United States Steel Corporation, pipe alone is said to remain. Merchant pipe, on the supply of which electrical rigid conduit depends, is enjoying an excellent demand, and the independent mills are still able to maintain their list prices about $7 a ton over the corporation list.

Demand for rigid conduit in the electrical trade is not very strong. Although it is the product of which supply jobbers have experienced the most difficulty in acquiring any kind of a stock, especially in the ½-in. size, producing mills have had to curtail their output probably to the extent of 20 or 25 per cent in order to keep their production down on a level commensurate with the slackened demand. This demand in the last few months, however, has not been steadily decreasing, but has fluctuated up and down in keeping with changing activity, each valley being lower than its successor, so that the entire trend has been downward.

Demand on steel and iron tube products is still very strong, and no indication of a let-down is seen in the near future. So long as this is so, just so long will the tonnage allotted for rigid conduit be relatively small. Manufacturers' sales of conduit in the past year would undoubtedly have been larger had more raw stock been available, but at the same time jobbers would have had bigger stocks than they have now. As it was, a great deal of shopping around was necessary to fill orders, and generally depleted stocks resulted; but it is doubtful whether any real amount of construction was held up because there was no pipe to be had.

Considering the demand still existing in the raw-pipe market it can hardly be expected that prices will go down to any extent in the near future, even for rigid conduit.

Advances in Washing-Machine Costs in Three Years

INASMUCH as so much is heard of the advances which have taken place in the price of washing machines in the last three years it may not be amiss to reproduce some figures just received from the American Washing Machine Manufacturers' Association. This association realizes, however, that list prices of washing machines have not followed the manufacturing costs in proper proportion and that with the hoped-for decline in prices there is a great deal of slack that must be taken up before list prices can be reduced.

AVERAGES OF PERCENTAGES OF INCREASE SINCE SEPTEMBER, 1917

Item	Per Cent	Item	Per Cent
Labor	106	Lumber	117
Motors	39	Cypress	201
Wringers	76	Cypress tubs	140
Cut gears or worms	68	Maple	144
Copper sheeting	21	Cedar	94
Castings	111	Gum	164
Malleables	95	Crating	118
Galvanized s[illegible]	80	Cut stock	201
Angle iron	92	Paint	81
Flat steel	104	Freight—inbound	77
Casters	66	Freight—outbound	79
Fittings	69		

The accompanying table shows the averages of percentages of increase since September, 1917, for the various items entering into the manufacturing cost of a washing machine. The average increase in list prices of the finished machine is given as 59.6 per cent.

Electric Truck Industry Is Growing Rapidly

MANUFACTURERS of electric trucks almost without exception are enthusiastic regarding the possibilities for business that are developing in line with the increase in transportation by electric vehicles throughout the country. One of the leading makers reports the best sales of electric trucks this year in the history of the business, and this statement finds an echo with several others. A reliable estimate of the number of electric trucks sold in this country during 1920 places the total at about 5,000, with an estimated value of $22,000,000. Of this number about 600 are accounted for by the metropolitan district of New York City alone, proving the latter to be the largest single market for vehicles of this type at present.

There are approximately 5,000 electric trucks in use in the latter district at present, representing about 10 per cent of the total. Within ten years, it is stated, the number of electric trucks in use in the city will from present indications surpass the gasoline-driven vehicles. In line with the excellent prospects for sales that are seen next year at least two of the large manufacturers are increasing their production facilities sufficient to allow an annual output of 1,500 trucks each.

Production conditions with respect to labor and raw material are favorable, so that deliveries in general can be made within five to eight weeks. No trouble is experienced in obtaining motors, it is stated, while truck batteries can be supplied in two or three weeks. The supply of batteries of this type incidentally is plentiful, as production has not been affected by the falling off in demand for starting and lighting sets on behalf of pleasure cars. Prices of trucks have undergone no change, and manufacturers state that price reductions are out of the question for the immediate future.

An interesting sidelight on the electric truck industry is the campaign of education which is being carried out by manufacturers. One of the latter recently sent out a questionnaire to users of commercial trucks asking their attitude toward the electric vehicle. Replies from non-users of these trucks indicate that ignorance is the chief obstacle to their wider use. Within the past twelve years, this company reports, 85 per cent of its sales have resulted in repeat orders.

Metal Market Situation

IN CONTRAST with last week's condition of comparative stability in the copper market this week shows recessions below the price of 14 cents on the part even of some producers. These are offering metal at 13.75 cents for delivery over the remainder of the year, but the run of large producers in general will not shade the price of 14 cents. In the outside market there is a small amount of copper for sale as low as 13.50 cents f.o.b. refinery for prompt and December delivery, but the amount is limited. For first-quarter use the seconds have little copper, and that is holding at 13.75 cents. Producers are holding 14 cents as a ruling price for early 1921 copper.

There is little buying of the red metal. Domestic consumers are operating at greatly reduced capacity, and brass mills are not buying at anything like their accustomed level. Mines in Butte are reported to have posted notices announcing a shutdown as the alternative to the reduction of wages, this decision to take effect Jan. 2.

The American Smelting & Refining Company, which has for many years marketed along with its own copper the copper of other companies whose product is treated in its refineries, announces that this practice will be discontinued and that hereafter it will sell only its own copper, just as it has heretofore sold only its own lead, spelter, tin, silver, gold and other metals.

As a consequence the Utah Copper Company, the Ray Consolidated Copper Company, the Chino Copper Company, the Nevada Consolidated Copper Company, the Chile Copper Company, the Kennecott Copper Corporation and the Braden Copper Company, whose product in the past has been sold through the American Smelting & Refining Company, will have as their selling agent after Jan. 1 the firm of Guggenheim Brothers.

Lead continues inactive, although inquiries for delivery for the first few months of 1921 have increased. There is little disposition, however, to quote for these futures. The official Eastern price is 5 cents, but the outside market is 4.60 to 4.70 cents for prompt and December.

NEW YORK METAL MARKET PRICES

	[illegible] 13	[illegible] 20
Copper	£	£
London, standard spot	76 15 0	74 [illegible]
	[illegible]	[illegible]
Electrolytic	[illegible] 14 25	[illegible] 14 [illegible]
[illegible]	14 00	14 00
Casting	13 25	13 12½
[illegible]	17 [illegible]	16 00 16 50
[illegible]	5 00	5 00
[illegible]	5 50	5 50
Nickel, ingot	45 [illegible]	45 [illegible]
Sheet zinc, f.o.b. smelter	[illegible]	[illegible]
Zinc dust	6 [illegible]	6 [illegible]
Tin	33 75	[illegible]
[illegible]	[illegible]	32 90

OLD METALS

[illegible]	[illegible]	[illegible]
[illegible]	6 00 6 50	[illegible]
[illegible]	4 [illegible] 5 00	[illegible]
[illegible]	[illegible]	[illegible]
Zinc	3 50 [illegible]	[illegible]

THE WEEK
IN TRADE

WITH the assistance of a holiday demand jobbers and dealers are still doing business. There is a constant amount of additional wiring required for lighting and power circuits, but not a heavy demand for motors and other apparatus. Stocks of motors are better and deliveries quicker. Jobbers are not augmenting any of their stocks just before inventory period, but are pushing sales in an endeavor to lower them. They are meeting with more or less success, depending on the effort. Building is quiet.

It seems to be no harder to make collections than it has been, but conditions in the money market will permit of no let-down in the energy required in following accounts.

Prices quoted below are those holding at the opening of business on Monday morning last.

NEW YORK

Little or no charge is evident in trade conditions here, quietness being still the prevailing feature of the industry. Jobbers apparently expect no increase in demand for some time to come and are concentrating their efforts upon sales of various small items which have a fair movement. This is meeting with some success, for though sales of staple articles, such as wire, loom, tape, cords, cable, etc., are at a minimum, there is enough of the so-called "fill-in" variety of goods sold to total a fair volume of business with many houses.

Stocks are being gone over carefully with the end of the year at hand, and jobbers are holding their inventories down as low as possible. The policy of interchanging stocks is aiding in this respect. Collections show no change but must be pushed hard and closely to being results. A feature of the price situation is the wide range shown in the quotations of jobbers on most items, indicating the variance of such conditions as demand, pressure to liquidate, condition of stocks, etc.

Reports on the volume of business done by dealers at present vary considerably, but from all accounts the Christmas trade will not show so large a total as in past years.

Rubber-Covered Wire.—The situation remains unchanged, with stocks too large on the whole for the present weak condition of this market. No. 14 in quantities of 10,000 ft. is quoted at prices ranging from $8.50 to $9.50.

Tape.—Though some jobbers are making fairly good sales to industrials, general tape demand is off and the supply is plentiful. In 100-lb. lots friction tape ranges from 46 cents to 55 cents per pound, and rubber from 45 cents to 50 cents per pound.

Non-Metallic Flexible Conduit.—Demand is poor both with manufacturers and jobbers. Stocks are well filled. In quantities of 1,000 ft., ½-in. brings from $3.25 to $4.50 per 100 ft., and ¾-in. from $3.50 to $4.50 per 100 ft.

Lamp Cord.—Almost no demand exists in this territory and stocks are too large. In 500-ft. quantities from $19.50 to $28.50 per 1,000 ft. is asked for No. 18 twisted.

Porcelain.—Demand has fallen off to such an extent that jobbers' shelves are fairly well stocked except for 3-in. tubes. In barrel lots 3-in. tubes are worth from $11 to $16.50 per 1,000, two-wire unglazed cleats from $21 to $23.50 per 1,000 and "Nail-it" knobs $32 per 1,000, net.

Outlet Boxes.—Demand is reported very slow with stocks well filled. In quantities of 100 the discount quoted by jobbers on black ranges from 23 to 30 per cent and on galvanized from 15 to 25 per cent.

Flashlights.—Demand on behalf of the temporary Christmas trade is reported as considerable, and sales of separate batteries and cases are good too. The supply is plentiful with no change in prices.

Safety Switches.—Although some jobbers are making good sales, the general demand is light owing to lack of building work. Stocks, while not large, are considered adequate. Prices remain steady.

CHICAGO

Christmas sales, in point of number, are about up to last year's figure, but the average value and resultant total in money is much less. In the field of household appliances trade is inclining to the lower-priced items. Dealers are watching reduction of their stocks complacently, showing but little disposition to refill their shelves. The general disposition is to permit inventories to get as low as possible. The jobber and the manufacturer are feeling this in the reduced number of orders being booked. Reduced output on the part of manufacturers of nearly all lines to protect their own finished-stock inventory is the order of the day.

Credits are being very closely scanned. Collections range around sixty days, which is not so good as the same figure a month ago, for the gross amount outstanding is getting lower and energy expended in collecting is increased. It is generally felt that by the middle of January a definite trend toward normal business will have been established.

Wire.—Prices fluctuate badly. The quotation on bare copper wire, No. 8, in 1,000-lb. lots, is 18½ cents. Weatherproof in similar quantities is, for the No. 6 triple-braided, 23 cents per lb., and for the No. 8, 23½ cents. Demand is light, material for maintenance purposes only being bought.

Poles.—As is usual at this time, a minimum of shipments is being made. Producers are active in accumulating stock in the woods and in many cases are operating at lower labor cost than last year. With the price of all lumber products reduced nearly 50 per cent, it is reasonable to look for cheaper pole quotations before spring business opens up. Transportation cost will remain high.

Insulators.—This is the one item in which a definite shortage still exists. Production is not yet able to supply current demands on glass, and back orders are being carried in large volume. Prices are firm. Porcelain stock remains almost unobtainable. Deliveries on small sizes of porcelain line insulators are upward of four months in arrears, and the heavy-strain types are in much worse shape. No real relief from this condition seems in sight.

Locust Pins.—These are in plentiful supply. Slight price revisions have been made, downward on the larger sizes and upward on the small size, the net result being to leave the line practically unchanged. This is another item which it seems that lower costs in the wood production field should affect.

Heating Appliances.—Total retail sales in the various items of this line are good, but dealers are showing no desire to replenish stocks. Curtailed output is reported by most manufacturers. At least two manufacturers have issued advanced price lists on scattered items, the result being an immediate decrease in sales.

Household Appliances.—Sales at retail in comparison with lower-priced electrical goods are light. Manufacturers report but few orders from jobbers. Sewing-machine sales are particularly light, and one maker has made a special price concession for a limited time. Demand for guaranteed prices is widespread and insistent. Washing-machine sales are good.

BOSTON

Business continues in moderate volume. In some quarters a better feeling is reported, although it has not yet been reflected in much new buying. Most jobbers will be occupied into the new year filling back orders. Prices are holding steady for the most part. Collections are slow, but some improvement is mentioned in central-station settlements. In some of the so-called "one-industry" towns where local manufacturing plants are shut down or running on short time contractor-dealers are finding it hard to obtain money

to pay for goods received from the jobbers. Emphasis upon the underlying soundness of the electrical industry is widely prevalent in discussions of trade conditions. Building operations are not keeping up to earlier records of increase over last year, though the total for 1920 will probably exceed the 1919 figures considerably for New England as a whole. Very cautious buying is the policy in the wholesale field, but with the turn of the year a better outlook is anticipated.

Appliances.—Jobbers do not appear to be overstocked in the lighter lines. The retail trade is showing excellent results. One large house surpassed last year's November sales and turned over a healthy output for early December.

Schedule Material.—Ample supplies of switches and sockets are on hand. Prices are firm and the demand is moderate. Until building picks up stocks are not likely to be drawn down rapidly enough to cause shortages.

Wire.—Recent declines in price do not appear to have stimulated the demand, although a routine volume of sales of rubber-covered and weatherproof is being booked. In 1,000-ft. lots No. 14 rubber-covered is quoted at $9, and the weatherproof base continues steady at 23 cents.

Motors.—Boston stocks are spotty as to smaller sizes of integral ratings. The lull in demand gives more time for considering motor applications from the engineering standpoint, and local distributers are fairly busy with proposition work. Manufacturers still have several months' orders on hand in some cases. Second-hand stocks appear to be increasing in size.

Portables.—Heavy stocks of portables are evident in the retail trade, and some doubt exists as to price stability after Christmas. Price cutting has not attained the proportions one might expect. Plenty of lamps are reported on hand for the holiday trade, and with the coming of longer days, the fear of a shortage this winter appears groundless.

Rigid Conduit.—Current requirements can now be met with little difficulty. On 1-in. pipe prices range from 18 to 19 cents per foot, and on ½-in. pipe from about 9 cents to 10 cents, in large quantities. It has been some time since shortages of fittings have been general.

Radiant Heaters.—Unusually mild winter weather has helped the sale of these devices. Prices are steady, with fair stocks.

Flexible Armored Conductor.—Quiet sales rule, with firm prices. No. 14 single-strip sells at $85 in 1,000-ft. lots. Some of this material of smaller size is being used in exposed wiring for public telephone stations.

ATLANTA

It is felt that the Foreign Trade Financing Corporation, which was recently formed, will aid much in financing exports of agricultural products and stimulating the movement of crops, and this will undoubtedly be reflected by better business conditions throughout the section. Building activities continue to slump and little or no construction of moment is reported this month, though repairs and improvements are being undertaken. The opinion is freely expressed, however, that the slump in the price of building material will stimulate building and that activities in this line will be resumed on a nearly normal basis by early spring. The Master Builder's Association at its last meeting adopted a new wage scale for the coming year. This is considerably below the present scale but still approximates an increase of 100 per cent over the wage paid in 1916. Undoubtedly considerable opposition will be met in putting this scale into effect. All lines of business report collections very slow. There is a fair amount of activity reported in the Christmas goods line, though the tendency of the public is to hold off buying until after the first of the year.

Pole-Line Hardware.—Slow movement and heavy stocks are responsible for a 15 per cent reduction in price just announced. Some jobbers predict that this reduction will soon be reflected in the price of other steel products.

Armored Conductor.—All jobbers report heavy stocks on hand, and orders are coming in, but slowly. Some of the smaller jobbers are heavily stocked, and there are isolated instances of this material being unloaded at $85 per 1,000 ft. in two-wire No. 14 sizes. The larger jobbers are holding the price steady at $95.

Conduit.—Conduit continues to move fairly satisfactorily, one or two firms reporting their stocks somewhat spotty, though in most cases ample supplies are on hand.

Metal Molding.—Repair work has served to stimulate the movement of this specialty, jobbers reporting it moving more actively than for some months past. Stocks and shipments are reported fairly satisfactory.

Christmas-Tree Outfits.—An unusual demand is reported, the stock of one of the largest jobbers having been completely exhausted. The eight-light and sixteen-light sizes appear to constitute the fastest moving stocks. Retail prices, eight light, $5.50; sixteen lights, $11.

Domestic Heaters.—The high price of fuel has served to create and sustain an excellent demand in this line. In fact, present indications are that this season will be a record breaker. Good shipments have enabled jobbers to hold up their stocks fairly well. Retail prices, single heaters, $12; double heaters, $15.

Mangles.—Heavy sales of washing machines have in turn awakened an interest in mangles. One of the large jobbers is expecting a good movement after the first of the year.

ST. LOUIS

There has been little change in conditions in the past week, sales of staple supplies remaining low and the demands of the holiday trade partly making up for this inactivity. Dealers and department stores report that retail buying picked up considerably during the week, and jobbers felt the effect of this in a satisfactory number of orders for heating appliances and hollow ware. They have been able to supply this demand, with the exception of percolators, on which they are unable to get delivery. Prices are holding firm except on wire. A few small houses are making concessions on other lines because of a need for cash, but this is not widespread enough to hurt the market to any extent.

Wire.—Quotations are nominally on the 23-cent base, but there are numerous cases of sales being made on a base as low as 19 cents for both rubber-covered and weatherproof and as low as 20 cents for magnet wire. Jobbers continue to carry heavy stocks of rubber-covered and weatherproof, but their stocks of magnet wire are not overlarge. There is very little demand.

Sockets.—Jobbers have more than enough to take care of a fairly steady demand. Lighting installations and additions are becoming more frequent in homes, plants and office buildings with the increase in the hours of darkness, and this is keeping the demand fairly strong. Pull sockets are quoted at 51 cents, key sockets at 28½ cents and keyless at 25 cents.

Non-Metallic Flexible Conduit.—Jobbers have stocks slightly over normal and are finding their interchange agreement useful. Demand is fair; $33 per 1,000 ft. in 5,000-ft. lots is a representative quotation for the ½-in. size.

Tape.—Demand has shown a slight increase, but jobbers have supplies large enough to take care of it. Both friction and rubber tape are quoted at 47 to 50 cents per pound.

Fixtures.—Fixture manufacturers and jobbers report that sales of the staple lines of fixtures have fallen off greatly but that this has been made up by the increase in demand for special work. Many buildings started last summer are reaching the stage where lighting fixtures may be installed. A slight slump is looked for in the early part of 1921 when this work has been completed.

Lamp Cord.—Jobbers have large stocks and demand is remaining steady though below normal. The silk cord is not in as large supply as the cotton-covered. No. 18 twisted pair cotton-covered is quoted at $16.75 per 1,000 ft. and silk-covered at $21 per 1,000 ft.

Lamps.—Stocks of lamps are good though not entirely complete. Demand is growing steadily as the winter sea-

son advances, though it is not expected to be as heavy as that of last year.

Fuse Plugs.—Demand is remaining normal and stocks are ample to take care of it.

SAN FRANCISCO

Compared with conditions of December, 1919, this year records a very marked difference. Last year stocks were practically non-existent and there was an early Christmas shopping season, whereas this year there are not only big stocks of both wiring and counter material but the buying public is holding off to an unprecedentedly late hour. Collections are more than holding their own because tighter conditions have produced more vigilance on the part of credit managers, so that the general average of collections is still well below fifty days. New credits are being cautiously extended, especially in districts where crops have been affected by weather conditions or other local causes. Credit managers state that they are receiving very few applications for credit from new firms. There has been a noteworthy effort by California power companies to market their bonds, especially among the electrical fraternity. For years lack of sufficient money has hampered the extension of much-needed electrical power, but it seems as though the answer has been found in widespread public subscription.

Motors.—For the first time in several years factory deliveries of motors are more than keeping pace with the local demand. The deliveries of sizes larger than 10 hp. are particularly good. After years of shortage there are plenty of single-phase motors in the smaller horsepowers. However, deliveries of two-phase and three-phase motors in the 5-hp. size are still slow.

Lamps.—Lamp stocks are very good and jobbers are able to keep their stocks down to an average of a forty-five-day basis. Dealers' stocks have been carefully edited, with the result that they are not topheavy in certain sizes and are well assorted.

Conduit.—Building operations have dropped off, and there are accumulated stocks on the Pacific Coast. These are not serious, because building is urgently needed, whatever its cost.

Vacuum Cleaners.—Dealers are stocking a variety of makes, which has resulted in good factory sales for nearly all manufacturers. Prices have been steady with little likelihood of any startling recessions. Christmas sales have been disappointingly low.

Wire.—Rubber-covered wire stocks are good, although in some of the larger sizes jobbers report considerable accumulations.

Schedule Material.—While the housing situation is desperate, it is felt that there must be plenty of building to meet the situation. There are large construction plans for the near future, and in fact it is estimated that there is $10,000,000 worth of bank buildings alone laid out for the San Francisco Bay region. Schedule material is beginning to accumulate in the jobbers' stocks because of better factory deliveries and a marked return to hand-to-mouth buying by contractors. Snap switches in small sizes are moving well after several years of comparatively low sales in comparison with push switches.

SEATTLE—PORTLAND

Business in Seattle and the Puget Sound territory during the past week showed no improvement worth mentioning. Both jobbers and dealers state that without a doubt this year's Christmas business has been the poorest in years. Stocks, generally speaking, are a trifle heavier than necessary because of the increasing unwillingness on the part of the public to buy. Building, in Seattle particularly, has virtually stopped, but some authorities believe it will revive around inauguration time. Contractor-dealers and small dealers are being hard hit.

Portland district reports business rather slow; in fact, business conditions throughout Oregon, especially in the smaller towns, indicate a marked slump in trade. There seems to be a general feeling of depression, and the talk is mainly of exceptionally poor business for the next few months. The principal reason for this condition seems to be that farmers are holding their wheat and fruit waiting for higher prices, thereby tying up money that should be in circulation. Moreover, increases in freight rates have seriously interfered with lumber shipments East and have resulted in shutting down many mills. The wool market also is in very poor condition. The situation in regard to three of the leading industries of the section has affected business conditions very seriously, and the result is becoming more apparent each week. The credit situation is in poor condition and collections are kept up to present standards only by persistent effort. All over the Northwest there is a considerable amount of idle labor. Contractors in this territory state that business is quieting down appreciably, with the future not particularly bright.

Farm-Lighting Plants.—From all over the Northwest come reports that these plants are not moving as well as expected. In nearly every locality stocks are in good shape and replacements are easy to make. In an effort to improve sales jobbers are guaranteeing prices on plants for six months so that the dealer and purchaser will be protected.

Hollow Ware.—Stocks are short and will undoubtedly be exhausted when Christmas sales are completed. In fact, an extreme shortage in percolators, toaster stoves, etc., is apparent at present. Stocks of electric irons are in good shape and the movement is satisfactory.

Fractional Motors.—Stocks are improving very fast and demand is light.

Rubber-Covered Wire.—During the last five weeks prices have dropped 25 per cent and the tendency is still downward. Demand is exceptionally light and stocks are becoming well filled.

SALT LAKE CITY—DENVER

One of the most hopeful signs of this stressful business era is the co-operative effort bankers are putting forth to prevent excessive liquidation on the part of dealers and jobbers. They are showing a disposition to extend time on paper to the point of extreme leniency, realizing that stringent measures would bring about a general condition of business demoralization. The Western Branch of the Federal Reserve Bank is right back of all its client institutions in this constructive movement. Electrical dealers are making vigorous appeals in their holiday advertising and seeing to it that electrical merchandise is not overlooked in the selection of gifts. Useful lines are being especially featured, eleventh-hour Christmas shopping has shown a gratifying increase in rural districts, and the response is particularly good. Farmers have recently received substantial checks for their beet crop and are showing no tendency to hoard. Business has experienced a noticeable pickup in rural districts.

Radiant Heaters.—A price range from $12.50 to $14 is being advertised. The season for good selling is past and the demand is off. Dealers are pretty well cleaned up on stocks.

Percolators.—This line is in especial favor as gifts and they are reported going well in most sections. Dealers are well stocked, and prices run from $12.50 to $29.50.

Waffle Irons.—The demand is rather light; the average price is quoted around $20.

Curling Irons.—There is not much call for these except among well-to-do persons; a range of price is from $7 to $8.

Chafing Dishes.—These are perhaps the most popular in the hollow-ware line, especially with Christmas shoppers, and sales are good.

Washers and Cleaners.—While dealers generally have been driving hard on these two lines in all their selling efforts the response has not been satisfactory. Buyers still hesitate over investments involving any considerable outlay of money. There is a decided disposition to wait and watch for developments.

NEW APPARATUS & APPLIANCES

A Record of Latest Developments
and Improvements in Manufacturers' Products
Used in the Electrical Field

Clip Connector for Large Capacity

A spring clip has been placed on the market by the Mueller Electric Company, Cleveland, Ohio, for testing



CARRIES 500 AMP. WITHOUT OVERHEATING OF JOINT

motors, transformers, etc., requiring up to 400 amp. or 500 amp. The clip is made of copper containing sufficient alloy to give the necessary stiffening effect when combined with the reinforcing flanges on the sides. There are no teeth in the jaws, but a sort of hair-lip effect is used to hold the clip onto a stud or terminal. The opening of the jaws is sufficient to take a 2-in. boiler pipe, and the pressure exerted by the spring is about 50 lb. A copper connection shunts the hinged joint. This keeps heavy currents away from the spring and prevents its overheating.

Portable Phase-Sequence Indicator

To enable phase sequence to be determined easily the States Company, Hartford, Conn., is placing on the market a light and compact indicating device. It is so designed that when the phases of a circuit are connected to the binding posts a pilot lamp set into



LAMP INDICATES DIRECTION OF PHASE ROTATION

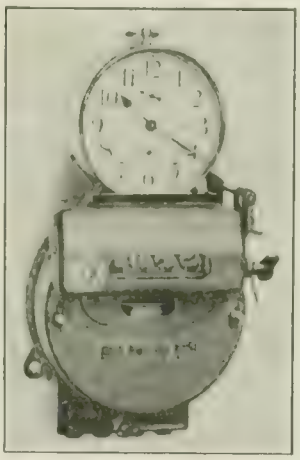
a recess in the case indicates by its brightness or dimness the direction of phase rotation. A push-button in the case reverses two of the leads and provides the contrasting indications of the lamp by modifying the magnetic-flux resultant of the interior coil windings. The device has no moving parts and weighs less than 3 lb.

Cigar Lighter

The midget-type cigar lighter developed by the Duralectric Corporation, Jamestown, N. Y., for home use is finished in mahogany and consumes about 20 watts. This type is built for 110-115 volts and 60 cycles.

Meter-Reading Device

For use on watt-hour and polyphase meters the Economy Appliance Company, Waterloo, Iowa, is manufacturing a meter reading and recording device. A clock is provided for operating the device at any specified time for recording the meter reading on a card especially made for that purpose.



RECORDS READING AT SPECIFIED TIME

Watchman's Clock System

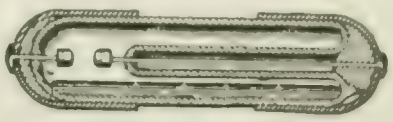
The E. Howard Clock Company, Boston, Mass., has developed a watchman's clock system requiring but two wires per circuit, with an indefinite number of boxes on a circuit connected in multiple, each making its own distinctive number record. The station number and time of recording are shown as a perforated record in a paper dial.

Automobile Test Set

The F. B. test set, manufactured by the F. B. Electric & Manufacturing Co., Detroit, Mich., consists of three ammeters and three voltmeters specially designed for use in making, with apparatus in place, necessary tests to determine starting and lighting troubles. Instruments are contained in one case, with which go two sets of cables. Zero center correction may be applied, and a special scale is shown in different colors and special markings for making cadmium tests.

Mercury Contactor Fits Fuse Clips

The Absolute Con-Tac-Tor Company, 127 North Dearborn Street, Chicago, placed on the market a hermetically sealed circuit-breaking device which can be used as a switch or to make and break an electric circuit rapidly. The contactor consists of a glass tube containing a certain quantity of mercury, an inert gas to prevent oxidation or



CAN BE BUILT INTO CONNECTOR OF ELECTRIC IRON

combustion, and two central electrodes with a gap between. The electrodes are connected to outside brass caps at each end of the tube. The simplest type of these contactors is operated by being tilted so that the mercury makes and breaks the circuit between the electrodes.

In the relay form of construction the necessity of tilting is eliminated by the use of a hollow iron cylinder which is lined with an inner sleeve of porcelain. The gap between the electrodes is inside of the iron cylinder, which is actuated by a magnetic coil around the glass tube.

Remote-Control Panel for Radio Operation

To save time and labor in the operation of radio sets of substantial size, the Wireless Specialty Apparatus Company, Boston, is just placing on the market a remote-control panel designed to govern important circuit adjustments



APPARATUS MAY BE INSTALLED WHERE CONVENIENT

at a distance from the main apparatus assembly. This equipment is being marketed for 2-kw. sets, is being built for 5-kw. sets and may be built soon for units up to 30-kw. rating.

MANUFACTURERS' ACTIVITIES

Record of Changes Affecting Sales and Distribution
Together with Trade Personals and Notes on Foreign Trade,
Jobbers' News and New Trade Literature

THE MATTHEWS ENGINEERING COMPANY, Monroe and Kings Street, Sandusky, Ohio, will start work at once on the erection of an addition, 100 ft. x 150 ft. to cost about $75,000. The company manufactures isolated electric lighting plants.

THE DUPLEX STORAGE BATTERY COMPANY, Milwaukee, organized about a year ago with a capital stock of $60,000, has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $350,000, of which $70,000 is invested in Wisconsin. The company has moved its works from Milwaukee to Beaver Dam, where it occupies the former factory of the Beaver Dam Manufacturing Company, which it has remodeled.

THE GENERAL IGNITION & BATTERY COMPANY, 347 Florida Street, Milwaukee, Wis., is erecting an addition, two stories, 50 ft. x 65 ft., to its plant for manufacturing and repairing electrical automotive devices, storage batteries, etc.

THE BLACK & DECKER MANUFACTURING COMPANY, Towson Heights, Md., has established a new branch office at 303 Penn Avenue, Pittsburgh, Pa., in charge of W. D. Royer, formerly sales engineer of the Robbins Electric Company, Pittsburgh. This office will be the headquarters for the Black & Decker sales force in western New York, western Pennsylvania and the northwestern part of West Virginia. A service station has also been established at the same address.

THE WHITMAN ELECTRIC MANUFACTURING COMPANY, 352 South Avenue, Whitman, Mass., has enlarged its plant and is anticipating manufacturing other lines of electrical supplies in the near future. Arrangements have been made by the company with J. J. Wirtner, Wells Fargo Building, San Francisco, to act as its representative on the Pacific Coast. Negotiations are under way at the present time to secure a representative in Chicago to cover that district.

THE AMERICAN BLOWER COMPANY, 141 Broadway, New York City, manufacturer of mechanical draft equipment, fans, motors, etc., has increased its capital stock from $1,500,000 to $3,750,000. The company has plants at Green Island, N. Y., and Detroit, Mich.

THE SIMMS MAGNETO COMPANY, North Arlington Avenue, East Orange, N. J., is contemplating increasing its capital stock from $1,500,000 to $2,000,000. A bond issue of $500,000 is also under consideration.

THE WESTINGHOUSE UNION BATTERY COMPANY, Swissvale, Pa., which now occupies three stories in a building at the plant of the Union Switch & Signal Company, Swissvale, it is reported, contemplates the erection of new works on adjoining property. The present plans provide for increasing the output to three times the present capacity.

E. W. CHARLAND, Tilton, N. H., manufacturer of mica insulating materials, is enlarging his plant and installing new machinery to cut and to grind mica. When improvements are completed 1,000 lb. of mica washers will be cut per day.

THE AMERICAN BOSCH MAGNETO CORPORATION, Springfield, Mass., has enlarged its sales personnel at both the branches and main office. T. C. Mills, who had charge of the New York branch, has been advanced to district sales manager for the Eastern district. W. G. Brown, formerly branch manager at Chicago, has been made district sales manager of the Western district. M. Tost, former manager of the Detroit branch, has been advanced to district sales manager for the Central district. C. S. Stanley, who formerly acted as assistant branch manager of the New York branch, has been made manager. A. K. Chambers, formerly of general sales department at Springfield, Mass., has been appointed manager of the Chicago branch. R. S. Davy, until recently manager of the Packard Motor Truck Company at Allentown, Pa., has been appointed branch manager at Detroit.

THE VATTER COMPANY, Louisville, Ky., manufacturer of batteries, etc., has increased its capital stock from $20,000 to $40,000.

THE NE PAGE-MCKENNY COMPANY, Seattle, Wash., electrical contractor and manufacturer, is planning to erect a two-story building, 61 ft. x 131 ft. to cost about $40,000.

THE LOUISVILLE ELECTRICAL MANUFACTURING COMPANY, 660 South Second Street, Louisville, Ky., is planning to erect a new plant, 60 ft. x 150 ft., for the manufacture of portable electric tools.

THE FRANKLIN APPLIANCE CORPORATION, Elizabeth, N. J., has filed notice of change in name to the Franklin Conduits Company. The company manufactures conduits and other electrical specialties.

LANDERS, FRARY & CLARK, New Britain, Conn, will soon begin the erection of two manufacturing buildings, one 50 ft. x 150 ft. and the other 50 ft. x 160 ft.

THE DE FOREST RADIO COMPANY, 1415 Sedgwick Avenue, New York City, recently lost its plant by fire. The damage is estimated at about $500,000.

THE BRENNER MANUFACTURING COMPANY, 19 Gray Avenue, Utica, N. Y., manufacturer of air compressors, etc., has filed notice of increase of capital stock from $250,000 to $500,000.

THE LEWIS & ROTH CORPORATION, Philadelphia, announces a change in name to the Electric Power Equipment Corporation. This change affects the name only. The personnel practically remains the same, as does the sales policy and manufactured product. All apparatus which was formerly manufactured by the Lewis & Roth Corporation will hereafter be designated as "Elpeco lines of equipment."

THE MERCURY MANUFACTURING COMPANY, 4118 South Halsted Street, Chicago, announces that J. R. Lewis has taken over the Cleveland office, succeeding Conrad Hibbeler, now in charge of the New England territory. Mr. Lewis has been with the Cleveland office as a salesman for a number of years. He will be assisted by E. S. Dawson, who will handle the Cincinnati territory as well.

THE M. W. DUNTON COMPANY, 150 Niagara Street, Providence, R. I., is moving into a new factory recently purchased, where it will have five times the space it formerly occupied.

THE AUTOMATIC RECLOSING CIRCUIT BREAKER COMPANY, Columbus, Ohio, announces the appointment of the W. D. Hammer Company, 508 Traction Terminal Building, Indianapolis, Ind., as its representative in the State of Indiana and western Kentucky.

THE LAKE ENGINEERING COMPANY announces the removal of its offices to 53 West Jackson Boulevard, Chicago.

THE WESTERN ELECTRIC COMPANY, 195 Broadway, New York City, has leased a one-story building at 505 St. Mark's Avenue, Brooklyn. The building contains about 20,000 sq.ft. and will be used for general works service.

STRAUSS & COMPANY, 306 West Fifty-second Street, New York City, have leased the property at 621-23 West Forty-second Street, on which they propose to establish a new plant, including an electric repair and construction department. The company manufactures metal display signs.

THE AMERICAN INSULATING MACHINERY COMPANY, Fairhill and Huntingdon Streets, Philadelphia, has filed notice of increase in capital stock from $50,000 to $200,000.

THE JOHN E. THROPP'S SONS, Lewis Street, Trenton, N. J., has acquired property in the vicinity of Fair Street for future extensions. The company manufactures rubber working machinery, mechanical stokers, etc.

THE VIRGINIA ELECTRIC & MACHINE WORKS, Charleston, W. Va., has filed notice of increase in capital stock from $50,000 to $100,000.

THE MUTUAL ELECTRIC & MACHINE COMPANY, Wheeling, W. Va., has increased its capital stock from $100,000 to $500,000.

THE INTERNATIONAL TIME RECORDING COMPANY, Binghamton, N. Y., has filed notice of increase in capital stock to $2,075,000.

THE NORTH AMERICAN STORAGE BATTERY COMPANY, it is reported, is planning to establish a plant at 40 West Pratt Street, Indianapolis, Ind., where it has leased 17,000 sq. ft. of floor space. The company proposes to manufacture starting and lighting batteries for motor cars and batteries for electric cars. H. E. Von Grimmenstein is president.

THE SUPERIOR ELECTRIC COMPANY, Pittsburgh, Pa., has leased a three-story building at 8 South Sixth Street, Philadelphia, which will be used as a branch factory. Improvements will be made to the building. The company manufactures electrical specialties.

THE NOVELTY ELECTRIC SIGN COMPANY, 165 Eddy Street, San Francisco, has leased a one-story and basement building to be erected at 435-37 Turk Street, which will be used for extensions.

Supply Jobbers' Notes

THE CAROLINA STATES ELECTRIC COMPANY, which was organized as a jobbing house at Charlotte, N. C., last April, has made unusual progress. Although the company has devoted its attention entirely to the states of North Carolina and South Carolina, it has developed a business among central stations, industrial plants and contractor-dealers in eight months which has called for a stock exceeding $150,000 and a large staff to handle it. It was originally intended to use three salesmen in soliciting business, but this has been found unnecessary owing to the volume of orders that have been received by mail. Eugene B. Graham, vice-president of the Charlotte Supply Company, one of the oldest mill supply houses in the South, is president, and H. T. Long, for seven years with the Westinghouse Electric & Manufacturing Company in Charlotte as manager of the lamp division, is vice-president. J. P. McMillan, for eight years in charge of the supply and apparatus department of the Westinghouse Electric & Manufacturing Company, is secretary, and W. A. Emerson, formerly in charge of the textile motor division of the Westinghouse Electric & Manufacturing Company, is treasurer. The company does a strictly distributing and jobbing business and has a large warehouse adjoining the offices of the Southern Power Company at Charlotte. The president of this company is inactive owing to his connection with the Charlotte Supply Company, and H. T. Long, vice-president, is in charge of the company's affairs.

Foreign Trade Notes

LACK OF FIRE-ALARM SYSTEMS IN SOUTH AMERICA.—George Hough Perry, director general of the American National Expositions, who is in Buenos Aires, Argentina, completing details for the opening of the United States Manufactures Exposition, March 4, 1921, writes that there is an excellent opportunity for American manufacturers of fire-alarm, fire-extinguishing and fire-prevention apparatus to develop trade in South America. In Buenos Aires, with a population of more than 2,000,000, Mr. Perry states there is no electric fire-alarm system.

THE MARCONI WIRELESS TELEGRAPH COMPANY OF CANADA, LTD., it is announced, has effected a merger with the Canadian General Electric Company, Toronto, Ontario. This follows upon the merger effected some time ago in the United States between the American Marconi Company and the General Electric Company of America under the name of the Radio Corporation of America. By this merger all of the Marconi interests in the British Empire now share in the use of all wireless patents of the General Electric Company of America.

ELECTRICAL GOODS IN SPAIN—The Department of Commerce, Bureau of Foreign and Domestic Commerce, Washington, D. C., has issued Special Agents' Series No. 197, entitled "Electrical Goods in Spain." It is a report by Trade Commissioner P. S. Smith on the markets for electrical goods in Spain and deals with existing generating plants, projected hydro-electric developments, electrical manufacturing and the future of the industry in that country.

HENRY S. MOOS, director tecnico, American Machinery Corporation, Sociedad Anonima Espanola, Zerrilla, 25, Madrid, has returned to Spain to present to Spanish users American machine tools and machinery. While in America Mr. Moos, in behalf of his associated companies, the American Machinery Corporation, S. A. E., Madrid, and Sindicato de Maquinaria Americana, Bilboa, has made arrangements to represent, among others, the following manufacturers: Cincinnati Electric Tool Company, Cincinnati Machine Tool Company, Detroit Electric Furnace Company, Heald Machine Company, Watson Stillman Company, United States Light & Heat Corporation, Curtain Supply Company and Globe Electric Company.

Trade Publications

COAL COMBUSTION.—"Automatic Combustion Control," descriptive of the Gray system of automatic control, is being issued by the Automatic Fuel Saving Company, 549 West Washington Boulevard, Chicago.

STEEL POLES.—The National Tube Company, Pittsburgh, Pa., has issued "National" bulletin 14C, a forty-seven page booklet on "National" tubular steel poles, with attractive photographs of installations.

CONTACTORS.—A bulletin describing the "absolute contactor," a mercury-contact form of switch, is being distributed by the Absolute Con-Tac-Tor Company, 127 North Dearborn Street, Chicago.

LIGHTING.—A second set of lighting data bulletins has been issued by the Edison Lamp Works of the General Electric Company as part of the company's lighting data library. These compromise bulletins L. D. 115 to 124 inclusive covering respectively lighting of armories and gymnasiums, the Edison "Mazda" lamp for stereopticon service, calculation of lighting installations, the history of the incandescent lamp, the manufacture of the Edison "Mazda" lamp, lighting of coal mines, medical lighting including hospitals and dental offices, commercial photometry, and lighting of shoe factories.

New Incorporations

THE BIGHEART (OKLA.) LIGHT & POWER COMPANY has been incorporated by Horace B. Wild, P. J. Minck, both of Bigheart, and J. C. Blankenship, Yale, Okla. The company is capitalized at $50,000.

THE GENERAL RESEARCH CORPORATION, Providence, R. I., has been incorporated with a capital stock of $300,000 to manufacture electrical specialties. The incorporators are Henry C. Hart, Patrick Curran and Karl Karkas, 147 Wheeler Avenue, Cranston, R. I.

THE COWLES ELECTRIC COMPANY, New Britain, Conn., has been incorporated by W. B. and C. W. Cowles and F. J. C. Ensworth, all of New Britain. The company is capitalized at $25,000 and proposes to manufacture electrical products.

THE WARE ELECTRIC COMPANY, Brockton, Mass., has been incorporated by Charles F. Hutch, Arthur G. Cole and Herman Dewhurst, East Bridgewater, Mass. The company is capitalized at $100,000 and proposes to manufacture electrical products.

THE ELECTRIC REGULATOR MANUFACTURING COMPANY, New York City, has been incorporated by J. G. Hockman, M. Samburg and A. M. Levy, 195 Chrystie Street. The company is capitalized at $100,000 and proposes to manufacture electrically operated regulating apparatus and other equipment.

THE PERFECTION ELECTRIC EQUIPMENT COMPANY, Newark, N. J., has been chartered with a capital stock of $50,000 to manufacture electrical products. The incorporators are C. C. Farr and Edward C. Daniels, 411 Halsey Street, Newark, N. J.

THE INLAND SPECIALTY COMPANY, 1169 North Rose Street, Chicago, Ill., has been incorporated by M. Seigel, S. L. Wellins and F. O. Seigel. The company is capitalized at $[illegible] and proposes to manufacture electrical toys.

THE LINCOLN LIGHT CORPORATION, Milwaukee, Wis., has been organized with a capital stock of $250,000 by Adolph Herbert and James Mercer, 19 Twenty-sixth Street, Milwaukee. The company proposes to manufacture generating equipment.

Construction News

Projects, Plans, Bids and Contracts Contemplated or Under Way

New England States

MANCHESTER, N. H.—The Manchester Traction, Light & Power Company has increased its capital from $3,864,000 to $4,250,000, the proceeds to be used for new construction and general financing.

CAMBRIDGE, MASS.—Extensions and improvements to the power house of the C. A. Cook Company, 16 Osborn Street, will be made in connection with a plant extension to be erected. The cost is estimated at $30,000.

NEWBURYPORT, MASS.—The Newburyport Gas & Electric Company has applied to the Department of Utilities for permission to issue $850,000 in bonds to be used for expansion, financing, etc. A. W. Wood is president.

NORWICH, CONN.—The street-lighting committee of the Chamber of Comerce is making investigations in view of installing an ornamental street-lighting system. R. D. Judd is chairman of the committee.

Middle Atlantic States

BROOKLYN, N. Y.—Plans have been prepared for the Kings County Lighting Company, New Utrecht Street, for the erection of a generating plant at 5402 First Avenue to cost about $25,000.

BURDETT, N. Y.—The village officials have been granted authority by the State Public Service Commission to operate an electric lighting plant at this place and to secure energy from Watkins by means of a transmission line in Hector.

POUGHKEEPSIE, N. Y.—The Central Hudson Gas & Electric Company has filed notice of increase of $900,000 in its capital for general expansion.

READING, PA.—The installation of an electrically operated water purification system is planned by the City Council at a cost of about $600,000. E. L. Neubling is city water engineer.

WILLIAMSPORT, PA.—Bids will be received by H. A. Sterner, secretary of the School Board, until Jan. 13 for furnishing and installing electric light equipment for the Theodore Roosevelt and the Andrews G. Curtin Schools.

BALTIMORE, MD.—The Potomac Power & Development Company, care of W. H. Stineman and A. M. Quick, engineers, 418 Equitable Building, has had preliminary plans and surveys made for the development of a project to include the erection of a dam, 1,200 ft. long and 65 ft. high and a main dam, 1,200 ft. long and 22 ft. high; a 20,000-hp. power plant, including the installation of five 5,000-hp. vertical turbines, generators and three-phase, 60-cycle, 13,200-volt transmission lines; a 30,000-hp. power plant including the installation of five 700-hp. vertical turbines and generators; flood gates, 18 ft. x 30 ft., etc.

BALTIMORE, MD.—The Consolidated Gas & Electric Company, Lexington Building, is arranging a construction and improvement program for the coming year which includes $5,652,415 to be expended for the electrical department.

BALTIMORE, MD.—The Lafayette Mill & Lumber Company, Pulaski and Lafayette Streets, contemplates the erection of a new power house at its property.

BALTIMORE, MD.—Plans have been filed for the United Railways & Electric Company for the erection of an [illegible] to the present power & Light and Howard Street.

CHEVERLY, MD.—The erection of the McCready Memorial Hospital including a 42-ft. x 45-ft. power house, is contemplated [illegible] & Brown, 109 North Dearborn Street, Chicago, Ill., are architects.

FAIRMONT, W. VA.—The Monongahela Valley Traction Company contemplates the [illegible] high-tension lines from Hutchinson to Clarksburg.

GRAFTON, W. VA.—The city officials plan to remodel the street-lighting plant at a cost of about $120,000. S. T. Scanlon is engineer.

CLARKSVILLE, VA.—The [illegible] Development Company, Richmond, contemplates the erection of a hydro-electric plant on the Roanoke River at Buggs Island.

PORTSMOUTH, VA.—The City officials contemplate the installation of an electric power plant. J. P. Jervey is city manager and W. L. Davis is mechanical engineer.

RADFORD, VA.—The Norfolk & Western Railway, care of J. E. Crawford, Roanoke, contemplates the erection of a power plant, 60 ft. x 90 ft. The installation of a signal system is also planned.

North Central States

READING, MICH.—It is reported that the power house and other parts of the plan of the Acme Chair Company have been destroyed by fire causing a loss of about $150,000.

TRAVERSE CITY, MICH.—The city officials will have plans prepared for the erection of a 500-kw. steam-electric power plant to cost about $90,000.

CLEVELAND, OHIO—M. Makof, 3533 Woodland Avenue, contemplates the erection of a theater and office building at a cost of about $2,000,000. The company also plans to generate its own electricity.

DECATUR, IND.—Bids will be received by the city clerk after Jan. 1 for the erection of a municipal power plant.

CHICAGO, ILL.—The Sanitary District of Chicago, 900 Harper Building, contemplates the erection of a power house at East 125th Street, to cost about $538,000.

SHEBOYGAN, WIS.—The Board of Education has had plans revised for the erection of a central high school, and bids will be received about Jan. 1 for the first unit including a power and boiler house. The total cost is estimated at $1,250,000. Childs & Smith, 64 East Van Buren Street, Chicago, Ill., are architects.

Southern States

LENOIR, N. C.—The Catawba Valley Light & Power Company, Morgantown, contemplates the erection of a hydro-electric plant on Wilson Creek.

GREER, S. C.—Bonds to the amount of $40,000 have been voted for the erection of a transmission line from this place to Fair Forest to connect with the lines of the Blue Ridge Power Company.

BOYNTON, FLA.—Bonds to the amount of $10,000 have been voted for improvements to the electric light plant, etc.

SARASOTA, FLA.—Bonds to the amount of $35,000 have been sold for extensions to the municipal electric light plant.

ANNISTON, ALA.—The Alabama Power Company, Birmingham, contemplates the [illegible] of its Noble Street line at a cost of $40,000.

MILLINGTON, TENN.—An election will be held for the purpose of submitting to the voters a proposition to issue bonds to the amount of $20,000 for the erection of a new electric light and power plant.

OKLAHOMA CITY, OKLA.—Preliminary plans have been prepared for the erection of the American Legion Hospital to cost about $2,000,000. Plans include a 1,000 hp. power plant. C. P. Needer and M. Jayne, Empress Theater Building, are associate architects.

RANGER, TEX.—The [illegible] Association will provide funds for the installation of fifteen blocks of street-lighting system at this place.

SAN ANTONIO, TEX.—The Hot Wells Mineral Bath & Hotel Company contemplates the erection of a dam across the San Antonio River for a hydro-electric plant to develop 140 hp. Plans include the installation of four turbines.

SNYDER, TEX.—The Snyder Utilities Company contemplates improvements to its electric light and ice plants.

Pacific and Mountain States

SPOKANE, WASH. — The Washington Water Power Company is having plans prepared by their engineering staff for immediate installation of a hydro-electric plant on the Spokane River to generate 14,000 hp. Contract for a hydraulic turbine wheel has been awarded to the William Cramp & Sons Ship & Engine Building Company, Richmond and Norris Streets, Philadelphia, Pa. Other contracts for generators, electric equipment, power house, etc., will be awarded as soon as plans are ready for submission to contractors.

WALLA WALLA, WASH. — The City Council recently discussed plans and specifications submitted by E. B. Hussey, engineer, Seattle, for the development of 900 hp. on Mill Creek. Mr. Hussey estimates the cost of the project at $381,000.

JEFFERSON, ORE.—Preliminary plans and estimates are being prepared by J. H. Cunningham, consulting engineer, Portland, for the erection of a proposed hydro-electric plant to develop about 1,500 hp. at this place.

KLAMATH FALLS, ORE.—The city budget of 1921 includes $10,000 for the installation of a fire-alarm system.

PORTLAND, ORE.—The initial movement by residents of this place to have all electric wires placed underground has been launched.

BRIDGEPORT, CAL.—The Southern Sierras Power Company, Riverside, has acquired the Lee Vining Creek Falls for hydro-electric power development. The electrical energy to be generated has been estimated at from 10,000 hp. to 20,000 hp.

KERMAN, CAL.—An election will be held on Dec. 27 to vote on the question of forming a public highway lighting district. D. M. Barnwell is clerk.

PASADENA, CAL.—Announcement has been made by C. W. Koiner, general manager of the municipal light plant, that enlargements will be made during the coming year to cost about $300,000.

RIVERSIDE, CAL.—The proposition to develop a large light and power scheme by Riverside, San Bernardino, Redlands and possibly other cities is under consideration. Mayor Porter of this place is interested.

SAN FRANCISCO, CAL. — The Pacific Gas & Electric Company has applied to the Railroad Commission for authority to issue $10,000,000 in bonds to carry out its hydro-electric construction program, particularly for what is known as the Pit River projects of the Mount Shasta Power Corporation, a subsidiary of the Pacific Company. It is also estimated that betterments and additions to the Pacific Gas & Electric Company's property for the years of 1921 and 1922 will cost in excess of $20,000,000.

SAN FRANCISCO, CAL.—The Sierra & San Francisco Power Company and the Pacific Gas & Electric Company have made joint application to the Railroad Commission for certificate of convenience and necessity for the construction of a power house on the Stanilaus River. Plans include one 7,000-kva. generator, three 2,500-kva. transformers and erection of an 18-mile transmission line, having a voltage of 104,000 volts.

SAN FRANCISCO, CAL. — The Federal Telegraph Company, Hobart Building, is having plans prepared for the erection of four wireless plants in the vicinity of Palo Alto, San Diego and Los Angeles, Cal., and Portland, Ore. The cost is estimated at $500,000, including equipment.

GLOBE, ARIZ.—City Engineer Genin and other contemplate a visit to El Paso, Tex., to investigate the lighting plan for the purpose of securing suggestions for a street-lighting system at this place.

Canada

GRANDE PRAIRIE, ALTA.—The plant of the Grande Prairie Electric Company will be taken over by the city officials on Jan. 1. It is also planned to purchase generator, exciter and transmission equipment in the spring.

PRINCE GEORGE, B. C. — C. Gordon, president of the Dominion Textile Company, 112 St. James Street, Montreal, Que., is interested in a project which includes the erection of a pulp and paper plant at this place to cost about $5,000,000 and the development of power on the Fraser River.

HALIFAX, N. S. — The Nova Scotia Power Commission contemplates the installation of a 20,000-hp. unit.

AVONMORE, ONT.—A by-law will be submitted to the ratepayers on Jan. 3 to vote on authorizing the borrowing of $9,000 for a hydro-electric plant.

HUTTONVILLE, ONT. — Residents of this place have petitioned the Brampton Hydro Commission to supply them with power. The commission estimates that the erection of a new line will cost about $10,000.

Record of Electrical Patents

Notes on United States Patents

(Issued Dec. 7, 1920)

1,360,999. ELECTRIC HEATER; Robert P. Barnstead, Boston, Mass. App. filed Oct. 29, 1919. Water heater cannot burn out.

1,361,017. WATER-HEATING ATTACHMENT FOR INTERNAL-COMBUSTION MOTORS; Oscar B. Clayton and George T. Oberwetter, Houston, Tex. App. filed March 16, 1920. Operates with motor at rest.

1,361,363. DYNAMO-ELECTRIC MACHINE; James Burke, Erie, Pa. App. filed April 23, 1917. Compensated machine with commutating poles.

1,361,425. ELECTRICAL CONNECTING AND SUPPORTING DEVICE; Ernst C. White, New York, N. Y. App. filed Jan. 10, 1920. For hanging and connecting fixture.

1,361,426. ELECTRICAL CONNECTING AND SUPPORTING DEVICE; Ernest C. White, New York, N. Y. App. filed Jan. 17, 1920. Supports and connects fixture on wall.

1,361,432. LOW-POTENTIAL ELECTRICAL SYSTEM AND METHOD OF CHARGING SAME; Hubert K. Wood, Bayside, N. Y. App. filed Nov. 23, 1917. Charging from 110 volts or 220 volts.

1,361,436. MAGNETO; Peter F. Bessy, Whiting, Ind. App. filed Dec. 3. 1918. For ignition.

1,361,437. MEANS FOR AUTOMATICALLY SUPPLYING STORAGE BATTERIES WITH DISTILLED WATER; Edward Blau, Newark, N. J. App. filed March 20, 1919. Maintains proper level.

1,361,442. ELECTRICALLY HEATED PERFORATOR; Alexander B. Campbell, Glasgow, Scotland. App. filed April 24, 1920. For perforating cloth by burning small holes therein.

1,361,448. ELECTRIC SYSTEM; John L. Creveling, Tucson, Ariz. App. filed Sept. 21, 1916. Automobile starter.

1,361,461. ELECTRIC LIGHT STRUCTURE; Max Herskovitz, Chicago, Ill. App. filed Apri 28, 1919. For table lamps.

1,361,486. COMPOSITE SIGNALING SYSTEM; Harold S. Osborne, New York, N. Y. App. fled Dec. 11 1918. Simultaneous telephone and telegraph.

1,361,487. PLURAL DEMODULATION CIRCUITS; Harold S. Osborne, New York, N. Y. App. filed Jan. 6, 1920. Selecting desired frequencies.

1,361,488. PLURAL MODULATION SYSTEM; Harold S. Osborn, New York, N. Y. App. filed March 31, 1920. Signals by carrier currents.

1,361,499. MANUFACTURE OF DRY CELLS; Otto E. Ruhoff, Madison, Wis. App. filed Jan. 30, 1920. No porous separator.

1,361,510. TELEPHONE TRANSMISSION SYSTEM; Ray S. Wilbur, Lyndhurst, N. J. App. filed Dec. 10, 1917. Two-way, two-repeater circuits.

1,361,522. PLURAL MODULATION SYSTEM; Lloyd Espenschied, Queens, N. Y. App. filed March 18, 1920. Telegraph signals by carrier currents.

1,361,533. ELECTRICALLY HEATED AUTOMOBILE HOOD AND RADIATOR COVER; George T. Newell, Jr., Beverly, N. J. App. filed Feb. 2, 1920. To prevent freezing.

1,361,546. DYNAMO-ELECTRIC MACHINE; Peter P. Politowski, Chicago, Ill. App. filed June 23, 1917. Number of poles may be varied.

1,361,556. ELECTRIC HEATER; Herbert E. Welchel and Aaron A. McCray, Indianapolis, Ind. App. filed July 12, 1920. Heater and fan.

1,361,557. ELECTRIC LAMP; Grant Wheat, Corry, Pa. App. filed Jan. 8, 1917. Miner's.

1,361,590. TELEPHONE TRANSMITTER; Henry Koch, Jamaica, N. Y. App. filed Sept. 3, 1919. Used in automobiles.

1,361,623. PUFF IRON; Benjamin Schindler and Jacob G. Viertel, Freeport, N. Y. App. filed June 26, 1919. Standing iron.

1,361,642. LAMP-SOCKET CONSTRUCTION; Oscar S. Swanson, Jamestown, N. Y. App. filed Dec. 10, 1918. Shell body easily engaged with cap.

1,361,650. IGNITION DEVICE FOR GAS STOVES; Joseph Varin, Montreal, Quebec, Can. App. filed Jan. 13, 1920. Attached to lighting circuit.

1,361,651. BATTERY-PROTECTING DEVICE FOR CHARGING AND LIGHTING SYSTEMS; Richard Varley, Englewood, N. J. App. filed Nov. 29, 1919. Protective relay.

1,361,652. WELDING APPARATUS; Miner P. Wetmore, Newark, N. J. App. filed April 29, 1920. For mounting filaments of incandescent lamps.

1,361,675. CURRENT-CONTROLLING DEVICE; Lynde Bradley, Milwaukee, Wis. App. filed Feb. 12, 1916. Compression resistor.

1,361,676. MEASURING AND INDICATING APPARATUS; Henry Brewer, Philadelphia, Pa. App. filed Feb. 21, 1919. Graphic meter.

1,361,710. QUARTZ MERCURY-VAPOR LAMP; Henri George, Paris, France. App. filed April 11, 1919. For alternating current.

1,361,795. HEAT DISTRIBUTER; George E. Latham and William F. Whiteman, San Francisco, Cal. App. filed July 1, 1919. Radiator.

(Issued Dec. 14, 1920)

1,361,800. VOLTAGE-PROTECTIVE DEVICE; Chester T. Allcutt, Wilkinsburg, Pa. App. filed Sept. 1, 1917. Liquid type.

1,361,801. LIGHTNING ARRESTER; Chester T. Allcutt, Wilkinsburg, Pa. App. filed Sept. 1, 1917. Telephone.

1,361,806. CLAMP TERMINAL; Mathew A. Allison, Canebrake, W. Va. App. filed Feb. 5, 1919. Readily applied or disconnected.

1,361,813. RADIO CABINET; Wilfred E. Booth, New York, N. Y. App. filed July 19, 1917. Receiving and sending unit.

1,361,885. AUTOMATIC TELEPHONE SYSTEM; Talbot G. Martin, Chicago, Ill. App. filed Dec. 8, 1917.

1,361,912. SWITCHING APPARATUS; William M. Scott, Tredyffrin Township, Chester County, Pa. App. filed Aug. 29, 1917. Automatic control.

1,361,928. TESTING AND ADJUSTING APPARATUS FOR CORD CIRCUIT; John F. Toomey, New York, N. Y. App. filed May 3, 1917. Indicates improper operation.

1,361,929. MONITORING CIRCUIT FOR TELEPHONE REPEATERS; John F. Toomey, New York, N. Y. App. filed May 18, 1917. Operation of repeater interconnecting two lines may be observed.

1,361,934. MOTOR STARTER; Hermon L. Van Valkenburg, Milwaukee, Wis. App. filed Sept. 7, 1918. Running switch cannot be closed in less than predetermined interval.

1,361,935. MEANS FOR ADJUSTING AND INDICATING THE TRAVEL OF MACHINE OR INSTRUMENT OPERATED BY THE CORE OR ARMATURE OF AN ELECTROMAGNET; Edward C. Villiers, Hendersyde, Ascot, England. App. filed Nov. 12, 1918.

1,361,945. MEANS FOR DELIVERING MATERIAL FROM ROLLS; William M. Wheildon, Ashland, Mass. App. filed April 6, 1918. Taping machine.

1,361,946. BATTERY HAND LAMP; George D. Gallagher, Washington, D. C. App. filed April 13, 1920. Cushioned lamp.

1,361,948. INSULATOR; James L. Widmyer, Minneapolis, Minn. App. filed Sept. 29, 1919. For telephone, telegraph, etc.

1,361,954. COMBINED FOOT SUPPORT AND HEATER FOR VEHICLES; Alfredo Zecchini and Innocente Panza, Turin, Italy. App. filed Feb. 24, 1920. Electrically heated.

1,361,955. METER-TEST DEVICE; Albert P. Ball, Royal Oak, Mich. App. filed July 17, 1917. For customers' meters.

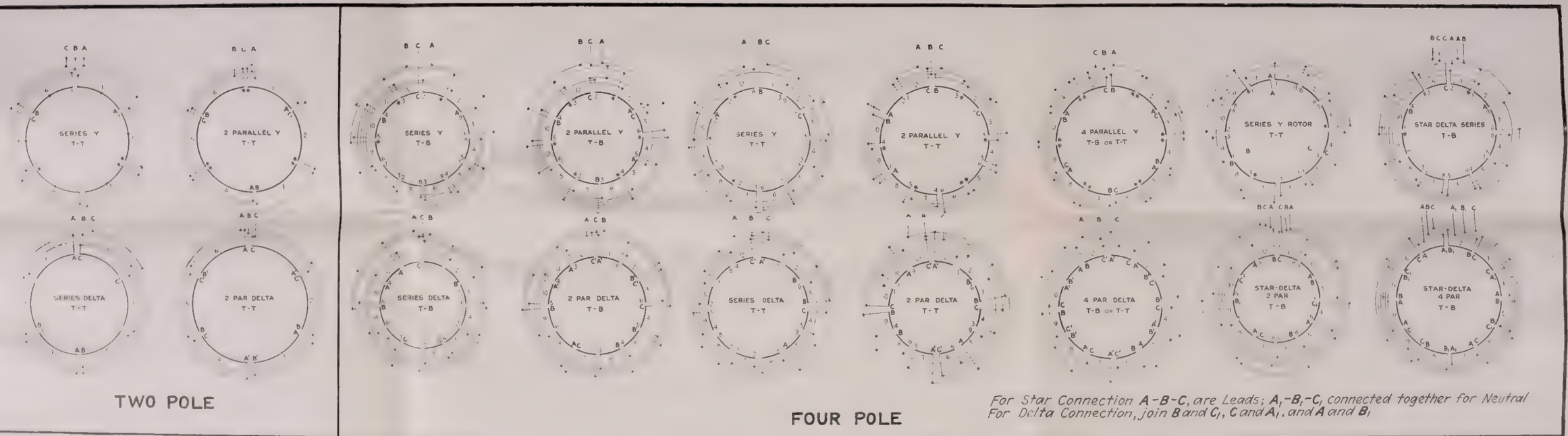
1,361,967. LIGHTNING ARRESTER; Almon W. Copley, Wilkinsburg, Pa. App. filed Sept. 1, 1917. Discharge-gap type.

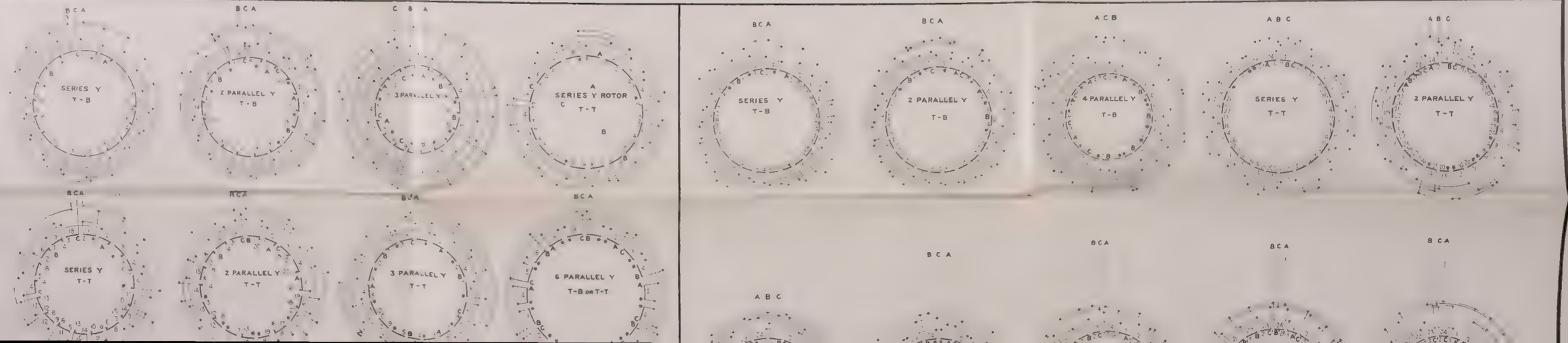
1,361,968. BRUSH HOLDER; John S. Dean, Edgewood Park, Pa. App. filed Feb. 3, 1917. Will not materially injure commutator by accidental engagement.

1,361,980. TELEPHONE SYSTEM; Charles L. Goodrum, Brooklyn, N. Y. App. filed Dec. 30, 1916. Machine switches.

Diagrams and Tables for Connecting Three-Phase, Lap-Wound Induction Motors

Supplement of the ELECTRICAL WORLD, July 24, 1920, for the article "Connecting Three-Phase Induction Motors," page 170, prepared by A. C. Roe, New York Service Department, Westinghouse Electric & Manufacturing Company

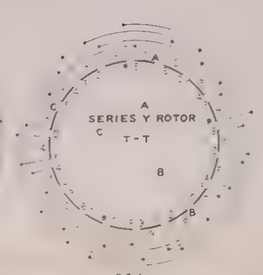






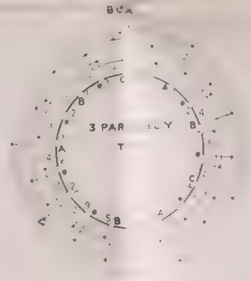






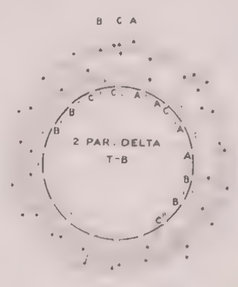


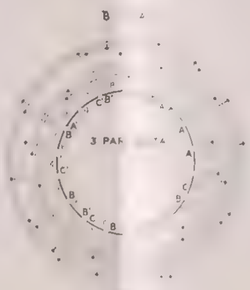


















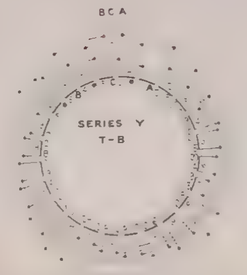


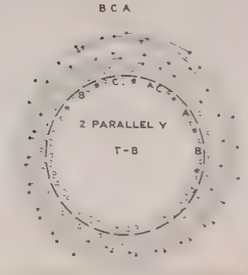


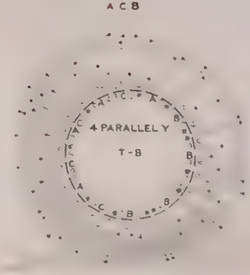


For Star Connection A-B-C, are Leads: A_1-B_1-C_1 connected ...ether for Neutral
For Delta Connection, join B and C_1, C and A_1, and A and B.

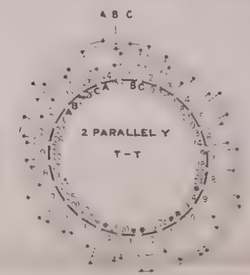
SIX POLE

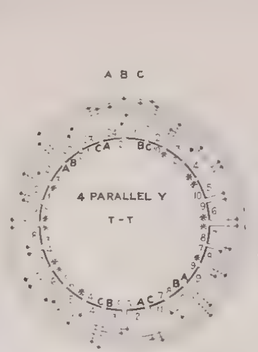


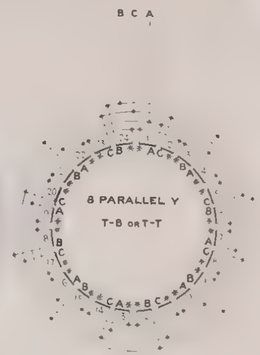














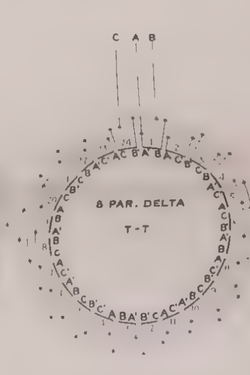




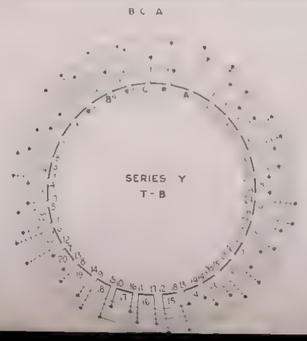


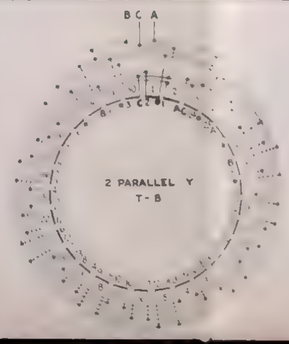




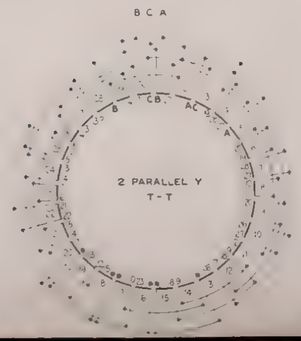


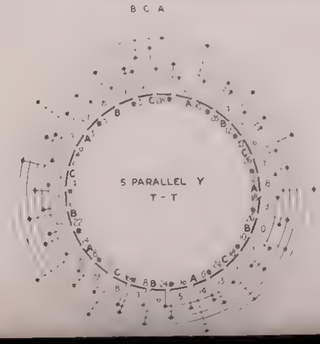
EIGHT POLE



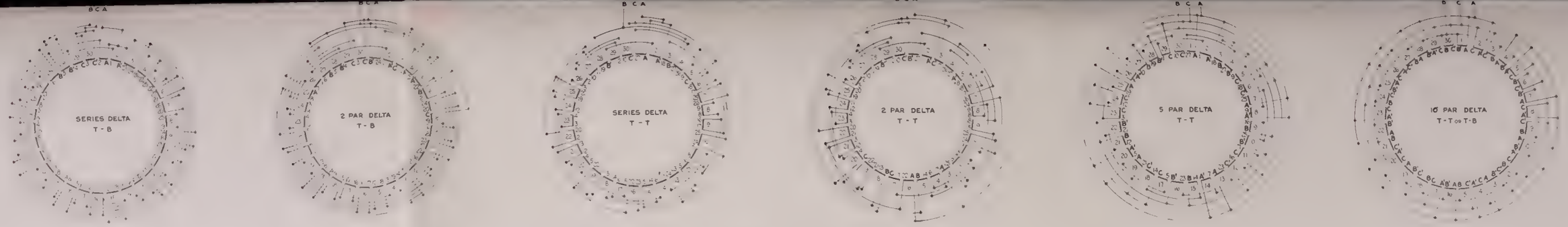




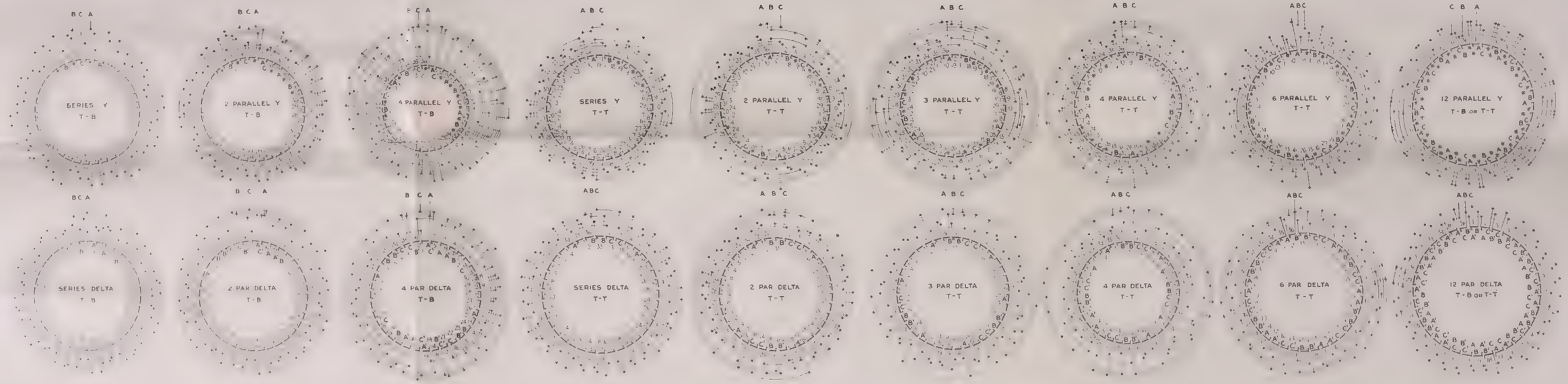








TEN POLE



TWELVE POLE

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MASTER TABLE—NUMBER OF COILS PER GROUP FOR THREE-PHASE MOTORS

A figure mark (*) in the master chart indicates that a coil must be killed each group where the mark appears in the sub-chart. If this mark (*) does not appear in the master chart for the winding in question, then no coil is killed, regardless of what appears in the sub-chart.

A figure mark (*) in the sub-charts indicates that the group has fewer coils one of which is always killed.

A blank space (..) in the master chart indicates that there is no practical group winding for the number of coils and poles.

R.P.M.	No. of Poles	Windings Possible	Total Number of Coils: 12	18	24	30	36	54	60	72	90	84	96	90	108	108	120	126	135	144	150	156	160	168	180	216	240	Windings Possible	No. of Poles
1,800	3,600	2	Series Δ																									Series Δ	2
			2-parallel																									2-parallel	
			Series and 2-parallel																									Series and 2-parallel	
900	1,800	4	4-parallel																									4-parallel	4
			Series and 2-parallel																									Series and 2-parallel	
600	1,200	6	3-parallel																									3-parallel	6
			6-parallel																									6-parallel	
			Series and 2-parallel																									Series and 2-parallel	
	900	8	4-parallel																									4-parallel	8
			8-parallel																									8-parallel	
			Series and 2-parallel																									Series and 2-parallel	
	720	10	5-parallel																									5-parallel	10
			10-parallel																									10-parallel	
			Series and 2-parallel																									Series and 2-parallel	
	600	12	3-parallel																									3-parallel	12
			4-parallel																									4-parallel	

VOLTAGE TABLE—CONNECTION REQUIRED FOR CHANGE IN VOLTAGE WITHOUT REWINDING MOTOR

The original connection is known in the left-hand column. The new connection after the change is known in the right-hand column. The relative voltage resulting from the change is indicated along a line to the right of the original connection and directly under the changed connection. All voltages are in per cent of the original voltage. As an example, suppose it is desired to increase the voltage of a 4-parallel-Y-wound motor from 110 volts to 220 volts. The voltage desired is 200 per cent of the original voltage. Start at the 4-parallel Y winding in the left-hand column, follow to the right until the figure 200 is reached. Directly above the figure 200 is shown the desired connection, which is 2-parallel-Y.

A blank (..) indicates that the connection is not possible. If this table does not give the information required to the change in voltage considered, the motor will have to be rewound.

Connection of Motor Before Change (Voltage = 100)	Connection of Motor After Change—Voltage Below is per Cent of Original Voltage: Series Y	Series Δ	2 parallel Y	2 parallel Δ	3 parallel Y	3 parallel Δ	4 parallel Y	4 parallel Δ	5 parallel Y	5 parallel Δ	6 parallel Y	6 parallel Δ
Y	100	58	50	33	29	19	20	13	17	14.5	11.5	9.6
Series Δ	173	100	87	58	50	33	35	23	29	25	20	17
2-parallel Y	200	116	100	67	58	39	40	26	33	29	23	19
2-parallel Δ	346	200	173	116	100	67	69	45	58	50	40	33
3-parallel Y	300	173	150	100	87	58		39	50	43		29
3-parallel Δ	520	300	260	173	150	100		67	87	75		50
4-parallel Y	400	231	200	150	116	100		77	67	58		39
4-parallel Δ	693	400	346	231	200	173		133	116	100		67
5-parallel Y	500	289	250		144		100				58	
5-parallel Δ	866	500	433		250		173				100	
6-parallel Y	600	346	300	200	173	150		116	100	87		50
6-parallel Δ	1,039	600	520	346	300	260		200	173	150		08

TABLE V—TWO-POLE MOTORS COILS PER GROUP

No. of Coils	Coil Group: 1	2	3	4	5	6
12	1	2	3	4	5	6
18	1	2	3	4	5	6
24	1	2	3	4	5	6
30	1	2	3	4	5	6
36	1	2	3	4	5	6
54	1	2	3	4	5	6
60	1	2	3	4	5	6
72	1	2	3	4	5	6
90	1	2	3	4	5	6
84	1	2	3	4	5	6
96	1	2	3	4	5	6
90	1	2	3	4	5	6
108	1	2	3	4	5	6
108	1	2	3	4	5	6
120	1	2	3	4	5	6
126	1	2	3	4	5	6
135	1	2	3	4	5	6
144	1	2	3	4	5	6
150	1	2	3	4	5	6
156	1	2	3	4	5	6
160	1	2	3	4	5	6
168	1	2	3	4	5	6
180	1	2	3	4	5	6
216	1	2	3	4	5	6
240	1	2	3	4	5	6



TWELVE POLE

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MASTER TABLE—NUMBER OF COILS PER GROUP FOR THREE-PHASE MOTORS

Numerals in the Master Table show the number of coils to be connected in each group for even windings.

Letters indicate odd coil groupings as shown in the sub-charts. Y or H-tap test connections and wound-in shunts must be used for the odd coil groups.

A degree mark (°) in the master chart indicates that a coil must be killed in each group where that mark occurs in the subchart. If this mark (°) does not appear in the master chart for the winding in question, then no coil is killed, even though the mark occurs in the sub-chart.

A figure such as (7-1) in the sub charts, indicates that the group has seven coils, one of which is to be killed.

A blank space ( ) in the master chart indicates that there is no practical grouping with the given number of coils and poles.

Synchronous Speed, R.P.M. 25 cycles	60 cycles	No. of Poles	Winding	Total Number of Coils: 12	18	24	30	36	48	54	60	72	90	84	96	90	96	104	108	120	128	135	144	150	156	160	168	180	216	240	Winding Possible	No. of Poles
1500	1800	2				4				10		12		14		15	16		18	20			24	25	26		28	30	36	40	Series and 2-parallel	2
750	900	4	Series and 2-parallel	1	B	2	3	4	B	5	B	6	B	7	B	B	8	B	9	10	B	B	12	B	13	B	14	15	18	20	Series and 2-parallel	4
			4-parallel	1		2	3	4		5	B	6		7	B		8		9	10		B	12		13	B	14	15	18	20	4-parallel	
500	600	6	Series and 3-parallel	1	C	2	C	3	C	C	4	C	C	C	5	C	C	6	C	C	C° C°	8	C	C	C° C°	C	10	12	C	Series and 2-parallel	6
			3-parallel Δ-parallel	1		2		3			4				5			6		C	C	8					..	10	12		3-parallel Δ-parallel	
375	450	8	Series and 4-parallel	1	D	2	D	D	D	3	D	D	D	D	4	D	D	5	D	D	D	6	D	D	D	7	D	9	10	Series and 2-parallel	8
			4-parallel 8-parallel	1	D	2		D	D	3		D	D	D°	4	D°	D	5	D°	D	6	D°	D	D	7	D	9	10	4-parallel 8-parallel	
300	360	10	Series and 2-parallel		E	1	2	1	E	1	E	E	E	3	E	E	E	4	E	E°E	E	5	E	E	L	6	E	8	Series and 2-parallel	10
			5-parallel 10-parallel				2	E						3				4				5				6		8	5-parallel 10-parallel	
250	300	12	Series and 2-parallel			1	H	H	H	H	2	H	H	H	H	H	3	H	H	H°	4	H	H	H	H	5	6	H	Series and 2-parallel	12
			3-parallel 4-parallel			1	H	H	H	H	2	H	H	H° H	H° H	H° H	H° H	H° H	3	H	H°	H°	4	H	H°	H° H	H° H	5	6	H° H	3-parallel 4-parallel	
			6-parallel 12-parallel			1		H			2		..	H			3			H		4	H°			H°	5	6	H°	6-parallel 12-parallel	

VOLTAGE TABLE—CONNECTION REQUIRED FOR CHANGE IN VOLTAGE WITHOUT REWINDING MOTOR

The original connections are shown in the left hand column. The connection after the change is shown along the top of the table. The relative voltage resulting from the change is indicated along a line to the right of the original connection and directly under the changed connection. All voltages are in per cent of the original voltage. As an example, suppose it is desired to change the voltage of a 4-parallel-Y-wound motor from 110 volts to 220 volts. The original connection will be 4-parallel-Y, and the new connection will be 2-parallel-Y. The voltage ratio is 200 per cent of the original voltage. Start at the 4-parallel-Y winding in the left-hand column, follow to the right until the figure 200 is reached. Directly above the figure 200 is shown the desired connection, which is 2-parallel-Y.

A blank ( ) indicates that the connection is not possible. If the table does not give the exact ratio required for the change in voltage, connect for the one which will give the closest voltage.

Connection of Motor Before Change	Connection of Motor After Change—Voltage Below is in per Cent of Original Voltage																	
Voltage × 100 per Cent	Series Y	Series Δ	2-parallel Y	3-parallel Y	2-parallel Δ	4-parallel Y	3-parallel Δ	6-parallel Y	4-parallel Δ	6-parallel Δ	5-parallel Y	5-parallel Δ	8-parallel Y	8-parallel Δ	10-parallel Y	10-parallel Δ	12-parallel Y	12-parallel Δ
Series Y	100	58	50	33	29	25	20	19	17	14.5	11.5	9.4						
Series Δ	173	100	87	58	50	43	35	33	29	25	20	17						
2-parallel Y	200	116	100	67	58	50	40	39	33	29	23	19						
2-parallel Δ	346	200	173	116	100	87	69	67	58	50	40	33						
3-parallel Y	300	173	150	100	87	75		58	50	43		29						
3-parallel Δ	520	300	260	173	150	130		100	87	75		50						
4-parallel Y	400	231	200	150	116	100		77	67	58		39						
4-parallel Δ	693	400	346	231	200	173		133	116	100		67						
5-parallel Y	500	289	250		144		100											
5-parallel Δ	866	500	433		250		174				58							
6-parallel Y	600	346	300	200	173	150		116	100	87		50						
6-parallel Δ	1,039	600	520	346	300	260		200	173	150		86						

TABLE A—TWO-POLE MOTORS—COILS PER GROUP

No. of Coils	Coil Group 1	2	3	4	5	6
62	10	10	11-1	10	11-1	10

TABLE B—FOUR-POLE MOTORS—COILS PER GROUP

No. of Coils	Coil Group 1	2	3	4	5	6	7	8	9	10	11	12
48	2	1	2	1	2	1	2	1	2	1	2	1
54	1	2	1	2	1	2	1	2	1	2	1	2
62	3-1	2	3	2	3	2	3	2	3	2	3	2
80	3	4	3	4	3	4	3	4	3	4	3	4
84	4	3	4	3	4	3	4	3	4	3	4	3
86	4	4-1	4	3	4	3	4	3	4	3	4	3
90	3	4	4°	3	4	4°	3	4	3	4	3	4
104	5°	4	4	4	5°	4	4	5°	4	5-1	4	5°
108	5	4	5	4	5	4	5	4	5	4	5	4
128	6°	5	5	5	6°	5	5	5	6°	5	6-1	5
135	6	6-1	6	5	6	6-1	6	5	6	6-1	6	5
150	7°	6	6	6	7°	6	6	6	7°	6	6	6
156	7	6	7	6	7	6	7	6	7	6	7	6
160	7	7-1	7	6	7	7-1	7	6	7	7-1	7	6
180	8	7	8	7	8	7	8	7	8	7	8	7

TABLE C—SIX-POLE MOTORS—COILS PER GROUP

No. of Coils	Coil Group 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
54	2	1	1	1	1	2	1	2	1	2	1	1	1	1	2	1	2	1
62	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
72	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2
80	3	3	3	3	3	4	3	3	3	4	3	3	3	3	4	3	3	3
84	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3
86	4	4	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3
90	3	4	4°	3	4	4°	3	4	3	4	3	4	3	4	4°	3	4	3
104	5°	4	4	4	5°	4	4	5°	4	5-1	4	5°	4	4	5°	4	4	5°
108	5	4	5	4	5	4	5	4	5	4	5	4	5	4	5	4	5	4
128	7	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
135	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
150	8	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
156	8	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
160	8	7	7	7	7	8	7	7	7	8	7	7	7	7	8	7	7	7
180	9	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
216	10	9	9	9	9	10	9	10	9	10	9	9	9	9	10	9	10	9
240	11	10	10	10	10	11	10	11	10	11	10	10	10	10	11	10	11	10

* Refers to two-parallel winding only.

TABLE D—EIGHT-POLE MOTORS—COILS PER GROUP

No. of Coils	Coil Group 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
36	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1
54	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2
60	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2
62	3	3-1	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2
80	4	3	3	3	4	3	3	4	3	4-1	3	3	3	3	3	3	3	3	3	3	3	3	3	3
84	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3
86	4	4-1	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3
90	3	4	4°	3	4	4°	3	4	3	4	3	4	3	4	4°	3	4	3	4	3	4	3	4	3
104	5°	4	4	4	5°	4	4	5°	4	5-1	4	5°	4	4	5°	4	4	5°	4	4	5°	4	4	5°
108	5	4	5	4	5	4	5	4	5	4	5	4	5	4	5	4	5	4	5	4	5	4	5	4
128	6°	5	5	5	6°	5	5	5	6°	5	6-1	5	6°	5	5	5	6°	5	5	5	6°	5	5	5
135	6	6-1	6	5	6	6-1	6	5	6	6-1	6	5	6	5	6	5	6	5	6	5	6	5	6	5
150	7°	6	6	6	7°	6	6	6	7°	6	6	6	7°	6	6	6	7°	6	6	6	7°	6	6	6
156	7	6	7	6	7	6	7	6	7	6	7	6	7	6	7	6	7	6	7	6	7	6	7	6
160	7	7-1	7	6	7	7-1	7	6	7	7-1	7	6	7	6	7	6	7	6	7	6	7	6	7	6
180	8	7	8	7	8	7	8	7	8	7	8	7	8	7	8	7	8	7	8	7	8	7	8	7

TABLE E—TEN-POLE MOTORS—COILS PER GROUP

No. of Coils	Coil Group 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
48	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1
54	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
60	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
62	3-1	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2
80	3	3	3	3	3	4	3	3	3	4	3	3	3	3	3	4	3	3	3	4	3	3	3	3	3	4	3	3	3	3
84	3	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3
86	4-1	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3
90	3	4	4°	3	4	4°	3	4	3	4	3	4	3	4	4°	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3
104	5°	4	4	4	5°	4	4	5°	4	5-1	4	5°	4	4	5°	4	4	5°	4	4	5°	4	4	5°	4	4	5°	4	4	5°
108	5	4	5	4	5	4	5	4	5	4	5	4	5	4	5	4	5	4	5	4	5	4	5	4	5	4	5	4	5	4
128	6°	5	5	5	6°	5	5	5	6°	5	6-1	5	6°	5	5	5	6°	5	5	5	6°	5	5	5	6°	5	5	5	6°	5
135	6	6-1	6	5	6	6-1	6	5	6	6-1	6	5	6	5	6	5	6	5	6	5	6	5	6	5	6	5	6	5	6	5
150	7°	6	6	6	7°	6	6	6	7°	6	6	6	7°	6	6	6	7°	6	6	6	7°	6	6	6	7°	6	6	6	7°	6
156	7	6	7	6	7	6	7	6	7	6	7	6	7	6	7	6	7	6	7	6	7	6	7	6	7	6	7	6	7	6
160	7	7-1	7	6	7	7-1	7	6	7	7-1	7	6	7	6	7	6	7	6	7	6	7	6	7	6	7	6	7	6	7	6
168	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
180	8	7	8	7	8	7	8	7	8	7	8	7	8	7	8	7	8	7	8	7	8	7	8	7	8	7	8	7	8	7
192	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
216	9	8	9	8	9	8	9	8	9	8	9	8	9	8	9	8	9	8	9	8	9	8	9	8	9	8	9	8	9	8
240	10	9	10	9	10	9	10	9	10	9	10	9	10	9	10	9	10	9	10	9	10	9	10	9	10	9	10	9	10	9

*Where a degree mark (°) occurs in a sub-chart, a coil is to be killed only if the same mark occurs in the master chart of the winding in question. This mark is to be disregarded in the sub-chart unless it occurs in the master chart. The groupings in these sub-charts apply only to the top-to-top connections shown in the diagrams.

TABLE H—TWELVE POLE MOTORS—COILS PER GROUP

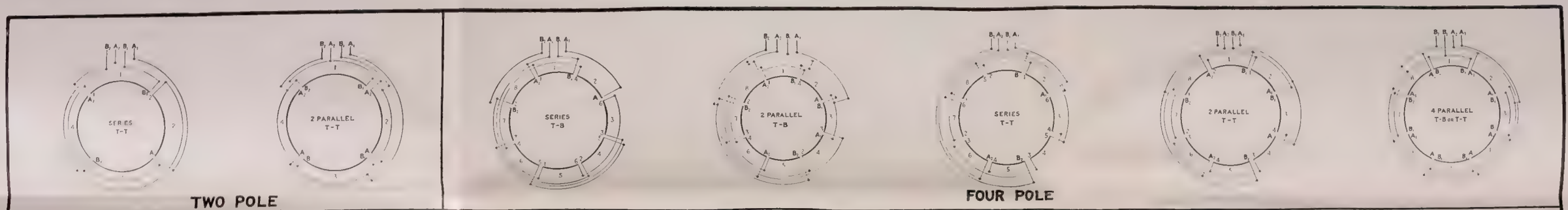
No. of Coils	Coil Group 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
48	2	1	1	1	1	2	1	2	1	2	1	1	1	1	2	1	2	1	2	1	1	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1
54	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
60	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
62	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
80	3	3	3	3	3	4	3	3	3	4	3	3	3	3	3	4	3	3	3	4	3	3	3	3	3	4	3	3	3	3	3	4	3	3	3	3
84	3	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3
86	4-1	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3
90	3	4	4°	3	4	4°	3	4	3	4	3	4	3	4	4°	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3
104	5°	4	4	4	5°	4	4	5°	4	5-1	4	5°	4	4	5°	4	4	5°	4	4	5°	4	4	5°	4	4	5°	4	4	5°	4	4	5°	4	4	5°
108	5	4	5	4	5	4	5	4	5	4	5	4	5	4	5	4	5	4	5	4	5	4	5	4	5	4	5	4	5	4	5	4	5	4	5	4
120	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
128	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
135	5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
144	5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
150	5	5	5	5	5	4	5	4	5	4	5	4	5	4	4	5	4	5	4	4	5	4	5	4	5	4	5	4	5	4	5	4	5	4	5	4
156	6	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
160	6	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
168	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
180	7	6	7	6	7	6	7	6	7	6	7	6	7	6	7	6	7	6	7	6	7	6	7	6	7	6	7	6	7	6	7	6	7	6	7	6
192	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
216	8	7	8	7	8	7	8	7	8	7	8	7	8	7	8	7	8	7	8	7	8	7	8	7	8	7	8	7	8	7	8	7	8	7	8	7
240	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8

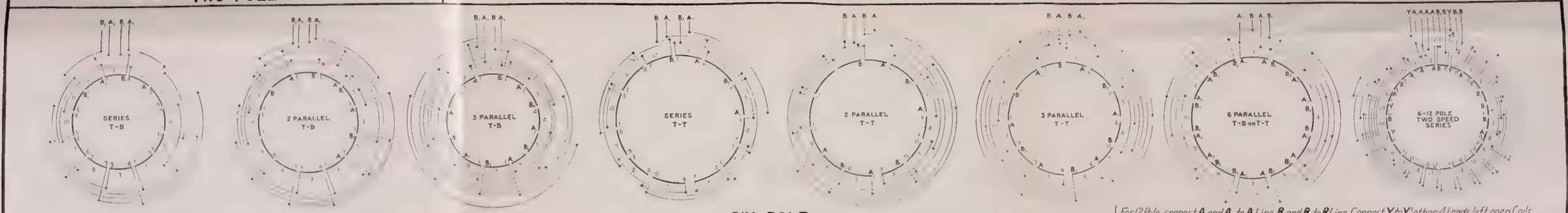
Diagrams and Tables for Connecting Two-Phase, Lap-Wound Induction Motors

Supplement of the ELECTRICAL WORLD, October 2, 1920.

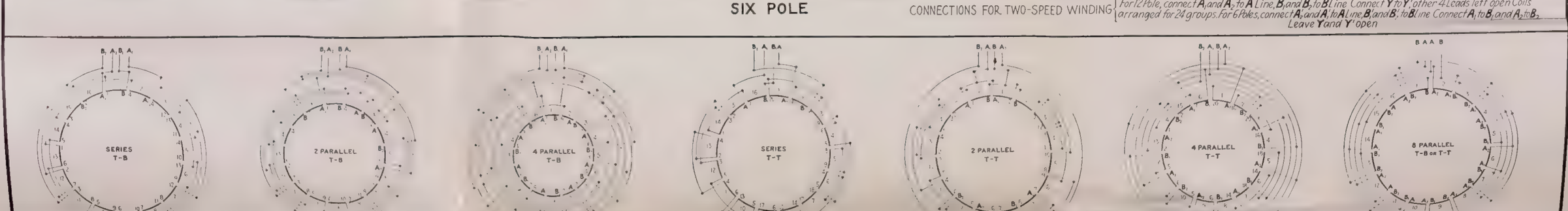
T-B in a diagram means the top lead of one group is connected to a bottom lead of the next group in series with it. T-T means the top leads connect to top leads and bottom leads connect to bottom leads.

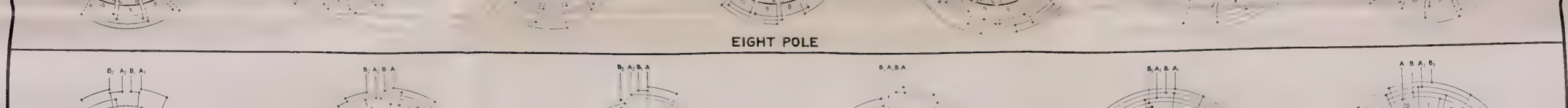
For the article "Connecting Two-Phase Induction Motors," page 683, prepared by A. C. Roe, Detroit Service Department, Westinghouse Electric & Manufacturing Company





CONNECTIONS FOR TWO-SPEED WINDING { For 12 Pole, connect A_1 and A_2 to A Line, B_1 and B_2 to B Line. Connect Y to Y' other 4 Leads left open Coils arranged for 24 groups. For 6 Poles, connect A_1 and A_1' to A Line, B_1 and B_1' to B Line. Connect A_1 to B_1 and A_2 to B_2. Leave Y and Y' open

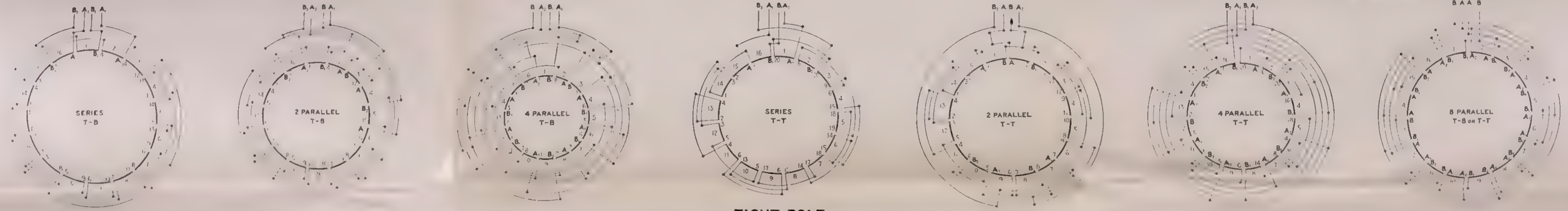




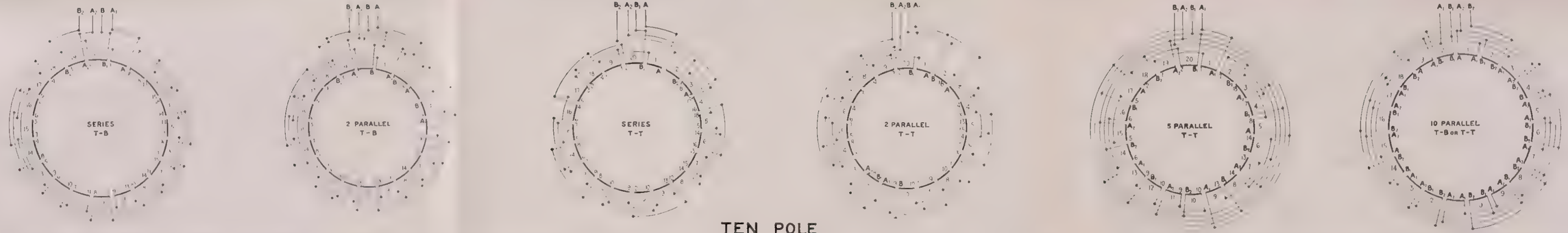


SIX POLE

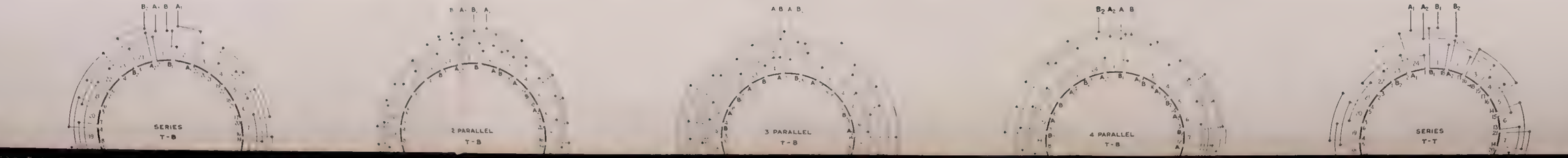
CONNECTIONS FOR TWO-SPEED WINDING { For 12 Pole, connect A_1 and A_2 to A Line, B and B_2 to B Line. Connect Y to Y' other 4 Leads left open Coils arranged for 24 groups For 6 Poles, connect A_2 and A to A Line, B and B_2 to B Line. Connect A_1 to B, and A_2 to B_2 Leave Y and Y' open

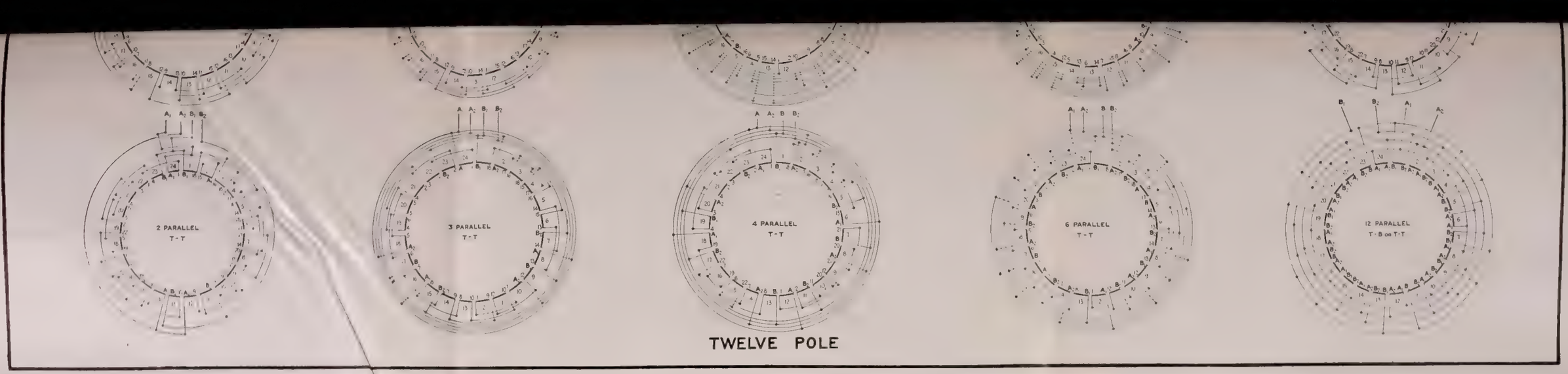


EIGHT POLE



TEN POLE





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Numbers in the Master Table show the number of coils to be connected in series per group for even windings.

Letters indicate odd coil groupings as shown in the sub-charts K to S. Top-to-top connections, shown in diagrams, must be used for the odd coil groupings.

MASTER TABLE—NUMBER OF COILS PER GROUP FOR TWO-PHASE MOTORS

A heavy mark (-) in the master chart indicates that a coil must be killed in order to obtain the connections shown in the sub-charts. If this mark (-) does not appear in the master chart for the winding in question, then no coil is killed, even though the mark occurs in the sub-chart.

A sign such as (7-1) in the sub-charts, indicates that the group has seven coils, one of which is always killed.

A blank space ( ) in the master chart indicates that there is no practical grouping with the given number of coils and poles.

| Synchronous Speed | | No. of Poles | Winding Possible | Total Number of Coils | | |

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MASTER TABLE—NUMBER OF COILS PER GROUP FOR TWO-PHASE MOTORS

Numbers in the Master Table show the number of coils to be connected in series per group for even windings.

Letters indicate odd coil groupings as shown in the sub-charts K to S. Top-to-top connections, shown in diagrams, must be used for the odd coil groupings.

A degree mark (°) in the master chart indicates that a coil must be killed in each group where the numbers occur in the sub-charts. If this mark (°) does not appear in the group for the winding in question, then no coil is killed, even though the mark occurs in the sub-chart.

A sign such as (7-1) in the sub-charts, indicates that the group has seven coils, one of which is always killed.

A blank space ( ) in the master chart indicates that there is no practical grouping with the given number of coils and poles.

Synchronous Speed 25 cyc.	Synchronous Speed 60 cyc.	No. of Poles	Winding Possible	Total Number of Coils: 12	18	24	36	48	54	60	62	72	80	84	88	90	96	104	108	120	128	135	144	150	156	160	168	180	216	240	Winding Possible	No. of Poles
1,500	3,000	2	Series and 2-parallel	3	K	6	9	12	K	15	K	18	20	21			24	26	27	30	32		36		39	40	42	45	54	60	Series and 2-parallel	2
750	1,800	4	Series and 2-parallel		L	3	L	6	L	L	L	9	10	L	L	L	12	13	L	15	16	L	18	L	L	20	21	L	27	30	Series and 2-parallel	4
			4-parallel			3		6				9	10			L	12	13		15	16		18			20	21		27	30	4-parallel	
500	1,200	6	Series and 2-parallel	1	M	2	3	4	M	5	M	6	M		M	M	8	M	9	10	M	M°M°	12	M	13	M	14	15	18	20	Series and 2-parallel	6
			3-parallel 6-parallel	1	M	2	3	4	M	5	M	6	M°		M	M	8	M°	9	10	M°	M°	12	M°	13	M°	14	15	18	20	3-parallel 6-parallel	
	900	8	Series and 2-parallel			N	N	3	N	N	N	N	5	N	N	N	6	N	N	N	8	N	9	N	N	10	N	N	N	15	Series and 2-parallel	8
			4-parallel 8-parallel			N	N	3	N	N°	N°	N	5	N	N	N	6	N	N°	N	8	N°	9	N°	N°	10	N	N°	N	15	4-parallel 8-parallel	
	720	10	Series and 2-parallel					R	R	3	R	R	4	R	R	R	R	R	R	6	R	R	R	R	R	8	R	9	R	12	Series and 2-parallel	10
			5-parallel 10-parallel							3	R		4							6						8		9		12	5-parallel 10-parallel	
	600	12	Series and 2-parallel			1	S	2	S°	S	S	3	S	S	S	S	4	S	S	5	S	S	6	S	S°	S	S	7	S°	9	10	Series and 2-parallel	12
			3-parallel 4-parallel			1		2		S	S	3	S	S°	S	S	4	S	S°	5	S	S°	6	S	S°	S	7	S°	9	10	3-parallel 4-parallel	
			6-parallel 12-parallel			1	S	2		S	S	3		S	S		4		S	5		S	6		S		7	S	9	10	6-parallel 12-parallel	

VOLTAGE TABLE CONNECTION REQUIRED FOR CHANGE IN VOLTAGE WITHOUT REWINDING MOTOR

The original connection is shown in the left-hand column. The connection after the change is shown along the top of the table. The relative voltage resulting from the change is indicated along a line to the right of the original connection and directly under the changed connection. All voltages are in per cent of the original voltage. As an example, suppose it is desired to increase the voltage of a 4-parallel wound motor from 110 volts to 220 volts. The voltage desired is 200 per cent of the original voltage. Starting at the 4-parallel winding in the left-hand column, follow to the right until the figure 200 is reached. Directly above the figure 200 is shown the desired connection, which is 2-parallel.

A blank ( ) indicates that the connection is not practical. If the table does not give the information required for the change desired, the motor will have to be rewound.

Connection of Motor Before Change Voltage is 100 per Cent	Connection of Motor After Change—Voltage Below is in Per Cent of Original Voltage: Series	2-parallel	3-parallel	4-parallel	5-parallel	6-parallel	8-parallel	10-parallel	12-parallel
Series	100	50	33	25	20	17	12.5	10	8.3
2-parallel	200	100	67	50	40	33	25	20	17
3-parallel	300	150	100	75	60	50	38	30	25
4-parallel	400	200	133	100	80	67	50	40	33
5-parallel	500	250	167	125	100	83	63	50	42
6-parallel	600	300	200	150	120	100	75	60	50
8-parallel	800	400	267	200	160	133	100	80	67
10-parallel	1,000	500	333	250	200	167	125	100	83
12-parallel	1,200	600	400	300	240	200	150	120	100

TABLE K—TWO POLE MOTORS COILS PER GROUP

No. of Coils	Coil Group 1	2	3	4
18	4	5–1	5–1	4
54	13	14–1	14–1	13
62	15	16–1	16–1	15

TABLE L—FOUR-POLE MOTORS COILS PER GROUP

No. of Coils	Coil Group 1	2	3	4	5	6	7	8
12	4	4	2	2	4	4	2	2
36	4	4	5	5	4	4	5	5
54	7-1	6	7	7	6	7-1	7	7
60	7	7	8	8	7	7	8	8
62	8-1	7	8	8	7	8-1	7	8
84	10	10	11	11	10	10	11	11
86	11-1	10	11	11	11	10	11-1	11
90	12-1	11	11	11	11	12-1	11	11
108	13	13	14	14	13	13	14	14
135	17	16	17	17-1	17-1	17	17	17-1
150	19-1	18	19	19	18	19-1	19	19
156	19	19	20	20	19	19	20	20
180	22	22	23	23	22	23	23	23

TABLE M—SIX POLE MOTORS COILS PER GROUP

No. of Coils	Coil Group 1	2	3	4	5	6	7	8	9	10	11	12
18[1]	2	2	1	1	2	2	1	1	2	2	1	1
18*	2-1	1	2	2	1	1	1	2-1	2	2	1	1
54[1]	4	4	5	5	4	4	5	4	4	5	5	4
54*	5-1	4	5	5	4	4	5	5-1	5	5	4	4
62	6-1	5	6	6	5	5	6	6-1	6	6	5	5
80	6	7	7	7	6	7	7°	6	7	7	7°	7
84	8-1	7	7	7	7	7	7	8-1	7	7	7	7
90	7	7	8	8	7	7	8	8	8	8	7	8
104*	9-1	8	9	9	8	8	9	9-1	9	9	8	8
108	10	11	11	11	11	11	10	10	11	11°	11	11
135	12	11	11	11	11	12-1	11	11	12	11	11	11
150[2]	12	12	13	13	13	12	12	13	13	12	12	13
150*	13-1	12	13	13	13	12	12	12	13-1	13	13	12
168	14	13	14	14	13	14	13	13	14	13	13	13

[1] For 3-parallel and 3-parallel connections.
* For 2-parallel connection.

Where a degree mark (°) occurs in a sub-chart, a coil is to be killed only if the same mark occurs in the master chart for the winding in question. This mark is to be disregarded in the sub-chart unless it occurs in the master chart. The groupings in these sub-charts apply only to the top-to-top connections shown in the diagrams.

TABLE N—EIGHT POLE MOTORS COILS PER GROUP

No. of Coils	Coil Group 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
24	2		1	2	2	1	1	2	2	1	1	2	2	1	1	2
36	3	2	2	2	3°	2	2	3°	2	2	2	2	2	3°	2	2
54	4	3	4–1	3	3	4°	3	3	4	3	3	4–1	3	4°	3	3
60	5	4°	4	4	4°	4	4	4	4	4	4°	4	4°	4	4	4
62	5	4°	4	4°	4–1	4	4	4	4–1	4	4°	4	4	4	4	4
72	4	4	5	5	4	4	5	5	5	4	5	5	4	5	5	5
84	6	5	5	5	6°	5	5	6	5	5	5	6	5	6°	5	5
86	6°	6–1	5	5	6°	5	5	6	5	5	6–1	5	5	6°	5	5
90	6–1	6	6	5	5	6	6	5	6–1	6	6	5	5	6	6	6
104	6	7	7	6	6	7	7	6	6	7	7	6	6	7	7	7
108	6	7	7	7°	6	7	7	6	7°	7	7	7°	6	7	7	7
120	7	8	8	7	7	8	8	7	8	8	8	7	7	8	8	8
135	9°	8	8	9–1	9°	8	8	9°	8	8	8	9–1	9°	8	8	8
150	10°	9	10–1	9	10°	9	9	10°	9	9	10–1	9	10°	9	9	9
156	9	10	10	10	10°	9	10	10	9	10	10	10	10°	9	10	10
168	10	10	11	11	10	10	11	11	10	10	11	11	10	10	11	11
180	12°	11	11	11	11	12°	11	11	12°	11	11	11	12°	11	11	11
216	14	14	13	13	14	14	13	13	14	14	13	13	14	14	13	13

TABLE R—TEN POLE MOTORS COILS PER GROUP

No. of Coils	Coil Group 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
48	3	2	3	3	2	3	2	2	3	2	2	3	2	3	3	2	2	3	2	2
54	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
62	4-1	3	4	3	4	3	3	3	4	3	3	3	3	4	3	3	3	3	3	3
72	5	4	4	4	5	4	4	5	4	4	4	4	4	4	4	4	4	4	4	4
84	6	5	4	4	5	5	4	5	5	4	4	4	4	5	4	4	4	4	4	4
86	5	4	4	5–1	5	4	4	5	4	4	5	4	5–1	4	4	5	4	4	4	4
90	6–1	4	4	4	5	4	4	5	4	4	4	5	4	4	5	5	4	4	5	5
96	4	5	5	5	5	5	4	5	5	5	4	5	5	5	5	5	5	5	5	5
104	6	5	5	5	6	5	5	6	5	5	5	6	5	5	6	5	5	5	5	5
108	6	5	5	6	6	5	5	6	5	5	6	6	5	6	6	5	5	6	5	5
128	7	6	6	7	7	6	6	7	6	6	7	7	6	7	7	6	6	7	6	6
135	7–1	7	7	6	7	6	7	7	6	7	7–1	7	7–1	7	7	6	7	7	6	7
144	8	7	7	7	7	8	7	7	8	7	7	8	7	8	7	7	7	7	7	7
150	8–1	7	7	7	8	7	8	7	7	8	7	7	8	7	8	7	7	8	7	7
156	7	8	8	8	8	7	8	8	7	8	8	8	7	8	8	8	8	8	8	8
168	9	8	8	9	9	8	8	9	8	8	9	8	8	9	8	8	8	9	8	8
216	10	11	11	11	11	10	11	11	11	11	10	11	11	11	11	10	11	11	11	11

TABLE S—TWELVE POLE MOTORS COILS PER GROUP

No. of Coils	Coil Group 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
36	2	2	1	1	2	2	1	1	2	2	1	1	2	2	1	1	2	2	1	1	2	2	1	1
54	3	3	2	2	3	3	2	2	3	2	2	2	3	2	2	2	3	2	2	2	3	2	2	2
60	3°	3°	2	2	3	3	2	2	3°	3	2	2	3°	3	2	2	3	3	2	2	3	3	2	2
62	3	3	2	2	3	3–1	2	2	3	3	2	2	3	3	2	2	3	3	2	2	3	3	2	2
80	4	3	3	4	3	4	3	3	4	3	3	4	3	3	3	4	3	3	3	4	3	3	3	4
84	4°	4°	3	3	4	4	3	3	4	4	3	3	4°	3	3	4	4	4	3	3	4	4	3	3
86	4°	4°	3	3	4	4–1	3	3	4	4	3	3	4°	3	3	4	4	4	3	3	4	4	3	3
90	3	4°	4	4	4	4	3	3	4	4	3	3	4°	3	3	4	4	4	4	3	4	4	4	3
104	5	4	4	5	4	4	5	4	4	5	4	4	5	4	4	5	4	4	4	5	4	4	4	4
108	5°	5°	4	4	5	5	4	4	5	5	4	4	5°	4	4	5	5	5	4	4	5	5	4	4
128	6	5	5	6	5	5	6	5	5	6	5	5	6	5	5	6	5	5	5	6	5	5	5	5
135	6°	6°	5	6–1	6	6	5	5	6	6	6–1	5	6°	5	5	6	6	5	5	6	6	5	5	5
150	7°	6	6	6	6	7	6	6	6	6	6	6	7°	6	6	7	6	6	6	6	6	6	6	6
156	7°	7°	6	6	7	7	6	6	7	7	6	6	7°	6	6	7	7	6	6	7	7	6	6	6
160	6	7	7	6	7	7	6	7	7	6	7	7	6	7	7	6	7	7	6	7	7	6	7	7
180	8°	8°	7	7	8	8	7	7	8	8	7	7	8°	8°	7	7	8	8	7	7	8	8	7	7

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